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ADDRESSES

PAPERS

MINUTES

BY-LAWS

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ADDRESS

Howard F. Harris
Vice President, Public Affairs

before the Annual Meeting of the
American Peanut Research and Education Assn.
San Antonio, Texas
July 13, 1970

Maybe some of you have heard a phonograph record called "Bert and I" which gained some limited popularity a few years ago. On the record is a brief exchange between two Down East Maine characters. One, admiring the craftsmanship of the other on a carpentry project, asks: "How'd you know how to do that?" The other replies, "Heck, I can't understand all I know!"

That's my problem with the subject of consumerism, and maybe the problem all of us have. We know a lot about consumerism. We know that its impact is being felt over and over again on all our businesses and some of our other consuming passions; we know there are literally hundreds of bills in the Congressional hopper, all expressing new and greater consumer demands.

But how much of this do we really understand? Or, putting the question more directly, how can we afford not to understand a movement of such compelling importance and strength?

It is completely obvious that the consumer is playing an increasing role in regulation of the food industry.

In the next few minutes, I will try -- as best I can -- to predict where the so-called consumer movement will be taking us. As if this weren't risky enough, I will try also to interpret, in my own way, what it is all about. Please appreciate my courage.

First, let me offer four statements:

- 1 The consumer movement is a misnomer
- 2 This thing is more complex than we imagined
- 3 It is more powerful than we supposed
- 4 It is not a recent political invention

The consumer movement is a misnomer because lately it has attracted and been taken over by many powerful forces other than consumers and consumer activists. Where once there may have been a small band of crusaders, now we can hear labor, youth, black, intellectual, and housewife all talking pretty much the same language -- and, in fact, joining together in common cause, as they did seven months ago at the White House Conference on Food, Nutrition and Health. Indeed, the sound we are hearing is the noise of the new concerns, new values and new ideas colliding with the old. This is why the consumer movement is more complex than we imagined. We can no longer isolate consumer demands from others being brewed within our total society -- from the concern for our environment, from the fear of technology, from the suspicion that people are being manipulated. Thus, the best way to look at consumerism is not too closely, not too separately, not as a single force, but as a combination of many forces.

For this reason, consumerism is more powerful than we supposed. We used to trust in the false assumption that one by one, group by group, we could manage

our problems, be they race, youth, labor, consumer, or what have you. But to our surprise and chagrin, sometimes to our dismay, we are finding that they are not separate, but intertwined, and so most difficult to deal with. Moreover, in dealing with these complex matters, we are hampered by a growing mistrust of business. Negative public attitudes toward our advertising range from discounting its credibility to outright resentment; our guarantees and warranties are viewed as evasive gibberish; our safety measures and scientific testing are regarded as sketchy at best, and motivated only by the hope of competitive advantage; our total attitude is considered to be resolutely obstructionist when it comes to doing anything for the consumer. It doesn't much matter that we are the victims of misunderstanding. The fact of the matter is, we have lost public confidence and once lost it will be difficult to recapture.

That political capital is now being made of our troubles and of these new ideas is undeniable. But to label consumerism as a recent political invention is a grave mistake. It existed long before it was adopted by the current crop of politicians.

Consumer protection measures are almost one hundred years old in this country. They date back to the passage by Congress of the Criminal Fraud Statute in the 1870's. In 1887 the Interstate Commerce Commission was formed in order to make the then powerful railroaders more accountable to the public. Upton Sinclair, a literary (not literal) forebear of Ralph Nader, so aroused the public with his expose' of conditions in meat packing plants that the Federal Meat Inspection Law was enacted and the Food and Drug Administration was established. The Federal Trade Commission came into being in 1915, charged with protecting businesses innocent of monopolistic, unfair, or deceptive trade practices from the depredations of their more rapacious cousins. By broadening and extending this charge, the FTC has become one of the government's most important instruments for consumer protection.

At this point it appears that the consumer protection movement is not the captive of government, but its captor. Ralph Nader and Company have launched a concerted attack on the FDA, and other government agencies, accusing them of complicity with business and failure to pursue the consumer cause with proper diligence.

With these as my premises, let me now attempt to predict the direction of this very complex movement in the years immediately ahead. Let me take all the noise, all the hundreds of bills, and group them under four major thrusts:

- 1 The demand for information
- 2 The demand for standards
- 3 The demand for the satisfaction of grievances
- 4 The emerging concept of a vested consumer

First, the demand for information. Everybody seems to want to know everything about everything these days. Communications media churn out vast quantities of data and interpretation to satisfy our great inquisitiveness. But the more we get, the more we want. The desire for knowledge is so great, in fact, that we hesitate even to suppress obscenity lest in so doing we leave some bit of truth unrevealed. And so disclosure is the order of the day. The right to know, the right to information is becoming absolute.

This desire for information is resident, too, within the mind of the consumer. She wants to know what's in the product, how it performs under given

conditions, how it compares with similar products. No matter that the answers may be inapplicable or so highly technical they are difficult, if not impossible for her to understand. Any attempt to tell less than the whole truth will be viewed with suspicion by the consumer.

Certainly, in the seventies, labels, advertising, and promotion will have to become much more responsive to this thirsting after information. Consumers feel inundated by product choices, and the better educated consumer, particularly the consumer on a tight budget will want to make rational selections. It won't be enough to advertise and promote only the sizzle -- the consumer will want a full description of the steak.

Unless manufacturers provide more and better information about their products, the demand that government take over this function could become irresistible. Strong moves have already been made in the direction of government testing of products and publicizing the results. Underlying such moves is the innate suspicion that any information provided by manufacturers is self-serving -- that it may not deliver the whole truth about a product.

The second consumer demand is for standards. Now a standard, according to Webster, is something set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality. While you can, I'm sure, cite many exceptions, by and large product standards have in the past measured quantity, weight, and extent. The American consumer has been most concerned that she was receiving her full measure, that the product was what it purported to be, and not an adulterated or cheaper substitute. But now there are new concerns being voiced - with the quality of our environment, with the safety and well-being of the individual. We are an affluent society, and it is our conceit that such a society can afford to erect at least minimum supports under the quality, safety and value of the things we produce. So it is that I see in the years ahead a vast extension of the standard-setting process as it is applied not only to the counting of things but to their intrinsic worth. Nutritional standards, of one kind or another, are a virtual certainty.

Again there is the question of whether industry will respond with adequate voluntary standards or whether by popular demand they will be made mandatory.

Consumer demand number three is for satisfaction of grievances. One of the reasons people are alienated from the establishment is their belief it is unresponsive, that it has things all its own way, that it deals highhandedly in matters of justice and equity. In the consumer area this is translated into a disaffection with guarantees and warranties, and with total lack of clout should the buyer feel (or actually be) cheated. It also takes the general form of dissatisfaction with the complaint and repair procedures available to the consumer.

Guarantees and warranties are under scrutiny to remove the fine print today. Change-your-mind periods which are being proposed today to lower the high pressure of the door-to-door salesman may tomorrow be demanded for all transactions. It appears likely that we shall soon have a new Federal law enabling consumers to bring class actions against business, actions in which groups of consumers could bring suit for collective harm done them by a company's unfair or deceptive act. The idea is that a single consumer, suing for a piddling amount, couldn't get close to a court. Class action bills are already on the books in many states but their application has not been thoroughly tested.

It may strike you, as it does me, that beneath all this is not only a desire for just redress, but for punishment, retribution, a tooth for a tooth, and new teeth in the prohibition of certain practices. It is not unlike the demand of the blacks for reparations from churches, businesses and institutions for past indignities to their people.

Anyway, the idea grows that the odds against the little guy ought to be evened.

Finally, there is the concept of the vested consumer. That may sound cryptic to you, so let me explain.....

From the modest beginning of entitling people to life, liberty and the pursuit of happiness, our society has produced a catalogue of new rights.....to a public education, a job, a decent income, health care, and so on.

The reversal of the ancient doctrine of let the buyer beware, which I think we would agree occurred a while back, opened the way for the establishment of a whole set of consumer rights. Our own executives have been proclaiming these implicitly for many years, in saying that the consumer is sovereign in the market place. But lately these rights have been made more explicit -- and by the nation's chief executive, President Nixon. He said:

"I believe that the buyer in America today has the right to make an intelligent choice among products and services.

"The buyer has the right to accurate information on which to make his free choice.

"The buyer has the right to expect that his health and safety is taken into account by those who seek his patronage.

"The buyer has the right to register his dissatisfaction, and have his complaint heard and weighed, when his interests are badly served."

What in essence is in the process of being created is an entirely new kind of consumer. No more will her role be confined to "voting" through buying decisions. No longer will she be the passive object of our persuasion. She will be granted a stake in the market place, a voice in what is sold, and how it is to be sold -- not after the fact, but at the moment of decision.

None of this would mean very much without the loud and articulate voice of the consumer -- which we have today. Tomorrow, this voice may be strengthened and focused by the granting of statutory authority for an official consumer spokesman in the White House and by an independent consumer agency.

In a sense, the underlying concept springs from the philosophy that land, water, air, sea, sky -- natural resources -- are in the public domain, and business may use or borrow them but only by public sufferance, and with the stipulation that they be maintained in good condition. Simply by defining that abstraction called a "market place" as a public resource, business would be subject to these same conditions of use.

If philosophy isn't your bag, however, look at history. Note the steady erosion of management's perogatives once unions and employees were endowed with rights. Look at some of the NLRB decisions respecting the vested rights of an employee in a job.

I say we may look back on the 1960's as idyllic times for businessmen, times when they had things pretty much their own way.

(Ladies and) Gentlemen, I am not advocating these things. I am just reporting them. We may properly be scared to death of them because they upset the status

quo, re-orient the market place, and carry the threat of confusion, regimentation, and imposed authority. But we should also accept them for what they are -- demands, demands which in our society are not necessarily to be met, but which are to be negotiated.

Let's not make the mistake of underestimating their force, however. They are not just consumer demands. They grow out of a whole set of new values and views being formed within our society. And to someone not programmed as we are, they sound fair and reasonable, and not the least bit dangerous. We, in fact, can be made to seem backwards, narrow-minded, and selfish for totally opposing them.

The most frequent advice given to businessmen is to tell the story of their accomplishments to the consumer. I would have to agree that this is generally sound advice, even though I disagree with some of the specific forms such stories can take, and despite some reservations about the impact of these messages.

One form which tires me and which, I'm sure, turns off the consuming public, is to be told for the millionth and second time that American industry has produced the highest standard of living in the world, and the greatest array of goods the world has ever seen. The public knows all about it, for heaven's sake. And because industry has done such a terrific job it is taken for granted.

And why not? But the public does want to know what we have done for them lately -- and they should be told. And it wants to be reassured that when we do things, we -- business -- have the public interest firmly in mind. Surely it is in our interest to make sure they get that message.

It is a fact that bad news, scandal, disorder, predictions of dire consequences are driving out the good news from all our media. And this is a source of constant frustration to all communicators. It means that the impact of these glad tidings is already dissipated. But that should not serve as a convenient excuse not to communicate. On the contrary, we must try all the harder to get our good stories told. And if we want them told as news, then we must prepare them as news stories, making them timely, interesting, and above all newsworthy -- that is, not loaded with material which is self-pleading, self-serving or polemic.

Another frequently given piece of advice to businessmen has been to engage in dialogues with the consumer. This is probably sound advice, but let me tell you what is likely to happen. They'll modify our point-of-view more than we'll change theirs. Because the only conclusion we can reach is that there is more to it than verbiage, rhetoric, and dogma; there is the inescapable conclusion that something is amiss in the market place, and we have not been as sensitive to it as we should have been.

I have no list of concessions to this state of affairs, no magic formulas which will set things right again. But we must cease to be antagonistic to the consumer -- or even to sound that way. We must arrive at some agreements in principle with the consumer, and then struggle to find solutions with which we can live -- or face the prospect of imposed solutions. There is nothing society wants, after all, that industry does not want.

Consumers are becoming impatient with dialogue. From now on we face the danger that with not too much more, business may be accused of duplicity, the greatest consumer deception of all -- a put-off.

Certainly the time has come for aggressive and responsive action in our business and in all of business and industry.

ADDRESS
ROLE OF THE PEANUT ADMINISTRATIVE COMMITTEE
IN THE PEANUT INDUSTRY

by
Robert R. Pender
Greenwood, Fla.

Mr. President, distinguished guests, members of the American Peanut Research and Education Association, visitors and friends: I consider it a privilege to appear on your distinguished program, to enjoy the fellowship of such a dedicated and important segment of the peanut industry -- that of research, education and development. The historic atmosphere of San Antonio, along with its valiant spirited people, the glorious heritage of this great state of Texas, certainly lends truth that there is no impossible dream.

I am just a layman in the peanut industry -- appearing on the program with such learned and distinguished scholars and professional people is about as out-of-place for me as a head start kid would be if he was kicked into the freshman class at Harvard University.

Our domestic lives are being effected more each day by the ever sensitive and increasing wave of consumerism. The relatively new word ecology is becoming a household word already, even for children. Research and development have brought us so far so fast that it has been a problem for industry to keep abreast, to make the necessary adaptations and changes in their production, their formula and technic, and their products to satisfy the consuming public, and the regulatory agencies of the Federal Government that they are enjoying the most wholesome food items that is humanly, scientifically and mechanically possible to place before them. These are cautious days and times -- and the scientific community tells us that they can measure accurately down to one Ppb of any unwholesome or potentially dangerous compound which might exist in any food item. You bet your boots industry has been concerned, and is still concerned.

Do you know what one part per billion is? That's equivalent to one second every 32 years. That's accuracy, if you can believe it. I don't believe even Bulova with its accurate watch would challenge that claim to accuracy ... yes, industry is very much concerned and lives in an atmosphere of uncertainty. In spite of all the progress of combined efforts. I am not sure the American Industry could stand two Naders. The self appointed crusader of consumers everywhere. Certainly the Peanut Industry needs no Nader!

I'd like to briefly give you a little background of the Peanut Administrative Committee and the Marketing Agreement.

A potential crisis presented itself to the Peanut Industry in 1964 in the form of Aflatoxin -- one of the most toxic of the Mycotoxins. Our ever alert and zealous bio-chemist detected the ugly presence of toxic molds on some of our delicious peanuts and peanut products. We came to refer to our problem as "A Mycotoxin Problem" -- and a problem it has been. This was before the wave of consumerism became as sensitive as it is today. Aflatoxin in raw peanuts moving into commercial channels was deemed unwise, unwholesome and posed a potential threat to an industry and could have possibly touched off a public panic. We were in trouble! It was years before we would even mention the word "aflatoxin" above a whisper. It was kept behind closed doors. In recognition of the seriousness of this problem to the industry, the United States Department of

Agriculture was instrumental, with assistance and cooperation from all segments of the industry, growers, handlers and manufacturers, in initiating a program to deal with this serious and delicate problem. Due to the time element involved in 1964 USDA administered what we referred to as the 1003 program which met the needs for that year. This was one program the Government made money on. The next year the marketing agreement was formed with all handlers becoming signers. A 100 per cent sign-up of all commercial peanut shellers.

The Peanut Administrative Committee is the administrative agency of the marketing agreement which regulates and controls the quality of all raw peanuts that move into commercial food channels in the entire United States of America. There are approximately 1,000,000 tons of farmers stock peanuts purchased annually for commercial and seed purposes in the United States.

The marketing agreement is divided into three separate and distinct parts:

(1) The in-coming quality regulations which covers the grade and quality of all farmers stock peanuts which handlers may buy or acquire for commercial shelling or cleaning, including seed peanuts.

(2) The out-going quality regulations covers the grades and specifications of all shelled peanuts and inshell peanuts which a handler might sell or dispose of for human consumption, the inspection and identification procedures, and the handling methods permitted.

(3) The indemnification regulations covers the terms and conditions and procedures relating to rejected lots, the sales contracts, re-milling and conditioning of confirmed unwholesome lots and the indemnification of the different grades and types ... our regulations come under close review each year. Changes have to be made. They have to be approved by the Secretary of Agriculture each year. The size of the problem varies from crop year to crop year and our problem does not seem to be disappearing rather but becoming more complex in spite of all the progress we think we have made. Out of necessity, we have been forced to draw ever tighter quality guidelines on both our in-coming and out-going quality regulations in an effort to further minimize the probability of any unwholesome lot of peanuts being manufactured into food products. Always keeping in mind the high quality of peanut products and the consumers' interest. All this is accomplished at the lowest possible cost to the committee, and this cost is not small. It runs into millions of dollars and with ever increasing pressure being brought upon food and drug administration from consumer interest, tighter guidelines on raw peanuts and finished products is not inconceivable. Of course, any move of this nature would bring more pressure upon the committee and the industry handling future peanut crops.

The peanut administrative committee is a self-supporting agency. Handlers are assessed the amount deemed necessary to administer and provide indemnification and insurance in the amount of \$6,000,000.00 on a commercial peanut crop valued in excess of \$250,000,000.00. This is a lot of money -- all of it coming from handlers.

The peanut administrative committee is composed of 18 members directly under the secretary of agriculture, several of which are in this room this morning. The governing body is composed of 3 grower members and 3 sheller members from each of the 3 production areas -- a total of 18. All 3 peanut production areas being represented equally on the governing board. Since the inception of the marketing agreement in 1965 the peanut administrative

committee will have spent, through this past crop year, in excess of \$7,000,000.00 handling claims on peanuts due to excessive levels of aflatoxin. Our claim cost reflects several things more than just the cost of the peanuts themselves. It includes freight, re-milling cost, inspection fees, storage as well as indemnification. Our losses on the peanut crops per year has been as follows:

1965	\$213,000.00
1966	343,000.00
1967	2,695,000.00
1968	2,136,244.00
1969	Estimate 1,500,000.00

We are enjoying somewhat of a better year this year -- if you can call a million and half dollars in losses good.

During the past year I was asked to appear on a seminar conducted by the United States Department of Agriculture Agri-research Service in Washington to discuss the geographic distribution of aflatoxin. This was a most interesting program, where all the research projects involving aflatoxin by Agri-research were being reviewed, and a report of their progress was made. Millions of dollars have gone into this research work, and I can say it is continuing and attracting priority in Agri-research. We can thank Dr. Senti and his devoted USDA research staff for much of this fine work. Much progress is being made to evaluate the effects of toxic mycotoxins in various animals. I was somewhat at a loss in attempting to address myself to the geographic distribution of aflatoxin -- having been close to the aflatoxin problem since its ugly appearance into the peanut industry in working with the peanut administrative committee, it is impossible to establish its exact bounds geographically. During the past crop year it appeared in all the three main production areas. Our peanut being the unpredictable legume that it is refuses to be a conformist all the time. Strange and freakish phenomena, coupled with unfavorable weather patterns do cause some areas to have more peanuts effected by aspergillas molds than other areas some years. These type phenomenas are impossible to pinpoint or predict. Our un-predictable legume leaves us baffled at times in its inconsistency to conform. When these things happen, we call in our foremost expert, your president, Bill Dickens, and sometimes I know he has been puzzled, as we all have.

The peanut administrative committee's primary purpose is quality control at every level up to the manufacturer and the removal of nnwholesome peanuts from the market at the lowest possible cost. Quality is more than just a word in the peanut world today. It is a way of life! A way of life necessary for survival.

Recognition of this fact has been a unifying force throughout the industry ... uniting all segments of this great industry ... a result of our common problem was some good coming with the bad. The darkest cloud sometimes shows a silver lining. We now enjoy a unity in the peanut industry that is equaled by no other commodity which is proof. The common bond of quality we all share.

It is all handlers, as well as producers, desire to move the highest quality peanuts possible to the manufacturers...peanuts which manufacturers can work into a wholesome and delicious peanut product ... one which will contribute to an ever increasing and expanding market for our peanuts.

Every segment of the industry has a role in this program...producers, handlers and manufacturers. Producers have a great responsibility in this program. This is where it all begins. Peanut producers must realize that they are the original

producer of quality. Consequently he is the first to be responsible for its preservation. No one, absolutely no one beyond the producer can restore the quality lost or destroyed through poor and irresponsible harvesting, combining and curing practices. Practices which cause quality deterioration such as high percentages of cracked hulls, high percentages of loose shelled kernels, high percentages of splits in the farmers stock sample. Some of this is unavoidable, doing the best you can, some of it is the price we pay for mechanization. But when the averages are greatly exceeded, you could be contributing to our mycotoxin problem. There is a definite correlation between loads which evidence this type of deterioration and abuse and aflatoxin.

The producer receives the full market price for these peanuts whether they are placed in segregation three storage or not. When the peanut is robbed of its best natural shield and protector, its shell, or when its shell has been abused or cracked from improper, unadjusted combining operations, the producer is costing himself money, as well as contributing to our problem. Nature has done its best in providing the peanut kernel protection with its shell. To cause a loose shelled kernel or to crack its shell, permitting moisture, air and dirt which contains mold spores to come in direct contact with the kernel is an invitation for trouble. On many loose shelled kernels and kernels from cracked, hulled peanuts there is enough bruised and damaged tissue implanted on the kernel to permit ideal places for this mold spore to culture and grow. I do not believe this particular mold is by nature characteristic of our peanuts. A combination of things create ideal conditions for its presence sometimes. Some of which we might not be able to avoid, such as weather, certain soil borne insects. But where we can help, we must! We are enjoying progress in this area through agriculture research, agriculture engineering. They are making dramatic progress in developing new and better machinery which is minimizing this type damage to our peanut pods and kernels, making better quality nuts available.

Where the producer's responsibility ends, the handler's begins. He is prepared to handle and warehouse efficiently, to mill to the high quality standards of the marketing agreement out-going quality regulations which govern the industry. Most handlers today, because of the marketing agreement, have invested huge sums of money installing more and better equipment, up-grading their plants, to meet today's high quality standards. Penalties have been applied through the marketing agreement upon handlers to encourage the best milling practices. While all farmers stock peanuts undergo the "dickens" visual method of identification of a-flavous molds prior to purchase, our shelled peanuts are pretested prior to usage for aflatoxin, assuring the manufacturer that he is receiving good wholesome raw peanuts. When and if any lot of peanuts exceeds our guideline they are turned over to peanut administrative committee for conditioning and clean up to remove the aflatoxin by either re-milling or blanching, or if we are unable to clean up a lot of peanuts, it is then wholly indemnified, and the peanuts sold for crushing, with the meal going for fertilizer or other non-fed usage.

Progress is our most important product.....it is the byword of one of America's largest corporations. That of General Electric! Progress might not be the peanut industry's most important product because peanuts are! We must look to the scientific community for much of our progress....to dedicated research people in the various areas of agriculture research extension work. We,

in the peanut administrative committee are prohibited by the marketing agreement, from funding any research projects. Fortunately United States Department of Agriculture has recognized this and directed their great resources to many of our industry's problems.

Progress is sometimes immeasurable. We, in the peanut industry and the peanut administrative committee, feel that we have made some progress. The years of transition which the industry is experiencing today, the readiness with which the peanut industry shouldered its responsibilities are all great signs of progress. The great unity of all segments working together, yes progress does come! Progress will come and along with it will come change. Change is accepted as a daily occurrence in our business today. Yours and mine! Regardless of what segment you might be associated with. I can remember when, and it has not been long ago, that most people in the peanut business, industry also, measured progress by the amount of change they were able to avoid. Just would not accept any change at all. Mutual understanding and appreciation for each others responsibilities have removed much of the fear and doubt that change generated in the past. The ability to re-act....to adjust to change is an intangible that all segments of this great industry has, out of necessity, had to acquire. Producers, handlers and manufacturers. I sincerely believe that the progress of the next ten years will far surpass all that we have experienced thus far in this youthful industry. The phenomenal capacity for research is just reaching the stages to make their greatest contributions. It would well be that the golden age of the peanut is yet to come. I, for one, believe it is. Of course, along with the progress will come new and different problems to be dealt with. Problems for all of us including the Department of Agriculture. Problems that will require the best of us, if we are to continue to hold our rightful position in today's keen and competitive market place.

The complexities and tensions that overshadow all of our operations today just might cause us to become disenchanted and discouraged. It's easy to do! We miss that feeling of self satisfaction. We must avoid this. Take a little time for evaluation and review of our individual responsibilities and our opportunities. Talk to yourself fairly and objectively. With dramatic breakthroughs on the horizons from research and development....with the entire industry enjoying cooperation and unity, along with United States Department of Agriculture support, I think we can rightfully look to the future with confidence and expectancy. We may not be able to turn all the problems of today into tomorrow's opportunities, but if we continue to take advantage of research, education and developments from the scientific community and government, and the extension people, couple them with the progressive quality programs of the industry and we continue to meet the challenges that come with unity, interest and devotion, which we have in the immediate past, I feel confident that we, all segments working together, can restore, perpetuate and preserve the harmony and tranquility which the peanut industry justly deserves.

It is toward this end that much of the work of the peanut administrative committee is directed. That's the challenge that each of us, working in the peanut administrative committee must keep in mind in formulating programs that have such a profound effect on this industry. We solicit your cooperation, and continued guidance and advice, which we have called for from time to time.

Your program committee has been overly generous with the time allotted to me. If there is time remaining and if permissible, I will be glad to try to answer any questions you might have.

It has been a pleasure being with you this morning. I certainly consider it an honor. I've been in the peanut industry all my life and have come to love it. I believe in its future!

Again, I appreciate your kind invitation. Thank you!

PEANUTS: FROM BREEDING LINE TO VARIETY IN VIRGINIA AND NORTH CAROLINA

by

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INTRODUCTION

In Virginia and North Carolina a peanut breeding line goes through several stages of critical evaluation before release as a new variety. These breeding lines are developed by the standard breeding procedures.

Breeder Evaluation

Evaluation in breeder's preliminary and advanced trials determine the merit of lines for further testing. In these trials, observations are made for resistance to diseases or insects in addition to the collection of data on agronomic characteristics and market grade factors. A committee representing the Virginia-Carolina Sheller's Association rates these lines in the early generations for uniformity and acceptability in shape and size of the seed and pod. Those lines rated acceptable by the shellers and exhibiting desirable agronomic characteristics are further evaluated by the breeder.

Once the breeder determines that a line exhibits enough desirable characteristics for possible release it is eligible for evaluation in the Virginia-North Carolina Peanut Variety and Quality Evaluation Program.

Virginia-North Carolina Peanut Variety and Quality Evaluation Program

Virginia's peanut acreage is approximately 103 thousand acres while North Carolina produces approximately 170 thousand acres. The majority of these acres are produced in a nine county area of southeastern Virginia and a thirteen county area of northeastern North Carolina with the state line dividing the two production areas almost in half. The same varieties are grown by producers in both areas. In 1968 the Virginia and North Carolina Agricultural Experiment Stations pooled their resources and initiated the Virginia-North Carolina Peanut Variety and Quality Evaluation Program based at the Tidewater Research Station in Holland, Virginia. The purpose of the project is to evaluate potential peanut varieties developed in both states for adaptability and industry acceptance throughout the bi-state production area.

Cultural practices are carried out by the use of project personnel and production equipment. This is done so that uniform testing procedures can be assured for each test with soil type and environmental conditions the only variables.

An advisory committee composed of a breeder, sheller, grower, an extension specialist and experiment station representative from each state advises in the

operation of this project. This committee reviews the breeding line candidates and makes acceptance decisions based upon the data presented by the breeder. Once accepted a line goes through a rather extensive evaluation in small plot tests and those with exceptional characteristics are tested in large increase plots.

Small Plot Test

The small plot test consist of six locations - three in each of the two states. At each location all entries are dug at two digging dates with three replications for each date of digging. The data collected from farmer stock samples include: yield pounds per acre, percent moisture, percent loose shelled kernels (LSK), percent foreign material (FM), percent fancy pods, percent hulls, percent meat, percent extra large kernels (ELK), extra large count per pound, percent medium, medium count per pound, percent number one, number one count per pound, percent sound splits (SS), percent other kernels (OK), percent damaged kernels (DK), percent sound mature kernels (SMK), support price - dollars per hundred weight, and value - dollars per acre. Skippy Laboratories, A Division of CPC International, Inc., and the Virginia Department of Agriculture and Commerce assists in collecting percent oil, percent protein, iodine value, maturity index and organoleptic values on the shelled samples.

Table 1 and 2 contain some of the 1969 results from the farmer stock samples and quality evaluations. This is only a portion of the data collected and is shown to illustrate the type of results obtained.

Table 1. Average of six small plot tests, 1969.

Variety or Line	% Fancy	% BLK	% SMK	Support Price Dol/cwt	Yield lbs/A	Value Dol/A
Digging I						
Florigiant	75	23	68	\$13.28	3741	\$489
N.C. 15714	82	36	69	13.52	3506	465
Va. 56R	75	23	68	13.17	3112	396
Va. 61-24-7	78	24	65	12.74	3487	433
Digging II						
Florigiant	72	23	71	13.81	3006	407
N.C. 15714	81	41	70	13.95	3145	434
Va. 56R	70	28	72	13.89	2584	348
Va. 61-24-7	75	32	70	13.67	3600	482

Data of this type are summarized and reviewed by the advisory committee. Those exhibiting excellent agronomic characteristics and quality are eligible for the increase plot tests in addition to further testing in the small plot tests.

Table 2. Quality results from small plot tests, 1969.

Variety or Line	CLER Score ¹	Iodine No.	% Oil	% Protein
Digging I				
Florigiant	54.3	97.7	48.9	30.5
N.C. 15714	62.8	92.6	48.7	31.8
Va. 61-24-7	56.3	99.0	47.3	30.1
Digging II				
Florigiant	57.7	98.4	47.8	30.2
N.C. 15714	67.7	93.2	47.8	31.8
Va. 61-24-7	60.7	99.9	47.0	30.1

¹ Critical laboratory evaluation roast - Skippy Laboratories.

Increase Plot Test

The increase plot tests consisting of one-half acre for each experimental line are located in three counties in the bi-state production area. Agronomic characteristics and market grade factors are collected from the farmer stock samples. In addition mill outturn data are obtained by shelling the one-half acre production in a pilot shelling plant. The percent jumbo and percent fancy pods are determined for the hull goods. The mill outturn consisting of percent extra large kernels, percent medium, percent number one, percent number two, percent oil stock, percent damaged kernels, percent loose shelled kernels, percent foreign material, percent total mill outturn and percent hulls is determined and is of primary interest to the commercial sheller. From each grade a sample is checked for count per pound, percent splits, percent damaged and percent passage through a predetermined screen size to determine if USDA standards are met.

Samples from jumbo, fancy, extra large, medium and number ones are evaluated by a manufacturer of end products from that grade for consumer acceptance. These products include salted in the shell, roasted in the shell, oil cooked and salted, dry roasted and peanut butter.

An example of the type of data collected from the mill outturn is shown in table 3 for the experimental line N.C. 15714. These data are an average of the three locations for 1969.

Table 3. Experimental line N.C. 15714 mill outturn data - 1969.

Character	Outturn
% ELK	28.9
% Med.	22.5
% No. 1	11.2
% No. 2	5.6
% Oil stock	0.7
% DK	0.8
% LSK	0.3
% Total outturn	70.0

These mill outturn data along with the agronomic data and manufacturer's test run evaluation are summarized for review by the evaluation program's advisory committee and the Variety Advisory Release Board should the breeder wish to release the line.

Variety Advisory Release Board

The Variety Advisory Release Board, composed of grower, sheller, manufacturer, research and extension representatives from the two states, reviews all available information on any breeding line being considered for release. All segments of the industry are represented for reviewing the advantages and disadvantages of releasing any line as a variety. The board considers the data presented and then makes a recommendation to the original breeder regarding release as a new variety.

Variety Release

The final decision to release a variety in the case of experiment station lines is solely the responsibility of the director of the experiment station from which it originated. The evaluation program and advisory board mentioned above presents all available information and opinions to the director as an aid in the final decision.

Summary

In summary, the breeding lines tested in Virginia and North Carolina go through a thorough evaluation before release as a new variety. The breeder's development and evaluation is only the beginning phase. Once past the breeder's evaluation, a line is tested in the bi-state program in both small plot and increase plot tests. Acceptance from these programs plus shellers and manufacturers acceptance is desired before release.

With the cooperation of all segments of the industry this procedure of release is making great strides in assuring that new varieties will be of high quality and acceptable to all segments of the industry.

RESPONSE OF FLORIGIANT AND VIRGINIA BUNCH 46-2 PEANUTS TO TIBA IN VIRGINIA

by

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ABSTRACT

The growth regulator 2,3,5-triiodobenzoic acid (TIBA) was sprayed on 'Florigiant' and 'Virginia Bunch 46-2' peanuts (*Arachis hypogaea* L.) at rates of 10, 20, 40, 80, and 160 grams per acre (g/a) in 1968, and 15 and 30 g/a in 1969. Application dates were June 26 or July 23 or August 16 in 1968, and June 26, July 11 or 25, or August 15 in 1969.

Virginia Bunch 46-2 fruit responses to TIBA were mainly small yield increases from plots which received the 80 g/a rate applied June 26, 1968 and the 15 g/a rate in 1969 when averaged over dates. Seed size tended to increase both years. Florigiant responses to TIBA were increased fruit yields in 1969 only, particularly from the June 26 application. Seed size tended to increase both years. The 160 g/a rate in 1968 generally produced unfavorable results.

General effects both years were slightly decreased branch elongation in both cultivars, a more than normal vertical orientation of the branches, particularly in Virginia Bunch 46-2, and a temporary leaflet rolling or puckering following TIBA application.

INTRODUCTION

Considerable research with the growth regulator 2,3,5-triiodobenzoic acid (TIBA) has been directed toward legume crops recently. Much of this research concerned the effect of TIBA, an antiauxin, on soybeans. Galeston (3) reported that TIBA caused up to a 10-fold increase in the number of floral buds, reduced vegetative growth, and a partial loss of apical dominance in soybeans. Also, Greer and Anderson (4) noted that application of TIBA at the beginning of flowering increased yields of beans 10 to 15%. Reduced vegetative growth and improved leaf exposure to light were suggested as possible effects of TIBA creating improved floral development, etc. Other effects on soybeans, such as increased number of seeds per plant, reduced seed size, less lodging, as well as foliar orientation and elongation responses have been reported (1,2,5,6,7).

Similar responses may be beneficial in peanut production. Only a low percentage of flowers develop into fruit. Excessive vegetative development has been suggested as a cause of low yields. Mechanical harvesting efficiency should be favored by reduced vine growth and entanglement.

The experiments described herein investigated rates and dates of TIBA

1. Work reported here was supported in part by a grant from International Minerals and Chemical Corp., Skokie, Illinois.

application effects on large-seeded bunch and runner type peanuts planted in three spacing patterns. This paper discusses results with TIBA principally, which generally were not significantly affected by the spacing treatments imposed.

EXPERIMENTAL PROCEDURE

This study was conducted at the Tidewater Research Station, Holland, Va. during 1968 and 1969. Peanuts were grown on a moderately well-drained Woodstown loamy fine sand (Aquic Hapludults: fine-loamy, siliceous, mesic), one of the principal soils on which peanuts are grown in the Coastal Plain of Virginia.

Prior to planting the peanuts, a rye cover crop about 15 inches tall was moldboard-plowed under in late March each year. Further land preparations procedures were completed as recommended for peanut production in Virginia. Phosphorus and K at rates of 35 and 130 lb/a, respectively, were broadcast and plowed under before planting corn which preceded peanuts in the rotation. Virginia recommendations were followed for use of DBCP (1,2-dibromo-3-chloropropane), vernolate before planting, disulfoton, DNBP (4,6-dinitro-O-sec-butyl-phenol), carbaryl, diazinon, dusting S and Cu-S mixtures, and gypsum at 600 lb/a. Supplemental weed control was provided by machine cultivation and hand hoeing. Excellent growth and uniform development of the plants occurred both years.

Commercial 2-row planting and digging equipment was used each year. Following digging, the peanuts were stacked on poles and allowed to dry before threshing with a stationary picker. Fruit samples were obtained from each plot and graded with equipment and according to procedures outlined by the Federal-State Grading Service.2

1968 TEST

TIBA treatment rates were 0, 10, 20, 40, 80 and 160 g/a. They were sprayed over the peanut row as broadcast applications using a tractor-mounted sprayer equipped with T-jet no. 8004 nozzles which emit a fan type spray. The TIBA was IMC experimental formulation 3889. It was applied under a pressure of 40 psi in 30 gal/a of water which contained 1000 ppm of surfactant. Application dates were June 26 (early flowering), or July 23 (full flowering) or August 16 (early fruit formation stage).

Thiram - treated seeds of Florigiant (runner) or Virginia Bunch 46-2 (Bunch) were planted May 31 in two row-spacing sequences: (1) four 36-inch wide rows per plot with 5-inch plant drill spacing and (2) four 12-inch wide rows in a bed with 10-inch plant drill spacing bordered by 36-inch rows. Thus, all plots were 12 feet wide and 20 feet long. The central two 36-inch or four 12-inch rows were used for all observations. All TIBA rate and date of application treatments, and cultivar and spacing treatments were completely randomized within blocks replicated 4 times. Plants were dug October 28.

2. *Inspection Instructions - Farmer's Stock Peanuts. 1967, 27 p. (USDA Consumer and Marketing Service, Fruit & Vegetable Division)*

Measurements at various times after sprayings were made on the first or second principal lateral branches of six randomly selected plants per plot to assess TIBA effects on vegetative development. The outer internode measured was between the last fully developed node and the previously formed node. Branch length includes the distance from the central stem to the last node on the principal stem of the branch.

Soil sample analyses prior to planting indicated that the plow layer of the test area was pH 6.2, high in available P, and medium in available K, Ca, and Mg. The soil contained 1.5% organic matter.

1969 Test

TIBA treatment rates were 0, 15, and 30 g/a applied as described for 1968. Application dates were June 26, or July 11, or July 25, or August 15. Florigiant and Virginia Bunch 46-2 seeds were planted May 26 in four 36-inch wide rows per plot with 4-inch plant drill spacing or three 18-inch wide rows in a bed with 6-inch plant drill spacing and bordered by 36-inch rows. Plot size was 12 feet wide and 20 feet long. All treatments were completely randomized within blocks replicated five times. Vegetative measurements were made as described previously. In 1969, maximum leaflet length and width were measured using leaves formed at the third node from the apex of the second lateral branches. Plants were dug October 15.

Soil sample analysis prior to planting indicated a pH of 5.4, a high available P level and medium available K, Ca, and Mg levels. The soil contained 2.0% organic matter. Dolomitic lime at a rate of 1 ton/a was disked in the soil prior to planting.

RESULTS AND DISCUSSION

Weather

The total precipitation obtained weekly during the period June through September 1968 and 1969 is plotted in Fig. 1. Rainfall was above average during June and July 1968 and July 1969, and below average during August and September both years. However, soil moisture levels were favorable for growth on the dates of TIBA application shown by the arrows in Fig. 1.

Unshelled Fruit Yields

The yields of unshelled fruit obtained in 1968 and 1969 are given in Table 1. Florigiant yields were significantly 3 higher than Virginia Bunch 46-2 yields both years. TIBA had a significant effect on Florigiant yields in 1969 but not in 1968. Conversely, Virginia Bunch 46-2 yields were influenced most in 1968. Virginia Bunch 46-2 yields for 1968 were statistically adjusted for bird damage which systematically occurred on the top plot of each stack. Since the 1968 Florigiant yields were not significantly influenced by treatments, no adjustment

3. Statistical significance in this paper is based on the 5% level.

was made for bird damage.

The highest Virginia Bunch 46-2 yield in 1968 was obtained from the 80 g/a rate applied June 26, however, check plot yields were statistically equivalent. The 160 g/a rate decreased 1968 yields of the bunch cultivar below check plot yields for all dates of application. When the 1968 data for both cultivars were combined, average yields for the June and July spray treatments were significantly higher than the August spraying. Data combined over both cultivars and dates indicated that average yields for all TIBA treatments except the 80 g/a rate were significantly lower than the check, and the 20 and 160 g/a rates were lowest.

In 1969, the yields of Florigiant were increased by both the 15 and 30 g/a rates sprayed June 26. TIBA did not effect yields significantly when applied on the other three dates. When the data for each cultivar are combined over dates, yields from the 15 g/a rate were highest in Virginia Bunch 46-2 and yields from the 30 g/a rate were significantly higher than the check in Florigiant.

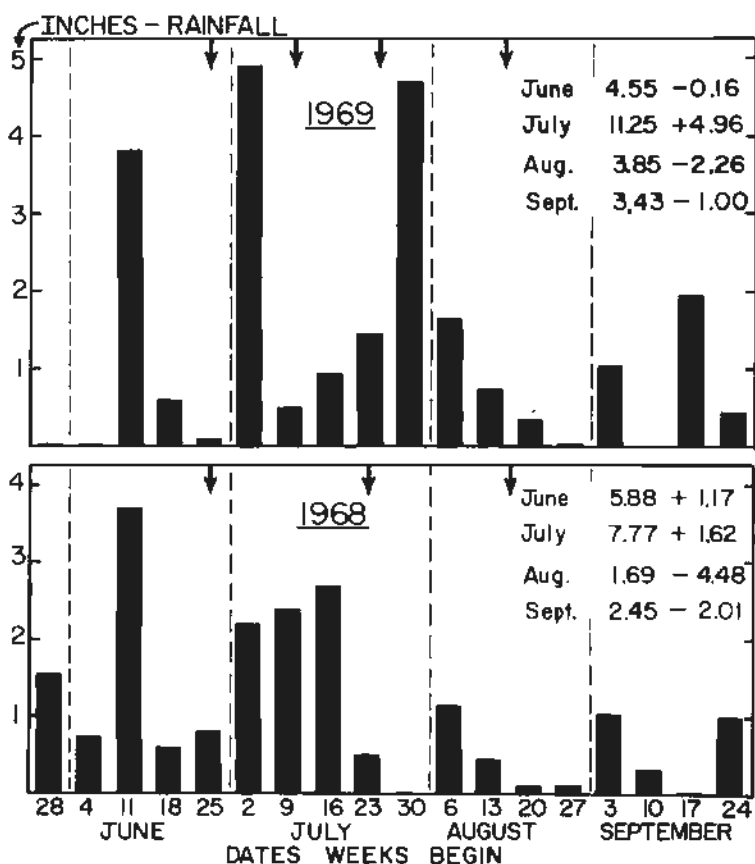


Figure 1. Total precipitation by 7-day periods and monthly with departures from the 35-year mean during peanut development, Holland, Va. 1968 and 1969. The arrows represent TIBA application dates.

Fancy Pods

The effect of TIBA rates on the percentages of fancy size pods or fruit obtained in 1968 was significant only when data were combined over cultivars (Table 2). Pod size was significantly larger in plots sprayed in August than for the plots sprayed in June. In the data combined over dates, pod size was higher for the 80 g/a rate than for the 20 and 160 g/a treatments.

The July 25 spraying was the only TIBA application that influenced pod size in 1969 (Table 2). Both rates significantly increased pod size over the check in Virginia Bunch 46-2, but only the 30 g/a rate increased pod size of Florigiant. Data combined over dates and cultivars indicate that the average pod size was significantly increased by both TIBA rates.

Seed Size

The percentages of extra large seed obtained in 1968 and 1969 are presented in Table 3. In 1968, spray-date-treatment means were similar within cultivars, but when combined for both cultivars, the peanuts sprayed in August produced significantly more extra large seed than those sprayed in June. Most of this difference occurred in the bunch cultivar. Among the 1968 TIBA rate-treatment means of all dates and both cultivars, only the 40 g/a rate significantly increased the extra large seed content over that in the check treatment. The 30 g/a rate significantly increased extra large seed content in each cultivar sprayed August 15, 1969. Similar trends occurred for the other dates in 1969.

Data combined over dates and cultivars indicate that the average extra large seed content was significantly higher for the 30 g/a TIBA rate than the 15 g/a rate which, in turn, was significantly higher than for the check treatment.

The percentages of sound mature seed obtained are given in Table 4. No significant differences were found among the TIBA-treatment means in 1968, except when the data were combined over cultivars and dates. Then the 40 g/a-rate mean was higher than the 20 g/a-rate or check means, although differences were small. In 1969, both rates of TIBA significantly increased the content of this seed size in both cultivars sprayed June 26. TIBA applied on the other dates did not influence this factor, significantly. However, when the data were combined over all dates and cultivars, the TIBA treatment means were higher than the check treatment mean.

Vegetative Effects

Outer internode lengths measured at two dates in 1968 are given in Table 5. There was no significant difference among the TIBA-rate treatment means in the data obtained August 12 unless both dates of application were combined over cultivars. Then outer internode length was significantly shorter for the 10, 20, and 160 g/a rates than for the 0 or 80 g/a rate. TIBA applied July 23 caused significantly shorter outer internodes of both cultivars in the August measurement than did TIBA applied June 26. Similar results also were obtained in the September measurement. However, some differences were noted among TIBA rate treatment means for the July 23 spraying. In the bunch cultivar, outer internodes of plants sprayed at the 160 g/a rate were significantly shorter than

Table 1. Effect of several rates and dates of application of TIBA in 1968 and 1969 on yields of two large-seeded Virginia type cultivars, Holland, Va.

TIBA (g/a)	Yield Unshelled Peanuts (Lb/a - 8% moisture)					Mean ²
	1968					2-Cultivars
	June 26	July 23	Aug. 16	Average		
VIRGINIA BUNCH 46-2 ²						
0	-	-	-	4105a	4435a	
10	3590 bc ^a	4285a	4010a	3960a	4140 bc	
20	3865abc	3815ab	3645 bc	3775a	4005 cd	
40	3815abc	4120a	3900ab	3945a	4145 bc	
80	4310a	4055a	4155a	4175a	4275ab	
160	3420 c	3500 b	3315 c	3410 b	3875 d	
Mean ¹	3800B ^a	3955B	3805B	3955B		
FLORIGIANT						
0	-	-	-	4490		
10	4430	4240	4380	4355		
20	4500	4310	5995	4265		
40	4790	4000	4500	4430		
80	4430	4250	4275	4320		
160	4335	4335	4100	4260		
Mean ¹	4500A	4225A	4250A	4325A		
Mean(Date) ^{1,2}	4210a	4130a	3935 b			
	1969					Mean
	June 26	July 11	July 25	Aug. 15	Average	2-Cultivars
VIRGINIA BUNCH 46-2						
0	3330	3360	3195	-	3360 b	3475 b
15	3720	3620	3350	3585	3650a	3705a
30	3680	2980	3500	3610	3320 b	3630ab
Mean ¹	3600	3300B	3425B	3600	3485B	
FLORIGIANT						
0	3370 b	3580	3725	-	3590 b	
15	3850a	3770	3840	3585	3760ab	
30	4080a	3920	4135	3610	3935a	
Mean ¹	3965	3845A	3990A	3600	3850A	

* / Treatment means followed by all unlike letters are significantly different at the 5% level. Large letters compare cultivar means.

1 / Represents TIBA treatments only.

2 / Values are statistically adjusted for bird damage (see text).

Table 2. Effect of several rates and dates of application of TIBA in 1968 and 1969 on pod size of two large-seeded Virginia type cultivars, Holland, Va.

TIBA (g/a)	Percentage Fancy Pods (34/64-inch minimum diameter)					Mean
	1968					2-Cultivars
	June 26	July 23	Aug. 16	Average		
VIRGINIA BUNCH 46-2						
0	-	-	-	87	85ab ^a	
10	87	88	90	88	85ab	
20	89	87	86	88	83 b	
40	91	90	92	91	85ab	
80	89	90	93	91	86a	
160	86	88	87	87	84 b	
Mean ¹	86A ^a	89A	90A	89A		
FLORIGIANT						
0	-	-	-	80		
10	80	82	81	81		
20	78	78	80	79		
40	80	76	80	79		
80	80	82	82	81		
160	75	84	82	81		
Mean ¹	79B	80B	81B	80B		
Mean(Date) ¹	83.5 b	84.5ab	85.5a			
	1969					Mean
	June 26	July 11	July 25	Aug. 15	Average	2-Cultivars
VIRGINIA BUNCH 46-2						
0	86	86	88 b	-	87	89b
15	86	88	92a	87	89	81a
30	89	90	90a	89	90	82a
Mean ¹	88A	89A	91A	88A	89A	
FLORIGIANT						
0	71	74	72 b	-	72	
15	74	74	73 b	74	74	
30	72	74	77a	74	74	
Mean ¹	73B	74B	76B	74B	74B	

* / See Table 1 for explanation.

1 / Represents TIBA treatments only.

Table 3. Effect of several rates and dates of application of TIBA in 1968 and 1969 on extra large seed content of two large-seeded Virginia type cultivars, Holland, Va.

TIBA (g/a)	Percentage Extra Large Seeds (21.5/64-inch minimum diameter)				
	June 26	July 23	Aug. 16	Average	Mean
	1968				
	June 26	July 23	Aug. 16	Average	2-Cultivars
VIRGINIA BUNCH 46-2					
0	-	-	-	34	28 b*
10	33	32	36	34	30ab
20	34	32	35	34	29 b
40	38	35	38	37	31a
80	34	24	36	35	30ab
160	36	34	33	34	30ab
Mean [†]	35A*	31A	37A	35A	
FLORIGIANT					
0	-	-	-	23	
10	28	25	27	27	
20	24	25	24	24	
40	25	26	26	26	
80	24	26	25	25	
160	26	26	26	27	
Mean [†]	25B	26a	26B	26B	
Mean(Date) ¹	30.0ab	29.5 b	31.5a		
	1969				
	June 26	July 11	July 25	Aug. 15	Mean
	June 26	July 11	July 25	Aug. 15	2-Cultivars
VIRGINIA BUNCH 46-2					
0	26	26	26	-	26
15	30	26	29	27 b	28
30	27	28	30	28a	28
Mean [†]	28A	27A	30A	28A	28A
FLORIGIANT					
0	14	18	17	-	16
15	15	17	16	16 b	16
30	16	20	16	18a	18
Mean [†]	16B	18B	18B	17B	17B

*/- See table 1 for explanation.

¹/ Represents TIBA treatments, only.

Table 4. Effect of several rates and dates of application of TIBA in 1968 and 1969 on sound mature seed content of two large-seeded Virginia type cultivars, Holland, Va.

TIBA (g/a)	Percentage Sound Mature Seeds (15/64-inch minimum diameter)				
	June 26	July 23	Aug. 16	Average	Mean
	1968				
	June 26	July 23	Aug. 16	Average	2-Cultivars
VIRGINIA BUNCH 46-2					
0	-	-	-	68	69.0 b*
10	68	70	69	69	69.6ab
20	68	69	69	69	69.0 b
40	69	70	68	69	70.0a
80	69	68	69	69	69.3ab
160	68	66	67	67	69.1ab
Mean [†]	68B*	68B	68B	68B	
FLORIGIANT					
0	-	-	-	70	
10	71	70	70	70	
20	69	69	70	69	
40	70	70	71	70	
80	70	70	70	70	
160	72	70	70	71	
Mean [†]	70A	70A	70A	70A	
	1969				
	June 26	July 11	July 25	Aug. 15	Mean
	June 26	July 11	July 25	Aug. 15	2-Cultivars
VIRGINIA BUNCH 46-2					
0	62 b	64	62	-	63
15	67a	62	64	66	65
30	64a	60	64	63	63
Mean [†]	66	61	64	64	64
FLORIGIANT					
0	60 b	65	63	-	62
15	65a	66	64	64	65
30	66a	64	67	66	66
Mean [†]	66	65	66	65	66

*/- See Table 1 for explanation.

¹/ Represents TIBA treatments only.

for the 80, 20, or 10 g/a rates, which in turn, were shorter than the 0 or 40 g/a treatments. The 10 and 80 g/a rates failed to reduce internode length in Florigiant plants. When the data were combined over dates and cultivars, internode length was significantly shortest in plants treated with the 160 g/a rate, intermediate from the 80, 40, 20, and 10 g/a rates, and longest in the untreated check plots.

Outer internode lengths measured at three dates in 1969 are given in Table 6. Both TIBA rates in the June 26 spraying significantly reduced internode length in the bunch cultivar, whereas only the 15 g/a rate was effective in Florigiant by the July 18 measurements. In the August 8 measurements, TIBA-treated plants averaged significantly shorter outer internodes in both cultivars when the data were combined over dates of application. Generally, similar results were obtained in the September 4 measurements, except that the plants sprayed July 25 had shorter internodes, particularly from the 15 g/a rate. Outer internode length in Virginia Bunch 46-2 was significantly less than in Florigiant in most cases.

The principal lateral branch lengths measured in 1968 and 1969 are recorded in Table 7. In 1968, the measurements were made early (July 29), but significant differences among both rate-and date-treatment means occurred. Generally, branches of plants sprayed June 26 were shorter than those sprayed July 23. In the bunch cultivar, the 160 g/a rate reduced branch length significantly more than the other TIBA rates except the 20 g/a rate in the July 23 spray application. General results with Florigiant were similar except that the 80 and 160 g/a rates reduced branch length most and all TIBA treated branches were shorter in average length than the checks. Also, for the July 23 spraying, the shortest branches were found in the 20 g/a-plots. Later measurements (September 4) were made in 1969 and TIBA effects were noted principally for the July 11 and 25 sprayings. Branch elongation was decreased significantly by both rates of TIBA. Florigiant branches were considerably longer than Virginia Bunch 46-2 branches.

In 1969 only, mature leaf blades of leaves at the third node were measured on September 4 (Table 8). Blade length was not influenced significantly by TIBA in either cultivar. Small differences were noted among date of application-means for blade width. In the bunch cultivar, blade width was significantly less in the plants sprayed July 11 than for those sprayed June 26 and August 15. The average width of blades treated at the 30 g/a rate was shorter than for the 0 or 15 g/a rate. The date of application effects were similar in Virginia Bunch 46-2 and Florigiant, but the rate effects were not significant in the latter. The average maximum length and width of Florigiant blades were significantly longer than for Virginia Bunch 46-2.

Certain other general effects of TIBA were noted each year. A more than normal vertical orientation of the branches occurred particularly in Virginia Bunch 46-2. There was a temporary leaflet rolling or puckering following TIBA application at the higher rates. The 80 and 160 g/a rates in 1968 caused a speckled condition on the leaves, but the plants appeared completely healthy.

CONCLUSIONS

None of the TIBA treatments studied had large effects on Virginia Bunch 46-2

Table 5. Effect of five rates and three dates of application of TIBA on outer internode length in the second lateral branches of two large-seeded Virginia type cultivars, Holland, Va., 1968.

TIBA (g/s)	Outer Internode Length (Inches)				Mean 2-Cultivars
	June 26	July 23	Aug. 16	Average	
VIRGINIA BUNCH 46-2 - MEASURED AUG. 12					
0	-	-	-	1.62	1.64a*
10	1.56	1.45	-	1.50	1.58 b
20	1.49	1.56	-	1.52	1.56 b
40	1.69	1.64	-	1.66	1.66a
80	1.76	1.37	-	1.56	1.62ab
160	1.75	1.39	-	1.57	1.58 b
Mean	1.65B*	1.48A	-	1.56	1.60
FLORIGIANT - MEASURED AUG. 12					
0	-	-	-	1.67	
10	1.63	1.69	-	1.66	
20	1.74	1.46	-	1.60	
40	1.74	1.58	-	1.66	
80	1.80	1.54	-	1.67	
160	1.68	1.48	-	1.58	
Mean	1.72B	1.55A	-	1.63	
VIRGINIA BUNCH 46-2 - MEASURED SEPT. 16					
0	-	-	-	1.24	1.30 c
10	1.16	1.19 b	1.19	1.18	1.23 b
20	1.24	1.16 b	1.22	1.20	1.23 b
40	1.28	1.24 c	1.20	1.24	1.24 b
80	1.22	1.14 b	1.20	1.19	1.24 b
160	1.19	1.02a	1.14	1.12	1.18a
Mean	1.22B	1.15A	1.19B	1.18b	1.22
FLORIGIANT - MEASURED SEPT. 16					
0	-	-	-	1.36	
10	1.25	1.31 b	1.28	1.28	
20	1.31	1.20a	1.26	1.26	
40	1.23	1.22a	1.26	1.24	
80	1.33	1.24ab	1.28	1.29	
160	1.25	1.20a	1.24	1.24	
Mean	1.28B	1.23A	1.27B	1.26a	

*/ See Table 1 for explanation. Large letters compare dates within cultivars.
/ Represents TIBA treatments, only.

Table 6. Effect of two rates and four dates of application of TIBA on outer internode length in the second lateral branches of two large-seeded Virginia type cultivars, Holland, Va. 1969.

TIBA (g/s)	Outer Internode Length (Inches)				Mean 2-Cultivars
	June 26	July 11	July 25	Aug. 15	Average
VIRGINIA BUNCH 46-2 - MEASURED JULY 13					
0	1.28 b*	0.96	-	-	1.12
15	1.60a	1.04	-	-	1.02
30	0.96a	1.08	-	-	1.02
Mean	0.98B	1.06B	-	-	1.02B
FLORIGIANT - MEASURED JULY 13					
0	1.68 b	1.84	-	-	1.72
15	1.52a	1.72	-	-	1.62
30	1.72 b	1.64	-	-	1.68
Mean	1.62A	1.68A	-	-	1.65A
VIRGINIA BUNCH 46-2 - MEASURED AUG. 8					
0	2.20	2.12	2.32	-	2.21 b
15	2.24	1.96	2.12	-	2.11a
30	2.16	2.00	2.16	-	2.11a
Mean	2.20B	1.98B	2.14B	-	2.11B
FLORIGIANT - MEASURED AUG. 8					
0	2.36	2.52	2.40	-	2.43 b
15	2.44	2.36	2.28	-	2.36a
30	2.44	2.24	2.44	-	2.37a
Mean	2.44A	2.30A	2.36A	-	2.37A
VIRGINIA BUNCH 46-2 - MEASURED SEPT. 4					
0	0.76	0.88	0.92 b	0.84	0.85 b
15	0.84	0.72	0.72a	0.76	0.78a
30	0.72	0.76	0.80ab	0.76	0.76a
Mean	0.79B	0.74	0.76	0.76	0.79
FLORIGIANT - MEASURED SEPT. 4					
0	0.96	0.80	0.88 b	0.88	0.88 b
15	0.88	0.80	0.72a	0.80	0.80a
30	0.80	0.72	0.76ab	0.88	0.84ab
Mean	0.84A	0.86	0.74	0.84	0.82A

*/ See Table 1 for explanation.
/ Represents TIBA treatments, only.

Table 7. Effect of several rates and dates of application of TIBA in 1968 and 1969 on first (1968) or second (1969) lateral branch length in 2-large-seeded Virginia type cultivars, Holland, Va.

TIBA (g/s)	Branch Length (Inches)				
	1968				
	June 26		July 23	Average	
VIRGINIA BUNCH 46-2 - MEASURED JULY 29					
0	-		-	9.8 b	
10	9.5 bc*		10.0 c	9.8 b	
20	8.4a		9.4 b	8.9a	
40	10.0 c		9.4 b	9.7 b	
80	9.2ab		9.8 bc	9.5 b	
160	8.5a		8.9a	8.7a	
Mean ¹	9.1A*		9.5A	9.3A	
FLORIGIANT - MEASURED - JULY 29					
0	-		-	15.2 c	
10	13.6abc		15.3 c	14.4 b	
20	15.0 c		13.5a	14.2 b	
40	14.0 bc		14.5ab	14.2 b	
80	12.6ab		14.8 bc	13.7a	
160	12.2a		14.4ab	13.3a	
Mean ¹	13.3B		14.5B	14.0B	
Mean ¹ (dates)	11.3a		12.0 b		
	1969				
	June 26	July 11	July 25	Aug. 15	
VIRGINIA BUNCH 46-2 - MEASURED SEPT. 4					
0	20.2	21.9 c	21.2 b	-	21.1 b
15	21.1	20.0 b	19.2a	20.7	20.2a
30	19.2	19.0a	20.3ab	19.0	19.4a
Mean ¹	20.0A	19.5A	19.8A	19.8A	19.8A
FLORIGIANT - MEASURED - SEPT. 4					
0	25.2	25.2 b	25.1 b	-	25.2 b
15	23.8	25.9 b	24.3a	25.5	24.9a
30	24.6	23.7a	24.5a	27.0	24.9a
Mean ¹	24.1B	24.6B	24.4B	26.2B	24.9B

* See Table 1 for explanation.

¹ Represents TIBA treatments, only.

Table 8. Effect of two rates and three dates of application of TIBA on the length and width of leaf blades at the third node from the apex of the second lateral branches of two large-seeded Virginia type cultivars, September 4, 1969, Holland, Va.

TIBA (g/s)	June 26	July 11	July 25	Aug. 15	Average
VIRGINIA BUNCH 46-2 (B)*					
LEAF BLADE LENGTH (INCHES)					
0	2.16	2.16	2.24	-	2.19
15	2.24	2.16	2.16	2.20	2.19
30	2.16	2.24	2.12	2.16	2.17
Mean ¹	2.20	2.20	2.14	2.18	2.18
LEAF BLADE WIDTH (INCHES)					
0	1.08	1.08	1.12	-	1.09 b
15	1.12	1.04	1.08	1.08	1.08 b
30	1.04	1.04	1.04	1.08	1.05a
Mean ¹	1.08 b*	1.04a	1.06ab	1.08 b	1.06
FLORIGIANT (A)					
LEAF BLADE LENGTH (INCHES)					
0	2.24	2.32	2.32	-	2.29
15	2.24	2.28	2.32	2.40	2.31
30	2.44	2.32	2.28	2.32	2.34
Mean ¹	2.34	2.30	2.30	2.36	2.32
LEAF BLADE WIDTH (INCHES)					
0	1.16	1.16	1.16	-	1.16
15	1.20	1.12	1.16	1.20	1.17
30	1.20	1.12	1.12	1.20	1.16
Mean ¹	1.20 b	1.12a	1.14a	1.20 b	1.16

* See Table 1 for explanation.

¹ Represents TIBA treatments, only.

or Florigiant peanuts. The data indicate that TIBA effects on yields were greatest when TIBA was applied at early flowering stage. On the other hand, TIBA application at about the peak flowering stage restricted vegetative growth most toward maturity, whereas the effects of earlier applications tended to disappear. Hence, multiple applications beginning when the first flowers appear and ending in the full flower stage may be more effective on large-seeded Virginia-type peanuts.

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PROTECTING THE ENVIRONMENT DURING PROCESSING

by

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This group has been asked by the Program Chairman, Bill Dickens, to discuss the Protection of the Environment During the Processing of Peanuts.

Before we get started I want to introduce the gentlemen on this panel. Some of you know Mr. W. M. Birdsong, Jr. of the Pretlow Peanut Division of Birdsong Storage Company at Franklin, Virginia who will discuss the hull problem in the shelling plants and may offer us some suggestions as to how we might improve our environment by doing something else with hulls.

Mr. M. L. Benson is with the Western Precipitation Division of Joy Manufacturing Company whose office is in Hillside, Illinois. Mel will show us a film that was prepared by the Industrial Gas Cleaning Institute of Rye, New York.

I am Jim Roe, a partner of Tate and Roe of Dallas. For the past 24 years we have worked with the peanut industries in the southwest and other areas. Along with several other members of our firm I am a Professional Engineer registered in both Texas and Oklahoma and have been for the past 32 years.

As stated this will be a discussion group and each of you are requested to ask questions and add comments if you so desire. We will limit our discussion to the control of pollution from any peanut processing plant. We are all familiar with the pollution control boards and we are lead to believe we are not going to be permitted to discharge particulate matter into the atmosphere or into streams except in very limited quantities. Most of the State and Local Standards will be based on the National Codes and in some cases will be much more rigid.

There are Professional Services that are available to determine to what extent a plant is in violation of the existing codes but these services are expensive based on the time required to take samples and readings. The cost will be in the neighborhood of \$2,000.00 to \$4,000.00 per plant depending on the extent of the report.

Probably the first thing any plant is to do is to instigate a very rigid maintenance program and do a better job of housekeeping. Any holes in the air systems should be repaired at once. When particulate matter is allowed to accumulate on roofs or on the ground there is a possibility that it will get picked up by the wind and carried across the property line. Regardless of the equipment used unless it is properly maintained and good housekeeping practiced the results will not be good. I would suggest that anyone interested in the handling of air get a copy of Industrial Ventilation Manual of Recommended Practice as published by the Committee on Industrial Ventilation as it covers the whole field rather completely. Copies of the regulations from each State can be obtained from the Air Control Board.

When you ask for the standard that apply to your locality you will be furnished a list of units that will be permitted at the source or at the property line. We will not try to go into detail on these requirements but you might be interested in some of the terms and units that might be used.

The land usage is divided into type such as:

Type 'A' - Residential or Recreational

Type 'B' - Business or Commercial

Type 'C' - Industrial

Type e 'D' - Other than 'A', 'B', or 'C'.

Each of these types will have limits as to the amount of Particulate Matter that will be allowed. These units will probably be in micrograms per cubic meter or parts per million. In most cases with the peanut industries the units will be micrograms per cubic meter. A microgram is one millionth of a gram. There are 453.6 grams per pound and a cubic meter is approximately 35.3 cubic feet. As we are more familiar with pounds and cubic feet - lets assume the plant has five cyclones each handling 5000 C.F.M. The plant is located in an area that has a permissible emission of 175 micrograms per cubic meter. The plant will be permitted to release .0164 pounds per hour, or to state it differently you can release one pound of Particulate Matter every 61 hours. I am snre each of you who has been around any process plant will realize that a great deal of work will need to be done to meet these conditions.

Another term you will become familiar with is a micron. A micron is one millionth of a meter or approximately one twenty five thousandth of an inch. In selecting the proper method of collecting Particulate Matter the physical size of the particles will be one of the determining factors.

The Particulate Matter in smoke will vary in size of .001 to .3 microns. You can see that particles this size are ultra microcopic and can only be seen with high power microscope. To remove these particles an electrical precipitator will be required.

For particles from .3 to 10 Microns we can use the standard commercial felt type filters. Most of you have seen this type filter but as a reminder you will recall the felt bags are about the same as a felt hat. You will remember that it will take 2500 of the 10 micron size to equal one inch. Filters with woven fabrics or felts that are porous will not filter out the smaller size particles.

Woven cloth filters may be used to collect particles from 10 microns to 60 microns. It should be remembered that the woven cloth or felt can only stop particles that are larger than the spaces between the fibers. Cleaning mechanisms have to be provided to keep the filter media clean or the particles will build up on the media and the power to force the air through the cloth or felt will become prohibitive or the fan, running at a fixed speed, will develop its maximum static pressure but handle very little air.

Centrifugal Cleaners or Cyclones will do a good job on particle sizes from 60 microns up if they have enough mass to be separated from the air by centrifugal force. There are many types of cyclone collectors available but all of them work on the same principle. The proper application of the cyclone will do a good job if it is correctly sized and the particles have enough mass to cause them to be held against the cone and not get air borne and discharged with the air.

All of these separations are known as dry type separators and are the types used where you do not have elevated temperatures or unusual conditions. Wet or scrubber separators are used where the conditions are such that a dry type separator is not applicable.

Before we get into the discussion and questions - I will ask Mel Benson to make his remarks on air pollution and show us the film, "The Air We Breath."

Following the picture we will ask Bill Birdsong for his comments on how we can help the environment around the processing plant by trying to do something with hulls besides grinding them.

EFFICACY OF CHEMICALS FOR CONTROL OF AFLATOXINS IN PEANUT PODS

by

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INTRODUCTION

Aflatoxin contamination of oil seed crops, especially peanut, has caused concern for human and animal health. Research has indicated that prevention is more practical than detoxification of contaminated products. Chemicals that inhibit or retard growth of aflatoxigenic fungi and/or elaboration of aflatoxins, primarily in artificial and to a lesser extent in natural substrates, have been investigated (1,2,3,4,5,6,7,9). The types of chemicals tested included polyvalent metal compounds, oxidants, enzyme inhibitors, and fungistats-fungicides.

Chemical control of aflatoxins in peanut presents serious problems. The primary fungi involved, *Aspergillus flavus* Link and *A. parasiticus* Speare, are ubiquitous and capable of colonizing diverse organic substrates under broad ranges of moisture and temperature. Peanut pods may become infected by aflatoxigenic fungi before digging, in the windrow, during curing, and in storage. Fungi in interocular areas and in kernel tissues cannot be reached easily by treatment of pod surfaces. Commercial chemicals must be effective fungistats-fungicides, safe in food and feed and must not reduce quality of harvested peanuts.

One objective of this study was to screen diverse classes of chemicals on rehydrated, whole naturally fungal-infested pods under controlled moisture and temperature for prevention or reduction of *A. flavus*-*A. parasiticus* and/or aflatoxin accumulation. Primary emphasis was placed on chemicals used in foods or feed as preservatives or stabilizers. Secondary emphasis was placed on fungicides.

MATERIALS AND METHODS

Whole, naturally fungal-infested pods of cultivar Starr were rehydrated by holding in moist flannel cloth 24 hours at 24 C. Rehydrated pods were soaked 2 minutes in aqueous solutions or suspensions of chemicals listed in Table 1. Three 100-pod replicates, unless otherwise noted, of each treatment were placed in shallow pans and maintained at 99% RH-27 C for 7 days in constant humidity/temperature cabinets. After incubation 50 randomly selected kernels from each replicate were soaked 3 minutes in 0.5% w/v sodium hypochlorite and plated, five per petri dish, on warm rose bengal-streptomycin agar. Plated kernels were held 5 days at 27 C and fungal colonies enumerated. Twenty-five grams of kernels from each replicate were assayed for aflatoxins by the aqueous acetone method (8).

Table 1. Laboratory studies on efficacy of chemicals for control of aflatoxins, *Aspergillus flavus*-*A. parasiticus*, and other fungi in peanut kernels from naturally infested whole pods soaked two minutes in aqueous solutions or suspensions.

Treatment	Aflatoxins, total ppb, (% of control)	<i>Aspergillus flavus</i> - <i>A. parasiticus</i> (% of control)	Other fungi (% of control)
Mean two replicates ^a			
Sodium bisulfite 1%	20	86	144
Sodium bisulfite 10%	-0-	95	111
Potassium meta-bisulfite 1%	181	93	133
Potassium meta-bisulfite 10%	179	100	188
Sodium meta-bisulfite 1%	91	100	222
Sodium meta-bisulfite 10%	-0-	93	133
Calcium hypochlorite 1%	108	70	141
Calcium hypochlorite 10%	-0-	102	83
Sodium hypochlorite 0.53%	31	82	141
Sodium hypochlorite 5.3%	11	107	66
Mean three replicates ^a			
Potassium sulfite 1%	246	78	100
Potassium sulfite 10%	75	146	63
Hydrogen peroxide 1%	70	89	118
Hydrogen peroxide 3%	57	78	109
Potassium azide 1%	-0-	120	111
Potassium azide 10%	-0-	-0-	-0-
Boracic acid 1%	-0-	60	108
Boracic acid 10%	-0-	-0-	41
Calcium ortho-phosphate 1%	41	85	154
Calcium ortho-phosphate 10%	12	100	127
Aluminum potassium sulfate 1%	246	110	108
Aluminum potassium sulfate 10%	16	160	116
Ferric oxide 1%	80	100	133
Ferric oxide 10%	201	120	108
Formaldehyde 1%	1	46	136
Formaldehyde 10%	11	107	72
Acetic Acid 1%	16	114	100
Acetic Acid 10%	-0-	107	36
Propionic acid 1%	87	125	127
Propionic acid 10%	62	92	45
Nutonex sulfur 7.2 g/liter of 94% a.i.	22	28	154
Nutonex sulfur 21.6 g/liter of 94% a.i.	58	170	116
Lime sulfur 52.6 ml/liter of 30% a.i.	12	104	82
Lime sulfur 157.8 ml/liter of 30% a.i.	11	144	82
Benomyl 3 g/liter of 50% a.i.	10	114	109
Benomyl 9 g/liter of 50% a.i.	34	96	90
Daconil 1.8 g/liter of 75% a.i.	57	88	82

^a Twenty-five grams of kernels for aflatoxins and 50 kernels for fungi per replicate.

RESULTS AND DISCUSSION

Aflatoxins were not recovered from kernels of whole pods treated with potassium azide and boracic acid or with 10% sodium bisulfite, sodium meta-bisulfite, calcium hypochlorite, and acetic acid (Table 1). Aflatoxins found in kernels of pods treated with formaldehyde, lime sulfur, sodium hypochlorite-5.3%, calcium ortho-phosphate-10%, aluminum potassium sulfate-10%, and acetic acid-1% were in amounts less than 15% of control. [Potassium meta-bisulfite, calcium hypochlorite-1%, potassium sulfite-1% aluminum potassium sulfate - 1%, and ferric oxide - 10% may have stimulated aflatoxin production and/or accumulation.

Numbers of isolated colonies of *A. flavus*-*A. parasiticus* did not always correlate with recovery of aflatoxins (Table 1). No fungi were isolated from the potassium azide-10% treatment, and no *A. flavus*-*A. parasiticus* was isolated from the boracic acid-10% treatment. In contrast aflatoxins were not recovered from eight treatments. In most treatments colonies of the *A. flavus* fungal group and other fungi exceeded those of the control.

Outer surfaces of dry stock pods were clean and bright. Surfaces of pods treated with acetic and propionic acids retained their bright color. Red deposits of ferric oxide occurred on pod surfaces so treated. Aluminum potassium sulfate and boracic acid crystals occurred on surfaces of pods treated with 10% solutions. Pod surfaces and kernels in the potassium azide-10% treatment were deep brown to black. Coloration of pod surfaces in other treatments ranged from slightly to moderately blackened or black spotted. Discoloration apparently resulted from microfloral colonization rather than from chemical treatment.

In this study 2 minute soaks in certain chemicals prevented or greatly reduced recovery of aflatoxins from kernels in whole, naturally fungal-infested, rehydrated peanut pods. Treated pods were infested internally with aflatoxigenic fungi and incubated in a manner to favor aflatoxin accumulation. Possible changes in kernel quality resulting from chemical treatment were not examined, but this would have to be determined before these or other chemicals could be used commercially. The efficacy and economic practicality of applying any of these or similar chemicals to windrowed peanuts for prevention of aflatoxin contamination are not known. These general types of chemicals might be desirable from a public health standpoint. The more effective treatments are to be applied to windrowed peanuts.

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PEANUT HULLS – THE GROWING NEED FOR NEW MARKETS & RESEARCH

by

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First of all, let me assure you that I am not here today to sell peanut hulls to any of you, but rather to sell you on some ideas concerning this product.

For a number of years peanut hulls were thought of by many of us as a waste product -- something to be disposed of, or something left to rot in piles like sawdust or old rusty automobiles. However, several periods of transition have taken place regarding the hulls since they became a problem with the advent of shelling plants. Some areas have a concentration of shelling plants, while in other areas the plants are widely spread.

For a period of time many of us thought we had the problem solved. Incinerators were installed at a number of plants, the hulls were burned, and we literally washed our hands of this disposal problem. A new day has come! Now with all the problems of air pollution, we have just as big a headache from the ash fall-out from the incinerators as we had with the other methods of hull disposal.

There are already many uses for peanut hulls but not enough to take the volume of hulls produced during the shelling season. Present uses include: (1) Litter for all types of poultry, chickens, turkeys, and ducks; (2) Bedding for dairy and beef cattle, hogs, horses, sheep and even rabbits; (3) Mulch for roses, rhododendrons, chrysanthemums, snapdragons, tomatoes, strawberries, and many other plants; (4) Soil conditioner for both inside and outside greenhouses and in potted plants; (5) Roughage for feeding beef cattle, dairy cattle, sheep, zoo animals, and other ruminant animals; (6) As a carrier for insecticides and pesticides; (7) As a conditioner in fertilizers. All of the above markets are most sporadic with the demand depending mostly on weather conditions. This means some good years and some bad years. No single use or combination of these uses seems to be large enough to take the output of approximately 270,000 tons of hulls produced. Or, perhaps I should say, we haven't found this use yet!

Well, what are the physical characteristics of peanut hulls? They are all organic, light and flaky, resist crusting and packing, have a good area coverage, one cubic foot weighs about 7 pounds, they are dry and porous, will absorb about 52% of their weight, and will analyze with a fertilizing value of approximately 1-0-1. These characteristics are definite assets for soil conditioning and bedding uses. They decompose so slowly that they do not leach nitrogen from the soil. They have a total digestible nutrient value of about 25%, crude protein value of about 7%, crude fiber about 60%, nitrogen free extract of about 20%, and about 29% lignin. Additional analysis is as follows: (figures approximate) acidity 3/4 of 1%, density .39%, ash 3%, calcium 1/4 of 1%, phosphorous .03 of 1%, cellulose 45%, pentosans 18%, dry matter 90%, ether extract 5%. The analysis will vary -- on some just a little bit and on others much greater. Some of

this information is 20 years old.

We know this information and more, but it just isn't enough! We need additional information and ideas. It is our feeling that peanut hulls are a very valuable product, however, we must find new and greater markets than we now have to utilize the peanut hull production. This can only be done through research. It cannot be done by one plant working alone, but this project must be backed by the entire peanut industry. In order to get this research done by competent people, we must have funds and these funds will have to be appropriated by the government, federal and state, and even local, if necessary.

A committee has been formed to work on ideas for new projects for research with peanut hulls. This is a new committee and has only had two meetings, but we hope we are beginning to get a few wheels turning. Research is the forerunner of every major breakthrough. Positive approaches for solving the peanut hull disposal problem must be made.

Our company has had some experiments run. We have sent samples to certain companies. If the experiments did not work out favorably for the particular use these companies had in mind, the project was dropped. We need research to further determine how to make hulls work for particular uses.

One drawback is, of course, that we are a seasonal business. However, we have found that the people who are really sold on hulls will find a place to store them during our "off" season. Also, if the price is right, and the market is there, the shellers might be forced to store hulls in vacant warehouses.

After we have gone ahead with our research program and found new uses for peanut hulls, our job has really just begun. We must find new markets and outlets; and equally important, we must educate the people about the uses for this product. Every phase of the peanut industry can have a part in finding new markets. Look about your part of the country, your community, and point out how the hulls can be used to advantage in all places possible. I hope that each of you will really take this message to heart, for we do need and solicit your help.

To give you an example of what we are doing, the disposal of peanut hulls is not a seasonal business with us at Birdsong Storage Company, Inc. We are continually looking for new markets, following up on new leads, donating hulls for experiments, and trying to find out any possible new uses. Also, before we have finished shipping for one season, we are already working on a new sales program for the new crop. With us, peanut hulls is a business -- one which we hope will continue to grow and expand each and every year.

A breakdown of peanut hull production is about 60,000 tons in the Virginia-Carolina area and the Southwest area, and about 150,000 tons in the Southeast producing area.

Now! Let's go through some ideas for possible uses of peanut hulls.

As roughage in cattle rations, regular hulls, cubed hulls, or pelletized hulls.

As poultry litter and livestock bedding.

As a mulch for horticultural crops.

As a soil conditioning material.

Flakeboard or particle board for building construction.

To produce furfural and glucose.

To make presto logs for fireplace heating.

For peanut hull flour or powder as a filler in plastics, dynamite, linoleum,

formica, synthetic adhesives, insulation board or furniture core filler, or acoustical panel board.

In floor sweeping compounds.

In a mud compound for oil drilling.

For charcoal cooking.

Activated charcoal for use as a decolorizing and a deodorizing agent.

As a natural habitat for microorganisms that have natural antibiotic properties.

Dry cleaning and fur cleaning.

Making fortified peanut hull pellets for use when planting trees, shrubs, or plants.

As an abrasive or polisher for steel or other products.

As a carrier for pesticides.

Making high protein foods from cellulose wastes (idea from Louisiana State University).

As a substitute for cork in insulation.

For making paper or cardboard.

In the preparation of magnesia tiles and plaster.

In making peat pots for potted plants for nursery and greenhouse use.

As a replacement for wood flour in molding sand for foundry use.

The above are just a few ideas for uses of peanut hulls. We do have some information for some of these uses but we are lacking information on others. Is there any doubt in your mind that experiments and research are needed?

EFFECTS OF DRYING, STORAGE GASES AND TEMPERATURE ON DEVELOPMENT OF MYCOFLORA AND AFLATOXINS IN STORED HIGH-MOISTURE PEANUTS ^a

by

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INTRODUCTION

Aflatoxins, and probably other mycotoxins, may be produced in peanut kernels as a result of development of mold fungi on incompletely dried or rain wetted pods after harvest. The kernels are even more likely to contain toxins as a result of mold development during bulk storage of pods in the interval after harvest preceeding final drying at a drying or processing plant. Aflatoxins, produced by *Aspergillus flavus*, are highly toxic and are sometimes carcinogenic to many warm-blooded animals. Because of the possible health hazard involved in using kernels from moldy pods, much research is being directed toward finding highly effective methods for preventing mold development and consequent toxin contamination of harvested peanuts. This paper reports results of research at Oklahoma State University directed toward control of mold development on high moisture peanut pods by storage in anaerobic and fungitoxic gases at two temperatures during 1968 and 1969. An abstract of the 1968 work has been published (4).

MATERIALS AND METHODS

Freshly harvested and field-dried (approx. 20% moisture) Starr peanuts were brought into a Department of Agricultural Engineering laboratory, and all soil clods, stem pieces, and rotting and immature pods were removed. Twenty-three pound lots of pods were spray-inoculated with a water suspension of conidia of *A. flavus*. Inoculated pods were placed in replicated (3X) polyvinyl chloride cylinders (1.6 ft. 3) equipped with plexiglass bottoms containing a gas inlet port. A false bottom of wire mesh prevented blockage of the port and aided gas diffusion. Removable plexiglass tops equipped with a gas outlet port were clamped in place. A thermistor in each outlet was connected to a temperature recording unit. During 1969, thermistors were not used after it was found in 1968 that the effluent gases and peanuts remained at the same temperature as the storage temperatures. One set of replicated cylinders was kept at ambient room temperature (70 degrees - 75 degrees F.) and a second set was kept in a

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cold room held at 35 degrees - 40 degrees F. These gases were metered through flowmeters and fed into the cylinders through chemically resistant plastic tubing at 0.5 cubic foot per hour. During 1968 and 1969, undiluted N₂ and CO₂ were used as test anaerobic storage gases selected on the basis of commercial usage on certain other crops and results from previous work elsewhere on peanuts (1, 5, 6, 7). During 1969, a mixture of 5 percent SO₂ and 95 percent N₂ by volume was also tested. Sulfur dioxide was selected as a test fungi toxic gas because it was found to be highly toxic to many peanut mold fungi (Table 1) (2, 3), and because it is used commercially as a mold inhibitor during drying of dried fruit products. Compressed air was used as a check gas each year. The gases were fed through the test chambers for 32 days. Equivalent volumes of treated pods were removed at scheduled intervals for fungal isolation work, aflatoxin analyses, quality determination and moisture content. Aflatoxin analyses were performed by WARF Institute, Madison, Wisconsin. Appearance of treated pods, odor, and mold development were recorded regularly.

RESULTS

Results of the 1968 tests are presented in Tables 2 and 3. Initial kernel moisture contents remained constant throughout the tests. Within 2 days air-treated pods, left at ambient room temperature during both years, became covered with a dense growth of mold consisting of species of *Fusarium*, *Rhizopus*, and *Mucor*. In 1968, these fungi soon became overgrown with *A. flavus*. In both years mold development on the high moisture pods was prevented for over 16 days by a CO₂ environment at ambient room temperature. In the same environment, mold development was prevented on partially dried pods for over 6 days. A N₂ environment at ambient room temperature greatly inhibited mold growth. A CO₂ environment at 35 degree - 40 degrees F completely prevented mold development, and maintained the original appearance of the pods, for 32 days. Similar results were obtained in 1969. In 1969, 5 percent SO₂ in N₂ prevented mold development for 32 days at both temperatures and produced bleached, attractive pods. During both years all moldy pods gave off a moldy odor. Mold free CO₂ and N₂ treated pods gave off a fermentation odor. The SO₂ treated pods yielded bleached kernels with a pronounced rff flavor. Roasting improved the flavor only slightly. Oil extracted from kernels from CO₂ and N₂ treatments was slightly darker than normal and had an odor slightly different from normal. Oil extracted from SO₂ treated kernels was very dark and had an odor distinctly different from normal. Kernels from CO₂ and N₂ treated pods not inoculated with *A. flavus* and determined to be aflatoxin free had minimally acceptable flavors and odors when roasted or made into peanut butter in organoleptic tests conducted by the Department of Agronomy. High concentration of aflatoxins occurred in kernels of pods stored in air at ambient room temperature. Concentrations increased with storage time. Higher concentrations occurred in kernels from high moisture kernels than in those from partially dried pods. All CO₂, N₂ and SO₂ treatments produced aflatoxin-free kernels. Mold fungi were isolated from all visibly mold free CO₂ and N₂ treated pods. Because SO₂ is highly fungitoxic it was assumed that SO₂ treated pods were free of fungi. Of the species present in the apparently mold free pods *A. flavus* was found only rarely. Species of *Fusarium* were predominant,

Table 1. Fungicidal activity of certain fungitoxic gases in controlling 13 peanut mold fungi in agar plate tests in gas canisters.

Gas ^{1/}	Shortest exposure regime that killed all, or most, test fungus species? ^{2/}	Fungi killed ^{3/}
Chlorine	1 min. flush + 0.5 min. hold	All test species
Sulfur dioxide	1 min. flush + 2 min. hold	All test species
Ethylene oxide	4 min. flush + 20 min. hold	All test species
Ammonia	3 min. flush + 30 min. hold	All test species except <i>F. oxysporum</i>
Methyl bromide	3 min. flush + 120 min. hold	All test species except <i>A. niger</i>
Hydrogen sulfide	6 min. flush + 180 min. hold	All test species

^{1/} Flushing flow rate = 2.00 CFH.

^{2/} *Alternaria tenuis*, *Aspergillus flavus*, *A. niger*, *Chaetomium globosum*, *Fusarium moniliforme*, *F. oxysporum*, *F. solani*, *Penicillium citrinum*, *Rhizoctonia solani*, *Rhizopus* sp., *Sclerotium bataticola*, and *Trichoderma viride*.

^{3/} Determined one week after exposure.

Table 2. Effects of gas environments and temperature on development of molds and odors in stored Starr peanut pods. 1968.

Treatment (beginning 10/29/68)	Sampling interval (days after initiation of experiment)				
	2 (10/31/68)	4 (11/2/68)	8 (11/6/68)	16 (11/14/68)	32 (11/30/68)
WXA ^{1/}	Very moldy. ^{2/} Moldy odor.	Very moldy. ^{2/} Moldy odor. Aflatoxins.	Very moldy. ^{2/} Moldy odor. Aflatoxins.	Very moldy. ^{2/} Moldy odor. Aflatoxins.	Discarded at 16 days.
WXC	Very sl. white molding on pods at top. ^{4/}	Slightly moldy. ^{4/}	Moderately moldy. ^{4/} Fermentation odor.	Moderately moldy. ^{4/} Fermentation odor.	Discarded at 16 days.
WXC	No mold. Normal odor.	No mold. Sl. fermentation odor.	No mold. Fermentation odor.	No mold. Fermentation odor.	Moldy. ^{2/} Moldy odor.
CXA	No mold. Normal odor.	No mold. Normal odor.	No mold. Sl. fermentation odor.	Moderately moldy. ^{2/} Moldy odor.	Very moldy. ^{2/} Moldy odor.
CXM	No mold. Normal odor.	No mold. Normal odor.	No mold. Sl. fermentation odor.	No mold. Sl. fermentation odor.	Moldy. ^{4/} Fermentation odor.
CXC	No mold. Normal odor.	No mold. Normal odor.	No mold. Normal odor.	No mold. Normal odor.	No mold. Normal odor.

^{1/} W = Ambient temp. (70-75°F), C = Cold temp. (35-40°F), X = Freshly-dug, high moisture peanuts, A = Air, N = N₂, C = CO₂.

^{2/} Species of *Fusarium* and *Rhizopus* mainly.

^{3/} Mainly *Rhizopus* species.

^{4/} Mainly *Fusarium moniliforme*.

followed by species of *Rhizopus* and *Mucor*. Other fairly frequent isolates included *Rhizoctonia solani*, *Alternaria tenuis*, *Sclerotium bataticola*, and species of *Trichoderma*. *Chaetomium* sp., *Epicoccum nigrum*, and *Aspergillus niger* were occasionally isolated.

DISCUSSION AND CONCLUSIONS

The long-term prevention of mold and aflatoxin development on both high moisture and partially dried peanut pods stored in CO₂ or N₂ without serious loss of flavor shows great promise as a storage technique. While 5 percent SO₂ in N₂ prevented mold development and aflatoxin contamination, the treatment caused serious off flavors in both raw and roasted kernels from the treated pods. The kernels from these pods would not even be salvageable for oil extraction as the treatment caused the oil to become very dark and have an off odor. All treatments involving SO₂ were mold-free throughout the test; and SO₂ is very promising from this standpoint. Perhaps if the concentration of this toxicant were lowered, the disadvantages would be eliminated or reduced to an acceptable level. Oil from CO₂ and N₂ treated pods was slightly darker than normal and had an odor somewhat different from normal. Oil from these treatments should be analyzed to determine if any of the constituents brought about by the treatments are undesirable.

Though CO₂ and N₂ prevented mold development for long periods, fungi could be isolated from treated pods. This illustrates that the two gases exhibited fungistatic rather than fungicidal action. Though *A. flavus* could occasionally be found in these isolations, no aflatoxins were ever found with an assay technique (Best Foods method) with a 2 ppb sensitivity.

Because of the very encouraging results from this investigation, further work has been planned but initiation is dependent upon financial support by an outside agency.

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Table 3. Effects of gas environments and temperature on development of molds and odors in stored Starr peanut pods. 1968.

Treatment (beginning 11/1/68)	3 (11/4/68)	6 (11/7/68)	12 (11/13/68)	24 (11/25/68)	32 (12/3/68)
WYA ^{1/}	Moderately moldy. ^{2/} Moldy odor.	Very moldy. ^{3/} Moldy odor. Aflatoxins	Very moldy. ^{3/} Moldy odor. Aflatoxins	Discarded at 12 days.	
WYN	Dots of white mold on top pods. ^{4/} Fermentation odor.	White mold on top pods. ^{4/} Fermen- tation odor.	White mold. ^{4/} Fermentation odor.	Discarded at 12 days	
WYC	No mold. Very slight fermenta- tion odor.	No mold. Very slight fermenta- tion odor.	Slightly moldy. ^{2/} Fermentation odor.	Moderately moldy. ^{2/} Moldy odor.	Very moldy. ^{2/} Moldy odor.
CYA	No mold. Normal odor.	No mold. Normal odor.	Slightly moldy. ^{2/} Normal odor.	Moderately moldy. ^{2/} Moldy odor.	Very moldy. ^{2/} Moldy odor.
CYN	No mold. Normal odor.	No mold. Normal odor.	No mold. Normal odor.	Very slightly moldy. Slight moldy odor.	Very slightly moldy. Slight moldy. odor.
CYC	No mold. Normal odor	No mold. Normal odor.	No mold. Normal odor.	No mold. Normal odor.	No mold. Normal odor.

^{1/} W = Ambient temp. (70-75°F), C = Cold temp. (35-40°F), Y = Field-dried pods, A = Air, N = N₂, C = CO₂.

^{2/} Species of *Fusarium* and *Rhizopus* mainly.

^{3/} *Aspergillus flavus* mainly.

^{4/} Mainly *Fusarium moniliforme*.

THE EFFECT OF SEED RATES AND MULTIPLE ROWS PER BED ON PEANUT PRODUCTION UNDER IRRIGATION

by

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Tests over the past several years have shown that cultural practices can have a marked effect on the production of peanuts grown under irrigation. During these studies, varying seeding rates of Starr peanuts were used to see what effect, if any, the density of plant population would have on southern blight, *Cercospora* leaf spots, and nut production.

Rates from 40- to 130-pounds of seed per acre were planted on raised beds on 40-inch centers at the Texas A&M University Plant Disease Research Station at Yoakum, Texas. In the 1963 and 1964 tests the same seeding rates were planted in single rows and double rows on the bed. In the 1965 and 1966 tests all seeding rates were also planted with three rows on a bed. The individual small plots consisted of a single raised bed three to four inches high and 30-feet long. The seed for all treatments were either counted or weighed for the single, double and triple rows. Thus, for the twin rows, half of the seed for each seeding rate was planted in each row. For the triple rows, one-third of the seed was planted in each row per bed. A special multicelled unit for small plot work was used to plant the peanuts. An "A" sweep on the unit leveled off the top of the bed as the peanuts were planted. The two rows and the outside rows of the three rows per bed were spaced about 10-inches apart. Thus, the individual rows for the three row planting were about five-inches apart. In some tests all the plots were treated at planting time with pentachloronitrobenzene (PCNB or Terraclor) at 10-pounds active per acre, row basis, in a 12- to 14-inch band. The tests were furrow irrigated. All treatments were randomized and replicated either six or eight times depending on the year. Southern blight was observed only on occasional plants in these tests in all years regardless of the density of the peanut population. The data are presented in Tables 1 and 2.

Tests were also conducted on the Frio County Agricultural Research Foundation Farm. In 1965 the peanuts were planted in single and twin rows at approximately 90- and 105-pounds of regular size Starr seed. The twin rows on the bed were approximately six-inches apart. There were six randomized replications. Each plot consisted of two beds 145-feet long with the beds 36-inches apart. The peanuts were planted and harvested with commercial equipment. The 1966 test in Frio County was similar to the tests at the Plant Disease Research Station at Yoakum and planted with the same multicelled planter unit with the same row spacing on the beds. The peanuts were harvested with commercial equipment. Some difficulty was encountered in digging the inside row of the twin and three row plots in some of the plots. The point of the digger sweep would miss some of the plants. Consequently, the yields of the twin and triple row plots should have been somewhat higher. The data are recorded in Table 3.

1. The assistance of the Frio County Agricultural Research Foundation and the Frio County Agricultural Agent is gratefully acknowledged.

Table 1: Effect of seed rates and multiple rows on peanut production at the Plant Disease Research Station at Yoakum

Year	Lbs Seed/ Acre	Lbs Nuts/Acre				Percent SMK			
		No. Rows/Bed				No Rows/Bed			
		1	2	3	Av.	1	2	3	Av.
1963	60	1753	1764		1758	70.0	69.8		69.9
	80	1723	1928		1826	71.2	70.0		70.6
	100	1715	2023		1869	70.0	70.8		70.4
	120	1810	1998		1904	72.5	68.8		70.6
Average		1750	1928			70.9	69.8		
L.S.D. @ 0.05: No. Rows - 103 Seeding Rate - n.s.									
1964	40	2617	2701		2659	70.2	69.0		69.6
	60	2744	3018		2881	71.5	71.5		71.5
	80	2853	3152		3003	72.0	71.0		71.5
	100	2866	3199		3032	71.8	71.5		71.6
Average		2770	3017			71.4	70.8		
L.S.D. @ 0.05: No. Rows - 121 Seeding Rate - 171									
1965	60	3520	3602	3533	3552	71.5	71.2	71.5	71.4
	80	3176	3596	3659	3477	71.5	70.0	70.2	70.6
	100	3522	3922	3855	3766	71.5	71.5	71.5	71.5
	120	3836	3958	4422	4072	71.8	71.5	71.2	71.5
Average		3514	3770	3867		71.6	71.1	71.1	
L.S.D. @ 0.05: No. Rows - 282 Seeding Rate - 325									
1966	60	3967	4424	4342	4244	70.0	70.8	70.5	70.4
	80	3994	4181	4087	4088	70.0	72.0	73.0	71.7
	100	4024	4855	4739	4539	72.2	72.8	72.5	72.5
	120	4247	4598	4951	4599	70.5	73.0	72.0	71.8
Average		4058	4515	4530		70.7	72.1	72.1	
L.S.D. @ 0.05: No. Rows - 283 Seeding Rate - 327									

Table 2: The effect of single vs twin rows per bed in a randomized test in 1967 at the Plant Disease Research Station at Yoakum

	Lbs.Nuts/Acre		Total % SMK	
	No. Rows/Bed		No. Rows/Bed	
	1	2	1	2
All Treatments Combined ^{2/}	2428	2860	71.6	71.5
L.S.D. @ 0.05: 121				

^{2/}These data are from a split plot test where foliage fungicides were compared on peanuts with one and two rows per bed. The twin rows were 9-inches apart on beds 40-inches apart.

Table 3: Effect of planting rates on single and multiple rows on a bed under semi-commercial conditions^{3/}

Year	Lbs Seed/Acre	Lbs Nuts/Acre		Grades			
		No. Rows/Bed		SMK OK		SMK OK	
		1	2	Single		Twin	
1965	90	2039	2473	70.5	4.7	71.5	4.3
	105	2404	2426	68.7	5.5	71.8	3.7

L.S.D. @ 0.05 Between any two totals: 329

Year	Lbs Seed/Acre	Lbs Nuts/Acre				Grades			
		No. Rows on the Bed				No. Rows on the Bed			
		1	2	3	Av.	1	2	3	Av.
1966	68	3724	3525	4035	3762	73.4	73.6	73.6	73.5
	93	3664	4041	4402	4036	74.8	74.2	72.8	73.9
	120	3973	3426	4398	3933	73.4	73.4	74.2	73.7
Average		3788	3664	4279		73.9	73.7	73.5	

L.S.D. @ 0.05 Between any totals: 473

Year	No. Rows/Bed	Lbs Clean Nuts Per Acre	Percent SMK+SS	Gross \$ Value Per Acre
1968	1	3346	70.4	\$404.94
	2	3691	71.1	451.04

^{3/}Frio County Agricultural Research Foundation Farm, Pearsall, Texas.

Table 4: The effect of one and two rows per bed on production in large commercial tests in Frio County^{4/}

Year	No. Rows/Bed	Lbs Clean Peanuts/A		Percent SMK + SS	
		1965 Crop			
		No Peanuts	Peanuts	No Peanuts	Peanuts
1966	1	4654	4290	73	75
	2	5174	4472	73	75
Year	No. Rows/Bed	Lbs Nuts/A		\$ Value/A	
				Av. % SMK+SS	
1967	1	3934		\$496.08	
	2 - 5"	4692		566.92	
	2 - 10"	4833		576.98	
L.S.D. @ 0.05		408		52.37	
				ns	

^{4/} The cooperation of Mr. Tommy Halff and Mr. Jimmy Phillips is greatly appreciated for their time and efforts in conducting these tests.

An observational test in 1966 and a large scale replicated randomized test in 1967 were conducted through the cooperation of Mr. Tommy Halff and Mr. Jimmy Phillips. In the 1967 Halff test there were nearly three acres in the test. The peanuts were planted on raised beds with a commercial slant-plate planter. Each planter unit had two planting outlets so that the seed could all go into one row or be divided to plant two rows. The seeding rate was 130-pounds per acre of large Starr seed per acre on both the one row and two rows per bed plots. The results are presented in Table 4.

RESULTS AND DISCUSSION

The data from the small plot tests (Table 1) indicates that increased production may be expected with increased seeding rates of regular size peanut seed up to 120-pounds per acre. Furthermore, that planting peanuts in twin rows on the bed approximately 10-inches apart will outyield the same seeding rate planted in a single row. The yield increases from the low to the high seeding rate were statistically significant in 1964, 1965 and 1966 but not in 1963. The average yield for the twin rows were statistically significant at the 5-percent level over the single row in 1963, 1964 and 1966 but not in 1965. In the 1965 test there was a gradual increase in average production of 3514 pounds for the single row plots to 3770 for the twin row plots to 3867 pounds per acre for the three row plots. These data from the three row plots were significant over the single row but not over the two row plots.

The data from the semi-commercial tests in Frio County gave results similar to the tests at the Plant Disease Research Station at Yoakum. The variability in the twin row plots in the 1966 test probably was due to the difficulty encountered in the digging operations. In this test, plots with three rows per bed significantly outyielded both the single and two rows per bed plots.

There were no appreciable differences in the grade of the peanuts from the different seeding rates, nor was there any apparent differences in the amount or severity of southern blight in any of the tests as determined by macroscopic observations.

DESIGN OF CONTROLLED HUMIDITY CHAMBERS FOR STUDYING EQUILIBRIUM MOISTURE PROPERTIES OF PEANUTS¹

by

J. M. Troeger and J. L. Butler²

Peanuts, like most agricultural products, are hygroscopic materials which gain or lose moisture in response to changes in their environment. The amount of moisture present within the kernel is a major factor in determining the respiration of the kernel and the activity of microflora associated with the peanut. For preservation of quality during storage, respiration and microflora growth must be minimized. Thus, maintenance of the proper moisture level in storage is important.

When a peanut is placed in a given environment, it will gain or lose moisture until its moisture content is in equilibrium with that environment. Temperature and relative humidity are the primary environmental factors which determine the equilibrium moisture value. Thus, an experiment was designed in which peanuts were held under conditions of constant temperature and relative humidity, and their equilibrium moisture content was determined. Three insulated chambers were designed and constructed for holding the samples under conditions of constant temperature and relative humidity for an extended period of time. Related experiments investigating mold and aflatoxin development at high relative humidities were also carried out.

DESIGN CONSIDERATIONS

In designing these chambers, control of the temperature and relative humidity was of primary importance. Relative humidity, by definition, is the ratio of the actual vapor pressure of the air (p) to the saturation vapor pressure (p_s) at the dry bulb temperature ($rh = p/p_s$). The dewpoint temperature is that temperature corresponding to the actual vapor pressure. Thus, by controlling the dewpoint temperature and the dry bulb temperature (each of which is independent of the other), the primary variables can be maintained.

In this system, air was first saturated with water from a bath maintained at the desired dewpoint temperature. The saturated air then passed over heaters which raised the temperature to the desired dry bulb temperature. Dewpoint and dry bulb temperatures were maintained with separate controllers.

1. For presentation at the Annual Meeting, American Peanut Research and Education Association, San Antonio, Texas, July 12-15, 1970, and to be published in the Journal.

2. Agricultural Engineers, Agricultural Engineering Research Division, Agricultural Research Service, U. S. Department of Agriculture, University of Georgia, College of Agriculture Experiment Stations, Coastal Plain Station, Tifton, Georgia.

3. Numbers in parentheses refer to appended references.

EQUIPMENT

Three constant humidity chambers were constructed, each made of 3/8-inch plexiglas with 2-inch styrofoam insulation on all sides. Expanded metal shelves held the samples. Each chamber was capable of holding 96 samples in screen wire baskets. A schematic diagram of the system is shown in Figure 1.

Air, supplied by a compressed air line, flowed through the system at 1 cfm, giving an air change every 8 minutes. This air was saturated at the desired dewpoint temperature by passing it upward through a packed tower with water at the dewpoint temperature trickling down. The saturated air was then heated to the desired dry bulb temperature before being passed through the samples.

Controls

Temperature in the water bath was held constant at the desired dewpoint temperature by a proportional-type controller operating a 75-watt electric immersion type heater. Chilled water was circulated through coils in the water bath when the desired control temperature was below ambient temperature. Temperature of the chilled water was limited by the refrigeration unit to 60 degrees F. For lower dewpoints, precision metering valves were installed in the line to mix the saturated air with dry air (dewpoint approximately 0 degrees F.) from the compressed air line.

A second temperature controller, operating a 100-watt electric resistance heater, controlled the dry bulb temperature of the air. The sensor for the dry bulb temperature control was placed downstream from the heater and shielded from any radiant heating.

Measurements

Temperatures in the system were sensed by thermocouples and recorded hourly by a multipoint recorder. The readings indicated that the controllers did a satisfactory job of maintaining temperatures in both the water bath and the airstream.

Relative humidity was measured with a lithium chloride coated cell and recorded continuously. Readings from the relative humidity recordings were used to check the calculated relative humidity, based on the dewpoint and dry bulb temperature readings. When dry air was mixed with the saturated air, the relative humidity sensors provided the only indicator of the relative humidity.

PROCEDURE

Samples were placed in the constant humidity chambers for 6 days or until the weight appeared to be constant. Weight determinations were made daily. Tests included peanuts from three varieties (Starr Spanish, Early Runner and Florigiant) in three forms (whole pods, kernels only, and hulls only). Dry peanuts were used in all of the tests although green peanuts were also included in some of the tests. Duplicates were included for each sample. A range of relative humidities was used at dry bulb temperatures of 70, 90 and 120 degrees F. Moisture content of each sample was determined at the end of the test by

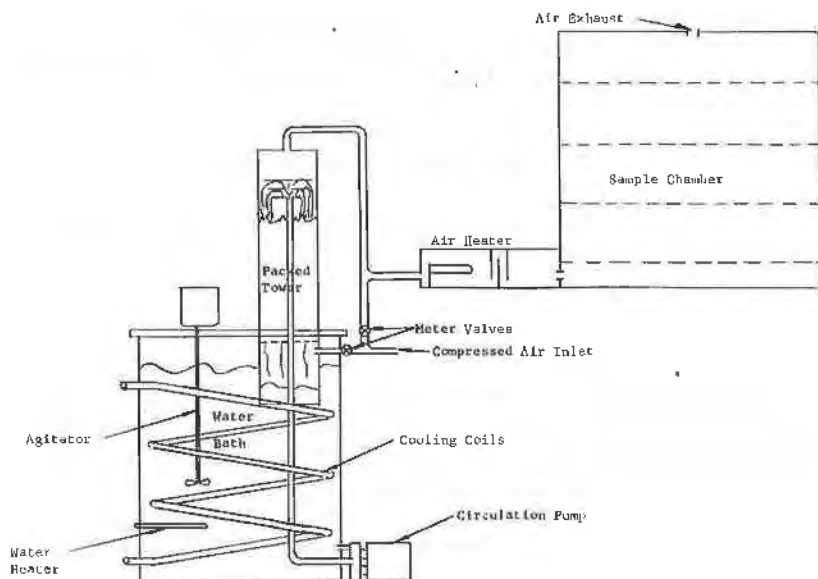


Figure 1. Schematic diagram of constant humidity system.

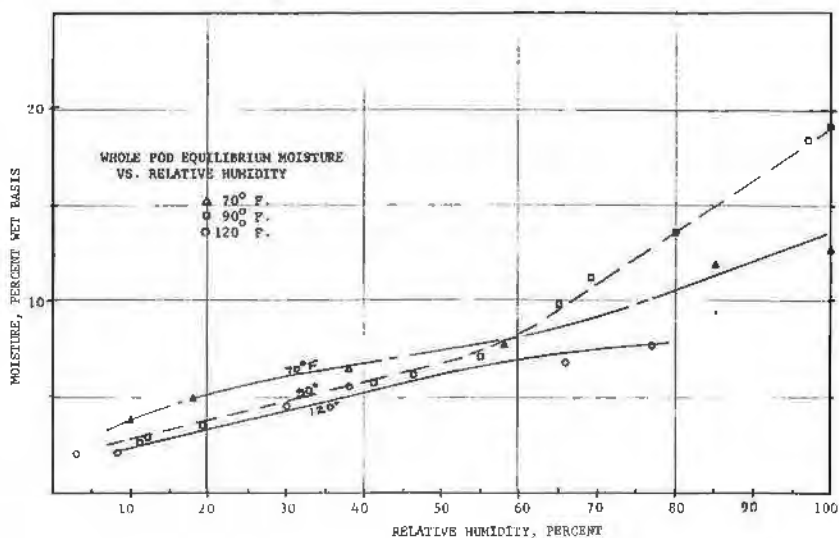


Figure 2. Whole pod moisture equilibrium plot.

placing the sample in an oven at 180 degrees F. for 48 hours.

After 6 days in the humidity chambers, the samples, while usually not reaching a constant weight, were close enough to allow extrapolation to zero weight change.

DISCUSSION OF RESULTS

Equilibrium moistures are plotted in Figures 2, 3 and 4 for each form of the peanuts (pod, kernel, hull) and for each of three dry bulb temperatures (70, 90, 120 degrees F.).

Variety

Equilibrium moisture data for the three varieties (Starr Spanish, Early Runner and Florigiant) were compared for each temperature and relative humidity condition. The data showed no significant difference among varieties. Thus data for all varieties were combined in subsequent analyses.

Green vs. Dry Peanuts

At low relative humidities, there was no significant difference between the equilibrium moisture reached by green peanuts and dry peanuts. At high relative humidities, however, the green peanuts continued to have a high rate of weight change at the termination of the test. This made extrapolation to zero weight change unreliable. Therefore only the equilibrium moistures determined by results from the dry peanut samples were used in plotting the equilibrium curves.

Temperature

As has been shown by other investigators (1, 2, 3), temperature plays an important role in establishing an equilibrium moisture level. Increasing the temperature (for a given relative humidity) will depress the equilibrium moisture level. This relationship was found to hold true at low to medium relative humidities. However, at high relative humidities, this relationship was reversed. For plots representing all three forms (pods, kernels, hulls), the 90 degrees F. equilibrium curve crosses the 70 degrees F. curve at high relative humidities. At high relative humidities, the problem of profuse mold growth was encountered because of the time required for the samples to reach equilibrium. This mold growth undoubtedly affected the total weight of the samples and thus could distort the moisture content determined by the oven method.

A separate experiment was conducted in which the equilibrium moisture content of rewetted kernels was determined by sampling the relative humidity of the air (using the lithium chloride cells) in a closed container holding the peanuts. This method provided a much more rapid determination (one hour) without allowing mold growth. Results showed a higher equilibrium moisture than was obtained in the humidity chambers. This would indicate that mold growth causes a decrease in total weight which may not be moisture loss, thus giving a false moisture indication. On the other hand, during storage, the peanuts are subjected to a given atmosphere for a long period of time so that the longer

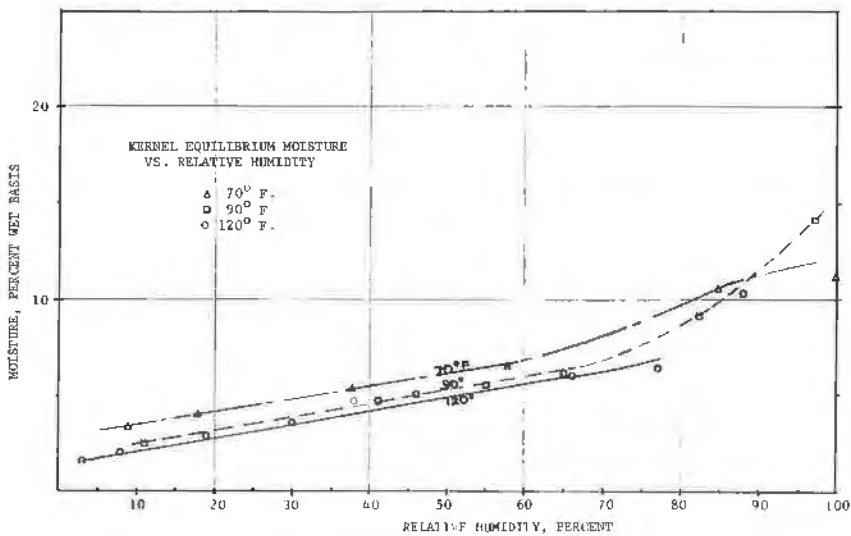


Figure 3. Kernel moisture equilibrium plot.

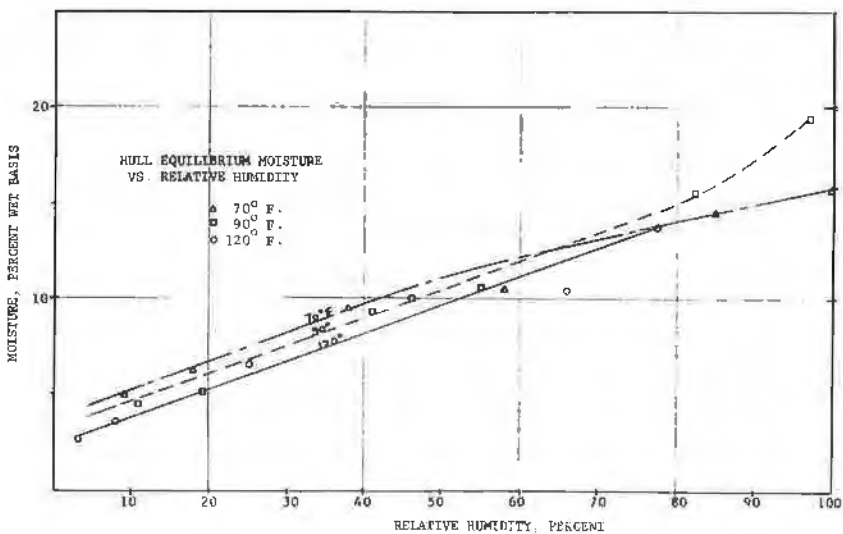


Figure 4. Hull moisture equilibrium plot

time for equilibrium to be established in the humidity chambers may give a more valid determination.

Pod, Kernel, Hull Relationship

Hulls exhibited a significantly higher equilibrium moisture than did the kernels. The pods, containing both hulls and kernels, had equilibrium moistures between the hulls and kernels. Using dry basis moisture, the hull moisture was found to be a constant 1.4 times the whole pod moisture while the kernel moisture was 0.87 times the whole pod moisture. This relationship appeared to hold at all relative humidity levels.

SUMMARY

Humidity chambers, capable of holding a constant temperature and relative humidity for an extended period of time, were designed and constructed. Using these chambers, equilibrium relationships were determined for three varieties of peanuts at three temperature levels.

Results indicated no significant difference among the three varieties (Starr Spanish, Early Runner and Florigiant). Temperature effects, with the higher temperature having a lower equilibrium moisture, were observed at low to medium relative humidities. At high relative humidities, the temperature effect tended to be reversed. Under high relative humidity conditions, however, mold growth was prevalent. This could likely affect the moisture content determined by any method involving a change in weight for determining the moisture content (e.g., oven method).

The relationship among whole pod, kernel and hull was found to be nearly constant throughout the range investigated. Hull moisture was 1.4 times pod moisture (dry basis) and kernel moisture was 0.87 times pod moisture.

Further research is being conducted to ascertain a more complete knowledge of equilibrium relationships at high relative humidities.

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SHELLING AND STORAGE OF PARTIALLY DRIED (CURED) PEANUTS

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ABSTRACT

Partially cured Spanish- and Virginia-type peanuts (kernel moistures of 6.0 to 15.0 percent, wet basis) were successfully shelled in a commercial-type sheller and shelled peanuts stored at various conditions from 42 to 73 days.

Higher shelling outturn, less skin slippage, and slightly lower shelling rates were obtained for peanuts shelled at the higher kernel moistures. Effect of kernel moisture on shelling outturn is greatly dependent on severity of drying exposure, peanut variety, and harvesting practices, and probably other factors which affect milling quality. Shelling efficiency was not significantly affected by hull or kernel moistures for the moisture ranges investigated. It appeared that normal shelling equipment and techniques (with slight modifications) were adequate for commercial shelling of partially cured peanuts.

Quality of shelled peanuts stored at moistures above 10.5 percent appeared to be acceptable. Market quality of the peanuts as determined by official grade analysis remained unchanged throughout storage; however, color of the peanuts stored at moistures above 10.5 percent were darker than peanuts stored at lower moistures.

Storage methods were very important in maintaining a desirable peanut color. Freezer-type storage (15 degrees F.) of peanuts in plastic bags caused the darkest peanuts, while storage in burlap bags at 35 degrees F. and 65 percent relative humidity provided lighter colored peanuts.

A recommended method of storage of high-moisture shelled peanuts would probably consist of storage in burlap bags (or aeration storage) at 35 degrees F. and 60 percent relative humidity, so the peanuts will remain cool and dry down to a safe moisture level within 2 to 3 weeks.

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INTRODUCTION

Loss of kernel moisture prior to shelling is a primary concern of warehousemen and operators of commercial peanut shelling plants. This loss in kernel moisture usually represents a \$2.00 to \$4.00 per ton loss in marketable weight and several percent reduction in whole kernel outturn when the peanuts are shelled.

Some research work (1) (2) (3) (4) is pointing out the effects of kernel

1. Numbers in parentheses refer to References, Table 1.

moisture on shelling outturn of laboratory-type shellers has been reported. The earlier work (2) (3) (4) was conducted in 1948-1952 when peanuts were cured on the stackpole or in the windrow. The latter work (1) was conducted after 1957, using the official grade sheller for determining shelling outturn. Very little information is available on the effects of kernel moisture on shelling outturn of commercial shelling plants. Also, data have not been reported showing the combined effects of kernel moistures, etc., on the shelling outturn at commercial shelling plants. Very little data are available on methods of maintaining desired moisture levels of farmers' stock peanuts during storage.

During the past 3 years, the Transportation and Facilities Research Division, Agricultural Research Service of the U. S. Department of Agriculture at Dawson, Georgia, has devoted considerable effort toward obtaining these needed data on the effects of peanut moisture on the performance of commercial shelling plants and data on methods for maintaining or obtaining desirable peanut moisture levels for shelling.

The work reported herein provides data obtained from an exploratory investigation conducted to determine the problems associated with shelling and storing partially dried peanuts. Tests were designed so that some of the results could also be applied to the shelling and storage of peanuts where moisture has been added prior to shelling.

PROCEDURE

Peanuts were "green" harvested (40 to 50 percent kernel moisture), cleaned, thoroughly mixed, and divided into 12 lots. Each lot was dried in a small box 18 inches long by 18 inches wide by 24 inches deep with a hardware cloth bottom. The peanuts were air dried with ambient air at a rate of approximately 80 cfm per cubic foot of peanuts. Each lot weighed about 40 pounds (dry).

As the peanuts reached each of the assigned moistures (wet basis) of 15, 14, 12, 10, 8 and 6 percent, respectively, two lots were removed from the dryers and shelled immediately in a small commercial sheller. Data obtained with this sheller correlated well with data obtained from the pilot peanut shelling plant. Kernel moistures were obtained with a Motomco moisture meter and confirmed by the standard oven method. The shelling results (weights of hulls, split kernels, bald peanuts, sound mature kernels, and unshelled) were recorded. Outturn data were computed on percent of total farmers' stock weight.

The different storage treatments are indicated by figures 1 and 2. For the Spanish-type peanuts (Starr variety), the shelled peanuts (except for a control lot) were stored at 15 degrees F. in plastic bags. After 26 days of storage, part of the Spanish-type were removed, graded, and placed in burlap bags for storage at 35 degrees F. and 65 percent relative humidity. The other portion of the shelled Spanish-type peanuts remained at 15 degrees F. for the entire storage period (42 days) and then were subjected to grade and visual inspections.

The Virginia-type (Florigiant variety) shelled peanuts were stored at 35 degrees F. and 65 percent relative humidity. Some of the peanuts were stored in plastic bags and some in burlap bags. After about 15 days in storage, grade and visual inspections were made on the shelled peanuts stored in burlap bags. After about 60 days storage, all of the shelled Virginia-type peanuts were removed, graded, and inspected.

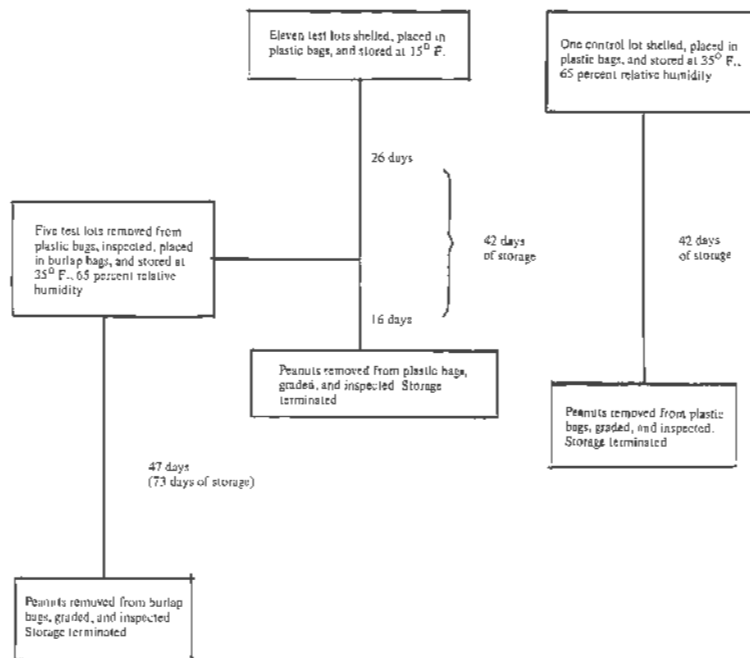


Figure 1 - Storage history of shelled Spanish peanuts (Starr variety, CY 1968) stored at kernel moistures of 8.3 - 14.9 percent (wet basis)

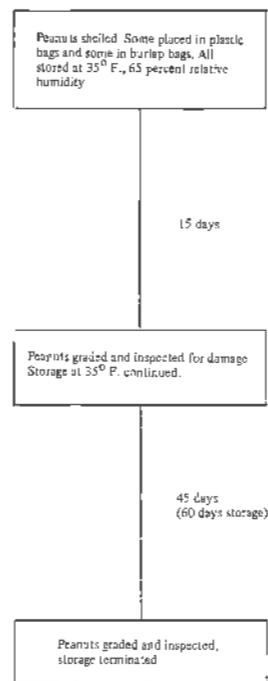


Figure 2 - Storage history of shelled Virginia-type peanuts (Florissant variety, CY 1968) stored at kernel moistures of 6.1 - 15.0 percent (wet basis)

DATA AND RESULTS

Shelling

In earlier research work, we have found that the effect of kernel moisture on shelling outturn is greatly dependent on the artificial drying treatments: the more severe the drying treatment, the larger the effect of kernel moisture on shelling outturn (see figure 3).

To minimize the effect of drying and harvesting on the peanuts, very gentle treatment was used. The peanuts were harvested green, the combine was operated at a slow cylinder and ground speed, and the peanuts were dried with ambient air. Normal harvesting and drying methods would provide a greater effect. An insignificant amount of skin slippage when shelling these peanuts confirmed that the harvesting and drying methods used were not severe.

Both the Spanish- and Virginia-type peanuts shelled exceptionally well at the higher moistures (10-15 percent). The shelled peanuts exhibited a very pleasant color (light pink) and shelling outturn was considerably higher than for the peanuts of lower (6-10 percent) kernel moistures (see figures 4 and 5). Effect of kernel moisture on shelling outturn was much smaller than has been reported or found in other research work. The Florigiant variety was much more sensitive to loss of kernel moisture than the Spanish-type peanuts. The Florigiant variety is very sensitive to harvesting, drying, handling, and other treatments. Commonly used practices usually sharply reduce the whole kernel outturn and increase the amount of split kernels.

Damage as evidenced by bald and split kernels was very low for all tests. Only a few bald kernels were noted and they generally occurred when shelling peanuts of the lowest kernel moisture. These data emphasized the importance of using gentle harvesting and drying treatments and the practice of shelling sensitive peanuts early in the shelling season. Green harvesting did not appear to be detrimental to milling quality.

Shelling efficiency was not greatly affected by loss of kernel moisture. Size of pod usually determines to a large extent the shelling efficiency for a particular sheller grate size; however, we have obtained data on other investigations which show that shelling efficiency is affected by hull moisture.

Shelling rate was observed to be 10-30 percent less for the peanuts shelled at the higher kernel moistures; however, this effect has since been found to be indicative of hull moisture rather than kernel moisture.

Shelling techniques and methods were approximately the same for shelling the higher moisture peanuts as for those of lower moisture. The same sheller grate and separating screen sizes were used for peanuts of all moisture contents. The slightly larger kernels for the higher moisture peanuts were still small enough to fall through the grates and screens used for dry peanuts. Size grading of the shelled peanuts was not a part of this study and some adjustments in selecting the sizes of screens would probably be necessary when and if peanuts are shelled at the higher range of moistures. A 10 to 20 percent higher air flow rate was needed to separate the heavier hulls from the shelled higher moisture peanuts.

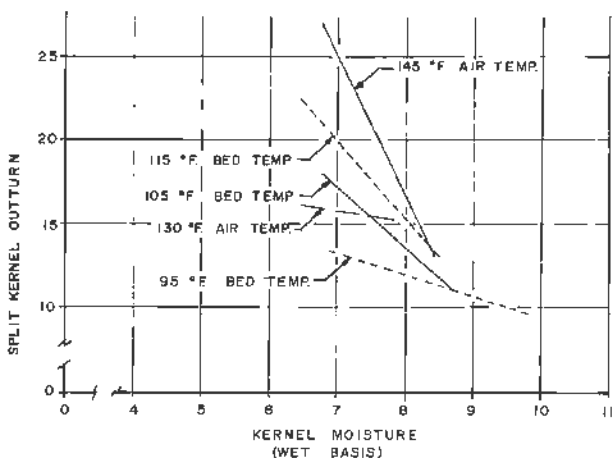


Figure 3.--Effect of drying exposure and kernel moisture on shelling outturn (Virginia type peanuts, CY 1967).

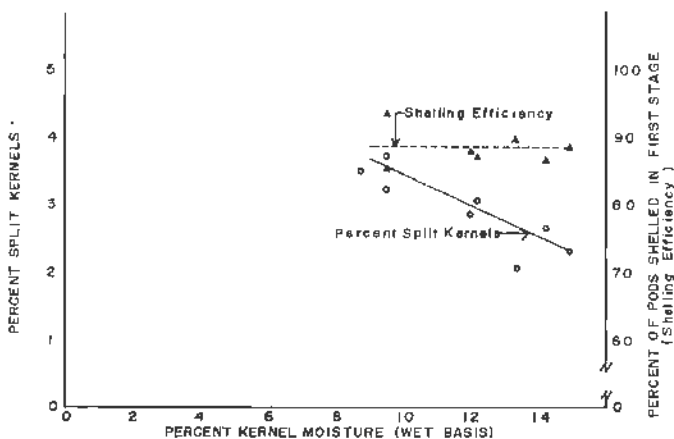


Figure 4.--The effect (minimum) of kernel moisture (wet basis) on shelling outturn of Spanish peanuts (CY 1968).

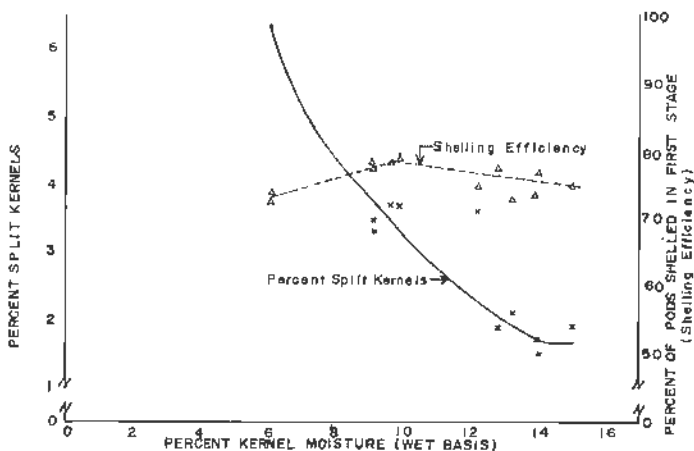


Figure 5.--The effect (minimum) of kernel moisture (wet basis) on shelling outturn of Virginia (Florissant) type peanuts.

Storage

The storage data are presented in tables 1 and 2. There was no detectable change in shelled stock grade caused by storage at high moistures. The higher damage figures which occurred on these tests were discolorations which appeared to be characteristic of the peanuts rather than the storage treatment. Sampling errors confounded the comparisons since several of the final damage values at the completion of storage were lower than the respective values prior to storage.

Storage of Spanish-type peanuts at 15 degrees F. in plastic bags did not provide a desirable color. The color of these peanuts changed from a light pink to a reddish color during the first few weeks of storage. As length of storage increased, the peanut color became noticeably darker. Spanish-type peanuts removed from plastic bag storage at 15 degrees F. and placed in burlap bags at 35 degrees F. and 65 percent relative humidity, had a more desirable color than those which remained in plastic bags at 15 degrees F. Those stored in the burlap bags at 35 degrees F. and 65 percent relative humidity, dried down to a safe moisture level (8 percent wet basis) by the end of storage.

After observing the change in color of Spanish-type peanuts stored at 15 degrees F., it was decided to store all of the Virginia-type peanuts at 35 degrees F. and 65 percent relative humidity. Virginia-type peanuts stored in burlap bags for 15 and 60 days had only a slight change in color and dried down to an equilibrium moisture content of 7.2 percent (wet basis). The peanuts of 14-15 percent kernel moisture lost an average of 2.3 points of moisture during the first 2 weeks of storage and were probably below 10.5 percent kernel moisture after 30 days' storage.

The Virginia-type peanuts stored in plastic bags at moistures above 10.0 percent were darker than those stored in burlap bags. Plastic bags prevented the peanuts from drying down to a safe moisture level.

Storage method and length of storage at high moisture were the primary factors in preserving a desirable peanut color for the peanuts stored at kernel moistures above 10.0 percent; however, peanut color also appeared to be directly related to kernel moisture (above 10.0 percent). The higher the kernel moisture, the darker the peanuts became during storage. After storage, immature peanuts often appeared darker than mature peanuts, probably because the immature peanuts were of a higher kernel moisture during storage than the mature peanuts.

CONCLUSIONS

The data indicate that conclusions may be drawn as follows:

1. Artificial drying treatments, varieties, and probably other factors affect the relationship of kernel moisture to shelling outturn.
2. Gentle harvesting and drying treatments provided a good shelling outturn, even at low kernel moistures.
3. Maximum whole kernel outturn was obtained at kernel moistures of 14-15 percent wet basis.
4. Commercial shelling equipment and procedures (with only slight modifications) were adequate for shelling partially dried peanuts.

TABLE 1.--Shelling and storage data for Spanish-type (Starr variety, CV 1968) peanuts of different kernel moistures

Test number	Kernel moisture content (wet ba- sis) before and after storage				Split kernels Percent	Shelling efficiency Percent	Storage treatment	Damage determined by official grade before and after storage							
	Before Percent	After Percent	Before Percent	After Percent				Concealed		High moisture		Discoloration		Total	
								Before Percent	After Percent	Before Percent	After Percent	Before Percent	After Percent	Before Percent	After Percent
1	14.9	14.9	2.3	88.3	1/	0.06	0	0	0	1.2	1.3	1.3	1.3		
2	14.1	14.0	2/	2/	1/	0.08	0	0	0	1.2	1.0	1.3	1.0		
3	13.4	7.6	2.0	89.7	3/	0.08	0	0	0	1.2	1.3	1.5	1.3		
4	14.2	7.1	2.6	86.7	3/	0.08	0	0	0	1.2	0.06	1.1	0.04		
5	12.2	11.2	3.0	86.9	1/	0.08	0	0	0	1.2	1.3	1.3	1.3		
6	12.0	7.9	2.8	87.6	3/	0.08	0	0	0	1.2	1.0	1.3	1.0		
7	9.5	9.4	3.7	83.4	1/	0.08	0	0	0	1.2	3.0	1.3	3.0		
8	9.5	7.4	3.2	93.7	2/	0.08	0	0	0	1.2	1/	1.3	2/		
9	8.4	8.4	3.1	88.0	1/	0.08	0	0	0	1.2	0.0	1.3	0.0		
10	8.3	8.3	3.2	88.7	5/	0.08	0	0	0	1.2	1/	1.3	2/		
11	8.4 ⁵	8.4	3.2	95.8	1/	0.08	0	0	0	1.2	1.0	1.3	1.0		
12	8.4 ⁵	8.9	3.5	89.0	2/	0.08	0	0	0	1.2	0.26	1.3	0.20		

1/ Stored in plastic bags at 15° F. for 42 days.

2/ Data not available.

3/ Stored in plastic bags at 15° F. for 26 days; then removed from plastic bags and stored in burlap bags at 35° F., 65 percent relative humidity for 47 more days.

4/ Stored in plastic bags at 35° F. for 42 days.

5/ The desired kernel moisture content for this run was 6.0 percent. However, faulty moisture meter readings caused the peanuts to be removed from the dryer too soon.

TABLE 2.--Shelling and storage data for Virginia-type (Florigrande, CV 1968) peanuts of different kernel moistures

Test number	Kernel moisture content (wet ba- sis) before and after storage		Split kernels Percent	Shelling efficiency Percent	Storage treatment	Damage determined by official grade before and after storage									
	Before Percent	After Percent				Concealed		High moisture		Discoloration		Total			
						Before Percent	After Percent	Before Percent	After Percent	Before Percent	After Percent	Before Percent	After Percent		
1	15.0	13.4	1.9	80.1	1/	0.13	0	.00	.00	1.75	0.9	1.9	0.9		
2	14.0	7.2	1.5	82.3	2/	0.13	0	.00	.00	1.75	0.8	1.9	0.8		
3	13.9	7.5	1.7	78.7	2/	0.13	0	.00	.08	1.75	.67	1.9	0.8		
4	13.2	7.0	2.1	78.1	2/	0.13	0	.00	0.3	1.75	2.3	1.9	2.6		
5	12.8	8.3	1.9	83.0	2/	0.13	0	.00	.00	1.75	4.0	1.9	4.0		
6	12.2	11.4	1.6	80.0	1/	0.13	0	.00	.00	1.75	1.0	1.9	1.0		
7	9.9	9.0	3.7	84.0	1/	0.13	0	.00	.00	1.75	3/	1.9	3/		
8	9.6	8.5	3.7	83.8	1/	0.13	0	.00	.00	1.75	1.5	1.9	1.5		
9	9.1	8.3	3.5	83.8	1/	0.13	0	.00	3/	1.75	3/	1.9	3/		
10	9.1	8.1	3.3	82.4	1/	0.13	0	.00	.00	1.75	3/	1.9	3/		
11	6.1	7.3	6.4	78.7	1/	0.11	0	.00	.00	1.75	.59	1.4	.59		
12	6.1	7.1	6.6	77.4	1/	0.11	0	.00	.00	1.75	.53	1.9	.53		

1/ Stored in plastic bags 35° F., 60 days

2/ Stored in burlap bags 35° F., 60 days

3/ Data were not available

5. Shelling efficiency and shelling rate of commercial-type shellers appear to be sensitive to hull moisture rather than kernel moisture.

6. Deterioration of shelled peanuts in storage was not detected by official grade analysis.

7. High-moisture shelled peanuts stored in plastic bags at 35 degrees and 15 degrees F. were darker in color than high-moisture shelled peanuts stored in burlap bags.

8. A good method of storage of high-moisture shelled peanuts in order to maintain color quality appears to be a storage which provides circulation of cool air (35 degrees F. and 70 percent relative humidity) through the shelled peanuts so they may dry down to safe moisture level within a few weeks.

At the present time marketing regulations do not permit sale or shelling of partially dried peanuts for edible purposes. With all of the concern about toxin-producing molds, it is very doubtful that the regulations will be changed in the near future; however, the seed shelling industry may find early application to this technique. By shelling the partially dried peanuts and drying them down rather quickly while in refrigeration (aeration storage), a considerable increase in whole kernel outturn may be obtained. While this technique may not be economically feasible or practical for most peanut varieties when gentle harvesting and drying practices are utilized, it may be feasible for sensitive peanut varieties such as the Florigiant. The effect of cold storage on germination of these varieties should be considered prior to adopting such a technique.

These data emphasize to the commercial shelling plant operator the importance of shelling sensitive peanut varieties early in the shelling season before the kernels dry out. It also provides useful shelling and storage information if the operator shells peanuts at kernel moistures above 7.5 percent (wet basis).

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CONDITIONING PEANUTS IN A FLUIDIZED BED PRIOR TO DRYING WITH HEATED AIR

by

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INTRODUCTION

Studies were conducted to determine the feasibility of increasing the drying rate of freshly-dug peanuts by conditioning them with high-temperature air in a fluidized bed prior to bin drying with heated air.

A specially constructed fluidized-bed dryer consisting of a heater, fluidized-bed section and air handling equipment was used in these studies, Figure 1. The heater was of the ring type and was connected to the gas supply through a modulating valve. A thermostat operated the valve to maintain preset temperatures during the tests. The fluidized-bed section was constructed from a 6-inch diameter glass pipe connected to the heater and air handling equipment by flanges. The bottom flange was modified to include a perforated floor which rotated 90 degrees in order to remove the peanuts from the fluidized-bed section. The air handling equipment was a cyclone-type dust collector with a centrifugal fan mounted on top. This fan was capable of delivering 1200 cubic feet of air per minute (cfm) against an external resistance of 4.6 inches of water.

Small cylindrical bins, Figure 2, were used to dry the peanuts after they were exposed to the fluidized-bed treatments. These bins were 9 inches in diameter and consisted of two sections separated by a perforated floor which was installed on the bottom of the top section. The top section was used as a container for the peanuts. The bottom section served as an air chamber and was equipped with a sharp-edge orifice plate for measuring the air flow. A perforated metal plate was installed in the top of the upper section to provide a means of adjusting the airflow rate.

Air was supplied to the cylindrical bins by placing them over holes cut in the tops of plenum chambers. Each chamber was connected to a single fancoil conditioning unit through a main and lateral duct system. The lateral ducts to each chamber contained electric heaters for temperature control.

PROCEDURE

Peanuts used in these tests were supplied by the Plant Disease Research Station at Yoakum, Texas. They were dug one day, field dried for approximately 24 hours, threshed and transported in sacks to College Station. The peanuts were then held overnight in a storage room at 55 degrees F.

Tests were conducted by exposing 5-pound samples of wet peanuts at an approximate depth of 12 inches in the fluidized-bed dryer for the following air temperatures and time periods: (1) 200 degrees F. for 1 minute and (2) 150 degrees F. for 2.5, 5 and 10 minutes. The air velocity required to establish the fluidized conditions was approximately 520 feet per minute based on the cross-

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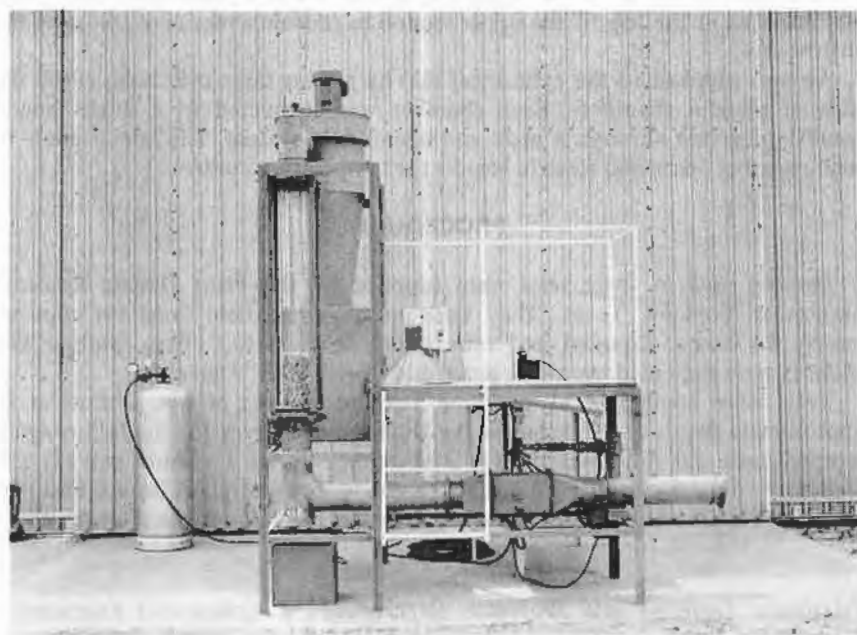


FIGURE 1. Fluidized-bed dryer used to condition peanuts prior to bin drying with heated air.

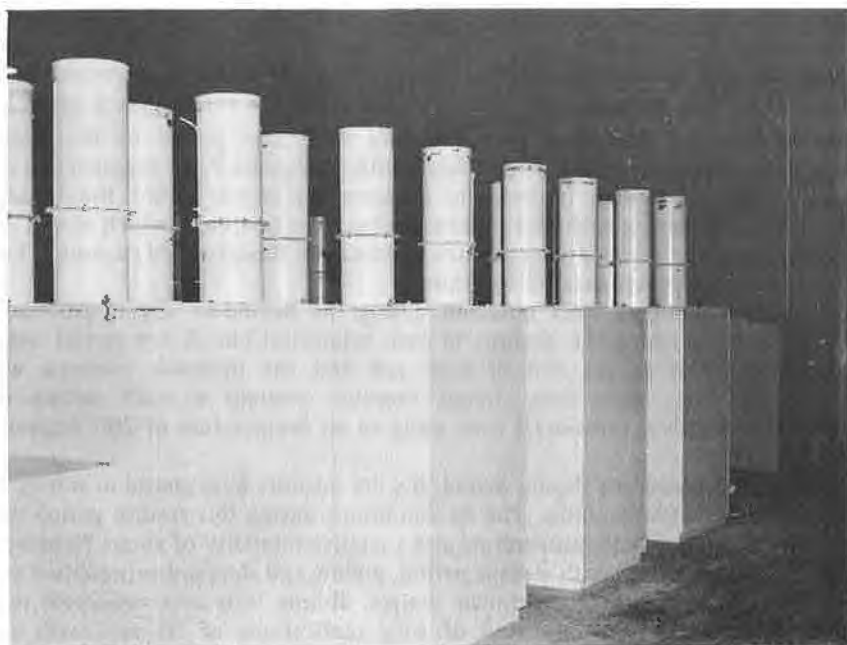


FIGURE 2. Controlled temperature plenum chambers used to supply air to the cylindrical bins during the heated air drying period.

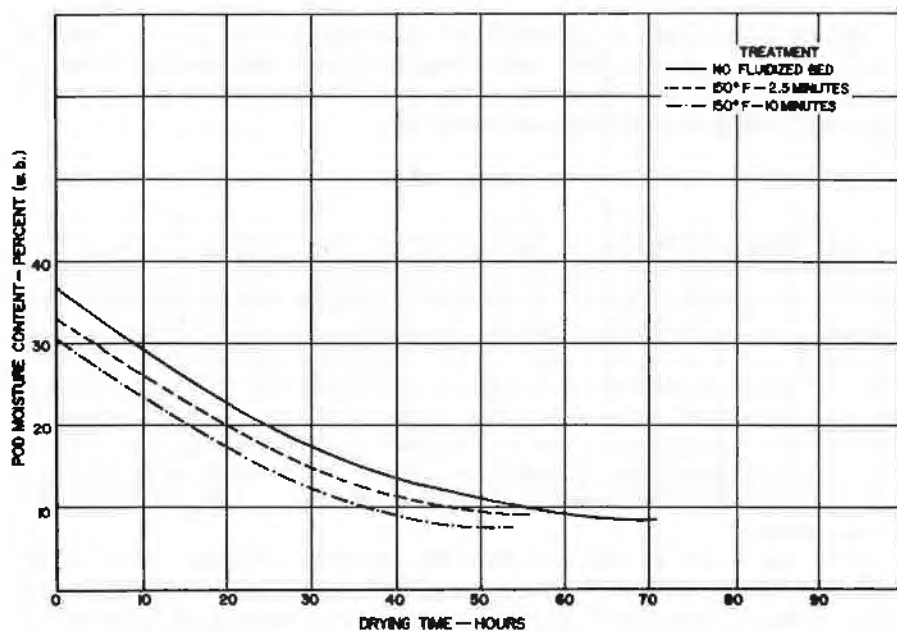


FIGURE 3. Relationship of the pod moisture content for several of the treatments to the time in the heated-air dryer.

sectional area of the fluidized-bed section. After the samples were exposed to the various fluidized-bed treatments, the heater was turned off and the peanuts were allowed to cool in the fluidized state for the same time period as the treatment. The peanuts were then removed from the fluidized-bed dryer and loaded into the cylindrical bins. The bins were then placed on the plenum chambers where the peanuts were dried with 90 degrees F. air supplied at a rate of 15 cfm per bushel. In order to compare the effects of the fluidized-bed treatment on drying time and peanut quality, one treatment which served as a check, consisted of bin drying peanuts without any fluidized bed exposure. Each of these tests was replicated three times.

Moisture contents were obtained during the heated-air drying periods by periodically weighing the peanuts in each cylindrical bin. A dry matter weight was determined at the end of each test and the moisture contents were calculated from these data. Initial moisture content of each sample was determined with a force-draft oven using an air temperature of 200 degrees F. for 48 hours.

After the heated-air drying period, the dry peanuts were placed in storage for approximately four months. The air conditions during this storage period were 45 degrees F. dry-bulb temperature and a relative humidity of about 70 percent. At the end of the 4-month storage period, milling and standard germination tests were conducted on each treatment sample. Milling tests were replicated twice and germination tests consisted of four replications of 50 seed with each replication consisting of two 25-seed samples.

RESULTS

Results of this research were analyzed to determine if the use of a fluidized bed prior to bin drying with heated air would increase the capacity of present peanut drying facilities. The effect of this drying method on the percent sound splits and seed germination were also analyzed.

Drying Rate

The effects of conditioning high-moisture peanuts in fluidized beds prior to drying with heated air on the moisture content and drying rate are presented in Table 1. Results show that the moisture loss during the fluidized-bed treatments varied from 1.0 percentage point for the 1 minute exposure treatment at 200 degrees F. to 5.9 percentage points for the treatment which exposed the peanuts for 10 minutes at 150 degrees F. This loss appeared to be directly proportional to exposure time for any constant temperature. For example, at 150 degrees F. doubling the exposure time from 2.5 to 5 minutes exactly doubled the moisture loss in the fluidized bed. A similar increase within the experimental limits of error in moisture loss occurred when the exposure time was increased from 2.5 to 10 minutes.

The overall drying rate, including the moisture reduction while in the fluidized bed, varied from 0.48 percentage points per hour for the treatment which had no fluidized-bed conditioning to 0.74 percentage points per hour for the treatment which conditioned the peanuts at 150 degrees F. for 10 minutes prior to heated-air drying. There was little difference in the drying rates of peanuts which had no fluidized-bed exposure and peanuts which were exposed to 200 degrees F. air for 1 minute. Also, little difference was found in the drying rates of peanuts exposed at 150 degrees F. for 2.5 and 5 minutes.

A significant increase in drying rate occurred between the peanuts dried at 150 degrees F. for 10 minutes and the other treatments. When compared to the heated-air method of drying, the 150 degrees F. - 10 minute treatment increased the overall drying rate approximately 54 percent. Using the no fluidized-bed treatment as the base, this increase in drying rate resulted in a 34 percent reduction in the drying time. A reduction of 16 and 21 percent in drying time resulted from the 150 degrees F. - 2.5 and 5 minute treatments, respectively. Peanuts dried by the bin drying method without fluidized-bed conditioning required 55.5 hours to dry to a moisture content of 10 percent compared to only 36.5 hours when the peanuts were conditioned in a fluidized bed at 150 degrees F. for 10 minutes prior to drying with heated air. This compared to drying times of 46.5 and 44 hours for the 150 degrees F. - 2.5 and 5 minute treatments, respectively.

All the increase in the overall drying rate did not result from the quantity of moisture removed during the fluidized-bed treatment. The relationship of the pod moisture content for several of the treatments to the time in the heated-air dryer is shown in Figure 3. Even though the initial moisture contents at the start of the heated-air drying period varied due to the moisture removed in the fluidized bed, the rate of drying during this period was significantly increased by several of the conditioning treatments in the fluidized bed. Peanuts conditioned at 150 degrees F. for 10 minutes had a drying rate of 0.58 percentage points per hour during the heated-air drying period. This represents a 21 percent increase in the drying rate when compared to peanuts dried without any fluidized-bed treatment. Superimposing the curves in Figure 3 to correct for differences in the initial moisture contents of peanuts indicates time savings during the heated-air drying period of 3.5 and 11 hours due to prior conditioning in fluidized bed at 150 degrees F. for 2.5 and 10 minutes, respectively. No explanation can be given at the present time concerning this change in drying rate.

Milling Quality

Results of exposing high-moisture peanuts to the different fluidized-bed conditioning treatments on the sound splits during shelling is given in Table 2. Percent sound splits varied from 8.6 for peanuts conditioned in a fluidized bed at 200 degrees F. for 1 minute to 13.6 for those conditioned at 150 degrees F. for 10 minutes. Peanuts dried without any fluidized-bed treatment had an average sound split of 9.4 percent. A statistical analysis of the results revealed that there were no significant differences in the sound splits for this treatment and the fluidized-bed treatments with the exception of the 150 degrees F. - 10 minute treatment. Peanuts conditioned in a fluidized bed for 10 minutes at 150 degrees F. prior to heated-air drying had a significantly higher average of sound splits at the 1 percent level than the other milling results.

Germination

Standard germination tests were conducted on each treatment to determine the effects of fluidized-bed temperature and exposure time on seed viability. Results of these tests are given in Table 2.

Peanuts which received no fluidized-bed treatment prior to drying with

TABLE 1. Effect of conditioning high-moisture Spanish peanuts in fluidized beds prior to bin drying with heated air on the moisture content and drying time.

Conditioning treatment	Initial pod moisture content, percent (w.b.)	Pod moisture loss in fluidized-bed dryer, percentage points	Time to dry to 10 percent moisture content (w. b.) in heated air dryer, hours	Average drying rate, percentage points per hour (w.b.)	
				Including fluidized-bed treatment	After fluidized-bed treatment
No fluidized-bed exposure (Check treatment)	36.7	---	55.5	0.48	0.48
200°F - 1 minute	35.6	1.0	51.0	0.50	0.48
150°F - 2.5 minutes	36.1	1.4	46.5	0.56	0.53
150°F - 5 minutes	35.9	2.8	44.0	0.59	0.53
150°F - 10 minutes	37.2	5.9	36.5	0.74	0.58

TABLE 2. Effect of conditioning high-moisture peanuts in fluidized beds prior to drying with heated air on the milling quality and germination.

Conditioning treatment	Kernel moisture content when shelled, percent	Sound splits, percent	Germination, percent
No fluidized-bed exposure (check treatment)	7.4	9.4	88.5
200°F - 1 minute	7.8	8.6	86.2
150°F - 2.5 minutes	7.7	10.2	90.3
150°F - 5 minutes	7.0	9.9	90.5
150°F - 10 minutes	6.8	13.6	68.5

heated air were used as the check treatment and germinated 88.5 percent. A statistical analysis was conducted on these data and revealed a highly significant loss in germination for peanuts exposed in the fluidized bed at 150 degrees F. for 10 minutes. The average germination for this treatment was only 68.5 percent which resulted in a 20 percentage point loss when compared to the check treatment. No significant differences were found between the check treatment and the other treatments used in this test. Even though no significant differences were found, the 200 degrees F. - 1 minute treatment showed a slight decrease in germination due to the high air temperature during the fluidized-bed exposure. Also, the 150 degrees F. - 2.5 and 5 minute treatments indicated a small increase. These treatments germinated 90.3 and 90.5 percent, respectively.

SUMMARY OF RESULTS

Under certain combinations of temperature and time, freshly-dug peanuts exposed in a fluidized bed prior to bin drying with heated air resulted in an increased drying rate without a significant decrease in quality. Exposing peanuts at 150 degrees F. for 2.5 and 5 minutes increased the overall drying rates and decreased the drying time by 16 and 21 percent, respectively. No significant differences in the sound splits and germination were found due to these treatments when compared to the heated-air method of mechanically drying peanuts.

ACKNOWLEDGEMENTS

This report summarizes the results of one phase of cooperative research on peanut drying and storage being conducted by personnel of the Texas Agricultural Experiment Station of Texas A&M University and the U. S. Department of Agriculture. The authors express their appreciation for the assistance given by the following co-workers in this cooperative effort: A. L. Harrison, Plant Disease Research Station, Yoakum, Texas; C. E. Simpson and Shelby Newman, Tarleton Experiment Station, Stephenville, Texas; E. E. Burns and L. E. Clark, Soil and Crop Sciences Department, Texas A&M University; R. E. Pettit and Ruth A. Taber, Plant Sciences Department, Texas A&M University; O. R. Kunze, Agricultural Engineering Department, Texas A&M University; and H. W. Schroeder, U. S. Department of Agriculture.

DEVELOPMENT OF EXPERIMENTAL EQUIPMENT TO SEPARATE GREEN IMMATURE PEANUTS¹

by
George B. Duke²

Peanut harvesting studies conducted at the Tidewater Research Station, Holland, Virginia, have shown that peanuts combined the same day they are dug contain more immatures than those combined after 6 to 8 days in the windrow. The immature peanuts have no economic value, increase the cost of drying, lower the quality and grade, and are first to mold under unfavorable drying conditions. If green harvesting of peanuts becomes an alternate harvesting method, it will be desirable to remove the immatures before drying.

Studies were conducted to separate green immature peanuts from mature peanuts with two purposes in mind: (1) to determine some of the physical properties of green peanuts; and, (2) to find a method and develop equipment to separate green immature peanuts from the more mature ones on the basis of physical properties. This report describes one method used to separate a high percentage of the immatures. Virginia 56R and Virginia 61R runner type peanuts were used in these studies.

PHYSICAL PROPERTIES

In the physical properties studies conducted in 1963 and 1964, the specific gravity, grade, and dimensions of green peanuts were determined. Results from this research were published in a previous manuscript³. This report showed that:

1. The specific gravity of green peanuts varied between 0.62 and 0.99.
2. Mature, semi-mature, and immature peanuts were distributed throughout the specific gravity range of 0.62 and 0.99. Therefore, using specific gravity as the sole criterion for separation will not be satisfactory although a separation of those peanuts having a specific gravity of 0.94 and above would eliminate approximately 30 percent of immatures.
3. Relatively small differences existed between the average specific gravity and grade. For example, those peanuts of greatest maturity contained the largest kernels and were grade 1, had an average specific gravity of 0.84; grade 2, 0.85; grade 3, 0.86; and, grade 4, immatures (smallest kernels), 0.89.
4. A relationship existed between length and grade; as the length increased, the grade of the peanuts increased. A separation based upon length could remove approximately 46 percent of the immatures, and only about 1 percent of the mature peanuts.
5. A relationship existed between diameter and grade; as the diameter

1. For presentation at the American Peanut Research and Education Association Meeting, San Antonio, Texas, July 12-15, 1970.

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3. Duke, G. B. A Study of Selected Physical Properties of Green Peanuts. USDA, ARS 42-170, 1970.

increased, the grade increased. Diameter of the peanuts ranged from 8/32 inch to 26/32 inch and 70 percent of the immature peanuts did not exceed 16.5/32 inch in diameter. Thus, a separation based upon diameter differences would remove approximately 70 percent of the immatures without a loss of more than 1 percent of the mature peanuts.

6. A relationship existed between specific gravity and length; as the length increased, the specific gravity decreased.

7. A relationship existed between specific gravity and diameter; as the diameter increased, the specific gravity decreased.

8. In the lots of peanuts examined, 54 percent graded No. 1; 6.1 percent, No. 2; 17.1 percent, No. 3; and, 22.8 percent were immature (numerical count).

9. Both length and diameter of green peanuts shrink while drying to equilibrium moisture. Decrease in length of the four grades (No.'s 1, 2, 3 and 4) was, respectively, 4.1, 4.4, 9.7, and 16.3 percent; decrease in diameter was 5.2, 6.3, 14.7 and 35.5 percent.

10. Under favorable natural drying conditions inside the laboratory, where peanuts were stored in a thin layer, maximum shrinkage occurred within 4 days after digging.

EXPERIMENTAL METHODS AND EQUIPMENT

In 1963 samples of green harvested peanuts were placed in airtight containers and air expressed to the USDA Small Seed Harvesting and Processing Laboratory at Corvallis, Oregon. Attempts were made there to separate immature peanuts from mature peanuts using the ESM pneumatic separator (wet-product type) and an electrostatic separator (Booster model 2). Summary statements from the project leader, Mr. Jesse Hammond, were as follows: "(1) From observation without actually making a count, it looks as if the test did not show anything worthwhile except that the machines failed to make a clear-cut separation of the mature from the immature peanuts. (2) Generally, results from all trials appeared unsatisfactory since immature nuts could be found in every fraction."

Studies were made in 1963 at Holland with experimental equipment to separate green immature peanuts with pneumatic separators of the pressure and vacuum type. Also, attempts were made to separate immature peanuts using electronic color sorters (courtesy of Suffolk Peanut Company, Suffolk, Virginia). Neither of these methods made a satisfactory separation.

Experimental equipment was constructed to separate the smaller (immature) peanuts by a mechanical method using diameter as the main criterion.

The initial equipment, designed in 1963, to separate by screening and air is shown in Figure 1. Essential equipment components consisted of a hopper, a vibrating frame (12 inches wide by 65 inches long) designed to accommodate interchangeable perforated sheet metal screens with various sized openings, and a fan of the vacuum type. In 1964 a new separator, 30 inches wide, was constructed similar to the one above to increase machine capacity. This unit is shown in Figure 2.

Four sizes of perforated screens were tested with perforations 5/16, 3/8, 7/16 and 15/32 inch wide by 3 inches long. The vibrating frame was driven by a crankshaft having a 1 1/4-inch crank radius and operating at 220 rpm. The

vibrating frame was supported by rocker arms having a 7 1/2-inch radius and sloping 10 degrees from the vertical in the neutral position. Movement of the peanuts rearward was effectively achieved. Sloping the vibrating screen 3 degrees increased machine capacity.

Separation in both the 1963 and 1964 models was accomplished by dispensing peanuts from the hopper onto a vibrating slotted-type perforated screen which made a separation into two fractions. The fraction riding the screen and containing the larger diameter peanuts was passed through an air stream which removed additional foreign material. The fraction which passed through the screen contained small immature unshelled peanuts, some foreign material, and loose shelled kernels. In tests with both models, a small quantity of peanuts lodged in the slotted perforations, reducing separation efficiency.

The latest model separator, constructed in 1968, is shown in Figures 3 and 4. Its essential components are: (1) hopper with 25 cubic feet capacity equipped with a vibrating dispenser; (2) no-choke separator sizing assembly, 44 inches wide, and consisting of parallel 9/16-inch hexagonal rods, 24 inches long and spaced 1 inch on centers, attached at one end and open at the other end; (3) slatted chain conveyor equipped with crossbars which had projecting tines attached; (4) auger; (5) fan; (6) belt conveyor; (7) variable speed drive and driven fan sheaves; and (8) a 2-horsepower electric motor. The operation is as follows: peanuts are uniformly dispensed from the bottom of the hopper and fall on the parallel hexagonal rod assembly in a thin layer. A standard-type chain conveyor with crossbars operates underneath the assembly. The tines on the crossbars pass between the hexagonal rods to move the peanuts over the rod assembly. Some of the immatures, loose shelled kernels, and foreign material such as stems, soil particles, small gravel, clods of dirt, etc., fall by gravity from the top fraction. The separated material falls into a cross-mounted auger and is conveyed to one side of the separator. The top fraction (peanuts conveyed over the grate assembly) is dropped through an air stream to separate additional foreign material and then onto a cross-mounted belt conveyor for bagging or transferring to drying bins or drying wagons.

In the initial studies, separation efficiency of each screen was evaluated for removing immatures, loose shelled kernels and foreign material. A slotted opening, 7/16 inch wide by 3 inches long, was found to be the optimum and subsequent studies were made with that size. Virginia 56R variety peanuts were used in the studies conducted in 1963 and 1965 and Virginia 61R variety in studies conducted in 1969.

RESULTS

Results from recleaning green peanuts and semi-cured peanuts using a 7/16-inch by 3-inch slotted screen are shown in Tables 1 and 2, respectively. The equipment not only makes a partial separation of immatures, but also removes some of the foreign material and loose shelled kernels.

With green harvested peanuts, average numerical values showed that 25.6 percent were immature and that 72.7 percent of these immatures were removed by recleaning. Foreign material content was 6.3 percent and recleaning removed 62 percent of it. Loose shelled content was 5.4 percent and recleaning removed 91 percent of this.

Table 1. Effects of recleaning green peanuts on peanut grade, Holland, Va.

Green peanut samples	Immatures in sample 1/ %	Separation of immatures %	Grade at Equilibrium Moisture				
			Foreign material %	Loose shelled kernels %	Sound mature kernels %	Other kernels %	Hulls %
<u>1963</u>							
Composite sample	18.0	72.3	8.16	7.82	49.85	6.43	27.72
Top fraction	6.0		2.86	0.57	57.30	7.40	31.85
<u>1964</u>							
Composite sample	27.7	75.7	6.70	5.98	60.80	2.41	24.11
Top fraction	8.4		2.42	0.21	68.53	2.24	26.60
<u>1969</u>							
Composite sample	31.1	70.2	4.17	2.43	61.61	2.67	29.10
Top fraction	10.7		2.01	0.68	64.19	2.70	30.34
<u>Overall average</u>							
Composite sample	25.6	72.7	6.34	5.41	57.42	3.84	26.98
Top fraction	8.3		2.43	0.49	63.34	4.11	29.59

1/ Numerical values converted to percentages.

Table 2. Effects of recleaning semi-cured peanuts on peanut grade, Holland, Va.

Days in windrow	Immatures in sample 1/ %	Separation of immatures %	Grade at Equilibrium Moisture				
			Foreign material %	Loose shelled kernels %	Sound mature kernels %	Other kernels %	Hulls %
<u>6 Days - 1963</u>							
Composite sample	2.9	98.5	2.06	4.24	53.05	8.62	32.01
Top fraction	---		0.72	0.07	57.46	8.65	33.06
<u>2 Days - 1964</u>							
Composite sample	13.8	66.3	2.67	3.04	66.09	1.80	26.39
Top fraction	5.1		1.52	0.34	69.06	1.62	27.46
<u>10 Days - 1964</u>							
Composite sample	15.2	72.9	4.48	4.41	64.49	1.81	24.79
Top fraction	4.6		1.11	---	70.89	1.22	26.75
<u>6 Days - 1969</u>							
Composite sample	5.4	80.0	1.72	2.58	63.92	3.37	28.38
Top fraction	1.1		0.60	0.40	66.15	3.43	29.38
<u>Overall average</u>							
Composite sample	9.3	79.4	2.73	3.57	61.89	3.90	27.89
Top fraction	2.7		0.99	0.20	65.89	3.37	29.16

1/ Numerical values converted to percentages.

With semi-cured peanuts, average numerical values showed that 9.3 percent were immature and 79.4 of these were removed by recleaning. Foreign material content was 2.7 percent and recleaning removed 63 percent of this material. Loose shelled kernel content was 3.5 percent and recleaning removed 94 percent.

Green harvested peanuts contained 2.7 times more immatures than semi-cured peanuts.

Removing immatures from green harvested peanuts prior to drying will reduce the cost of drying and improve the market grade.

Loose shelled kernels removed from farmer's stock peanuts, if properly cured and dried, may involve problems in marketing since no market price support is presently available for loose shelled kernels. On the other hand, if the loose shelled kernels are left in the farmer's stock peanuts, they are valued at approximately 7 cents per pound. By eliminating the shelling of peanuts by the combine, the price received by the grower would be increased by approximately \$8 per ton, based upon 4 percent loose shelled kernels at the prevailing price of 12 cents per pound. Thus, for each 1 percent of loose shelled kernels, the value is reduced about \$2 per ton.

The operation of the 1968 recleaner shows several advantages over the previous models. Some future design improvements are:

- (1) More rigid bars in the sizing assembly.
- (2) Spacing between the bars should be adjustable for adaptation to different varieties and sizes of peanuts.
- (3) Air separation should be improved for more effective separation of foreign material from the top fraction.
- (4) A method should be incorporated to separate particles heavier than peanuts from the top fraction, such as stones and small pieces of metal.

If harvesting of green peanuts becomes an accepted harvesting method, the immatures should be separated before drying. We believe that separation should be done on a field harvester at the time of combining. Initially developed equipment removes approximately 72 percent of the immatures. The development of an improved separation system for removing a higher percentage of the immatures is desired.



Figure 1. Initial peanut recleaner designed to separate immatures, loose shelled kernels and foreign material by screening and air.

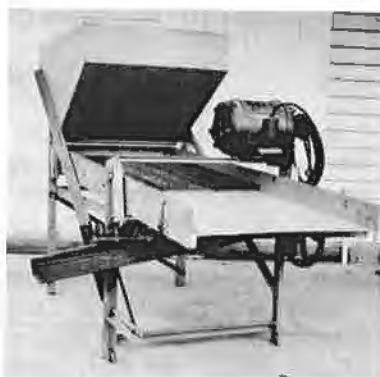


Figure 2. A 30-inch wide recleaner for separating immatures by screening.

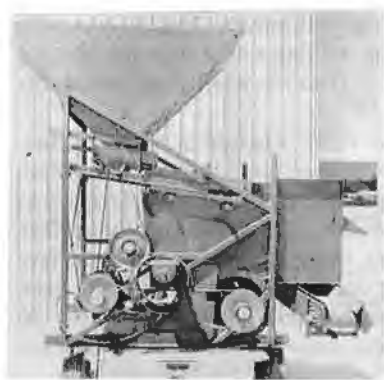


Figure 3. Right side view of 1968 model recleaner.



Figure 4. End view of 1968 model recleaner.

FIELD LOSSES OF PEANUTS IN NORTH CAROLINA

by

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INTRODUCTION

Peanut losses in the field have been of concern since mechanization of peanut harvesting became a practical reality in the mid-1950's. Mills and Dickens (1) reported that a limited number of measurements at Lewiston, N. C., in 1956 showed digging losses varying from 6 to 15 per cent. They made the observation that "a digger-shaker-windrower properly constructed and properly operated to handle the plants gently should reduce digging losses to 5 per cent."

More recent studies in Oklahoma (2), primarily on the Starr variety of Spanish peanuts, showed digging, shaking, and combining losses which averaged 3.0, 2.4, and 2.7 per cent, respectively, of the total yield. The Oklahoma study also revealed that inverting diggers lost only 1.31 per cent of the total yield in digging as opposed to 3.69 per cent for the non-inverting types, and only 0.64 per cent in shaking as opposed to 3.08 per cent. Combining losses were about the same for both type of diggers.

Field observations in North Carolina left the impression that our growers were losing more peanuts than the nominal 5 to 10 per cent which one would expect on the basis of the data cited above. Some preliminary field surveys were made very late in the 1967 harvesting season to determine whether we did indeed have a significant field-loss problem, and if so, to learn more about the sources and causes of the losses.

Five randomly chosen fields were surveyed in 1967, situated in Nash, Halifax, Edgecombe, and Bertie Counties. These fields had been combined up to 3 weeks prior to the survey, and consequently the lost peanuts could only be classified as occurring on the surface of the ground or beneath it. Those beneath the surface could safely be called "digging losses"; however those on the surface may have been caused by shaking or by some part of the combining operation itself. Also, some deterioration of the peanuts undoubtedly took place subsequent to harvesting and prior to the survey, so grades and dollar values of the recovered peanuts were diminished accordingly.

This limited survey revealed losses ranging from about 500 to 1000 pounds per acre, with dollar values from \$40 to \$100 per acre (Table 1.) The average loss of 650 pounds per acre, worth \$61.40, indicated that a significant problem did indeed exist with respect to mechanical harvesting efficiency, and that a more exhaustive study was desirable. This paper reports the results of a more thorough harvesting-loss study undertaken in 1968.

PROCEDURE AND RESULTS

In cooperation with Agricultural Extension personnel in the eight major peanut producing counties of the state, 40 fields were chosen at random and sampled for harvesting losses in 1968. The sampling and recovery technique was designed to classify the loss into one of six categories associated with the

Table 1.

Summary of Preliminary Peanut Field-Loss Studies, 1967

Field No.	Location	Projected Loss Per Acre, Lbs.	Yield Reported Lbs.	Projected Loss Percent	Value of Lost Peanuts, \$/100 lbs.	Projected Value of Lost Peanuts, \$/Acre*
1	Surface	110			9.53	10.48
	Subsurface	<u>380</u>			10.30	<u>39.14</u>
	Total	490	----	----		49.62
2	Surface	160			8.04	12.86
	Subsurface	<u>420</u>			9.97	<u>41.87</u>
	Total	580	----	----		54.73
3	Surface	300			10.94	32.82
	Subsurface	<u>630</u>			10.62	<u>66.90</u>
	Total	930	----	----		99.72
4	Surface	170		6.2	10.18	17.31
	Subsurface	<u>390</u>		<u>14.4</u>	5.91	<u>23.05</u>
	Total	560	2160	20.6		40.36
5	Surface	230		6.9	9.93	22.84
	Subsurface	<u>460</u>		<u>13.7</u>	8.64	<u>39.74</u>
	Total	690	2650	20.6		62.58
Average	Surface	194			9.72	19.26
	Subsurface	<u>456</u>			<u>9.09</u>	<u>42.14</u>
	Total	650	----	----	9.41	61.40

*Based on Virginia type, no foreign material or loose shelled kernels

harvesting operation, as follows:

Cut off - peanuts left in the ground because the digging blade was run too shallow.

Shedding - peanuts already disconnected from vines, or pulled off in digging, and found below soil surface.

Shaking - peanuts knocked off during shaking or reshaking, and found on the soil surface.

Pickup - peanuts detached as the combine picked up the windrow.

Picking - peanuts still attached to vines after passing through the combine.

Cleaning - peanuts picked but blown out of the combine with the trash.

The area from which losses were recovered and measured consisted of a rectangle containing 1/1000 acre, or 43.56 square feet, centered over the windrow and extending across the original two rows from which the windrow was formed, center to center of the outside middles. Length of the plot was adjusted according to (row) width to include the prescribed area, and the boundaries were marked with wire stakes and string. A section of windrow was gently removed by hand ahead of the combine at harvest. Shaking losses were those peanuts found lying loose on top of the ground in this exposed sample area. The soil within the sample area down to the depth at which the digger blade ran (to firm soil) was sifted for shedding losses. Soil below this depth was sifted for cut-off losses.

Pick-up losses were taken by gently placing a large cloth under the windrow and combining across this sheet at normal speed. After the combine header and wheels passed over the sheet, a second cloth was quickly unrolled over the first to catch the discharge from the rear of the combine. The appropriate area was measured off on these sheets; pick-up losses were recovered from the bottom sheet, and picking and cleaning losses from the top sheet.

Following recovery the peanuts were dried in open mesh bags by natural convention, cleaned, and weighed in-shell. Table 2 gives the projected losses per acre by category, or 1000 times the weights actually recovered.

To determine whether the peanuts lost in harvesting were of a quality worth saving, the samples were shelled and graded by the Federal-State Inspection Service, and the support price determined. It was assumed that they graded Virginia type, and no loose shelled kernels or foreign material factors were considered. These minor deviations from standard grading procedure had little effect on the price. A more important factor was the amount of damage in the samples. According to the current peanut marketing agreement, peanuts with more than 2 per cent damage are not acceptable for edible purposes. Almost half of the samples had 2 per cent damage or less, which is remarkable considering that all peanuts in the sample area were included. Grade factors, support prices, and dollar-per-acre figures are given in Table 3. Above-ground and below-ground portions were combined to obtain a working-size sample.

DISCUSSION

Losses varied considerably, as would be expected, from field to field and by type of loss within a given field. Some of the field-to-field variation can be attributed to the fact that only one location within a field was sampled, and observation has revealed that losses are not normally uniform over a given field.

Table 2. Pounds per acre lost in different phases of harvesting, 1968

County	Sample No.	Below Ground		Total BG	Above Ground				Total AG	Total
		Cut off	Shedding		Shaking	Pick-up	Picking	Cleaning		
Bladen	1	494	424	918	132	58	0	215	405	1323
"	2	7	156	163	135	62	19	89	305	468
"	4	99	629	728	208	89	20	63	380	1108
Avg.		200	403	603	158	70	13	122	363	966
Northampton	1	116	74	190	13	18	118	59	208	398
"	2	127	323	450	93	98	44	32	267	717
"	3	39	120	159	7	11	30	11	59	218
"	4	38	564	602	44	208	44	109	405	1007
"	5	16	95	111	53	12	9	37	111	222
"	6	341	216	557	122	180	11	17	330	887
Avg.		113	232	345	55	88	43	44	230	575
Edgecombe	1	84	486	570	193	25	7	40	264	835
"	2	19	259	278	112	158	0	133	403	681
"	3	198	108	306	43	42	97	156	338	644
"	4	76	2	78	10	37	36	26	109	187
"	5	0	30	30	26	76	17	30	149	179
Avg.		75	177	252	77	68	31	77	253	505
Martin	1	0	102	102	48	89	0	94	231	333
"	2	25	151	176	65	82	0	58	205	381
"	3	0	100	100	69	184	0	53	306	406
"	4	21	201	222	116	10	0	6	132	354
"	5	63	1543	1606	206	8	8	27	249	1855
Avg.		22	419	441	101	75	2	48	225	666
Halifax	1	57	305	362	38	97	0	0	135	497
"	2	26	26	52	32	67	75	23	197	249
"	3	5	175	180	140	50	0	25	215	395
"	4	10	223	233	36	32	16	27	111	344
"	5	31	385	416	211	0	6	126	343	759
"	6	0	131	131	83	0	8	0	91	222
Avg.		22	208	229	90	41	18	34	182	411
Gates	1	0	123	123	91	65	6	54	216	339
"	2	46	511	557	35	119	5	131	290	847
"	3	0	228	228	65	21	28	379	493	721
"	4	0	66	66	58	10	33	51	152	218
"	5	0	271	271	71	60	17	72	220	491
Avg.		9	240	249	64	55	18	137	274	523
Hertford	1	24	589	613	30	66	0	95	191	804
"	2	0	185	185	95	54	0	21	170	355
"	3	11	252	263	123	14	0	78	215	478
"	4	8	187	195	26	35	6	28	95	290
"	5	4	314	318	129	335	5	40	509	827
Avg.		9	305	315	81	101	2	52	236	551
Bertie	1	0	50	50	55	109	9	72	245	295
"	2	0	61	61	50	43	4	18	115	176
"	3	0	56	56	85	9	0	23	117	173
"	4	0	103	103	127	15	0	158	300	403
"	5	0	211	211	135	11	0	5	151	362
Avg.		0	96	96	90	37	2	55	186	282
Avg. for all counties		50	251	301	85	66	17	67	236	536
Percent of average total loss		9.3	46.8	56.1	15.8	12.3	3.2	12.5	43.9	100

Table 3.

Grade factors and dollar value of per acre losses, 1968

County	Sample No..	Total Meats %	OK %	Total Damage %	ELK %	Sound Splits %	Price* \$/cwt	Pounds per Acre	Value \$/Acre	Total Value \$/Acre	Avg. BG Loss \$/Acre	Avg. AG Loss \$/Acre	Avg. Total Loss \$/Acre
Bladen	1 BG**	63	3	7	33		8.81	918	80.88				
"	1 AG***	51	6	2	25		9.60	405	38.88	119.76			
"	2 BG	70	3	1	48		13.35	163	21.76				
"	2 AG	65	3	2	37		12.07	305	36.81	58.57			
"	4 BG	65	1	8	13		7.56	728	55.04				
"	4 AG	44	2	23	10	6	2.87	380	10.91	65.95	52.56	28.87	81.42
Northampton	1 BG	64	2	4	14		10.94	111	12.14				
"	1 AG	68	2	0	20		12.31	111	13.66	25.80			
"	2 BG	64	3	4	24		11.23	602	67.60				
"	2 AG	64	4	0	26		11.89	405	48.15	115.95			
"	3 BG	30	8	24	3		2.48	557	13.81				
"	3 AG	68	5	1	17	8	12.29	330	40.56	54.37			
"	4 BG	57	4	8	19		6.53	159	10.38				
"	4 AG	65	3	1	17		11.79	59	6.96	17.34			
"	5 BG	57	1	4	10		9.57	190	18.18				
"	5 AG	58	3	1	9		10.41	208	21.65	39.83			
"	6 BG	51	5	13	14		4.46	450	20.07				
"	6 AG	66	3	1	32		12.31	267	32.87	52.94	23.70	27.31	51.04
Edgecombe	1 BG	67	1	5	24		10.91	570	62.19				
"	1 AG	52	6	1	18		9.78	265	25.92	88.11			
"	2 BG	71	2	1	8		12.56	278	34.92				
"	2 AG	64	2	0	5		11.28	403	45.46	80.38			
"	3 BG	56	0	7	18	7	6.93	306	21.21				
"	3 AG	69	2	0	25	5	12.54	338	42.39	63.60			
"	4 BG	53	3	5	26		8.67	78	6.76				
"	4 AG	58	4	2	11		10.36	109	11.29	18.05			
"	5 BG	71	4	7	4	5	9.56	30	2.87				
"	5 AG	68	3	2	18		12.16	149	18.12	20.99	25.59	28.64	54.23

*Based on Virginia type, no foreign material or loose shelled kernels

**Below Ground

***Above Ground

(Continued)

(Continued)

County	Sample No.	Total Meats %	OK %	Total Damage %	ELK %	Sound Splits %	Price* \$/cwt	Pounds per Acre	Value \$/Acre	Total Value \$/Acre	Avg. BG Loss \$/Acre	Avg. AG Loss \$/Acre	Avg. Total Loss \$/Acre
Martin	1 BG	67	1	3	30		11.95	102	12.19				
"	1 AG	61	6	2	34		11.52	231	26.61	38.80			
"	2 BG	59	4	7	16		7.81	176	13.75				
"	2 AG	65	4	1	28		12.11	205	24.83	38.58			
"	3 BG	46	7	4	24		8.41	100	8.41				
"	3 AG	56	4	3	29		10.23	306	31.30	39.71			
"	4 BG	51	7	12	9		4.48	222	9.95				
"	4 AG	56	5	6	12		8.27	132	10.92	20.87			
"	5 BG	42	7	21	12		3.00	1606	48.18				
"	5 AG	49	7	11	21		4.41	249	10.98	59.16	18.50	20.93	39.42
Halifax	1 BG	57	3	12	16		5.39	362	19.51				
"	1 AG	64	3	3	16		11.25	135	15.19	34.70			
"	2 BG	70	0	4	31		12.21	131	16.00				
"	2 AG	62	4	1	17		11.35	91	10.33	26.33			
"	3 BG	48	6	1	22		9.19	416	38.23				
"	3 AG	48	6	1	26		9.27	343	31.80	70.03			
"	4 BG	53	8	1	18		10.09	233	23.51				
"	4 AG	60	5	0	16		12.09	111	13.42	36.93			
"	5 BG	74	0	1	14		13.07	180	23.53				
"	5 AG	73	2	1	16		13.08	215	28.12	51.65			
"	6 BG	48	2	19	19	5	3.82	52	1.99				
"	6 AG	52	10	2	14		9.81	197	19.33	21.32	20.46	19.70	40.16
Gates	1 BG	63	1	7	14		8.25	123	10.15				
"	1 AG	63	2	2	16		11.19	216	24.17	34.32			
"	2 BG	47	8	12	12		3.93	557	21.89				
"	2 AG	60	6	1	13		11.05	290	32.05	53.94			
"	3 BG	51	5	2	16		9.33	228	21.27				
"	3 AG	54	5	4	15		9.45	493	46.59	67.86			
"	4 BG	63	4	3	15		11.13	66	7.35				
"	4 AG	52	6	4	13		9.12	152	13.86	21.21			
"	5 BG	54	5	7	19		7.09	271	19.21				
"	5 AG	49	7	9	21		5.41	220	11.90	31.11	15.97	25.71	41.69

(Continued)

(Continued)

County	Sample No.	Total Meats %	OK %	Total Damage %	ELK %	Sound Splits %	Price* \$/cwt	Pounds per Acre	Value \$/Acre	Total Value \$/Acre	Avg. BG Loss \$/Acre	Avg. AG Loss \$/Acre	Avg. Total Loss \$/Acre
Hartford	1 BG	69	3	2	18		12.33	613	75.58				
"	1 AG	62	6	3	9		10.96	191	20.93	96.51			
"	2 BG	58	5	4	15		10.14	185	18.76				
"	2 AG	64	1	4	33		11.29	170	19.19	37.95			
"	3 BG	51	3	7	2		6.05	263	15.91				
"	3 AG	66	2	3	12		11.44	215	24.60	40.51			
"	4 BG	66	2	5	33		11.01	195	21.47				
"	4 AG	59	4	2	24		10.82	95	10.28	31.75			
"	5 BG	50	8	4	16		8.99	318	28.59				
"	5 AG	59	4	1	27		11.06	509	56.30	84.89	32.06	26.26	58.32
Bertie	1 BG	64	2	4	13		10.91	245	26.73				
"	1 AG	55	5	4	10		9.51	50	4.76	31.49			
"	2 BG	67	1	3	31		11.97	61	7.30				
"	2 AG	68	0	0	28		12.35	115	14.20	21.50			
"	3 BG	57	4	5	20	6	9.22	56	5.16				
"	3 AG	66	1	1	16		11.81	117	13.82	18.98			
"	4 BG	9	6	16	1		1.24	103	1.28				
"	4 AG	50	5	7	22		6.47	300	19.41	20.69			
"	5 BG	23	4	22	6		1.96	211	4.14				
"	5 AG	35	5	15	15		2.20	151	3.32	7.46	8.92	11.10	20.02
									Avg.	46.50	23.20	23.30	

Higher losses appear to occur in low spots where the digger blades do not penetrate well, and where the soil does not shed well, than in higher areas having more friable soils. Variations in the categories of losses, i.e., digging, shaking, pick-up, cleaning, etc., reflect both the physiological condition of the plant at harvest and the performance of the machine or machine component used for the particular operation. One may pick out individual fields where it is obvious that the digger was run too shallow (high cut-off losses), the shaker speed was not properly synchronized with ground speed or the rate of travel was too fast (high shaking losses), or the combine pick-up was not properly synchronized with ground speed (high pick-up losses).

On the average, the total value of peanuts lost below and above ground was almost exactly equal; however the pounds lost below ground was greater but of lower value. The average total damage in the peanuts recovered from below ground was 7.2 per cent, as opposed to only 3.2 per cent in those recovered on top of the ground. Eighty-two per cent of the samples taken from below ground had greater than 2 per cent damage; while only 35 per cent of those taken from the surface had greater than 2 per cent damage. This indicates that except where extenuating circumstances exist causing undue loss of good quality peanuts due to shedding or improper digging, it may not be desirable, even if practical to salvage the losses from beneath this soil surface. On the other hand, if a practical device for salvage from the soil surface could be devised, it might be economically feasible to use it in half or more of the peanut fields.

It was hoped that supplementary information about the field and harvest conditions, such as variety, days in the windrow, moisture content at combining, days since last rain prior to digging, etc., would permit an analysis that would correlate types and causes of losses. However the data actually procured was not complete enough with respect to these parameters to support such an analysis.

Per cent loss figures, where available, are given in Table 4 by counties and for the state as a whole. In some cases the per cent of loss could not be calculated because the marketed yield of the field was not available. Some attempt is made to separate the per cent loss by variety, type of windrower used, and the moisture content at combining. Although the data cannot be considered conclusive, it indicates that variety has an effect on the extent and type of harvest losses; that inverted windrows produce less harvesting loss, especially above-ground loss; and that combining at high moisture contents results in less above-ground loss than at intermediate moisture contents.

One fact obvious from the range of total field losses is that some operators are experiencing much lower field losses than others. This wide range of from 5 to 35 per cent losses could be due largely to the physiological state of the peanut plants at digging, but one suspects that it is also due in part to the care with which the harvesting equipment is adjusted and operated. If so, the monetary incentives are certainly adequate to justify increased attention to the harvesting operations on the part of many growers, especially those whose losses are in the \$75 - \$100 per acre range.

Some design improvement in equipment can undoubtedly be made which will lead to more efficient performance; however these potential improvements are marginal and are far overshadowed by the potential for reducing losses through proper operational adjustments and procedures on existing equipment, more

attention to digging at the proper time, and maintenance of the peanut plants in a disease-free condition up to the time of digging.

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Table 4. Loss percentages by counties, major varieties, and moisture content at combining, 1968

Category	No. of Samples in Test	Percent Loss					
		Below Ground		Above Ground		Total	
		Range	Average	Range	Average	Range	Average
County*							
Bladen	3	5 - 20	15	9 - 10	9	14 - 30	24
Martin	5	3 - 30	9	4 - 10	6	9 - 35	16
Halifax	6	2 - 16	8	2 - 13	6	7 - 29	14
Gates	5	2 - 14	7	5 - 18	9	8 - 26	16
Hertford	5	5 - 24	10	3 - 9	6	8 - 31	16
Bertie	5	2 - 11	5	3 - 16	9	5 - 21	13
State Average			9		7		16
Variety							
Florissant	10		10		7		17
NC-5	7		11		7		18
NC-2	7		6		6		12
Other	6		8		9		17
Type Windrow							
Inverted	2		8		3		11
Random	28		9		8		17
Moisture Content at Combining							
25-29%	6		6		5		11
20-24%	6		10		9		19
Less than 20%	13		8		7		15

*Northampton and Edgecombe Counties not included in this summary due to lack of yield data.

MECHANISMS FOR PICKING PEANUTS FROM ORIENTED PLANTS¹

by

J. L. Butler, F. S. Wright and E. J. Williams²

The quest for reducing the labor required for peanut harvesting has resulted in changing from the stack-pole stationary picker curing and harvesting to windrow curing and combining from the windrow. While this change has resulted in tremendous labor saving, it does have several disadvantages. Some of the major ones are: (1) peanuts are left to cure and dry in an environment over which we have no control; (2) undesirable mold growth may occur during the time the peanuts are in the windrow; (3) birds and rodents often take their toll of peanuts in the windrow; (4) cylinder-type combines must strike the pod hard enough to remove it from the plant, frequently causing breaks and splits and leaving an easy access for molds, insects and other contaminants to reach the kernels; and, (5) prolonged, heavy rainfall following windrowing may result in a total loss of the crop.

If the peanuts were combined immediately behind the digger, the windrow problems would be eliminated. The cylinder-type combine can handle peanuts in this condition, however, the combine must be made more aggressive, requiring more power and resulting in more damage to pods. Furthermore, the separating of vines and other foreign material from the peanuts is more difficult than when the vines are dry.

Early picking mechanisms depended upon dragging the vines across a stationary screen to remove the pods. In this process, the pods eventually dropped into the screen openings and were pulled from the plant. Because of the random orientation of vines and pods, this process was rather slow. If the plants were oriented so that only the pods instead of the entire vine mass were exposed to the screen, it should be possible to greatly increase the capacity. Further, if the screen or pod removing mechanism were rotating, it should be possible to get high capacity from a rather compact unit. Since the peanut plant grows in such an orientation, taking them from the ground and maintaining orientation until after picking appears to have possibilities.

Mills (2) was one of the first to make use of the oriented plant. He constructed a "once-over" machine which maintained plant orientation until the pods had been removed. The picking device consisted of two rotating reels, each containing 4 bars, which removed the pods by impact. This probably produced less damage than the cylinder-type combine. Since the pods were removed by impact, however, it may be expected that some damage was done and that a

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2. Agricultural Engineers, Agricultural Engineering Research Division, Agricultural Research Service, U. S. Department of Agriculture, located respectively, Coastal Plain Experiment Station, Tifton, Georgia; Tidewater Research Station, Holland, Virginia; and, Coastal Plain Experiment Station, Tifton, Georgia.

3. Numbers in parentheses refer to appended references.

reasonable amount of vines were left mixed with the peanuts. Wood (3) reported that research conducted in Australia with a similar machine gave quite variable results. Under conditions ranging from adverse to good, the total harvesting efficiency ranged from 1.7 to 70.3 percent. Since this is a "once-over" type of machine, the efficiency is for the total harvesting operation. Thus, even the most efficient machine needs considerable improvement in order to be acceptable.

Picking from oriented plants appears to offer several advantages, consequently, research on such mechanisms is being conducted at Tifton, Georgia and Holland, Virginia, by the AERD, ARS, USDA.

MECHANISMS AND TESTS

Tifton, Georgia - 1968

During the summer of 1968, an apparatus was constructed which would allow a rotating screen picking mechanism to be tested in the laboratory. Cylinders ranging in diameter from 9 to 15 inches were made from expanded metal. Preliminary tests were made using openings ranging from 1 1/4- x 2 1/2-inch to 1 3/4 x 3 1/2-inch. These indicated that cylinders with 1 3/4- x 3 1/2-inch openings were better than those with smaller openings. The cylinders were constructed so they could be rotated either concentrically or eccentrically. Paired, serrated rubber belts were used to grip the plants and move them across the cylinders. The configurations tested are shown in Figures 1 and 2. For Configuration No. 1, a reciprocating motion was used so that the pods on each side of the plant would be exposed to the cylinder. The six small cylinders indicated for Configuration No. 2 were 9 inches in diameter and were rotated either with or against the flow of vines. In Configuration No. 3, the cylinders picked from both sides of the vine at the same time and were angled so that the distance between them decreased as the vine progressed through. In addition, the axes were tilted so that more of the vine would be exposed to picking action. All cylinders except those used in Configuration No. 2 were 15 inches in diameter.

Peanuts used for these tests were mechanically dug and shaken, brought to the laboratory, and hand-fed into the picking mechanism. All peanuts remaining on the vines after passing through the picker were removed by hand, counted and the picking efficiency (based on number) calculated. Damages were assayed by using a sample of 100 pods. These were classified as broken pods, split pods, and those with no visible damage. Those with no visible damage were immersed in a solution of Fast Green dye, dried, and hand shelled to examine the interior of the hull. Those showing stain were considered to have invisible cracks and those showing no stain were considered intact.

Results of these tests indicated that any of the configurations could possibly be used to pick peanuts from oriented plants. Complete results of these tests have been presented (1), showing that none of these configurations produced damages much greater than hand picking. The efficiencies, using Starr Spanish, Early Runner and Florigiant peanuts, ranged from a low of 37 percent (Early Runner peanuts, Configuration No. 3 at 54 rpm) to a high of 84 percent (Starr Spanish, Configuration No. 2 at 154 rpm). Overall, it appeared that Configuration No. 1 produced the most uniform results.

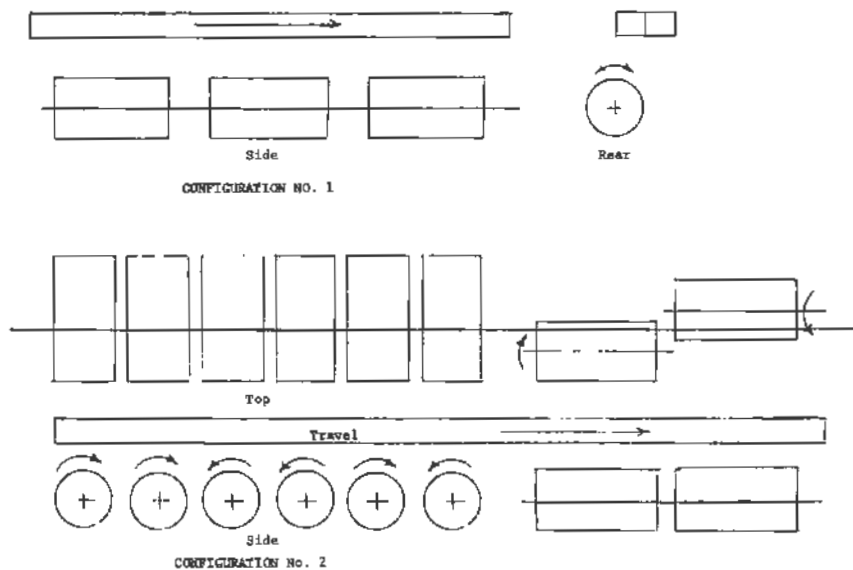


Figure 1. Multi-cylinder configurations, 1968.

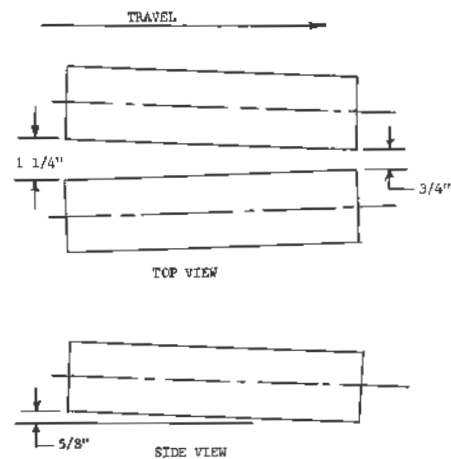


Figure 2. Cylinder Configuration No. 3, 1968.

MECHANISMS AND TESTS

Tifton, Georgia - 1969

For 1969, a device for testing different picking mechanisms was built on a set of combine wheels. This included pick-up belts to elevate the plants from ground level to the picking belts and a framework for mounting different picking screen or cylinder arrangements.

The first arrangement tried was that shown in Figure 3. This arrangement was used in the belief that it would combine the good results from Configuration No. 1 in 1968 with a rotating, rather than a reciprocating, system. To convey the peanuts over the picking cylinders, two pairs of serrated belts were tried. These were not satisfactory because the cylinders pulled vines out of the belts at the transfer point. The particular type of belt used was available only in this length, therefore the belts were replaced with chains.

The use of chains satisfactorily held the peanuts for the entire length of the picking cylinders. With the chains moving at 90 fpm, only about one second was allowed for each cylinder. As a result, the plant did not have time to be oriented to a cylinder before it was required to change direction again. To eliminate this problem, the five short cylinders were replaced by two cylinders, each 4 feet long. In order to get better contact between the vines and the cylinders, conveyor belting was mounted so that it hung in contact with the cylinder. As the peanut plants were conveyed along, the belting insured contact with the picking cylinder.

Preliminary tests indicated that top picking efficiency with this arrangement was in the range of 60 - 70 percent. To improve the efficiency, two counter-rotating cylinders were mounted similar to Configuration No. 3 of 1968, except the axes were parallel. After the peanuts had passed over the second primary cylinder, they were passed between these counter-rotating cylinders (Figure 4). This improved the efficiency considerably.

From early observations, it appeared that the larger peanuts were being picked first. To determine this, the space under the two primary cylinders was divided into 5 sections. These are referred to as pans 1 through 5. The container to catch those picked by the counter-rotating cylinders was designated No. 6. The results of the size distribution, picking efficiency and damage are shown in Table 1.

From this, it can be seen that the larger pods were picked first and also that the two counter-rotating cylinders, while increasing the picking efficiency, contributed heavily to the damage. More uniform feeding of these cylinders in subsequent tests resulted in lower damage. The combined averages (from two to four replications per test) are shown in Table 2. These results indicate that the rotating cylinder or screen does have the potential to efficiently pick peanuts with a minimum of damage.

MECHANISMS AND TESTS

Holland, Virginia - 1969

During the 1969 season, a device to pick peanuts from oriented plants was designed and constructed for laboratory testing. This mechanism consisted of a vine conveyor, vibrating rack, fixed rods, two rotating drums for picking, and a

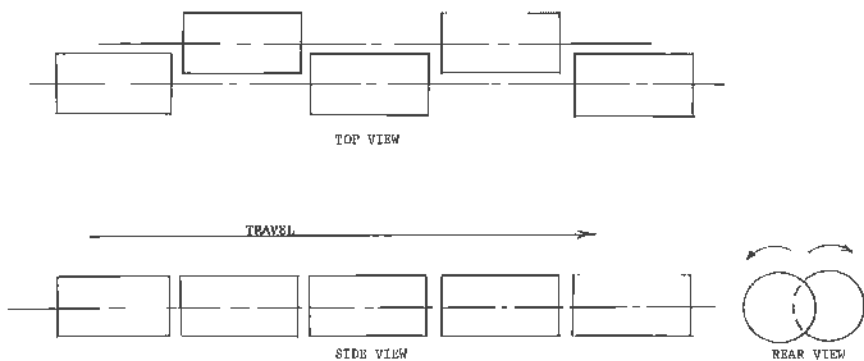


Figure 3. First arrangement tested in 1969.

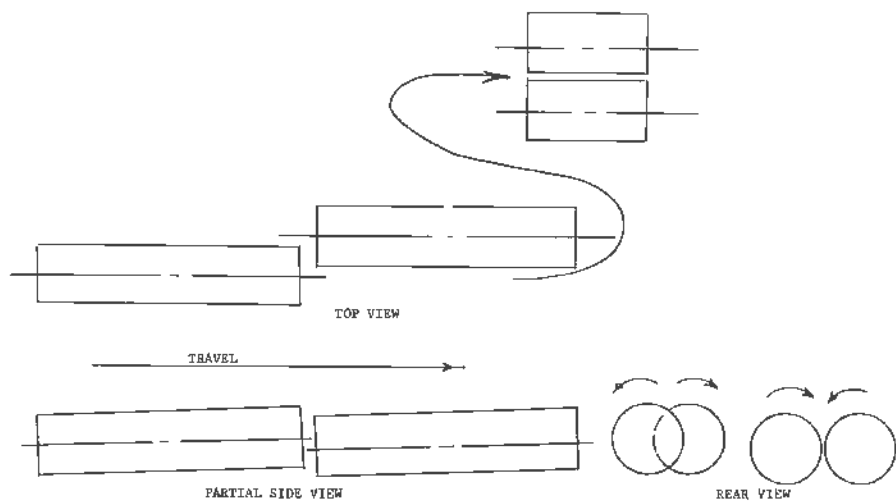


Figure 4. Second arrangement tested in 1969

TABLE 1. EFFICIENCIES AND DAMAGES TO FLORIGIANT PEANUTS FROM USING A ROTATING SCREEN PEANUT PICKER, 1969.

	Total Weight gms	Number	Damage to Hulls			No Stain %	Picking Efficiency %	Average Weight gms
			Broken %	Split %	Stain ^{1/} %			
Pan No. 1	120.1	63	6.0	3.0	49.0	42.0	18.3	1.91
Pan No. 2	224.1	122	27.0	11.0	45.0	17.0	34.1	1.84
Pan No. 3	55.2	36	25.0	11.0	32.0	32.0	8.4	1.53
Pan No. 4	32.0	24	8.0	17.0	38.0	37.0	4.9	1.33
Pan No. 5	14.5	21	14.0	19.0	48.0	19.0	2.2	0.69
Pan No. 6	142.5	93	33.0	13.0	29.0	25.0	21.7	1.53
Other ^{2/}	20.0	19	5.0	32.0	47.0	16.0	3.0	1.05
Total Picked	608.4	378	22.0	12.2	40.5	25.4	92.5	1.61
Unpicked	49.0	46	10.9	4.3	43.5	41.3	7.5	1.06

^{1/} Pods showing penetration by Fast Green dye.

^{2/} Pods which were picked, but not deposited in any pan.

TABLE 2. PICKING EFFICIENCY AND DAMAGE TO PEANUTS FROM ROTATING SCREEN PICKER, 1969.

	Picked %	Broken %	Split %	Stain ^{1/} %	No Stain %
Florunner ₁	84.0	8.5	11.6	30.6	47.8
Florigiant ₁	92.5	22.0	12.2	40.5	25.4
Florunner ₂	83.3	6.3	10.1	32.1	51.9
Florigiant ₂	90.0	4.9	9.3	20.2	65.6
Hand-picked Florunner (check)		0.0	4.0	25.0	71.0
Hand-picked Florigiant (check)		0.0	5.0	46.0	49.0

^{1/} Pods showing penetration by Fast Green dye.

feed conveyor (Figure 5). The mechanism without the feed conveyor was about 30 inches wide and 84 inches long. The feed conveyor was about 8 feet long.

From the feed conveyor the overhead vine conveyor moved the vines between the fixed rods and vibrating rack, across the rotating drums. Both conveyors were driven at the same linear speed with a variable speed motor, which permitted easy adjustment of the feed velocity. The vine conveyor consisted of $\frac{1}{4}$ -inch rods bolted to wooden strips which were attached between two chains. The wooden strips were spaced 8 inches apart.

The vibrating rack was constructed of $\frac{3}{8}$ -inch rods spaced 3 inches apart. It was vibrated at an amplitude of $\frac{1}{8}$ -inch and a frequency of approximately 800 cycles per minute. Vertical space between the fixed rods and vibrating rack was about one inch.

Two rotating drums, 12 inches in diameter and 27 inches long, were positioned under the vibrating rack. Each drum had 12 notched picking strips attached. The picking strips were about $1\frac{1}{4}$ inches high, and the notches, which were spaced $\frac{1}{2}$ -inch (center distance), were $\frac{5}{16}$ -inch deep and $\frac{1}{4}$ -inch wide. The rotation of drum No. 1 was against the flow of vines and the rotation of drum No. 2 was with the flow of vines. The speed (rpm) of the drum was set so that the relative velocity between the picking strips and the vine movement was the same for both drums. The drums were driven with a variable speed motor independently of the vine and feed conveyors.

In operation, freshly dug peanut plants are fed onto the vibrating rack. The peanut pods hang below the rods and are removed by the picking strips rotating drums.

For the laboratory tests, freshly dug vines were placed on the feed conveyor and fed through the mechanism operating at selected speeds. The peanuts removed by each drum were caught in separate containers. Pods remaining on the vines were picked by hand. The picking efficiency was determined on a weight basis (foreign material not included) after the peanuts were dried and stored (moisture content, 6 - 8 percent).

In addition, the peanuts were assayed for mechanical damage. Pods with "visible damage" were removed. The apparent sound pods were submerged in a Fast Green dye solution. Those pods in which the dye penetrated were classed as "invisible damage" peanuts.

Laboratory tests were conducted using three feed velocities (fpm) and three drum speeds (rpm). Each of the nine tests was replicated four times. The peanuts (Va. 61R variety) were dug with a commercial digger without the windrow fingers. The peanuts were taken to the laboratory and placed on the feed conveyor by hand. Even though the vines were handled carefully, some of the peanut fruit became entangled in the vine mass.

The picking efficiency (Table 3), using the two drums arranged as described above, ranged from 75.6 to 85.6 percent for the nine tests. The highest picking efficiency resulted at a feed velocity of 60 fpm and a relative velocity of 407 fpm (drum No. 1 speed - 90 rpm). An average of the nine tests indicated that 65.6 percent of the peanuts were removed by drum No. 1 and 16.0 percent were removed by drum No. 2. Drum No. 2 removed about 46 percent of the peanuts left on the vines after passing drum No. 1.

In general, the results (Figure 6) indicated that about 83 percent of the peanuts can be removed with a feed velocity of 90 fpm (ground speed about 1 mph) and a relative velocity of 450 to 550 fpm between the vine travel and

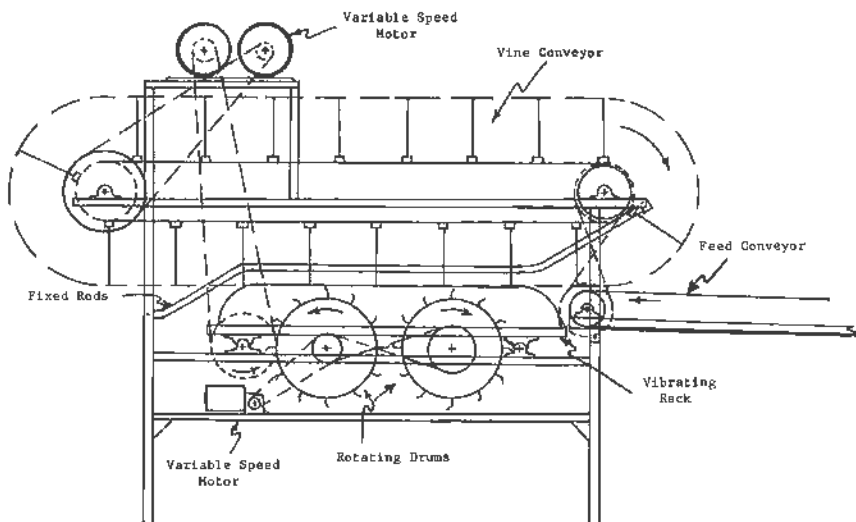


Figure 5. Schematic of laboratory picking mechanism, 1969.

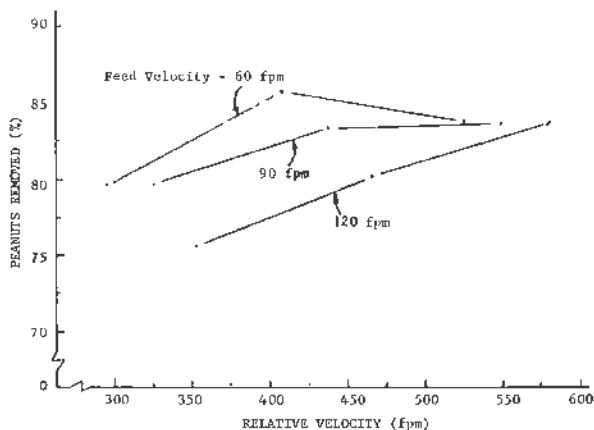


Figure 6. Picking efficiency versus the relative velocity for the laboratory picking mechanism, 1969.

picking drums (less than 20 percent of the relative velocity between cylinders in commercial combines). Because some peanuts became entangled with the vine mass, directing the plants into the picking component immediately behind a digging component should help maintain the natural (desired) peanut-plant orientation and increase the picking efficiency of this device.

Determinations of the pod damage indicated that the amount of visible hull damage for peanuts collected under drum No. 1 was about one-half that for peanuts collected under drum No. 2 (Table 4). Computing the total visible hull damage on a weighted basis of the peanuts picked by each drum, the visible hull damage averaged 4.5 percent with a range of 3.1 to 6.5 percent. This was considerably less than the visible hull damage done by commercial combines. A general trend was indicated between the visible hull damage and relative velocity within each of the feed velocity settings. That is, the visible hull damage increased with an increase in the relative velocity. The weighted average invisible hull damage was 21.7 percent with a range of 16.4 to 26.4 percent. Loose shelled kernels from the picked peanuts were less than 0.5 percent.

SUMMARY

The mechanisms tested indicate that it is possible to mechanically pick peanuts from an oriented plant with damage comparable to hand picking. Only a slight improvement in harvesting efficiency would bring this to an acceptable level. Since these are designed to pick freshly dug or "green" peanuts, complete mechanical drying will be required. This can be carefully controlled and could result in a highly acceptable product. The advantages of using such mechanisms to harvest "green" peanuts appear to make these worthy of additional investigation.

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TABLE 3. DAMAGE ANALYSIS OF THE PEANUTS PICKED WITH THE LABORATORY MECHANISM (VA. 61R), 1969.

Test No.	Relative Velocity fpm	Visible Hull Damage				Invisible Hull Damage ^{1/}			
		Drum No. 1	Drum No. 2	Weighted Total ^{2/}	Remaining on Vines ^{3/}	Drum No. 1	Drum No. 2	Weighted Total ^{2/}	Remaining on Vines ^{4/}
		%	%	%	%	%	%	%	%
1	292	2.8 ^{2/}	8.3	3.8	5.2	19.9	25.4	20.9	15.4
2	407	3.1	8.1	4.1	5.7	23.9	37.2	26.4	12.7
3	523	5.7	7.4	6.1	7.8	20.8	29.0	22.5	14.0
4	322	2.7	5.4	3.1	5.2	14.0	28.2	16.4	16.7
5	437	2.2	6.3	3.1	4.9	13.8	42.3	19.0	12.2
6	553	4.8	12.3	6.5	8.5	23.1	39.7	26.6	22.4
7	352	3.0	6.0	3.6	5.5	17.9	26.7	19.7	22.1
8	467	5.2	7.0	5.6	9.6	19.7	23.4	20.5	15.5
9	583	4.5	9.0	5.4	8.2	17.6	40.6	22.1	19.5
Ave.		3.7	7.8	4.5	6.7	19.0	32.5	21.7	16.7

^{1/} Pods showing penetration by Fast Green dye.^{2/} Average of four replications.^{3/} Weighted total damage of peanuts removed by picking drums^{4/} Peanuts remaining on the vines were picked by hand.

TABLE 4. TEST CONDITIONS AND PICKING EFFICIENCY FOR THE LABORATORY MECHANISM (VA. 61R), 1969.

Test	Feed Velocity fpm	Drum No. 1 Speed rpm	Relative Velocity fpm	Peanuts Removed			Peanuts Remaining
				No. 1	No. 2	Total	
				%	%	%	%
1	60	60	292	65.7 ^{1/}	14.2	79.9	20.1
2	60	90	407	69.1	16.5	85.6	14.4
3	60	120	523	66.1	17.4	83.5	16.5
4	90	60	322	66.0	13.6	79.6	20.4
5	90	90	437	68.0	15.3	83.3	16.7
6	90	120	553	65.6	17.8	83.4	16.6
7	120	60	352	59.8	15.8	75.6	24.4
8	120	90	467	62.8	17.2	80.0	20.0
9	120	120	583	67.0	16.4	83.4	16.6
Aver.				65.6	16.0	81.6	18.4

^{1/} Average of four replications.

IF I WERE DIRECTOR OF PEANUT RESEARCH

by

J. B. Roberts - Peanut Sheller, Oothan, Ala.

Presented at San Antonio, Texas July 14, 1970 at American
Peanut Research and Education Assn. Inc. Annual Meeting

When Bill Dickens asked me to appear on this program and present the research needs of the peanut shellers, I felt ill prepared and decided to seek assistance from other shellers. I requested the three sheller associations to send out questionnaires to their members and as a result, I received 27 fully or partially executed questionnaires. I consider the replies to be representative of the views of the Southeastern Shellers but an insufficient number were received from the other two areas to be representative of their views. I have reviewed the document entitled "A National Program of Research for Peanuts" prepared by a joint task force of the U. S. Department of Agriculture, the State Universities and the Land Grant Colleges and appreciate its value and comprehensive coverage of peanut research needs but decided to confine my remarks to the immediate production needs of the commercial dryer operator and peanut sheller as revealed by the questionnaires I received.

I, therefore, list below the top ten needs of the commercial dryer operator and peanut sheller with a brief explanation of what I think each means. I have tallied the items by a point system similar to the weekly football polls; that is, ten points for first, nine points for second, eight points for third, etc. In other words, if all persons who responded had voted for the same item as number one, it would have tallied 270 points. Twenty items were mentioned in all the questionnaires.

1. Utilization of Peanut Hulls. 142 points

Most shellers are concerned about air pollution from the present disposal method and also consider that burning large quantities of hulls is an economic waste. The new Richard B. Russell Laboratory at Athens, Georgia has been consulted and also the Southern Research Laboratory at New Orleans. This is an urgent matter with the shellers and its importance cannot be over emphasized.

2. Improvement in grading procedures of Farmers Stock Peanuts to more accurately reflect shell-out. 123 points

This is an age old problem which has been under discussion with the Federal - State Inspection for some years. The Inspection Service is convinced that the practice of grading hot (warm) peanuts directly from the dryers, is a contributing factor to this problem. Some research work has been done on this item and more is planned for the 1970 harvest season.

3. Better Drying Method (Faster, more efficient system) 111 points

There seems to be a limit to the potential improvement possibilities in the wagon or bin type dryer. A new or totally different approach is needed in this problem area.

4. TIE Better Insect Control Methods in Bulk Storage 94 points

This, of course, refers to Farmers Stock Storage Warehouses. Even though this item came in fourth in the poll, it is upper-most in the minds of the shellers in the extreme Southern Areas. The same control measures are not equally effective each year. The theory has been advanced that the insect cycle is worse each third year. The Agricultural Research Service Laboratories at Tifton and Savannah, Georgia are very much aware of our problem.

5. TIE More efficient cleaning system for Farmers Stock Peanuts 94 points

This would be very beneficial to better drying, better storage and better shelling. So far as I know, very little research work is being done in this important area.

6. Development of a better peanut sheller 91 points

There has been no major modification or improvement in the existing shellers since the peanut shelling industry started. Perhaps some bright, young scientist will develop an electronic device to shell peanuts (with no splits).

7. Better disposal method for peanut hulls 90 points

The sheller is saying here -- if research cannot utilize peanut hulls to some economic advantage then give us a better disposal method (less smoke and fly-ash from the incinerators).

8. Labor saving equipment for packaging or bulk handling of shelled peanuts. 76 points

One sheller commented to me that the shellers have instituted labor saving devices in other areas but we still end up with one bag of shelled peanuts to be handled by hand. Much work has been done in this area; in fact the National Peanut Council had a special Committee working on Bulk Handling of shelled peanuts but to my knowledge, no definite recommendations have resulted from their efforts.

9. Improvement in present Drying Methods. 69 points

There is a feeling that improvements can be made in the wagon and bin dryers with proper handling and temperature controls. In other words, work in this area of research should continue and not center totally on Item Three above. (New Method).

10. Better Farmers Stock Peanut Handling Equipment. 59 points

This means equipment that will handle Farmers Stock more gently with less breakage and damage to the hulls and kernels. It also includes faster handling.

I am listing below the remaining items mentioned in the poll as items eleven through twenty without comment but showing the points received in the poll:

11. Better Method of Sampling Shelled Peanuts 58 points

12. New Machinery to Handle Shelled Peanuts more gently 50 points

13. Faster Method of Grading Farmers Stock Peanuts 48 points

14. Development of More Efficient Elevating and Conveying Equipment 42 points

15. Development of better separating Machinery 41 points

16. Improvement in Bulk Storage of Farmers Stock to Protect Quality of Peanuts 39 points

17. More efficient Electric Sorting Machinery 34 points

18. More Efficient Sizing Machinery 27 points

19. Moisture Control While Shelling 8 points

20. Utilization of Peanut Protein for Human Consumption 7 points

You will notice I have omitted Marketing Research and the Mycotoxin Problem altogether. I hope the shellers can discuss Marketing Research with you when you solve our production problems; shall we say at next year's Annual Meeting? The Mycotoxin Problem was not mentioned as it is being amply covered by others on the program.

It is extremely difficult to talk about improvements in Commercial Dryer and Sheller Operations without getting over into the growers' Problems as many

shellers feel that improvements in harvesting methods are essential to effecting improvements at the Dryer and Sheller levels.

If you have any questions, I will be glad to try to answer them as time permits.

Thank you.

IF I WERE DIRECTOR OF RESEARCH FOR 1 DAY

by

Floyd L. King

APREA Meeting, San Antonio, Texas - July 14, 1970

Thank you, Mr. Conway, for the fine introduction and may I also thank the Officers and Directors of this Association for the tribute and the honor accorded me by your invitation to serve on this Panel?

First of all, I would like to express my gratitude to the highly dedicated research personnel in attendance here today for their persistent labor and untiring efforts toward peanut research and may I speak for the producers in thanking the industry for helping make the peanut industry the No. 1 commodity group in the nation, and I am sure we all have a great deal of pride within ourselves whenever the peanut industry is referred to.

We do not have to consider this very long before we begin to compare what we are now doing in research and promotion with what we were attempting to do in the 1950's and I must say the support far surpasses all efforts made during the 1950 decade.

"Research Director for a Day" -- I must ask the question "Did you really plan to get rid of us after one day's work -- or -- did you really think that we could solve it all in one day?" We must admit that an individual literally having this type of awesome task would be one that we could take our hats off to. I could say, and really mean; that we need to develop a peanut which will bloom and set on spikes in remarkable numbers within a very short period of time. One that will bloom extremely heavy and set fruit at an early stage and then put forth its energy into development and maturing at an early date.

This same peanut needs to be one that stands tough environmental conditions such as hail, flood, storms, bad herbicides, good herbicides, bad combine operators, etc. The vine needs to have a good harvesting height with strong stems to hold nuts to the vines, yet, have stems light enough so that when the cylinder of the combine hits it, it will easily break at the proper spot and otherwise combine well. It needs to be very resistant to diseases and insects. We need to have this peanut to grade from 78 to 80. It needs to taste well and have an excellent shelf life -- (in fact, maybe get better with age), and through the decade of the 70's yield 200 to 250 bushels per acre, and at the conclusion of the 70's this or another peanut will need to be yielding 300 bushels per acre.

These figures may seem astronomical to us now, but they are within range of reason and if escalation of cost follows the line that Kiplinger says it will follow, then we will simply have to have this kind of yields to just stay even economically. This peanut needs to have one other attraction; That is somehow it needs to have a make-up that will cause City Congressmen to further develop or recommend a program that would tend to help the producer to raise this peanut at a reasonable profit.

Now as to research specifics -- No. 1 Priority -- I believe the producers would say "This is mycotoxins or otherwise known to us as aflatoxin and its relatives." This needs to be delicately studied on a long term basis from numerous angles, but especially do we need research following through on questions of carcinogenic or non-carcinogenic aspects as related to our peanuts. This is urgent and I think absolutely necessary.

No. 2 Priority -- The complete mechanization picture needs to be changed otherwise, modified -- starting with the planters which plant the peanut seed. We

need a peanut planter that will give tender loving care to the seed, yet, be able to plant in a small or large quantity at a slow or rapid rate. Harvesting -- handling -- curing -- these items I think have been used to experiment on the producer with at the producer's expense. In other words, buy it, if it does not perform; we'll improve it next year and then you can buy it again, and don't worry too much who gets hurt. I do not purport to slam any certain company or manufacturer, but I do say that I think these things have happened and are pertinent and certainly have their place in this meeting today. The handling and curing processes at some drying points are not being used properly. There are too many bins and/or dryers on one blower. It is hard to follow through and maintain identity of the producer's peanuts as he would desire this to be done. Splits and shelled are blamed on the producer. We think it is wise to consider these recommendations. Why don't we start now to saving more of that 300 bushel potential.

No. 3 Priority -- Diseases and Insects -- Much could be said on this subject, but I wonder if we could develop mass rearing of good insects or biological solutions to diseases and/or insects such as the screw-worm eradication program. Insects have natural enemies, why would not diseases have natural enemies and if so, why should we not mobilize this force to solve more disease and insect problems?

No. 4 -- Breeding -- I think perhaps, anyone working in this particular field should feel proud and should be a dedicated person and certainly be subject to never ceasing long range work depending upon and believing in enormous dividends somewhere down the road. Resistant genotypes should receive every minute of attention possible to develop hybridization methods important toward creating varieties resistant to our many diseases -- good breeding can eliminate or solve many of our problems.

No. 5 -- Weed Control -- Each area has from one to three stubborn weeds or grasses that are gobbling up expense money paid out by the producer; two such weeds in the southwest and in particular Oklahoma are the sunflower and the common bull nettle. These are giants at eating up producer's expense money, and we seem to look at it, give up, and forget it. It will never go away by itself. Surely with a staff of research personnel gathered here today, coupled with the chemical industry, we can solve these problems. We also need a herbicide that is highly effective with grain sorghums, but yet will allow peanuts to be produced on this soil the next year. This is most important when related to rotational problems.

No. 6 -- Root and Pod Fungi -- Bacteria -- Soil Born Micro Organisms -- They really kill and stunt the peanut vines in a frustrating and costly manner. It is estimated that we have a 12% loss due to these soil born organisms including the nematode, which is a creeping giant causing roughly 18 million dollar loss annually to the producer.

No. 7 -- We need to look at objective methods of determining quality. I think we need to develop or build or otherwise perform a program whereby we could computerize the taste, the odor, the saleability, or otherwise called the plusses and minuses affecting consumption and somehow, in this computerized picture, look closely at those items which have to be researched in specific geographic locations. There are some things which could be researched separate from and not related to particular areas, thereby freeing some personnel for research on projects more related to their areas.

No. 8 -- We need to release those "negative" reports and their data which are and have been pigeon-holed in file cabinets in most University research centers, where benefits to the producer would be served without breaking unity of the industry.

No. 9 -- We need to have equal or near equal federal research funds in each area. We cannot afford to have severe divisions within the industries caused by such disparity.

No. 10 -- We need the entire industry to support research which would tend to correct the agricultural image as most people in the United States see it -- Agriculture is in severe danger of losing its identity and its influence. The producer of agriculture products has for the last twenty years, worked to gain access to the national economic mainstream of America. In fact, it has even to this day, still eluded the American farmer and I think this goal of the American farmer threatens to become even more elusive unless national attention and support can be mobilized to help solve agriculture's very difficult and persistent problems. Agriculture has lost representation, but its effect and influence is most persuasive on the U. S. economy; therefore, the entire agri-business sector -- steel -- chemical -- fertilizer -- oils -- all of these groups should recognize and should assist in solving this problem and help the farmer come out of this second class economic status.

I think, within this image, we must attempt to let every one know that despite all of these problems, there has been a marvellous and continuous flow of high quality goods into the American market and despite the fact that there has been improved growth in the national economy during the last twenty years -- farm income actually fell by 3 billion dollars. No other group or segment would have taken this loss without making it known far and wide.

In addition, to our research recommendations we would appeal and urge you to join with us in redressing an old and yet, new grievance through research. Yes, as Director for a Day -- I would direct that all personnel arm themselves with the facts and undertake to graphically illustrate where feasible and possible, the necessity for agriculture and its related fields to speak one language for the benefit of its own people and for the furthrance of (Research Tomorrow) yet unheard of today.

Yes, let's dream, but today let's start putting legs and wings on these dreams. Thank you.

SHELLING PLANT STUDIES WITH INSECT-INFESTED PEANUTS¹

by

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INTRODUCTION

Farmers stock peanuts improperly treated or inadequately stored invariably develop large populations of insects prior to shelling. Runner-type peanuts containing infestations of the four more common storage insects, almond moth, *Cadra cautella* (Walker); Indian-meal moth, *Plodia interpunctella* (Hubner); red flour beetle, *Tribolium castaneum* (Herbst); and merchant grain beetle, *Oryzaephilus mercator* (Fauvel), were shelled at the USDA experimental pilot shelling plant at Dawson, Ga. The objectives of our study were to determine the destination and distribution of insects during the shelling operation and to correlate the degree of insect infestation with the shelling outturn of farmers stock peanuts.

MATERIALS AND METHODS

Five 850-lb. lots of Runner-type farmers stock peanuts were used in the study. These lots were selected because they contained varying amounts of live and dead insects as a result of prior storage experiments. The peanuts were maintained under storage conditions ideal for the development of stored-product insects. At periodic intervals, insects were introduced into the storage environment in order to expose the peanuts to a high insect population pressure.

Process operations of the pilot peanut shelling plant are shown in the flow chart of Figure 1. Plant operations and equipment for the study were similar to those used throughout the shelling industry. Cleaning of the farmers stock peanuts was performed by processes involving aspiration, screening to remove sticks, dirt, and broken kernels, and air stoning to remove heavy foreign materials. Handling was performed by "easy dump" bucket-type elevators. Final stoning of unshelled peanuts was performed by a specific gravity separator (vibration and air flotation), and loose-shelled kernels (LSK's) were removed by vibrating screens. The loose-shelled kernels removed by the cleaner were held separately and were not rerouted around the shellers to the gravity table to enter the shelled peanut stream. Shellers were cast iron (grate and sheller bar) types, operating at 205 rpm. Hulls were removed at the shellers and also at the separators. Separators were 2-deck vibrating screens that separated most of the

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oilstock and unshelled peanuts from the shelled goods. A specific gravity separator table performed the final separation of shelled and unshelled peanuts. The shelled peanuts were graded by precision reel-type graders.

The shelling plant was set up to provide a maximum outturn of shelled peanuts that would meet U. S. grade standards. Samples were removed at the points indicated in Table 1. Generally, when insects were observed, the entire quantity of material was collected and retained for examination. Exhaust air was sometimes filtered to detect losses of insects through the aspiration systems.

All peanut samples collected were examined in the laboratory, and all stages of live and dead insects were recorded. Following examination, the peanut samples were maintained in a controlled environmental room for 35-40 days before they were examined again for insect emergence. The 35-40 day period allowed time for eggs to hatch and undetected small larvae to mature to a size to facilitate counting.

The shelling outturn data (Table 3) was transposed from 850-lb. lots to ½-ton lots to make the data comparable to terms used in the shelling industry.

RESULTS

Prior to shelling of the peanuts, the majority of the insects--approximately 97-99 per cent--were removed by aspiration and screening during the cleaning operation (Table 1). Most of the remaining insects were recovered from the loose-shelled kernel and oilstock peanuts destined for crushing. However, when farmers stock peanuts are heavily infested, adult insects are also recovered from the finished peanuts. At high infestation levels, insects are recovered from the hulls. This is especially true when large populations of merchant grain beetles are present.

Emergence of insects from peanut samples (Table 2) would seem to indicate that vibrational and aspirational equipment are effective in removing most insect eggs. However, under abnormally high infestation levels, large numbers of eggs and minute larvae carry over into the marketable-grade peanuts. From 65-100 per cent of the eggs and immature insects are carried with the loose-shelled kernels and oilstock peanut lines.

The relationship between insect infestation and the shelling outturn of farmers stock peanuts is presented in Table 3. In general, there was a direct correlation between unaccountable milling losses and the degree of insect infestation. Insect kernel damage increased in proportion to the insect population. As a result, the yield of No. 1 kernels decreased as the percentage of insect-damaged peanuts increased. Also, a concurrent increase in split kernels was associated with the increased population of insects. These comparisons are shown graphically in Figure 2. Lots No. 3, 4, and 5 did not grade Segregation 1 because of excessive insect damage.

SUMMARY AND CONCLUSIONS

Under normal levels of infestations, aspiration and vibration equipment seem to be effective in removing insects from farmers stock peanuts. Dead insects were rarely recovered from the marketable grades. Small larvae of merchant grain beetles and almond moths were recovered from finished edible-grade peanuts; however, these peanuts had much higher populations of insects than would be encountered in 1-year storage conditions.

Of particular interest is the number of eggs and immature insects carried with the loose-shelled kernel stock even at low insect infestation levels. The possibility of insect contamination of the marketable-grade peanuts increases when loose-shelled kernels from infested farmers stock peanuts are routed into the shelled line. It is evident that some insect carryover into marketable grades could be avoided by diverting loose-shelled kernels to other channels.

Insect distribution and shelling yield were correlated with the degree of insect infestation. Insects affected the percentage of sound split kernels--the higher the insect population, the greater the percentage of sound splits. Whole kernel out-turn decreased with insect infestation. Milling loss was directly related to the degree of insect infestation.

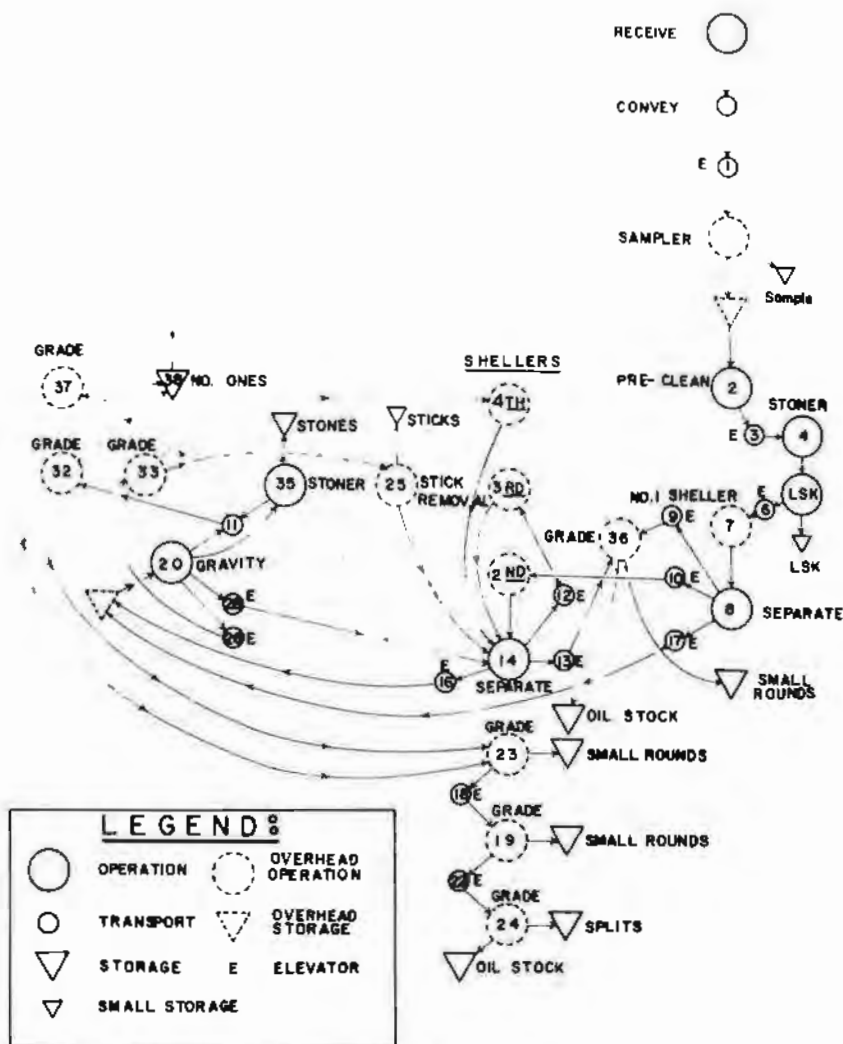


Figure 1. Process chart of pilot shelling plant.

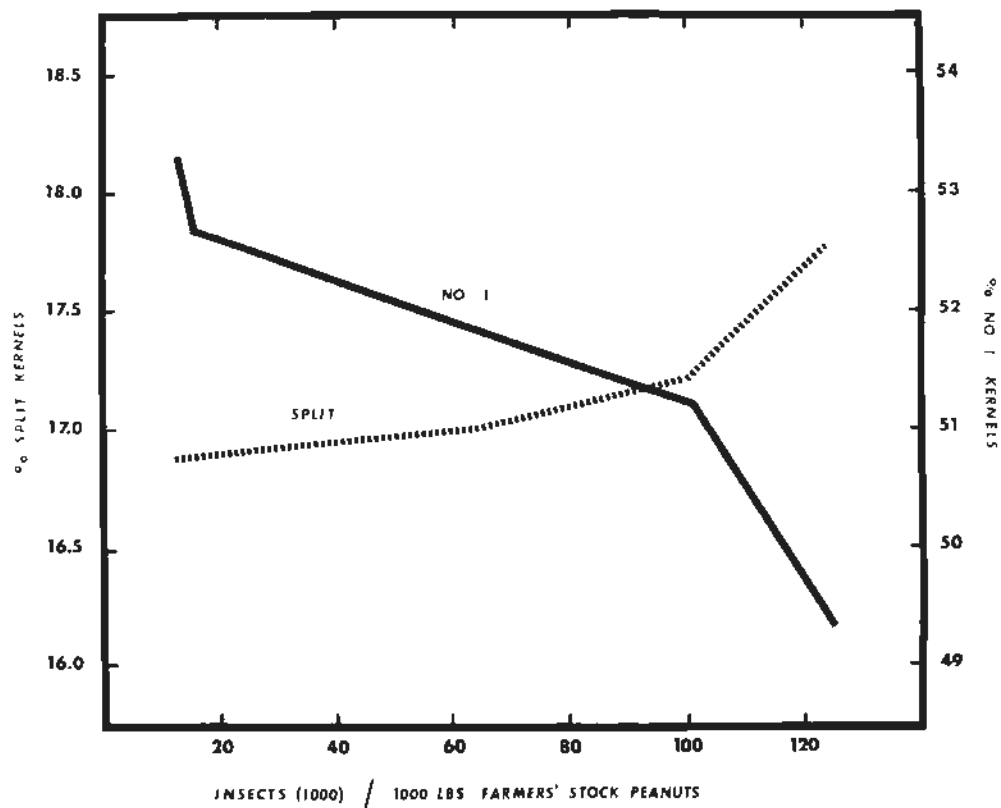


FIGURE 2. Percentage of split and No. 1 kernel yields from farmers stock Runner peanuts infested with storage insects.

TABLE 1.--Insects removed from infested farmers stock Runner peanuts during various stages of cleaning and shelling operations, Dawson, Ga., May 1969

Peanut cleaning and shelling stages	Percentage of insects removed from lot number--				
	1	2	3	4	5
	Percent	Percent	Percent	Percent	Percent
<u>Cleaning Stage</u>					
Light aspiration from cleaner	19.36	4.45	17.72	14.37	48.15
Fine siftings from cleaner	78.29	93.12	80.05	80.85	47.51
Rocks from cleaner	0	0	0	.01	.03
Sticks from cleaner	.23	.01	.04	.39	.20
Fine siftings from LSK machine	.74	.31	.86	1.21	.98
<u>Shelling Stage</u>					
No. 1's	0	0	0	0	.32
No. 2's	0	0	.01	.04	.07
Small rounds	0	0	.01	.01	.02
Grade A oilstock	0	0	0	.01	.01
Sound splits	0	0	0	.07	.11
Oilstock from shelling	.60	.26	.85	.44	.57
Oilstock from grading-handling	.57	.20	.10	.07	.11
LSK's	.20	1.64	.33	.16	.61
Stick machine	.01	.01	.01	.01	.02
4th stage (unshelled)	0	0	.02	.13	.03
Hulls	0	0	0	2.23	1.26
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Total insects removed	12,429	15,018	65,068	99,799	123,455

TABLE 2.--Insect emergence from samples of infested farmers stock Runner peanuts shelled at Dawson, Ga., May 1969

Peanut shelling stage	Percentage of insects emerging from lot number 1/				
	1	2	3	4	5
	Percent	Percent	Percent	Percent	Percent
No. 1's	0	0	0	26.00	3.30
No. 2's	0	0	0	1.24	.12
Small rounds	0	0	4.65	1.24	.41
Grade A oilstock	0	0	4.65	3.32	.10
Sound splits	0	0	0	0	.30
Oilstock from shelling	37.84	48.78	65.12	9.41	10.89
Oilstock from grading-handling	0	0	0	0	3.65
LSK's	62.16	51.22	25.58	55.47	78.85
Stick machine	0	0	0	1.52	1.61
4th stage (unshelled)	0	0	0	1.80	.77
Hulls	0	0	0	0	0
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Total insects emerged	37	41	86	723	19,979

1/ After 35-40-day holding period in controlled environmental laboratory room.

TABLE 3.--Shelling outturn in relation to insect infestation in lots of farmers stock Runner peanuts shelled at Dawson, Ga., May 1969

Peanut shelling stage, milling loss, and insects	Shelling outturn of peanuts from lot number--				
	1	2	3	4	5
	Pounds	Pounds	Pounds	Pounds	Pounds
<u>Shelling Stage</u>					
No. 1's	532.96	526.77	518.29	512.42	494.41
No. 2's	24.36	24.16	23.20	24.60	22.80
Small rounds	12.18	12.60	11.72	12.06	11.13
Grade A oilstock . .	6.01	5.78	5.37	5.45	5.04
Sound splits	168.86	169.23	170.73	172.15	177.06
Oilstock from shelling	15.30	17.39	15.62	15.46	16.62
Oilstock from grading-handling. . .	5.08	6.69	5.99	6.28	6.07
LSK's	11.68	11.80	10.07	9.40	7.87
Stick machine	1.02	.28	4.55	4.95	5.12
4th stage (unshelled)	4.48	6.40	7.34	8.57	6.54
Hulls	209.19	210.49	219.48	218.33	209.00
Total pounds	991.12	991.59	992.36	989.67	961.66
Milling loss	8.88	8.41	7.64	10.33	38.34
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
<u>Insects</u>					
Alive	76	19	714	1,625	39,968
Dead	12,316	14,958	64,268	97,451	63,508
Emerged	37	41	86	723	19,979

A ZINC NUTRITIONAL STUDY OF PEANUTS

by

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INTRODUCTION

Full recognition of zinc deficiencies of various crops under field conditions in the United States had been recorded as early as 1927 (1). In Texas this nutritional problem, except for the observation in pecan trees reported as early as 1932, was not recognized until about the early sixties when zinc deficiencies in various crops in the Rio Grande Valley were observed (4). It is only recently that this nutritional disorder has caused concern among Texas peanut growers and has caught the attention of investigators along this line.

Zinc availability is affected by a host of factors. An excellent discussion on this subject has been made by Thorne (16).

Zinc deficiency can be alleviated by supplying zinc-containing materials or fertilizers.

Of the zinc sources, $ZnSO_4$ has been the most widely used in rectifying zinc deficiencies in many crops but chelates, like Zn EDTA have been also used with promising success (16).

The effect of phosphorus on the uptake and utilization of zinc has been widely studied (4, 10, 11, 12) but there is no general agreement among the various workers regarding this relationship. Thorne (16) explained this antagonism on the basis of a chemical reaction between P and Zn in the growth medium thereby making Zn unavailable to the plant. Other workers (4, 15) offered evidence that P may inhibit Zn absorption into the roots or interfere with translocation of Zn from roots to metabolic sites in the leaf. There is also a theory advanced by some investigators (2, 3) that antagonism between P and Zn involves a physiological imbalance.

This study was carried out in two parts, one in the field and another in the greenhouse. The field phase of this study was being initiated on a peanut farm suspected to be deficient in zinc with the end in view of evaluating different sources and levels of Zn in relation to peanut yields. The greenhouse phase was conducted to determine whether or not P plays a role in causing zinc deficiency in this particular field.

MATERIALS AND METHODS

Field Experiment

Comparative Study of Different Sources and Levels of Zn in Relation to Yield, and Zn and P Contents of Peanut (*Arachis hypogaea* L.)

This study was conducted in 1969 on a Pontotoc sandy loam soil suspected to be deficient in zinc in Mason County, Texas which is located in the Central Basin land resource area.

Some of the chemical characteristics of the upper 6" are: pH 6.4 - 7.5 (1:2 soil:water ratio), CaO - 1300 No./A, O.M. - 0.2%, P_2O_5 - 76No./A (extracted by 1.4 N NH_4Ac in 1 N HCl buffered at pH 4.2), Zn - 0.60 ppm (.01 M DTPA extractable).

The treatments used are indicated in Table I. All treatments received N, P,

Table 1 -- The treatments used in the field phase of the study.

Source	Lbs. Zn/A
Control	0
ZnSO ₄	1
	3
	9
	27
	81
Zn EDTA	0.05
	0.10
	0.50
	1.00
	2.00
Zn NTA	0.50
	1.00
Zn Reax	1.00
Zn Rayplex	1.00
Zn Frit D-B-1013	3.00
Trend	3.00

and K at the rate of 30, 60, and 60 lbs. per acre, respectively. Each treatment was hand broadcast prior to bedding. Nitric phosphate containing N, P, and K at the rates indicated above was applied by a machine fertilizer spreader also before the beds were prepared.

A randomized complete-block design was used. Plot size was 19 feet by 50 feet. Each plot had 6 beds with 3 rows per bed.

Starr variety of peanut was seeded at the rate of 80 lbs. per acre. The plots were irrigated by sprinkler type irrigation. Insect pests were controlled chemically.

Three days before harvesting lateral branch samples were collected from all treatments. Whole plant samples were collected only from the ZnSO₄ treatments plus the control. The whole plant samples were separated into tops, roots, and pods. All tissue samples were washed with .1 N HCl solution with detergent (calgon) and rinsed with deionized water before being dried in forced-air oven. The dried samples were ground in a Wiley mill through a 40- mesh screen and dry ashed, except the pods, in a muffle furnace set at 550 degrees C. The ground pods were pre-ashed by treating with concentrated HNO₃. Zn was analyzed by the use of a Perkin Elmer Atomic Absorption Spectrophotometer 303. P was analyzed using the ammonium molybdate-stannous chloride colorimetric method (6).

The two middle beds were harvested for the yield data.

GREENHOUSE POT EXPERIMENT **Zn-P Interaction Study in Peanut**

This test was conducted simultaneously with the field experiment in a plastic covered greenhouse. The design used was a split-plot in three blocks with P levels as the main plots and Zn levels as the sub-plots. The treatments included are given in Table 2.

Two standard, plastic pots with a diameter of 10 inches were used for each treatment. The soil used was collected from the site of the field experiment. Each pot was filled with 10 kg. of this soil to which the respective treatment plus N (NH_4NO_3), and K (KCl) at the rate of 10 and 25 ppm, respectively, were mixed thoroughly in an electric twin-shell blender. Ten seeds of Starr variety of peanuts were sown in each pot, and 7 days after emergence the stand was thinned to 4 plants. The plants were supplied only with deionized water.

The plants of one pot of each treatment were used for Zn and P analyses. Two tissue samplings with two plants each were made at the vegetative stage and reproductive stage when some pods were already mature. Plants of the first sampling were separated into roots and stems and leaves, and those of the second were divided into roots, pods and stems and leaves. Thereafter, all procedures followed were exactly the same as those used for the field experiment. The plants of the other pot in each treatment were allowed to mature for pod counts.

Table 2 -- Treatments used in the greenhouse phase of the study.

P (ppm)	Zn (ppm)
0	0
	0.5
	1.5
	4.5
	13.5
	40.5
20	0
	0.5
	1.5
	4.5
	13.5
	40.5
100	0
	0.5
	1.5
	4.5
	13.5
	40.5

RESULTS AND DISCUSSION

Field Experiment

The means for yield (unshelled) are depicted graphically in Figure 1. The different sources and levels reflected substantial variations. The different levels of Zn from ZnSO₄ progressively enhanced yield, with 27 lbs. Zn/A giving the maximum increase. At the heaviest rate (81 lbs. Zn/A) yield dropped down to a magnitude comparable to that of the control. Apparently this rather drastic reduction in yield is due to zinc toxicity. Similar observations were reported previously (16).

Although Zn chelates have not found extensive use as fertilizer, in this study they have proved somewhat more efficient than the non-chelated materials notwithstanding the minute rates in which they were applied. The chelates Zn NTA, Zn Reax, Zn Rayplex which are relatively new products demonstrated promise as potential Zn sources. They gave yields comparable to those obtained from the higher levels of Zn applied as ZnSO₄. Although Zn Frit D-B-1013, a non-chelated material had given far better response than the control, perhaps it would have given even better response than it did, if it were not relatively insoluble. Trend, a "poly-nutrient" fertilizer that contains Zn Frit had also produced yields better than the control.

The data show that in order for ZnSO₄ to give a yield comparable to that of a chelate it has to be applied many times more than the rate at which the chelate is applied.

The Zn and P concentrations of the branch samples are given in Table 3. The pattern of the Zn contents of the treatments receiving ZnSO₄ was essentially the same as that exhibited by the yield data, except that there was a continuous increase in Zn content up to the highest Zn rate of 81 lb./A. The Zn contents of all other treatments were comparable to those of the lower levels of Zn from ZnSO₄. The percent P of the branch decreased as the Zn level from ZnSO₄ was increased. This decline of P content with increasing Zn applications, was interpreted to be due to a P-Zn interaction (13,16). Zn EDTA showed no definite pattern of Zn uptake.

In Figure 2 the Zn contents of the branch samples from the ZnSO₄ treatments are presented along with the values of the three segments of the whole plant, i.e. tops, roots and pods. Generally the Zn contents of the pods and the roots were higher than those obtained from the tops. The values for the branches are incorporated into this graph with the intention of demonstrating how close these values are to the values recorded from the tops. It will be noticed that the values from the branches were just as high as those obtained from the tops at all levels of Zn applied which shows that at this certain stage of the plant Zn was uniformly distributed in the tops.

The P concentrations of the lateral branches are, likewise, incorporated in the graph representing the P concentrations of the various plant parts (Figure 3). In contrast to the Zn concentrations, the P concentrations of the various plant parts, except the pods, tended to decrease with increasing levels of applied Zn. In the roots, the P contents were very low compared with the Zn contents. This indicates that the possibility of P-Zn interaction in the roots as reported by Burleson and Stukenholtz et al. (15) is not a factor of the suspected Zn deficiency of this soil.

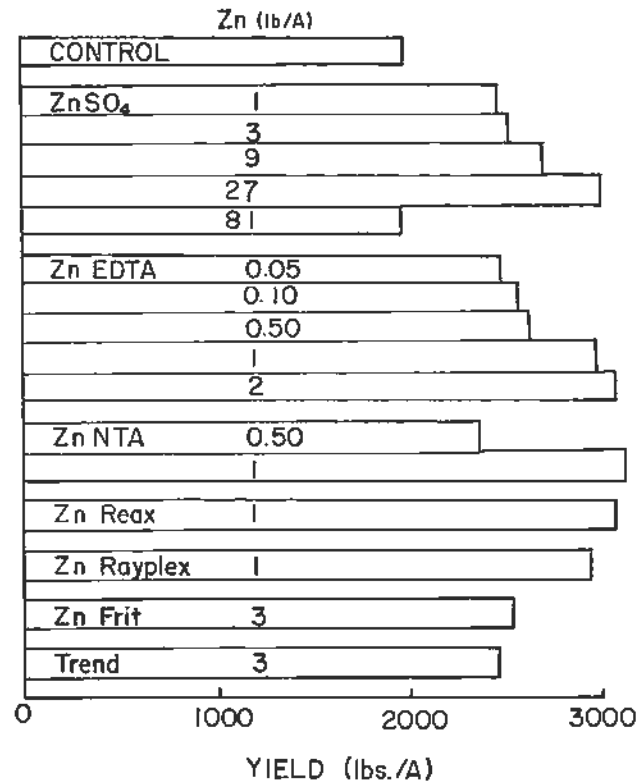


Fig. 1 -- Yield of pods as influenced by different sources and levels of applied Zn.

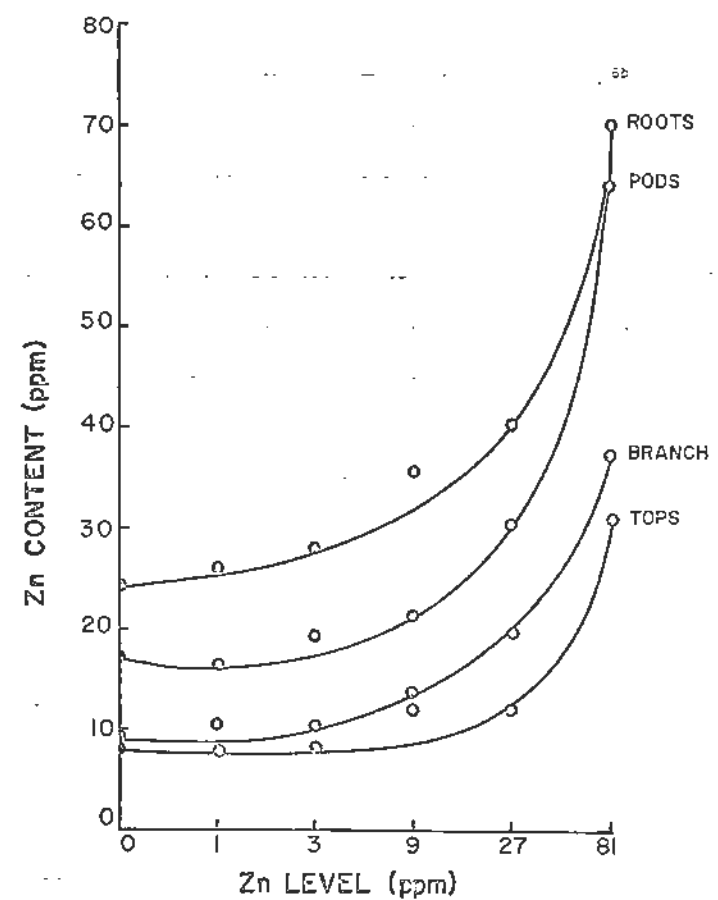


Fig 2 -- Zn distribution in different plant parts of field grown peanuts as influenced by different sources and levels of applied Zn.

Greenhouse Experiment

At the early stages of growth, the plants of the treatments receiving 100 ppm of P at all levels of applied Zn where showing symptoms of severe zinc deficiency, with severity decreasing with increasing Zn level up to 13.5 ppm. This observed disorder seemed to disappear during the later stages of growth. Zn toxicity was not visually observable during the growing period, but the reduction in pod number at the highest level of applied Zn (40.5 ppm) was suspected to be due to this phenomenon.

As shown in Figure 4 pod count was profoundly affected by the treatments. The number of pods continuously increased as applied Zn level increased, with the maximum at 13.5 ppm Zn. At 40.5 ppm Zn, the number of pods slightly decreased, presumably due to Zn toxicity. P levels had a pronounced effect on pod number. As the P level was raised from 0 to 20 ppm there was a concomitant increase in pod number at almost all Zn levels. However, when P level was increased to 100 ppm a drastic decline in pod count resulted. Evidently this marked reduction in pod count was due to a P-induced Zn deficiency. The phenomenon has been widely investigated (7, 8, 9, 10, 14).

Zn contents of the different plant parts as influenced by different levels of Zn and P are presented in Table 4. Zn contents of the leaves increased with increasing levels of applied Zn. At lower levels of applied Zn up to 4.5 ppm, P levels seemed to exert no influence on the Zn content of the leaves. A similar trend was shown by the Zn content of the stems, except that the values obtained from the leaves were generally higher. The Zn contents of the roots and pods followed a somewhat different trend from that exhibited by the leaves and stems.

In general the different levels of Zn increased the Zn content of the roots. At the Zn levels from 0 to 4.5 ppm increase in P levels resulted in reduction of Zn content of the roots. At 13.5 ppm of Zn applied, the Zn content of the roots remained unaffected as P level was increased from 0 to 100 ppm. However, when Zn level was raised to 40.5 ppm there were remarkable increases in Zn contents of the roots with increases in applied P levels. In the pods, there were increases in Zn content at the higher levels of Zn (4.5 to 40.5 ppm) as P level was increased from 0 to 100 ppm.

The percent P of the different parts of peanut plants as affected by Zn and P levels are presented in Table 5. As expected, percent P in all plant parts increased with increases in applied P levels, the greatest increase being obtained from the 100 ppm level of P. At some levels of P, and in some parts of the plant, it will be observed that Zn levels influenced P content. For instance, in the leaves at 100 ppm of P, increases in Zn level decreased %P. There were not much variations in the pods among the Zn treatments. Some appreciable differences were noted among the P levels.

The general relationships between Zn and P as they affect their respective concentrations in the plant as revealed by the results of the experiment are consistent with the finding reported by Burleson et al. (4).

Table 3 -- Zn and P contents of branches of field grown peanuts as influenced by different sources and levels of applied Zn (means of 4 replications).

TREATMENT		Zn	P
Source	Zn Level		
	#/A	ppm	Percent
Control	0	8.75	0.22
ZnSO ₄	1	10.25	0.16
	3	10.38	0.18
	9	15.50	0.15
	27	19.50	0.16
	81	37.00	0.12
Zn EDTA	0.50	11.38	0.22
	0.10	12.38	0.18
	0.50	9.88	0.17
	1.00	10.62	0.21
	2.00	10.50	0.17
Zn NTA	0.50	10.00	0.19
	1.00	10.12	0.12
Zn Reax	1.00	9.50	0.18
Zn Rayplex	1.00	8.75	0.21
Zn Frit D-B-1013	3.00	11.00	0.20
Trend	3.00	9.62	0.16

Table 4 -- Zn contents of different parts of greenhouse grown peanuts at the reproductive stage as influenced by different levels of P and Zn (means of three replicates).

Treatment		Plant Part			
		Leaves	Stems	Roots	Pods
ppm P	ppm Zn	ppm Zn			
0	0	65.91	33.17	45.00	74.17
	0.5	91.67	48.33	52.50	90.00
	1.5	121.67	61.67	75.83	70.00
	4.5	150.83	67.50	88.33	77.50
	13.5	265.00	122.67	155.00	119.17
	40.5	731.67	416.67	510.00	220.83
20	0	78.33	24.17	45.00	64.17
	0.5	91.67	25.83	34.17	70.83
	1.5	141.67	49.17	70.83	74.17
	4.5	174.17	54.17	65.83	79.17
	13.5	378.33	190.17	143.33	124.17
	40.5	900.00	637.50	579.17	238.33
100	0	47.50	17.50	27.50	48.33
	0.5	50.83	15.00	32.50	52.50
	1.5	73.33	27.50	36.67	60.83
	4.5	168.33	31.67	35.83	124.00
	13.5	300.83	127.50	152.50	168.33
	40.5	631.67	549.17	622.83	260.83

Table 5 -- P contents of different parts of greenhouse grown peanuts at the reproductive stage as influenced by different levels of P and Zn (means of three replicates).

Treatment		Plant Parts			
		Leaves	Stems	Roots	Pods
ppm	ppm Zn	Per. Cent P			
0	0	0.17	0.29	0.21	0.44
	0.5	0.23	0.30	0.36	0.38
	1.5	0.22	0.22	0.20	0.43
	4.5	0.14	0.18	0.13	0.38
	13.5	0.13	0.13	0.09	0.32
	40.5	0.15	0.11	0.08	0.34
20	0	0.24	0.30	0.27	0.44
	0.5	0.24	0.31	0.24	0.46
	1.5	0.23	0.28	0.25	0.42
	1.4	0.17	0.21	0.14	0.38
	13.5	0.19	0.14	0.06	0.36
	40.5	0.18	0.17	0.09	0.36
100	0	1.64	0.40	0.71	0.51
	0.5	0.49	0.45	0.46	0.52
	1.5	0.49	0.33	0.44	0.58
	4.5	0.42	0.34	0.45	0.50
	13.5	0.42	0.30	0.59	0.51
	40.5	0.41	0.37	0.84	0.52

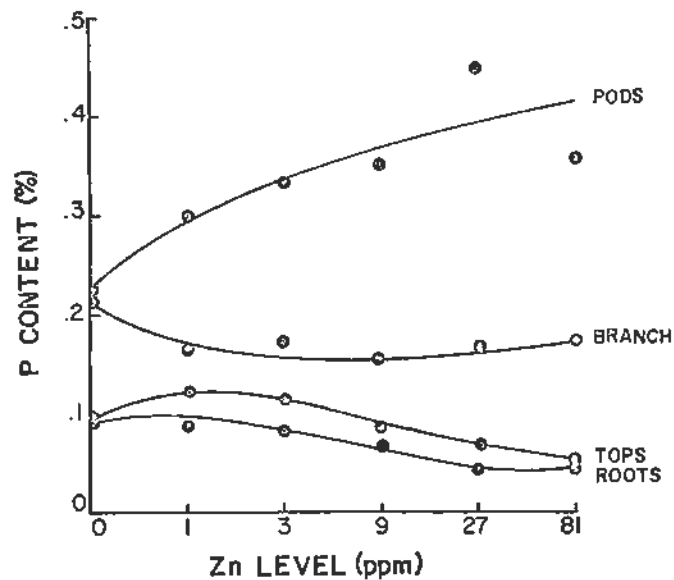


Fig. 3 -- P distribution in different plant parts of field grown peanuts as influenced by different sources and levels of applied Zn.

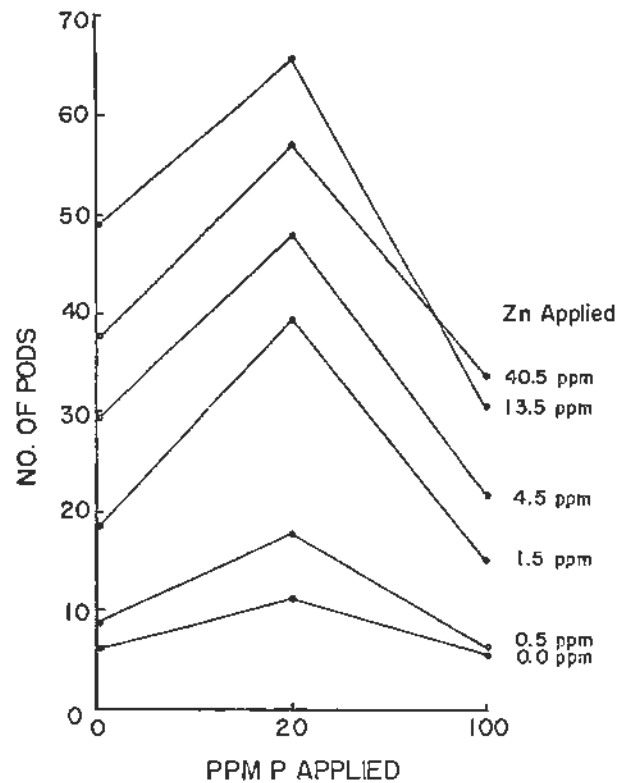


Fig. 4 -- Number of pods as influenced by different levels of applied P and Zn.

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STABILITY OF THE PEANUT PROTEINS TO HEAT AND ORGANIC SOLVENTS

by

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ABSTRACT

Peanuts to be used in confections, peanut butter, or beverage-type products were roasted and/or deoiled by mechanical pressing or solvent extraction. The effects of these conditions on the major peanut proteins, particularly arachin and conarachin, was investigated by column chromatography, sedimentation analysis, and immunochemical techniques.

Whole peanuts, dry roasted for one hour at 145 degrees C. showed a decrease in solubility of the total proteins and showed drastic changes in the albumins and most globulins. However, the structure of the major storage protein, arachin, was unchanged antigenically, as shown by the sensitive immunoelectrophoresis techniques. Though heating normally denatures most enzymes, the peanut allantoinase, a ureide-metabolizing enzyme, was stable up to 80 degrees C. for long periods of heating.

Proteins of peanuts deoiled by mechanical pressing or by extraction with carbon tetrachloride, heptane, or acetone were compared. Solubility of the total proteins in aqueous buffer was diminished in the solvent-extracted peanuts. There were also striking changes in the DEAE-cellulose chromatograms of the soluble proteins of solvent-extracted peanuts; particularly in the arachin peak of acetone-extracted seeds.

INTRODUCTION

The use of oilseed proteins as nutritional food supplements has increased in importance because of the needs of the expanding world population. Research today is aimed at a better understanding of the various chemical and biochemical changes which take place in these proteins and the effects on their taste, odor, texture, and nutritive value since roasting of whole peanuts is a prerequisite in the manufacture of many confections such as candies, cakes, and peanut butter.

Newell, et al. (1) investigated roasted peanut flavors and suggested possible typical reactions between sugars and amino acids might produce specific flavor components. Bensabat, et al. (2) cooked peanuts containing 6% moisture for one hour at 232 degrees F. and noted an 18% drop in free epsilon-amino groups of lysine. Others have noted a decrease in the nutritive value of proteins from sunflower seeds (3) and chick pea (4) after heating.

The effects of dry roasting conditions on peanut proteins have been investi-

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gated at the Southern Laboratory by various analytical methods: chromatography on DEAE-cellulose, polyacrylamide gel electrophoresis, immunoelectrophoresis, and ultracentrifugation. All of these methods are sensitive to modifications in protein structure, size, shape, and surface ionic charge. The results to be described will show that solubility of the total peanut proteins in phosphate buffer is reduced by roasting or by extraction of the peanuts with organic solvents before analysis. Normally, one expects heating at high temperatures to denature all proteins, especially those having enzymic and/or antigenic properties. However, α -arachin, one of the major peanut globulins, is not drastically altered by heating at 145 degrees C. for 1 hour and allantoinase, a ureide-metabolizing enzyme of the purine pathway shows increased activity up to 80 degrees C. heating.

MATERIALS AND METHOOS

Peanuts, Virginia 56-R variety, were used in all experiments. The certified seed was shelled and hand-selected for uniformity of size and quality by K. H. Garren and Mr. W. K. Bailey.

Buffer Extraction of Proteins

Washed cotyledons of untreated, roasted, or solvent-extracted peanuts were homogenized in pH 7.9 phosphate buffer, ionic strength 0.2, in an Omnimixer for 5 minutes at 0 degrees C., clarified by two centrifugations at 37,000 x g for 30 minutes, then dialyzed against 0.03 low ionic strength phosphate buffer for 24 hours. The solution was then equilibrated to room temperature and again centrifuged to remove a further precipitate. This final supernatant solution was employed in the tests.

Treatment of Peanuts

Shelled peanuts were roasted in an oven for one hour at 145 degrees C. The outer skins and embryos were removed before homogenizing the cotyledons in the Omnimixer. To study the effects of organic solvents on peanut proteins, cotyledons were homogenized in 5 volumes of either CCl_4 , heptane, or acetone to remove the oil in an Omnimixer, filtered through a coarse glass frit filter, under vacuum and washed once with the same solvent as described earlier (5). The air dried defatted meal was then extracted in buffer to solubilize the proteins for further examination.

Analytical Methods Employed

Protein contents were measured by the Lowry method (6); zone electrophoresis by the method of Evans, et al. (7); DEAE-cellulose chromatography according to Dechary, et al. (8); sedimentation analyses according to Schachnan (9); immunoelectrophoretic analysis (IEA) according to Grabar and Williams (10); and immunodiffusion by Ouchterlony (11).

RESULTS AND DISCUSSION

Several basic changes occurred in the roasting-process. First, the solubility of the total proteins in phosphate buffer was reduced to less than half of the

controls. Protein concentration of the unroasted control was 25 mg./ml.; that from the roasted seeds was 10 mg./ml. Secondly, as expected, the albumins and conarachin, one of the major peanut globulins, were drastically changed; but a-arachin, the major storage protein, was not significantly altered as illustrated by the sensitive immunochemical tests to be described.

Drawing conclusions based solely on gel electrophoretic migration patterns of proteins may sometimes be incomplete since migration is a function of several variables; gel concentration, buffer type, concentration, pH, ionic strength, applied voltage, etc. However, in conjunction with several analytical techniques it does provide valuable information. Figure 1 shows several changes induced by

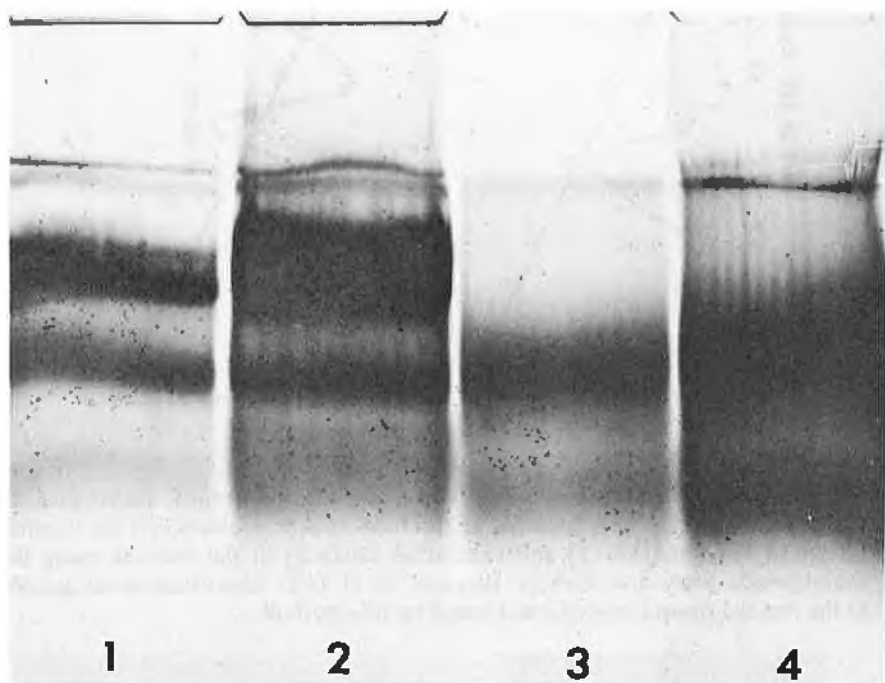


Figure 1

the roasting on polyacrylamide gel patterns. The first major band at the origin for unroasted proteins decreases considerably, as noted by comparison to the same zone in the roasted sample. There is also a disappearance of the uncharged (or positively charged) species which normally remain at the origin but arachin polymers can still be identified after roasting.

The effect of heat on the DEAE-cellulose chromatograms is shown in Figure 2. The four groups of proteins eluted from a DEAE-cellulose column separation of the total soluble proteins of the peanut have been characterized by Dechary et al. (8). Employing the same basis for grouping the proteins, the patterns for unroasted (a) and roasted (b) proteins appear quite similar except for groups II and III, which comprise the conarachin system. These are now eluted as a single broad peak after roasting and at a slightly lower salt concentration. Arachin (IV) also is eluted at a slightly lower salt concentration after roasting and the albumins peak seems diminished after roasting. The peaks labelled A, B, and C in

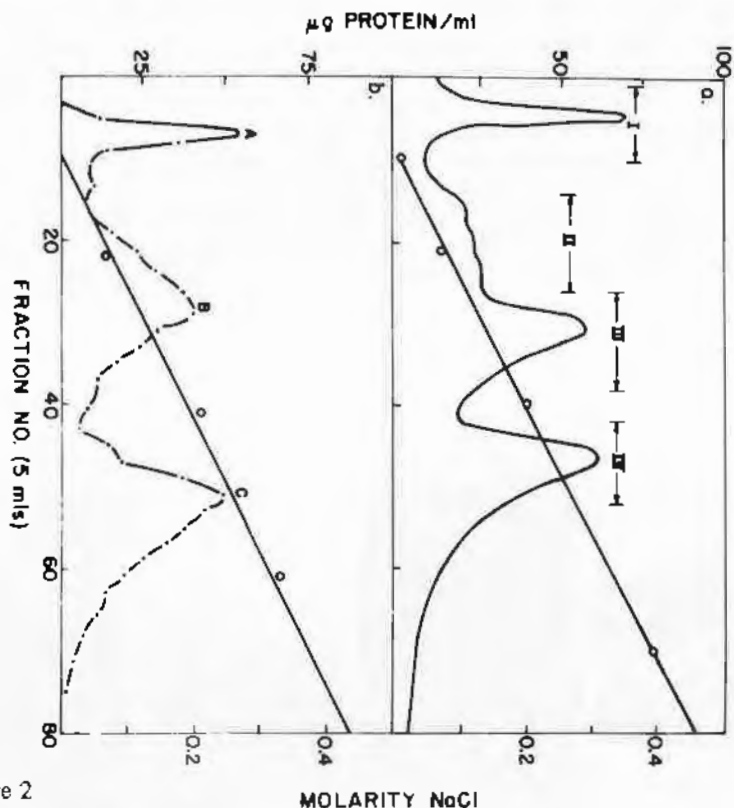


Figure 2

chromatogram (b) were examined further by immunochemical techniques. In Figure 3, we see the IEA patterns of the total peanut proteins and the identification of arachin (slide 1) and conarachin (slide 2) in the mixture using the monospecific assay described by Daussant, et al. (12). Identification of arachin in the roasted peanut proteins was based on this method.

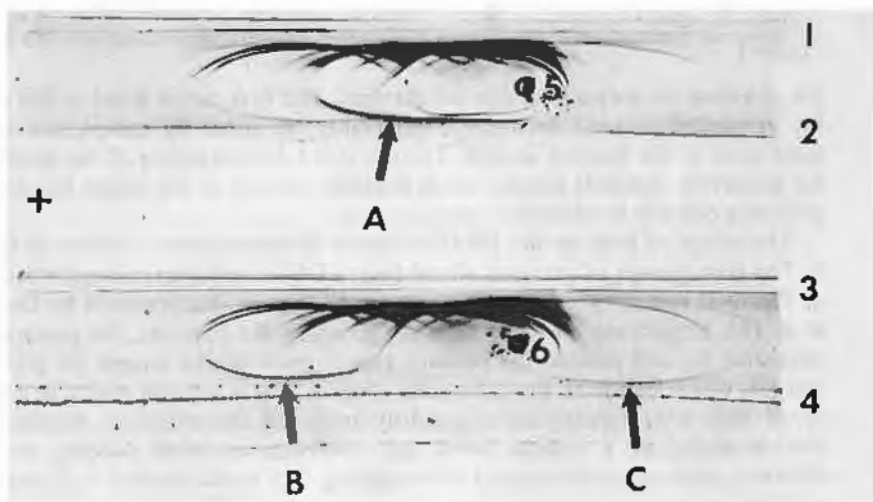


Figure 3

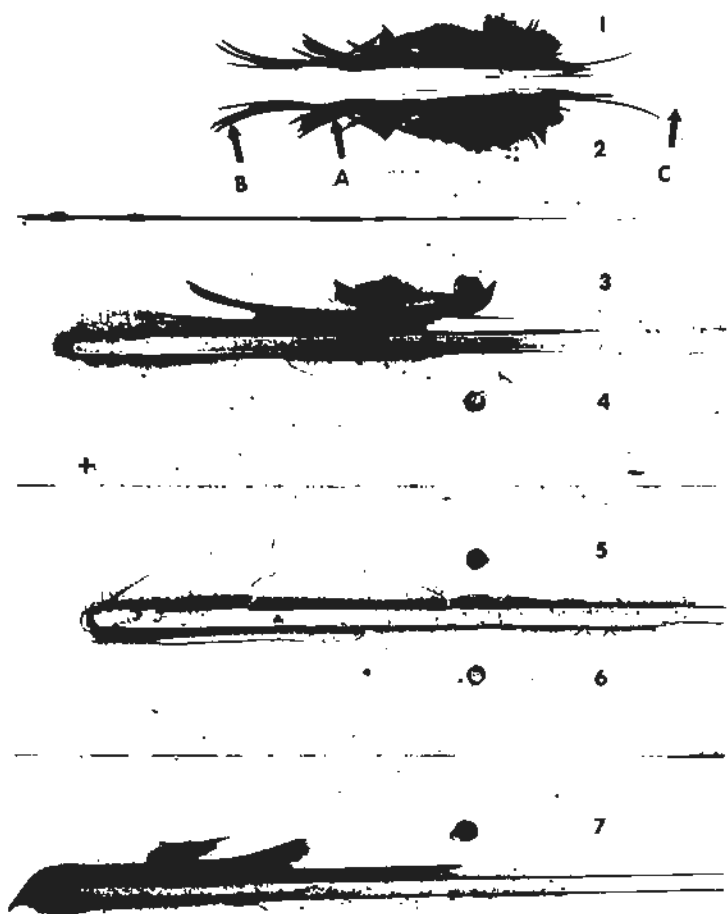


Figure 4

As illustrated in Figure 4, α -arachin increased in electrophoretic mobility (compare 2 and 6, Figure 4) but maintained its antigenic structure unchanged by the one-hour heating at 145 degrees C. The IEA patterns of the total peanut proteins of unroasted (Figure 4, 1) and roasted seeds (Figure 4, 2) show the greatest changes. Only arachin of the approximately 14 proteins is still antigenic after roasting (Figure 4, 3 & 7). The other proteins of the three fractions isolated from the DEAE-cellulose chromatogram in Figure 2 fail to show any precipitin bands at all (Figure 4, 5 & 6). Immunodiffusion (Figure 5) demonstrates the increase in diffusion coefficient of arachin from roasted peanuts compared to that in normal peanuts. This increase could be caused by a release of dissociated subunits which are still antigenic. The decrease in concentration of total soluble proteins after roasting is also evident in this figure.

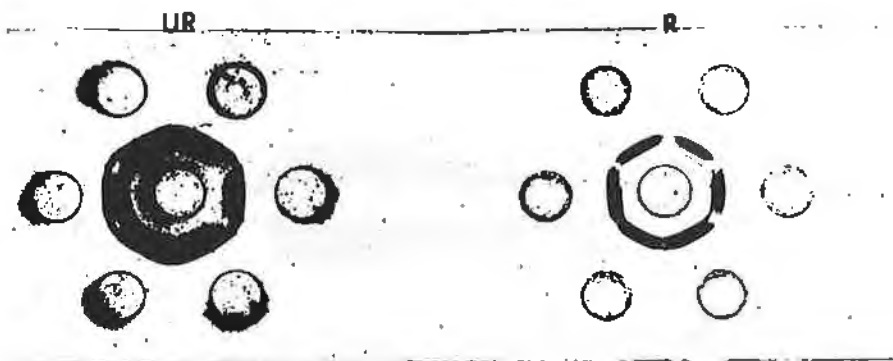


Figure 5



Figure 6

Sedimentation patterns of the total proteins before and after heating are shown in Figure 6. Arachin, the heaviest component in the unroasted proteins has a calculated S-value of 13.8, compared to 13.6 for the arachin peak in the roasted peanuts sample. The most noticeable difference in sedimentation patterns induced by heat is the increase of low molecular weight components in the roasted proteins, suggesting that both association and dissociation of the proteins is taking place.

While the stability of arachin to 145 degrees C. for an hour seems unusual, storage proteins are considered to be nonenzymic in character. Enzymes generally are rather labile to heat over 50 degrees C. for extended periods. The effect of varying amounts of heat on certain enzymes in the peanut has been investigated. One of the enzymes found at the lower end of the purine catabolic pathway, allantoinase, was stable to one hour heating periods up to 80 degrees C. (13). In fact, enzyme activity increased dramatically up to 80 degrees C. as illustrated in Figure 7.

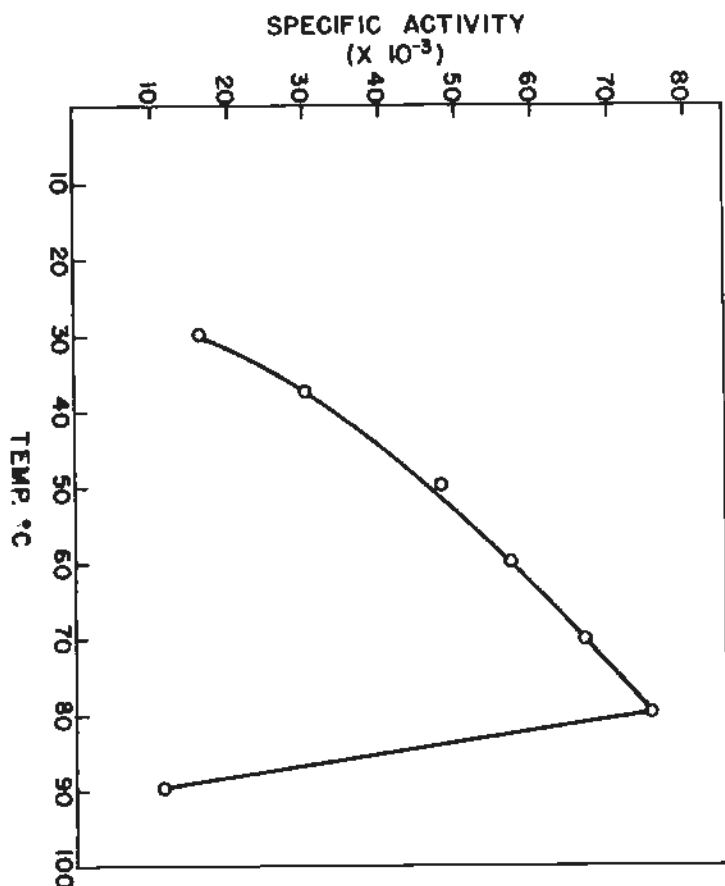


Figure 7

Another aspect of these studies into possible effects of processing conditions on peanut proteins was the effect of organic solvents used in deoiling peanuts. Crude oil is normally removed from oilseeds either by mechanical pressing, extraction with solvents, or by combinations of these methods. The meal residue from the oil-free seeds can then be further processed for use as a feed or in an edible food product. One principal use of highly soluble seed proteins, such as those of peanut and soybean, is in beverage-type products. If these proteins are to be used in such beverages, the processing conditions could be selected to remove the maximum amount of oil with the least amount of harmful effects on the meal.

Peanut proteins deoiled by natural expressing or mechanical pressing were compared to proteins from peanuts which had been deoiled with carbon tetrachloride, heptane, and acetone. The proteins were all extracted with buffer and compared by chromatography over a DEAE-cellulose column. The results (Figure 8) showed several changes in the chromatograms of solvent-treated

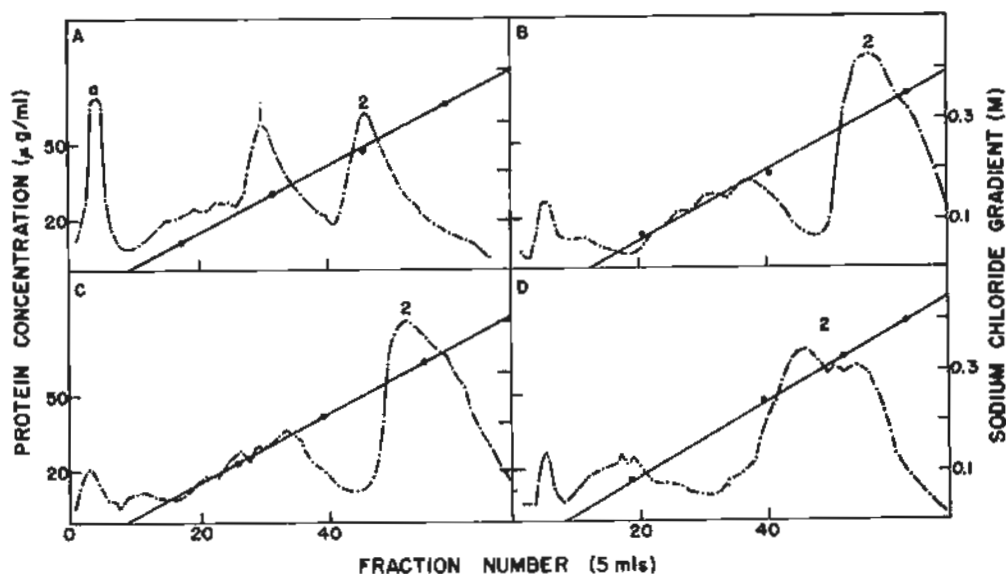


Figure 8

proteins which might affect their use in artificial milk-type beverages. Some proteins had become more insoluble, some appeared to be partially dissociated, and others appeared to form families of proteins with rather similar chromatographic properties. Solubility of all proteins was lowered. The albumin and the conarachin fractions showed the most drastically altered solubility properties (Figure 8, B, C, and D) while the elution pattern of arachin, the major reserve protein, was affected primarily by acetone extraction (Figure 8, D). There was a distinct separation of the arachin peak in the chromatogram into two closely related components after solvent extraction by acetone. The proteins from the mechanically pressed peanuts showed no adverse effects whatsoever. However, it should be emphasized that even though some of the peanut proteins undergo changes in their physical properties, this does not imply that their nutritive value has been impaired; only the protein solubility.

In summary, the effects of heat on peanut proteins show three basic observations. First, the concentration of total soluble proteins is decreased by more than half of the control. Second, the antigenic structure of the major reserve protein, α -arachin, is unchanged by one-hour heating at 145 degrees C. Third, the other proteins of the peanut undergo changes in their physical-chemical properties. The major reserve protein, α -arachin, should still be intact in all peanut products which are heated during processing. Also, deoiled peanuts produced in a mechanical-type pressing operation should be the most suitable for use in a beverage-type protein product.

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LEGENDS FOR FIGURES

Figure 1. Zone Electrophoretic Patterns of Peanut Proteins with and without Roasting. Conditions: proteins in phosphate buffer, pH 7.9, ionic strength 0.03; electrophoresis run 3 hrs. at 17 v./cm. at 5 degrees C., gel conc. 5%. 1,2 (unroasted peanuts) 0.05 and 0.1 mg. protein respectively; 3,4 (roasted peanuts) 0.05 and 0.1 mg. protein respectively.

Figure 2. DEAE-Cellulose Chromatograms of Peanut Proteins with and without Roasting. Conditions: 10 mg. protein absorbed on 2g. DEAE-cellulose, eluted with 500 ml. of NaCl in a linear gradient (0.0-0.6M) in phosphate buffer, pH 7.9, ionic strength 0.03. Straight line represents the NaCl gradient. (a) Unroasted peanuts, (b) roasted; peaks A, B, and C are fractions analyzed by IEA in Figure 4.

Figure 3. Immuno-electrophoretic Identification of Arachin and Conarachin in a Mixture of Total Peanut Proteins. Conditions: 1.5% ionagar gel in 0.25M Veronal buffer, pH 8.2, in LKB immuno-electrophoresis kit; voltage of 4 v./cm., 2 hr., room temp. (27-28 degrees C.). Immune serum in troughs; 1 and 3, total cotyledonary proteins antiserum; 2, anti-arachin serum; 4, anti-a-conarachin serum. Proteins in wells: 5 and 6, total cotyledonary proteins. Precipitin arcs: A, a-arachin; B, a1-conarachin; C, a2-conarachin.

Figure 4. Immuno-electrophoretic Analysis of Peanut Proteins with and without Roasting. Conditions: same as described in Figure 3. Immune serum in all troughs; total cotyledonary unroasted peanut proteins antiserum. Proteins in wells; 1 and 2, total proteins of unroasted peanuts (arrows indicate precipitin arcs A, B, and C identified in Figure 3); 3, total proteins of roasted peanuts; 4, dialysate from roasted peanuts extract; 5, 6, and 7, proteins of peaks A, B, and C from DEAE-cellulose chromatogram of Figure 2, respectively.

Figure 5. Immunodiffusion of Peanut Proteins with and without Roasting. Conditions: 1.5% ionagar gel in 0.25M Veronal buffer, pH 8.2; room temp. (27-28 degrees C.). UR, 0.1 mg. unroasted peanut proteins in each of outer wells; R, 0.1 mg. roasted peanut proteins in each of outer wells. Center wells filled with anti-arachin serum.

Figure 6. Sedimentation Patterns of Peanut Proteins with and without Roasting. Conditions: upper (native), total proteins of unroasted peanuts (S-values, left to right, are 2.2, 8.8, and 13.8); lower, total proteins of roasted peanuts (S-values, left to right, are 1.8 and 13.6). Migration is from left to right in phosphate buffer, pH 7.8, ionic strength 0.2. No corrections made to reduce sedimentation coefficients relative to the viscosity and density of water at 20 degrees C. and for zero concentration. Photographs were taken 28 min. after reaching top speed of 59,780 r.p.m.

Figure 7. Effect of Heat on Activity of Peanut Allantoinase. Conditions: enzyme plus substrate placed in hot water bath at designated temperatures for 30 min. periods before assay at 28 degrees C. Allantoinase activity measured as increase of reaction produced glyoxylic acid in 1 hr. according to Ory, et al. (14).

Figure 8. DEAE-Cellulose Chromatograms of Total Peanut Proteins with and without Organic Solvent Extractions. Conditions: for chromatography, as described in Figure 2. A, untreated by solvents; B, heptane extracted proteins; C, Carbon tetrachloride extracted proteins; D, acetone extracted proteins. Peak designations: (a) peanut albumins; 1, conarachin fraction; 2, arachin fraction.

ABSTRACTS

CYTOLOGICAL INVESTIGATIONS IN ARACHIS AS AIDS TO PEANUT VARIETY IMPROVEMENT¹

Donald J. Banks ²

ABSTRACT

The basic component of an organism is the cell and the way in which an organism functions is a result of its cellular structure and organization. Cytology is the field of study that deals with cell structure, function, development, reproduction, and life history. Cytological studies in peanuts have been conspicuously meager as compared with many other crop plants. Reasons for the small number of contributions in this area are believed to be: (1) the lack of interest on working with peanuts on the part of most plant cytologists, (2) the relatively small number of peanut cytologists, and (3) the difficulties encountered in working with peanut cells.

Numerous advances have been made through cytological and cytogenetical studies in many crop plants which have been useful in crop variety improvement. The present status of peanut cytology will be reviewed and compared with some other crops. Some cytological studies in our laboratory which are concerned with interspecific hybridization, autopolyploid induction, aneuploidy, embryo culture, endosperm development, pollen tube growth and pollen grain cultures will be summarized. The need for intensive cytological investigations in the future is suggested.

1. For presentation at the Annual Meeting of the American Peanut Research and Education Association, San Antonio, Texas, July 12-15, 1970, based on cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma.

2. Research Geneticist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Stillwater, Oklahoma, and Associate Professor of Agronomy, Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma.

PEANUTS - FROM BREEDING LINE TO VARIETY IN VIRGINIA AND NORTH CAROLINA

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ABSTRACT

Peanut breeding lines in Virginia and North Carolina are developed by standard breeding procedures and evaluated in breeder's preliminary yield trials and advance yield trials. The most promising lines are then entered into the Virginia-North Carolina Peanut Variety and Quality Evaluation Program for evaluation at locations throughout Virginia and North Carolina. Agronomic and market grade data are collected as well as organoleptic evaluations.

Lines exhibiting desirable agronomic characteristics, market grade factors and organoleptic scores are evaluated in one-half acre increase plots at three locations throughout the production area. Production from these plots is used to determine mill outturn from a pilot shelling plant. Graded peanut samples from the mill outturn test are submitted to peanut product manufacturers to evaluate their value for the consumer market. The results are reviewed by an Advisory Release Committee and release recommendations are made to the breeder.

The objective of this program is to assure the release of high quality peanut varieties acceptable to all segments of the industry.

PLANT EMERGENCE AND YIELD OF VIRGINIA TYPE PEANUTS AS AFFECTED BY SEED QUALITY

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ABSTRACT

In April and May, 1969, county extension agents collected 126 samples from different lots of Florigiant, NC-5, and NC-2 varieties of seed peanuts. Standard germination and tetrazolium tests were used to estimate viability of each seed lot. Seeds from each sample were field planted and emergence counts were made 10, 16, and 24 days after planting. The field plots were harvested to obtain yield data.

Percent plant emergence after 10 days was found to be very significantly correlated to seed vigor (based on tetrazolium test) in each variety. Germination test results and percent plant emergence after 24 days were significantly correlated for all varieties.

Within each variety, field plots with the highest percent plant emergence after 10 days also produced the highest yields at harvest time. Early plant emergence

showed a 300-400 pound per acre yield advantage in each variety tested. However, significant positive correlations between seed vigor and yield were found only in the Florigiant variety. Significant positive correlations between percent plant emergence and yield were found for the Florigiant and NC-5 varieties, but not for the NC-2 variety.

ESTIMATION OF COMBINING ABILITY IN ARACHIS HYPOGAEA L. II. FIELD PERFORMANCE OF F1 HYBRIDS

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ABSTRACT

The utilization of introductions of *Arachis hypogaea* L. will depend upon their performance as parents. In a preliminary study to determine the usefulness of introductions from South America, six lines from three geographic areas were crossed in diallel. Two lines from Peru, two lines from Bolivia and two lines from the area of Argentina-Paraguay were classified by branching pattern as Valencia, Virginia and Spanish types, respectively.

Diallel analysis of the F1 generation grown in a replicated field trial at one location showed that general combining ability was significant (.05 or .01 level of probability) for 8 of 17 characters. Specific combining ability was significant for 16 of the 17 characters measured. General combining ability was important for the six measurements of the vegetative plant (leaf length, plant height, plant weight, etc.) while specific combining ability was most important for fruit characters (weight of fruit, number of seed, weight of sound mature kernels, etc.).

Several of the crosses showed considerable heterosis when cross means were compared to mid-parent means. Crosses of Virginia type parents by Valencia type parents gave greater heterosis than other crosses for vegetative plant characters. However, crosses of Valencia type parents x Spanish type parents gave greatest heterosis for yield and fruit characters.

The usefulness of these six peanut lines as parents cannot be determined until later generation performance of segregating progenies are evaluated.

EFFECT OF SEED RATES AND MULTIPLE ROWS PER BED ON PEANUT PRODUCTION UNDER IRRIGATION

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ABSTRACT

Tests on seeding rates and multiple rows per bed have been conducted from 1963 through 1969 in small plot tests and some years in large replicated plots in commercial field tests. All tests were on slightly raised beds with the beds usually on 40-inch centers. In all the small plot tests, all seeding rates used were

planted in single and twin rows per bed. In some tests three rows per bed were also used for each of the seeding rates.

Increased yields of Spanish type peanuts grown under irrigation have usually been obtained when seeding rates have been increased from 60- to 130-pounds per acre. The highest seeding rates varied from 120- to 130-pounds per acre. These rates usually gave the highest yield of clean nuts per acre where direct comparisons could be obtained.

Peanuts planted in twin rows 5- to 10-inches apart have nearly always out-yielded peanuts planted in single rows at any particular seeding rate. Three rows on a bed have frequently outyielded peanuts planted with twin rows per bed. The differences, however, between the two and three rows per bed have not always been statistically significant.

TETRAZOLIUM INSIGHTS INTO PEANUT PLANTING SEED QUALITY

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ABSTRACT

Costly problems in the planting seed industry are frequently developing because of the lack of timely and reliable information concerning seed soundness, viability, and causes for inferior seed. The tetrazolium test has been developed and found useful for resolving these problems.

The test requires less than 24 hours. It makes use of a colorless solution that stains normal living tissues a carmine red; weak living tissues, an abnormal red; and dead tissues, no color. Seed dormancy is bypassed.

Causes revealed for seed quality disturbances prior to harvest include: calcium deficiency, plasmolysis-deplasmolysis injuries resulting from alternate dry and wet weather conditions, and stink bug damage.

The major quality disturbances were found to occur after digging. They include mechanical, progressive, freeze, and heat damage. Early losses in seed soundness and viability in storage are largely caused by deterioration and death of injured areas, enlargement of these dead areas (necroses), and rapid aging of immature seeds.

The tetrazolium test is now being effectively used by many seed peanut companies. Its merits are worthy of much more extensive use.

Colored slides are to be used to illustrate the nature of the test and to present useful insights into seed quality that are made possible by differences in staining patterns.

SEED DORMANCY OF PEANUT VARIETIES

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ABSTRACT

Seed dormancy of 19 peanuts of the Virginia botanical type was studied. Seed of certain varieties, stack-cured, showed up to 70% less dormancy in a germinator at 77 F. than when planted in sand in a greenhouse at 72-77 F. Dormancy of varieties, which ranged from 100 to 11% after curing 16 days at 70-90 F., had decreased appreciably after storage at 39+2 F. for 150 days. Dormancy was effectively broken in 15 genotypes following curing, by storage at 85 F. for 4 weeks or 70 F. for 8 weeks. 'Early Runner' still showed 10 and 'Florunner' 17% dormancy following 13 weeks at 39+2 F. plus 4 weeks at 85 F.

REGULATION OF GERMINATION OF PEANUT SEEDS

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ABSTRACT

Factors that induce dormant Virginia-type peanut seeds to germinate were studied. Kinetin, ethylene gas and the synthetic ethylene producing material 2-chloroethylphosphonic acid stimulated the germination of the dormant seeds. Seeds that were no longer dormant produced ethylene gas during germination. Ethylene gas alone was sufficient to stimulate the dormant seeds to germinate 85% above the control. Kinetin is thought to be effective due to its ability to stimulate ethylene production by the seeds. Non-dormant Spanish-type peanut seeds were also shown to produce ethylene during their germination. Ethylene gas is a natural plant growth regulator. It is apparently active in the initiation phases of peanut seed germination. The effect of storage conditions on ethylene production, germinability, and some major organic constituents of the non-dormant seeds was determined. Ethylene production and germinability were reduced about 80% and 63%, respectively, by 3+2 degrees C. and 80+15% relative humidity at 48 hours of germination. There was no significant, detectable changes in insoluble and soluble nitrogen or reducing sugar contents of the seeds. The most noteworthy result was the reduction in the ability of the seeds to produce ethylene. This may be a fundamental process that is essential for peanut seed germination and is adversely affected by unfavorable storage conditions.

THE RELATIONSHIP OF GROWTH HABIT AND ROW PATTERN ON YIELD AND MARKET GRADE OF THREE VIRGINIA PEANUTS

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ABSTRACT

A Virginia type peanut line, Va.67-189, along with 2 commercial varieties, Va.61R and Florigiant, were evaluated for performance in 4 planting row patterns and 2 harvest dates. The Va.67-189, having sparse vegetative growth and fruit concentrated around the taproot, yielded highest when planted on a bed of 3 rows spaced 46cm apart and 8cm in the drill. The lowest yield for this line was obtained when planted in 2 rows 91cm apart and 15cm in the drill. The commercial varieties, Va.61R and Florigiant were less influenced by varying the row pattern. Va. 67-189, had a lower percent of immature seed than the commercial varieties when harvested early giving support to the early maturing characteristic of the line. When yield and market grade factors are combined to obtain a value, little differences were noted for any line or variety.

DESIGN OF CONTROLLED HUMIDITY CHAMBERS FOR STUDYING EQUILIBRIUM MOISTURE PROPERTIES OF PEANUTS

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ABSTRACT

Enclosed chambers capable of maintaining a constant temperature and relative humidity for an extended period of time were designed and constructed. Conditions within the chambers were maintained through control of dewpoint and dry bulb temperatures of the incoming air.

Using these chambers, the moisture-relative humidity equilibrium curves for Starr Spanish, Early Runner and Florigiant peanuts were determined using whole pods, kernels only and hulls only. Tests were run at 70, 90 and 120 degrees F. using a wide range of relative humidities.

Results of these tests showed no significant differences among the three varieties. Higher temperatures gave lower equilibrium moisture levels for low to medium relative humidities. At high relative humidities, however, this relationship did not hold. Further work is being planned to determine if this discrepancy is because of excessive mold growth at high relative humidities or because of other factors. Results showed that the kernel equilibrium moisture was 0.87 times the whole pod moisture using dry basis moisture. The hull was 1.4 times the whole pod moisture. Both of these ratios held throughout the range of relative humidities.

THE EFFECT OF ALAR ON PEANUT YIELD AND QUALITY

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and

Astor Perry, Extension Peanut Specialist
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ABSTRACT

The effects of the plant growth regulator, Alar, on peanut yield and quality was measured in replicated tests at four locations in North Carolina in 1969. Two Virginia type cultivars, Florigiant and NC-2, in 18 and 36 inch rows with the same plant population per acre were treated with one pound of the commercial preparation, Alar-85, on three different dates, June 25, July 17, and August 13.

Significant differences were not found in yield with any of the treatment dates or row spacings with the NC-2 Variety. A significant increase of 489 pounds per acre over control did occur with the Florigiant Variety when planted in 18 inch rows and treated on June 25. No significant differences were found in the percent sound mature kernels, extra large kernels, fancy size pods, other kernels, damaged kernels, or the oil maturity index number at harvest with either variety in any of the treatment dates or row spacings.

Rainfall at all the test locations was abnormally high with over eleven inches falling at the Northampton County location between July 15 and August 10. The results obtained may have been influenced by weather but in general they are in agreement with results obtained in prior years under very different weather conditions.

One interesting observation was made at the Northampton County location where defoliation of the Florigiant cultivar occurred prior to harvest. Pod shedding was noticeably lower with this cultivar when Alar was applied at any of the treatment dates. This raises the interesting possibility that one of the effects of Alar on peanuts is to increase pod retention. If so, cultivars having poor pod retention may show the greatest yield increase with Alar especially if conditions favoring pod shedding occur at harvest time.

In addition to the above tests, 45 demonstrations consisting of a 3-acre check and a 3-acre area treated at the rate of one pound of Alar per acre were conducted in twelve counties. An average increase of slightly over 200 pounds was obtained with the Alar treatment. All of the commercially important cultivars such as Nc2, Nc5, Nc17, Florigiant, and Va-61R appeared in these demonstrations.

THE MOISTURE CONTENT RELATIONSHIP OF MATURE AND IMMATURE PEANUTS

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ABSTRACT

Mature and immature kernel moistures were chronologically measured and recorded during drying and storage of farmers' stock peanuts. In another investigation, mature and immature kernel moistures were determined during a short term, humidity controlled, aeration storage.

Freshly harvested peanuts had immature kernels that were 10 to 20 percent higher in moisture content than mature kernels. Immature kernels had a drying rate 0.2 to 0.4 points/hr. higher than the mature kernels and towards the end of drying the immature kernels were only 0 to 6 percent higher in moisture content than the mature kernels. By the end of 3 to 5 months storage, the moisture difference between mature and immature kernels had decreased to an average of 0 to 1.5 percent.

Low moisture peanuts were removed from storage and allowed to reach equilibrium in aeration bins (humidity controlled). Immature kernels were 1 to 3 percent higher in moisture content than mature kernels depending upon the percent moisture of the composite sample.

THE EFFECTS OF PENTACHLORONITROBENZENE UPON THE POPULATION OF LESION NEMATODES IN SPANISH PEANUTS

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ABSTRACT

The effects of pentachloronitrobenzene (PCNB) upon lesion nematode (*Pratylenchus brachyurus*) population in Spanish peanuts were investigated in field trials and box plot experiments. A split-plot randomized block design was used in the field trials with two dates of harvest, three nematicides and 0- and 10-lbs. active PCNB per acre. Nematode determinations were made of the soil and peanut shells at harvest and yield and quality data were collected. Ten-pounds active PCNB per acre at planting time significantly increased the numbers of lesion nematodes in the shells of Spanish peanuts. Significant negative correlations occurred between numbers of lesion nematodes per gram of shell and yield of pods per acre in these tests. Delaying harvest significantly increased lesion nematodes and reduced the yield of pods per acre.

In box plot experiments, a 12-percent reduction in yield occurred with the

use of PCNB in a soil infested with lesion nematodes. In the same soil there was no significant difference between yields from plots treated with PCNB and plots with no PCNB, when the lesion nematodes were controlled. Results of these investigations indicate the potential population increase which can occur in lesion nematode infested peanut fields with the use of PCNB if no nematode control practices are used.

EVALUATION OF SELECTED PEANUT LINES FOR RESISTANCE TO THE SOUTHERN ROOTWORM IN THE GREENHOUSE

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**D. M. Porter, Plant Pathologist, ARS, CRD, USDA,
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ABSTRACT

Differential varietal reaction to injury by larvae of the southern corn rootworm, *Diabrotica undecimpunctata howardi* Barber, of 9 previously tested lines and 3 commercial cultivars of peanuts, *Arachis hypogaea* L., was measured at 3 levels of infestation in the greenhouse. Significant differences in percent injured fruit were found between lines in immature, mature, and total fruit at the 25 and 50 larvae/basket level of infestation. High levels of injury resulted at the 100 larvae/basket level in the 3 categories of fruit, but differences (range 30.2 - 49.6) in mature fruit were not significant. Significant differences in percent injured fruit were found between levels of infestation.

NUMBER OF SAMPLES TASTED VS. FLAVOR RESPONSE

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ABSTRACT

The report includes a discussion of the influence of the number of samples tasted upon the responses from selected and moderately trained panels, consumer-type panels, and CLER-test participants. Materials tasted include ground roasted peanuts for the trained and consumer panels and roasted peanut halves for the CLER tests. Flavor evaluations include varieties from the three major commercial types of peanuts. Treatments evaluated for affect of number of samples tasted upon flavor response include those from the following types of experiments:

- Low-Temperature Drying
- Variable Degree of Roasting
- Runner Variety and Screening Size Comparisons
- Growth Regulation with Alar and Its Affect on Peanut Quality
- Farmers Stock Storage.

MECHANISMS FOR PICKING PEANUTS FROM ORIENTED PLANTS

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ABSTRACT

The principle of mechanically picking peanuts from the plant, as opposed to the present "impact-vine disintegration" combining, was tested by two different mechanisms, both of which require that a specific pod-plant orientation be maintained. The growing plant naturally has this orientation and, since green-harvesting completely eliminates the weather hazard, the use of this principle should reduce the aflatoxin potential.

The first mechanism discussed utilizes rotating screens, made from expanded metal, to remove the pods. While the pods are being picked, the plant is restrained between paired belts or chains which are used to convey the plants from the pick-up belts across the picking screen.

The second mechanism utilizes an overhead conveyor to move the plants between a set of fixed rods and a vibrating rack. The peanuts hang below the rack and are picked by notched metal strips attached to rotating drums.

The picking efficiencies for these two units ranged from 80 to 92 percent. The pod damage is approximately equivalent to that done by handpicking. Using these or similar mechanisms to direct-harvest peanuts would eliminate the losses normally occurring in the windrow and, consequently, add to the efficiency. Such green harvesting would require additional drying expense. However, the potential advantages appear to outweigh the disadvantages and additional work is planned in the development of these mechanisms.

CONDITIONING PEANUTS IN A FLUIDIZED BED PRIOR TO DRYING WITH HEATED AIR

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ABSTRACT

Studies were conducted to determine the feasibility of increasing the drying rate of freshly-dug peanuts by conditioning them with high-temperature air in a fluidized bed prior to conventional drying with heated air. Results show that conditioning high-moisture peanuts in a fluidized bed for one minute at a temperature of 200 degrees F. prior to heated air drying had little effect on the

overall drying rate, however, a 54 percent increase in the drying rate was obtained at 150 degrees F. for an exposure period of 10 minutes. This increased drying rate resulted in a 34 percent reduction in the time required to dry to a moisture content of 10 percent. The effects of the fluidized-bed treatments on the milling and germinating qualities of peanuts are also discussed in this paper.

MECHANICAL DAMAGE TO FARMERS' STOCK PEANUTS CONVEYED WITH BUCKET ELEVATORS

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ABSTRACT

Farmers' stock peanuts were conveyed with bucket elevators in a range of belt speeds and loading rates, and with two different spacings of buckets. Damage was assessed from the increase in loose shelled kernels (LSK), split kernels and cracked or broken pods.

The LSK and split kernel increase was very small for each time the peanuts were conveyed. Cracked or broken pod damage was much greater and larger pods showed the most damage.

Belt speed, bucket spacing and bucket loading did not significantly affect the amount of damage, but there was a slight increase in LSK at belt speeds above 200 FPM.

THE EFFECT OF PEANUT TEMPERATURES ON DAMAGE DURING SHELLING, SHELLING EFFICIENCY AND RATE OF SHELLING

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Laboratory, Handling & Facilities Research Branch,
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ABSTRACT

Shelling tests were conducted on laboratory and shelling plant scale to determine the effect of peanut temperature during shelling on split kernel outturn, shelling efficiency and shelling rate when shelling Spanish- and Runner-type peanuts.

Samples of Runner- and Spanish-type peanuts were stored at 35 degrees F., 45 degrees F., 55 degrees F. and 65 degrees F. When ambient temperature reached the temperature of the peanuts, the peanuts were shelled.

Split kernel out-turn increased 2%, shelling efficiency increased 5% and

shelling rate increased 15% as peanut temperature decreased from 65 degrees F. to 35 degrees F. The greatest effect of peanut temperature appeared to occur below 55 degrees F.

There was some indication that bald count increases directly with temperature.

Shelling should be discontinued at temperatures of 45 degrees F. or below when possible.

THE EFFECT OF PICKING AGGRESSIVENESS ON COMBINE DAMAGE TO PEANUTS

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ABSTRACT

The evolution of the present high capacity cylinder-type combine has brought with it the disadvantage of potentially high hull damage if not operated properly.

Objectives of this study were to determine the factors contributing to this damage and to suggest possible solutions to the problems at both the combine-manufacturer and combine-operator levels. Factors studied were combine cylinder speed, stripper-bar orientation, and cylinder tooth density. The cylinder section of a PTO-driven Lilliston combine was used in the test. Five replications of an 18-treatment test were run to determine the main effects and interactions of the combine parameters under observation.

As the combine cylinder speed increased, damage done to the hull also increased. The aggressiveness of the picking action and the hull damage increased as the stripper-bars were extended into the picking section of the combine. The tooth density had no significant effect on the amount of hull damage.

The ability of the combine operator to compensate for changing picking conditions of the peanuts with adjustments to the combine is an important factor in determining the amount of damage done to peanuts during harvest.

INSECT REMOVAL FROM INFESTED FARMERS' STOCK PEANUTS DURING SHELLING

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ABSTRACT

Farmers' stock peanuts improperly treated or inadequately stored invariably develop large populations of insects prior to milling. Five 800 pound lots of Runner peanuts previously infested with varying populations of almond moth, *Cadra cautella* (Walker), Indian-meal moth, *Plodia interpunctella* (Hubner), red flour beetle, *Tribolium castaneum* (Herbst), and merchant grain beetle, *Oryzaephilus mercator* (Fauvel) were shelled at the USDA experimental pilot shelling plant at Dawson, Georgia to determine the destination of insects during the milling operation. The shelling plant is very similar in design and set-up to commercial shelling plants.

Approximately 80% of the live insects (adults and larvae) were removed from the inshell peanuts as they were cleaned prior to shelling. Another 6-16% of the live insects were removed with the loose shelled kernels and oilstock peanuts destined for crushing. Dead insects and/or fragments were seldom found in the finished peanuts; however small living larvae were recovered from the finished edible-grade peanuts.

Shelling yield was correlated with the degree of insect infestation. Insects affected the percent of sound splits during milling, the higher the insect population, the greater the percent of sound splits. Milling loss (unaccountable losses) was also related to degree of insect infestation.

DIVERSION PROGRAM FOR FARMERS' STOCK PEANUTS WITH HIGH CONCENTRATIONS OF AFLATOXIN

J. W. Dickens and J. B. Satterwhite

**Research Agricultural Engineer and Engineering Technician, respectively,
Market Quality Research Division, ARS, USDA, North Carolina State
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ABSTRACT

Because aflatoxin is produced in peanuts by *Aspergillus flavus*, peanut kernels in grade samples from all lots of farmers' stock peanuts marketed in the United States during 1968 and 1969 were inspected for this mold. Lots identified to contain *A. flavus* kernels were designated segregation 3 and diverted to non-food use except the oil which was aflatoxin free. Lots not found to contain *A. flavus* kernels and with low levels of damage were designated segregation 1 peanuts. Studies made to test the efficacy of the program produced the following results:

(1) Over 400 kernels identified to have *A. flavus* growth during routine inspection were cultured after surface sterilization, and *A. flavus* grew from 93% of the kernels. (2) The average concentration of aflatoxin in 364 composite samples, representing 3,640 lots of farmers' stock peanuts was 203 parts per billion (ppb). (3) The average concentration of aflatoxin in samples from 2,347 lots of segregation 1 peanuts was 14 ppb compared to 281 ppb in samples from 825 lots of segregation 3 peanuts marketed at the same locations during the same time period. (4) The percent *A. flavus* kernels in peanuts shelled prior to sampling (LSK) averaged approximately 8 times greater than for the unshelled peanuts in samples from 305 lots of segregation 3 peanuts. Based on these data, when lots contain an average 0.55, 1.10 or 1.65% *A. flavus* kernels in the LSK portion there is a 77, 94 or 99% probability, respectively, that at least 1 *A. flavus* kernel will be included in present grade samples which consist of approximately 180 LSK and 750 unshelled kernels.

COMPARING THE OBSERVED DISTRIBUTION OF AFLATOXIN IN SHELLED PEANUTS TO THE NEGATIVE BINOMIAL DISTRIBUTION

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ABSTRACT

Suitability of the negative binomial distribution for use in estimating the probabilities associated with sampling lots of shelled peanuts for aflatoxin analysis has been studied. Large samples, called "mini-lots", were drawn from 164 lots of shelled peanuts contaminated with aflatoxin. These mini-lots were subdivided into 10-pound samples which were analyzed for aflatoxin. Variance of the sample means about the mean, M , of the mini-lots from which the samples were taken was determined. These variances were then used to compute the percent non-contaminated peanuts, $F(0)$, in the mini-lots by means of the equation for the negative binomial distribution. The relationship between $F(0)$ and lot mean M was found to be described by the regression equation: $F(0) = 99.983 - 0.003M$. The observed distribution of 10 sample means from each of 11 mini-lots were compared to the negative binomial distribution by means of the Kolmogorov-Smirnov test. The null hypothesis that each of the 11 observed distributions were negative binomial was not rejected at the 95% confidence level.

EFFECTS OF STORAGE TIME AND CONOITIONS OF PEANUT VOLATILES

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ABSTRACT

Quantitative changes in the volatiles of unshelled peanuts stored under simulated warehouse conditions and of shelled peanuts stored under controlled environmental conditions have been determined using gas-liquid chromatography. Under both storage conditions total volatile content reached a maximum after 90 to 120 days of storage and then declined. The largest quantity of volatiles was found in peanuts stored under the simulated warehouse storage conditions. Three compounds, pentane, acetaldehyde, and methanol accounted for 89-90% of the volatiles present and were primarily responsible for the changes found in the total volatile pattern during the storage period. Lipoxidase and pectin methyl esterase are discussed as enzymes possibly responsible for the production of these volatiles.

CHARACTERISTICS OF RHIZOCTONIA ISOLATES FROM PEANUTS

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ABSTRACT

Rhizoctonia solani Kuhn has been recognized as a peanut pathogen for many years. It attacks all parts of the plant, causing seed and pot rot; damping off; and peg, stem, and leaf lesions. We now have evidence to show that at least two basidiomycetes may be implicated in this disease complex. The organisms are macroscopically indistinguishable on solid culture media; however their nuclear numbers per hyphal compartment are consistently different. One species (*Rhizoctonia solani* Kuhn, perfect stage *Thanatephorus cucumeris* (Frank) Donk) contains many nuclei per compartment whereas the other species has only two nuclei per compartment. In general, the multinucleated isolates are more vigorous in culture and their hyphal diameters tend to be greater than those of the binucleated isolates. Binucleated isolates frequently die in culture, are less virulent pathogens, and parasitize the multinucleated isolates in two-membered cultures. Optimum growth of all isolates on 5 different media occurs between 25-35 C. We are now attempting to induce the sexual stages in pure culture. On the basis of recent work on the taxonomy of certain basidiomycetes in relation to nuclear numbers we believe the binucleated isolates may be one or more species of *Ceratobasidium*.

DISCUSSION GROUP SUMMARIES

PEANUT AROMA AND FLAVOR DISCUSSION GROUP

By

**W. E. Livingston, Director of Research
Derby Foods, Inc., Chicago, Illinois**

This meeting was well attended with some 50 members in the group representing all facets of the peanut industry. The discussion leader started the session off with an extemporaneous presentation of the simple test procedure used by one company to evaluate the quality of incoming lots of raw peanuts. Audience participation was very good resulting in many questions, elaborations and limits of various methods of determining the flavor and aroma of peanuts.

WEED CONTROL DISCUSSION GROUP

by

**T. E. Boswell, Leader
Texas A&M University Plant Disease Research Station
Yoakum, Texas**

Thirty-seven individuals, including State and USDA Research Personnel, Extension Staff, chemical company representatives and growers participated in the weed control discussion group.

Informal reports were presented by various individuals on research tests and on the farm demonstrations in their areas with pre-emergence and post emergence applications of herbicides. Problem weeds were discussed and the effectiveness of various herbicides for their control. Of greatest interest and concern to this group, based on number of questions and time spent in discussing the problem, was the broadleaf weed species which are tolerant to presently used pre-emergence herbicides in peanuts. Results with the use of 2,4-DB continued to be very promising from the various states reporting. A report was given on the present status of 2,4-DB in regard to clearance for post emergence application on peanuts.

The active participation and contributions to the discussions by those in attendance was very informative and enjoyable to the discussion leader, and I hope to all in the Weed Control Discussion Group.

DISEASE AND NEMATODE CONTROL DISCUSSION GROUP

**Mr. Kenneth H. Garren, Discussion Leader
Plant Pathologist, Agricultural Research
Service, Crops Research Division, Tidewater Research
Station, Holland, Virginia 23391**

The discussion leader, K. H. Garren, first recognized A. L. Harrison of Yoakum, Texas winner of this year's Golden Peanut Award. It was noted that Dr. Harrison is the third researcher on peanut diseases to win the award. The other two were L. I. Miller of Virginia and C. R. Jackson of Georgia.

The first disease discussed was the always-important and ever-present leafspot disease caused by *Cercospora* spp. Research on control of leafspot was discussed by D. M. Porter of USDA, Holland, Va., R. Pristou of V.P.I., Blacksburg, Va. and C. R. Miller of University of Florida. The consensus of these researchers was that some of the newer fungicides offer much promise for better leafspot control if labels can be obtained and if the cost is not prohibitive. Some of these newer fungicides, it was pointed out, seem to be "systemics" in that they may be absorbed and moved about within the plant. Two such systemic fungicides which show most promise for leafspot control are Benomyl and TBZ. An experimental label has already been obtained for Benomyl. There was a lively ad lib discussion on leafspot control in which some county agents, growers, and commercial representatives asked questions of the researchers.

The second topic discussed was nematode control. W. W. Osborne of V.P.I., Blacksburg, Va. described the nematode survey work in Virginia by which growers are advised on economic feasibility of fumigation for nematode control. He also discussed the procedures used to make comparative tests of menatocides as they are cleared for use on peanuts. There was some ad lib discnssion on nematode control in peanuts.

The third topic discussed was peanut pod rot or pod breakdown. K. H. Garren of USDA, Holland, Va. described the complexity of the problem in that at least two different fungi can cause it, that nematodes and soil insects may provide points of entrance for these fungi, and that wilt may be associated with it. This was done to explain why fumigants may control pod rot in one field and not in another. R. E. Pettit of Texas A. and M. discussed the over-all soil-borne peanut disease complex in Texas. This includes, he pointed out, pod rots caused by several fungi, root rots, wilts, etc. He noted our ignorance on the subject of soil borne diseases of peanuts is a great barrier to their control and we must study them much more before we can begin to speculate on their control.

In the closing discussion, K. H. Garren noted that the peanut stunt virus disease has been of almost no commercial importance in Virginia for two or three years. He questioned that this was due in any great part to controlling white clover, the host in which the virus overwinters, in the vicinity of peanut fields. J. C. Smith, entomologist of V.P.I., Holland, Va. noted that the vector of the stunt virus, an aphid, is present this summer (1970) in great numbers in peanut fields. A. L. Harrison described, briefly, circumstances under which PCNB is recommended for stem rot control in Texas. After this the session was adjourned.

PEANUT SEED STANDARDS DISCUSSION GROUP

by

**R. P. Moore, N. C. State University
Raleigh, North Carolina**

The discussion concerning Peanut planting seed standards was attended by 18 people, two of which represented seed producers. From earlier contacts by letter and from this discussion it appears as if Texas is the only state requiring planting seed to be sized. Their grades include Large (over 19/64 X 3/4); Regular (19/64 - 17/64); Medium (17/64 - 15/64); Small (15/64 - 13/64), Pee Wee (13/64 - 11/64). Most other states merely require that the splits be removed. Screen size

for this purpose ranges from about 13/64 to 15/64 depending upon the type of peanut.

The general impression gained from the discussion indicates that present planters handle non-graded seed in an acceptable manner. It was pointed out, however, that germination percentages of some seed lots could be improved by use of screens of sizes larger than the 13/64 to 15/64" screens commonly used for removal of splits. Such lots are most common for crops that have been subjected to drought. The drought injured seeds tend to be small, inferior in initial quality and to deteriorate rapidly in unfavorable storage conditions.

PEANUT IRRIGATION DISCUSSION

by

**L. E. Samples, Discussion Leader
Extension Engineer, University of Georgia
Tifton, Georgia 31794**

Reports were given on irrigation in the Southwest and Southeast with no new research data available from the Virginia-Carolina area. Very informative data was presented on tensiometer used to determine when to apply irrigation water. Oklahoma reports present use of tensiometer by growers over that area. These instruments are used to determine when to begin application of water and also to determine the amount of water to be applied.

Similar use of such tensiometer are being used in Georgia where many new systems are being used. A very rapid increase in the number of systems in Georgia was reported. Reports from both Southeast and Southwest indicate that from 600 to 1200 pounds more peanuts may be produced under irrigation when natural rainfall is excessively short during the fruiting portion of the peanut growth cycle. The discussion was well attended with excellent participation from those present.

AGRONOMIC PRACTICES DISCUSSION GROUP

by

**Allen H. Allison, Discussion Leader
Tidewater Research Station, Holland, Virginia**

The discussion group this year was quite good with a lot of interesting discussion. The following subjects were formerly discussed briefly:

(1) "Devices Used to Determine Maturity"

J. C. Wynn

N. C. State University

Raleigh, North Carolina

Mr. Wynn gave a brief summary of the concept of peanut oil color test or light transmission as a means of determining maturity. He reported that this method was used fairly extensively by certain members of the N. C. State staff and particularly by the Extension Peanut Specialist, Mr. Astor Perry, at many locations throughout the state, and he felt this method was quite successful. Other states showed a fair amount of interest in this method. About the only other methods discussed as being suitable by other states was the use of the old method of digging up sample plants in a given field and then pulling all of the

marketable nuts off and looking at the inside of the hulls for the brown stain as a means of maturity determination. When to start digging by this method varied from 60 to 75 per cent of the shells (inside) being brown depending on variety and acreage, which an individual farmer would have. The general consensus of opinion by this group was that we still needed a better method to determine optimum maturity, and that perhaps the oil color method may be developed into widespread use if it proves entirely satisfactory.

(2) "Fertilization and Liming"

Dr. Preston Reid
Scientist-in-Charge
Tidewater Research Station
Holland, Virginia

Dr. Reid gave a brief resume of the status of fertilizing peanuts from most of the peanut producing states and some from other parts of the world. Dr. Reid is in the process now of re-writing the chapter in *The Peanut - The Unpredictable Legume*, and stated that the general consensus of opinion from research workers and from a review of the literature, indicate that peanuts do not generally respond to direct fertilization but rather respond more to fertility levels. Nitrogen fertilization was also discussed at length and it was the general consensus of opinion here that if other soil factors are at their optimum then there was very little basis for ever applying nitrogen to the peanut crop. In the area of liming it was suggested by some sources that perhaps the soil pH did not have to be quite as high as we are liming for now.

One of the chief topics of discussion under this section was that of sources of calcium with special emphases on Standard Spray and Chemical's new product, "Magi-cal". Several comments were made regarding the translocation of calcium from the vegetative portion of the plant at all, and most especially down through the peg and into the peanut. Some felt that this source of calcium should be studied to see if and how this calcium is translocated.

(3) "Standardized Width of Band for Pesticides"

Dr. W. W. Osborne
Extension Plant Pathologist
Virginia Polytechnic Institute & State University
Blacksburg, Virginia

Dr. Osborne led the discussion on this subject and talked about the possible release of granular nematocides for use to control Parasitic nematodes on peanuts in place of the gaseous materials now being used. Dr. John Smith, Virginia Entomologist suggested that perhaps the band width for insect granular insecticides and herbicides and nematocides could be adjusted pretty much to be the same. General conversation was that some effort should be made to try to standardize the band width for peanut pesticides, if at all possible.

Approximately 30 people were present at this session.

VARIETIES AND BREEDING GROUP DISCUSSION SUMMARY

by

A. J. Norden, Discussion Leader

**Associate Professor, Department of Agronomy
University of Florida, Gainesville, Florida 32601**

Participants in this discussion included ten peanut breeders representing all of the major peanut producing states, one pathologist, one physiologist, two manufacturers of peanut products, seven persons primarily involved in peanut production and/or shelling, and four administrators. Topics discussed included new breeding techniques and screening procedures, ways of improving breeding methods, adaptation and performance including the characteristics of new and possible future peanut releases, and the needs of industry.

The trends in peanut acreages by types and varieties were given by representatives from the various states. Among the new 1969-70 peanut releases discussed were the Spanish varieties Spanhoma, Spancross, Tifspan and Comet; the Virginia variety, NC 17; and runner variety, Florunner. Although the need for continued improvement of quality was emphasized, it was pointed out that caution should be exercised in discarding exceptionally high yielding lines that may not be superior by all of our present measures of quality.

Dr. Aubrey Mixon discussed progress in Alabama in screening peanut genotypes for resistance to Aflatoxin. Although, as yet, he had not determined the factors responsible for the differences obtained among the various lines, he did indicate that resistance was not apparently associated with seedcoat thickness.

A number of selection indices being used by breeders was discussed. Such factors, for example, as the importance of iodine value, thickness of hull and seedcoat, seed dormancy, and factors associated with the classification of peanut varieties into the various commercial types.

A written report from Dr. R. O. Hammons, read in his absence, summarized the Georgia picture of varieties and breeding and the work of the Crop Science Society subcommittee on peanut variety registration of which he is chairman. Dr. Hammons pointed out the possible merits of publishing the records of peanut variety registrations in the Journal of APREA since it would provide reference data for the majority of APREA members who do not regularly read Crop Science.

SUMMARY OF DISCUSSION GROUP ON "PROTECTING THE ENVIRONMENT DURING PROCESSING"

James C. Roe, Discussion Leader

Mechanical Engineer

P. O. Box 30607

Dallas, Texas 75230

The group was not very well attended as most of the people were attending the Mycotoxin group. There were about ten (10) people at our group but there was a good deal of interest among those who were there. The picture was very

well received and several asked if copies can be obtained for showing to other groups. It is my understanding they can be obtained from Industrial Gas Cleaning Institute, 150 Purchase Street, P. O. Box 448, Rye, New York, 10580. Mr. M. L. Benson also offered to furnish details on any type of pollution control equipment from Electrostatic Precipitators through basic cyclones. His address is Western Precipitation Division, Joy Manufacturing Company, 4421 Harrison Street, Hillside, Illinois, 60162.

Mr. W. M. Birdsong, Jr. gave a resume of the work that is being done to try to find a use for peanut hulls. He advised the group of a committee formed by the Southeastern Peanut Association Peanut Supervisors to work further on the problem but felt APREA could and should assist in this work. He asked that if anyone had any ideas or had done any work with hulls he would like to be advised the results.

REPORT ON THE HARVESTING AND CURING DISCUSSION GROUP

by

**F. S. Wright, Leader, Agricultural Engineer
Tidewater Research Station, Holland, Virginia 23391**

In the harvesting and curing discussion group, formal comments were presented by Dr. B. L. Clarcy and Dr. R. P. Moore. These formal comments were limited to 10 minutes for each person. Approximately 30 people were in attendance.

Dr. Clarcy reviewed some of the problems in the digging, combining and drying operations of peanuts in the Oklahoma-Texas area. Major point of discussion from this review was centered on the "waiting period" which many of the peanuts were subjected to before being put on the drier. This problem exists to some extent in the Georgia-Alabama area and to a lesser extent in the Carolina-Virginia area.

Dr. Moore discussed points relative to when to dig for high quality peanut seed and maximum value per acre. Higher quality peanut seed are generally obtained from peanuts dug during the early part of the season.

Several questions were raised relative to new developments in harvesting and drying equipment. Representation from peanut equipment manufacturers was very limited.

Problems associated with harvesting (hull damage, losses, foreign material, LSK, etc.) were discussed to a limited extent. These were adequately covered in the storage and handling session which preceded this group in the same room.

Participation from people attending was excellent in raising questions and providing comments on the topics discussed.

MYCOTOXINS GROUP DISCUSSION

by

**U. L. Diener, Leader
Auburn University, Auburn, Alabama**

A series of topics suggested by APREA members on the status and various aspects of the aflatoxin and mycotoxin problem were summarized and sequenced with the NUMBER ONE concern involving the progress and outlook for CONTROL.

A. There have been reports on genetic resistance in peanuts to *A.flavus*. Is there any research information on the nature or mechanism of resistance in peanut kernels or pods to aflatoxin formation? What TECHNIQUES have been developed for the evaluation of this resistance?

W. K. Bailey reported that the aflatoxin resistance of certain varieties and breeding lines found in recent publications has not been verified by USDA workers evaluating these lines. Mixon described results of ongoing evaluations of peanut lines for aflatoxin resistance at Auburn.

B. It is widely agreed that the most practical avenue to control is to minimize growth and aflatoxin formation by *Aspergillus flavus* during curing and harvesting. What is the incidence of aflatoxin in the field? What conditions are conducive and/or limiting to aflatoxin production prior to digging, during curing, during picking, and during storage? What efforts are being made for control in this area?

Occurrence in the field was discussed by Pettit in his work in Texas. It corroborated in principle the findings of Bampton, MacDonald and Harkness, Diener et al., and Sellschop in that formation of aflatoxin prior to digging was associated with biological or mechanical injuries to the pod in the field, growth cracks from drouth followed by moisture, and overmaturity or premature physiological maturity induced by drouth. Emphasis was made by Doupnik, Virginia, and N. C. workers that high temperature in combination with high moisture were associated with occurrences of aflatoxin during curing and picking in the last two years. The problem of "soldiers" in warehouse storage with leaky roofs and the moldy upper crust in most storage bins indicate that molds and possible aflatoxin buildup in storage facilities will be continual hazards to the industry.

C. What is the status and progress in control measures by inspection for *A. flavus* and other molds in farmers' stock peanuts at the buying point?

A few further comments were made to this point by Bill Dickens, but in essence his morning paper summarized the status in this area. The outlook is that further refinements and experience will improve the effectiveness of the visual mold inspection system used at buying points.

D. What is the progress being made by shellers in control of mycotoxins?

J. B. Roberts discussed a number of points relative to shellers' problems with aflatoxin and mold development and deterioration of peanuts after they are received and stored by shellers.

E. What is the status of development of control methods at the processing and consumer product level?

Larry Atkins stressed the importance of the statistical probabilities associated with the level of aflatoxin in finished products such as peanut butter. It was pointed out that quality control was high and that zero tolerances are impractical, but the latter point is not always acceptable to the uneducated consumer.

Frank Dollear summarized work at Southern Reg.Res. Lab indicating that detoxification of peanut meals with ammonia appeared to offer the most effective means of control.

F. What is the importance of the aflatoxin problem to the peanut industry at the moment? In comparison to five years ago?

Aflatoxin is still considered the number one problem and concern with some segments of the peanut industry still uncomfortable, but no longer fearful or

hysterical as our knowledge and understanding of the nature of the aflatoxin problem has increased. Larry Atkins reminded us that "All must be alert and not become complacent". The fungus is everpresent and in favorable environments will form the toxic compound in a few days.

G. What do we know about the significance of other mycotoxins, produced by fungi other than *A. flavus*, that have been isolated from peanuts?

It appeared to the chairman that there is no valid data linking other mycotoxins to peanuts at this time. Most of the other mycotoxins are associated with storage and field fungi that are more commonly associated with the mycoflora of other agricultural commodities.

Others who contributed freely to the discussion that have not been mentioned were Messrs. Holaday, Porter, Garren, Sugg, Schroeder, and Barnes.

REPORT OF PEANUT INSECT DISCUSSION GROUP

by

Phillip J. Hamman, Leader
Associate Entomologist, Texas A&M University
College Station, Texas 77843

Quite frankly, I was extremely disappointed in the attendance at this particular session by those actively engaged in peanut insect research and Extension. The bulk of those attending were comprised of personnel from commercial chemical companies with only approximately three or four actual researchers or Extension workers. No one had comments or presentations regarding insect problems. I presented the peanut insect situation in Texas in 1968 and the accompanying research work during the year. I also elaborated on the proposed research for 1970.

PEANUT STORAGE AND HANDLING DISCUSSION GROUP

by

W. A. Horton, Leader
Sessions Company, Inc., Enterprise, Ala. 36330

The discussion group was attended by approximately 30 persons. The informal discussion was broken by a report on the activities of the Dawson Lab by Whit Slay and Jim Davidson, a report by Bud Redlinger on the scope of his work at Tifton and the parallel efforts at the Stored-Products Insect Lab in Savannah, and a brief outline of the efforts of the sheller committee on hull disposal by Bill Birdsong.

Each of these reports brought about discussions on related subjects, and there was an excellent exchange of ideas among the participants.

Additional areas of discussion were:

1. Differences in sheller outturns between Southeastern and Southwestern Spanish Peanuts;
2. The LSK elimination campaign staged in the Southeast in 1969;
3. Effect on storage and shelling of mechanical harvesting damage.

All three producing areas were represented by both sheller and research personnel who added considerably to the discussions.

**MINUTES OF THE REGULAR BUSINESS MEETING OF THE
AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION
St. Anthony Hotel, San Antonio, Texas, July 14, 1970**

President Moake called the meeting to order at 7:45 a.m.

He then recognized Dr. A. L. Harrison on his being the recipient of the "Golden Peanut Award" for the past year.

President Moake then thanked Sid Reagan for his many services to the association and help for the past year.

The Executive Secretary-Treasurer read his report and gave a financial account of the Association for the past year. These were approved by the membership. The financial statement is included as Appendix I of this report.

The minutes of the past meeting, as printed in the proceedings Volume 1, Number 1, were approved by the membership.

Dan Hallock gave a report for the finance committee and moved that we accept the proposed budget for the coming year. Seconded by Ross Wilson. Passed. The budget is included as Appendix II in this report.

Other reports were:

Publications -- Frank McGill -- see Appendix III

Quality -- Charles Holaday -- see Appendix IV

Public Relations -- Bill Mills -- see Appendix V

Program Planning -- Bill Dickens -- see Appendix VI

Nominating -- Harold Pattee -- see Appendix VII

The nominees were presented and elected by acclamation. For a list of the present Board of Directors see Appendix VIII.

A discussion was held on the continuation of holding concurrent sessions during the annual meeting. It was decided to leave them in at the present time.

Bill Dickens then succeeded David Moake as President of the Association.

Ross Wilson representing the Association then read a note of gratitude to David Moake for his service as president for the past year.

The meeting was adjourned at 8:45 a.m.

**AMERICAN PEANUT RESEARCH & EDUCATION ASSOCIATION
Board of Director's Meeting**

President David Moake called the meeting to order at 7:15 P.M., July 12, 1970. Those present were Norman Davis, J. W. Dickens, Don Banks, Coyt Wilson, Max Hinds, Allen Allison, Ross Wilson, Robert Pender, Peter Tiemstra, DeVoe Willard, Frank McGill, Charles Holaday, Dan Hallock, Bill Mills, Harold Pattee, Sydney Reagan, and Leland Tripp.

It was moved by Robert Pender and seconded by Allen Allison to dispense with reading of past minutes since each member present had a copy. Passed.

Sydney Reagan gave a report on the tax classification of the association. He said it looked very favorable and that we would be classified as a non-profit organization. President Moake gave his thanks to Sydney for his help to the organization.

President Moake requested that the committee chairman present Leland Tripp with copies of their committee reports at the time of presentation to the membership on Tuesday morning. Committee reports were then called for:

Peanut Quality--Charles Holaday, Public Relations--Bill Mills, Publication and Editorial--Frank McGill.

Coyt Wilson moved that the committee responsible for the revision of "The Peanut" be authorized to negotiate with possible publishers as soon as all chapters are turned in and report back to the Board of Directors the two best deals with a priority rating of 1 & 2. Then after authorization from the Board, the committee would work with DeVoe Willard on financial arrangements. Seconded by Ross Wilson. Passed.

Russ Wilson moved that the Executive Secretary-Treasurer serve as a permanent depository for APREA proceedings, sell all copies but three of each edition, and copies not sold would be disposed of by Board action. This includes all old copies now held in depository of the organization and its predecessor, PIWG. Seconded by Allen Allison. Passed.

Frank McGill moved that we send complimentary copies of APREA proceedings distributed on the same basis as the previous year. Seconded by Peter Tiemstra. Passed.

Finance Committee--Dan Hallock

Coyt Wilson made a motion that we allow \$25.00/month for Bookkeeping for the organization. Seconded by Peter Tiemstra. Passed.

Bill Dickens made a motion that the Executive Secretary-Treasurer make a financial report to the finance committee on a quarterly basis and to the Board of Directors at the end of the fiscal year and the calendar year. Max Hinds seconded. Passed.

Robert Pender moved we accept the proposed budget as reported by Dan Hallock. Seconded by Peter Tiemstra. Passed.

Program Planning Committee--Bill Dickens

Robert Pender moved that Raleigh, N. C. be selected as the location for the annual meeting of APREA with the committee picking the motel or hotel in which it is to be on July 18-21, 1971. Seconded by Allen Allison. Passed.

Nominating Committee--Harold Pattee

Harold Pattee moved that the nominating committee be instructed to submit a list of nominees to the President thirty days in advance of the annual meeting. Seconded by Robert Pender. Passed.

Harold Pattee read a letter of resignation from the Board by Peter Tiemstra. The Nominating Committee was instructed to nominate a replacement at the business meeting.

A letter from Joe Sugg was read to the Board which opposed the solicitation of funds for special purposes from organizations which are members of APREA. No action was taken with regard to this letter.

Allen Allison moved we adjourn. Seconded by Robert Pender. The meeting was adjourned at 10:20 p.m.

Appendix I

Financial Statement as of July 10, 1970

1. Income

a. Transfer from Curtisa Jackson in Georgia	\$4796.06
b. Membership (23) in the following categories:	
Sustaining (14)	\$1400.00
Organizational (54)	1350.00
Individual (159)	795.00
Student (4)	8.00
	3553.00
c. Contribution for annual meeting	
Breakfast	550.00
Social Hour	375.00
Last year's meeting	47.29
d. Sale of proceedings	
	<u>334.75</u>
	9656.10
	<u>4818.84</u>
	4837.26

Total income
Total expenses
Balance

2. Expenditures

Check #1 - U.S. Postmaster, for postage stamps	\$ 48.00
Check #2 - Sec. of State of Georgia, for recording	5.00
Check #3 - Gregory & Nenson, for audit	150.00
Check #101 - Public Office Service, for mailing of 1969 proceedings	54.01
Check #102 - Walker Ross Printing Co., for printing 500 copies of 1969 AFREA proceedings	1672.92
Check #103 - VPI Research Division, for printing 1000 copies of 1968 PTWG proceedings and mailing	1815.60
Check #104 - U.S. Postmaster, for postage stamps	30.00
Check #105 - The Bradshaw Agency, for \$5000.00 position bond for Exec. Sec.-Treas.	13.00
Check #106 - Leland Tripp, for expenses of Exec. Sec.-Treas. during Board of Directors Meeting	90.00
Check #107 - Fenton Office Supply, for 3 boxes of gold seals, 1 book of statements, and 1 receipt book	6.07
Check #108 - David Monks, for expenses during National Peanut Council meeting	254.32
Check #109 - Frank McGill, for expenses during National Peanut Council meeting	96.16
Check #110 - Bill Dickens, for postage	24.00
Check #111 - Agronomy Department, O.S.U., for postage	32.30
Check #112 - Fenton's Office Supply, for stationery	135.10
Check #113 - Agronomy Department, O.S.U., for secretarial service Oct. 1-69 to June 30-70	288.00
Check #114 - Kennedy Office Supply Co., for printing of 1970 programs for annual meeting	97.85
Bank charges, 1st National Bank & Trust Co., Stillwater	<u>6.51</u>
EXPENDITURES, TOTAL	\$ 4818.84

APPENDIX II

REPORT OF FINANCE COMMITTEE July 14, 1970

This Committee is charged with the responsibility "for preparation of the financial budget of this Association and for promoting sound fiscal policies within the Association." It also "directs the audit of all financial records of the Association and makes such recommendations as they deem necessary or as requested or directed by the Board of Directors."

A limited audit of the financial records of this Association was made by Gregory and Hinson, accountants of Griffin, Ga. prior to the transfer of these records from Dr. Curtiss Jackson to Dr. Leland Tripp and of funds from Commercial Bank and Trust Co. of Griffin, Ga. to First National Bank and Trust Company, Stillwater, Okla. The audit showed all records to be in good order. Also, a limited audit of the financial transactions of APREA during the remainder of 1969 was made by this committee at the suggestion of the Board of Directors. This Committee is satisfied that the executive secretary-treasurer is keeping adequate records which satisfactorily account for all financial activities through December 31, 1969.

This Committee commends Dr. Leland Tripp for his efforts concerning the finances of this Association and gratefully acknowledges the many services provided by him without monetary remuneration.

The Finance Committee presents for your consideration the following budget which has been accepted by the Board of Directors. Since this is the initial attempt to formulate an annual budget for APREA, this Committee suggests that these figures be taken only as estimates which may be somewhat inaccurate.

Respectfully submitted,
George McCleese
Ray Hammond
Ben Birdsong
Curtiss Jackson
Daniel L. Hallock, Chairman

American Peanut Research and Education Association, Inc.

BUDGET - 1970

ASSETS AND INCOME

Reserve	\$1,760
Membership	3,750
Proceedings - Sales	350
Registrations - Annual Meeting	1,000
Special Contributions	1,650
TOTAL	\$8,510

LIABILITIES AND EXPENDITURES

Proceedings - Printing	\$2,000
Annual Meeting - Printing - Catering - Miscellaneous	1,850
Secretarial Services	500
Postage	150
Office Supplies	300
Position Bond for \$5,000 (Exec. Secretary-Treasurer).	15
Travel - President	300
Travel - Executive Secretary-Treasurer).	200
Registration - State of Georgia	.5
Miscellaneous	190
SUB-TOTAL	5,510
 Reserve	 3,000
TOTAL	\$8,510

PUBLICATIONS & EDITORIAL COMMITTEE REPORT

August 1969 - July 1970

1. Developed appropriate stationery and letterhead for official use in all correspondence relating to the activities of the American Peanut Research and Education Association, making use of the word APREA as a symbolic insignia of the organization.

2. Established an APREA news column in the Peanut Journal & Nut World on an alternate month basis using president's picture. This column has and will continue to carry items of information and interest concerning APREA's activities for the enlightenment of all segments of the peanut industry.

3. Prepared and released an image building article entitled "The American Peanut Research & Education Association -- Its Past, Present & Future" which will be published in the Peanut Farmer and perhaps other peanut publications.

4. Peanut Research - the quarterly news letter edited by Mr. Wallace K. Bailey, was mailed to all members through the help of the National Peanut Council in a continuing effort to fulfill its goal of providing a continuing means for the exchange of information between all segments of the peanut industry.

5. Established a depository for all previous and future proceedings of PIWG and APREA in the office of our current Secretary-Treasurer, Leland Tripp, with the policy guide lines approved by the board for their dispensation. (For specific action refer to minutes of Board of Directors Meeting July 12, 1970.)

6. Established a list of 25 libraries and/or individuals who will receive a complimentary copy of the 1970 APREA proceedings and a list of 78 others who will be advised of their availability for purchase.

7. Standardized the format for all subsequent printings of APREA proceedings and expressed appreciation of Publications Committee member Joe Suggs for his accepting responsibility for its being printed and mailed to all dues paying members within 60 days of the annual meeting, provided all manuscripts are turned in by the speakers at time of delivery.

8. Under the leadership of committee member, Coyt Wilson, substantial progress during the year was made toward revising the peanut textbook entitled, "The Peanut -- The Unpredictable Legume". Ten of the 16 manuscripts have already been received by Dr. Wilson with the remaining six being promised at an early date. Dr. Wilson has established a deadline of September 1, 1970 for all remaining manuscripts and has obtained Board approval to proceed in securing the two best contracts for its publication for final board approval.

Respectfully submitted:

J. Frank McGill, Chairman
APREA Publications Committee

APPENDIX IV

REPORT OF THE PEANUT QUALITY COMMITTEE OF THE AMERICAN PEANUT RESEARCH AND EDUCATIONAL ASSOCIATION FOR 1969-70

The 1968-69 Quality Committee recommended four specific areas of endeavor for this year's Quality Committee. They are as follows:

1. Appoint an editor for the methods. We are happy to announce that Dr. Charles Simpson has agreed to serve in this capacity.

2. Run collaborative studies on the Optical Density Method for Maturity Measurement and the Cler Method for Flavor Evaluation. Eight laboratories were selected and 10 samples for each method were mailed to them for analyses. Statistical analyses were made on the data received from the eight collaborators and the results were presented to the Quality Committee. Because of the rather large standard deviation and coefficient of variation found in the Optical Density Method, the Committee decided to run another collaborative study after the sources of error in this method have been identified. These errors are believed to be due to improperly filtered oil and/or uncalibrated spectrophotometers.

The Committee accepted the Cler Flavor Method as an Official Method of APREA on the condition that the limitations of the method be defined in the procedure.

3. Try to obtain suitable methodology for milling and blanching quality characteristics. A simple device and appropriate methodology for measuring blanchability were developed at the National Peanut Research Laboratory under the sponsorship of the Quality Committee. A publication on this procedure will be coming out in the near future. Anyone interested may obtain details of the device and the procedure by writing the Peanut Quality Investigations, National Peanut Research Laboratory, Dawson, Georgia. No suitable equipment was found available on a method for measuring milling quality.

4. Further discuss quality standards and how these can best be implemented for the good of the industry. This was done to a limited degree during the year by members of the Committee. The off-flavor problem of spin-blanching peanuts was investigated by the National Peanut Research Laboratory in cooperation with the Quality Committee. A report on these findings was submitted to the Peanut Administrative Committee.

At the meeting in Atlanta last year a Sub-Committee on Sampling was proposed and adopted at the general meeting. Dr. Tom Whitaker was made Chairman of this sub-committee. Dr. Whitaker made a brief report to the Quality Committee on the activities of the Sub-Committee during the past year. His report is summarized below:

Since the objective of the sub-committee was not defined, members adopted the following objective:

To seek improvements in the sampling of peanuts by defining and promoting research to solve existing problems and to advance knowledge and understanding of how sampling results affect the reliability of any estimation of quality of peanuts.

The sub-committee feels that its objectives should be consistent with those of the Quality Committee except channeled in the specific area of sampling.

Since the area of sampling is so extensive, the committee wishes to initially concern itself to sampling of finish product and with problems associated with the more important quality factors such as maturity, aflatoxin content, flavor, milling quality, color, etc.

To define specific problem areas consistent with the stated objectives, a survey will be made (past surveys may have been made and need only to be supplemented) to determine the methods used to sample and quantify certain quality factors.

The committee would like to know such things as:

(1) Are procedures used to quantify a given quality factor uniform throughout the industry?

(2) Have the procedures been documented?

(3) Does any statistical bases exist for such procedures? and

(4) What are the industries objections to present prucedures?

The Sampling Procedures Sub-Committee welcomes any suggestions by members of APREA and the peanut industry.

This year's Quality Committee recommends the following action for the incoming committee:

1. Run collaborative studies on the following procedures: Iodine number by refractive index; blanchability; and optical density after the sources of error have been identified.

2. Develop equipment and methodology for measuring milling quality.

3. Further investigate the causes of off-flavor in certain lots of peanuts blanched before roasting.

4. Further discuss quality standards and ways and means of maintaining and improving quality for the good of the industry.

Respectfully submitted,

Charles E. Holaday - Chairman

Tom Whitaker

D. A. Emery

Astor Perry

Russell Schools

Daniel J. Kozub

Charles Simpson

J. E. Harvey

C. B. Smith

J. E. Sorenson

APPENDIX V

PUBLIC RELATIONS COMMITTEE REPORT TO THE APREA BOARD OF DIRECTORS July 12, 1970

The members of this committee, their term of office, and the area they represent are as follows:

Sydney C. Reagan	- 1 year - Shellers
Delton H. Harden	- 1 year - Growers
M. Dean Bond	- 1 year - State
Darold Ketring	- 2 years - USDA
Jack Fox	- 2 years - Manufacturers
Mrs. Ruth Moore	- 2 years - Services
William T. (Bill) Mills	- 1 year - Chairman

This report will cover New Member, Membership Renewal, and Financial Recognition activities of the committee.

I. New Member Activity - Hundreds of contacts were made by letter, quite a number by phone, and a few personally. The chairman does not have accurate knowledge of all the contacts, but will report on the ones he is aware of to indicate the scope of the committee's efforts.

The chairman contacted thirteen (13) chemical or equipment industries and invited them to join APREA. Five (5) joined with one (1) becoming a Sustaining Member, four (4) becoming Organizational members, and two (2) also paying for an Individual Membership.

Mrs. Ruth Moore made numerous personal contacts by phone which resulted in six (6) known new Organizational Members.

Mr. Sidney Reagan contacted every sheller in the U. S. by letter. The absolute results are not fully known, but the response from this group was disappointing.

Mr. Darold Ketring contacted all the SW members of APREA by letter and urged them to personally invite potential new members.

Mr. Dean Bond contacted many State workers in the SE involved with peanuts.

The activities of the Public Relations Committee resulted in at least thirteen (13) of our forty-eight (48) new members as of July 11, and possibly more.

The Program Committee is responsible for quite a few of the new members by virtue of the by-law that requires at least one author of each paper presented to be a member of APREA. We have not overlooked their contribution.

The availability of the 25 copies of the Journal each year will be an outstanding asset to the committee. Even though we received the 1969 Journals quite late the chairman personally knows that one copy resulted in a \$100 Sustaining Membership.

II. Membership Renewal Activity - Sustaining Members - On March 1, 1970, three (3) Sustaining Members had not renewed their membership. Letter contact was made to all three and one subsequently renewed.

Organizational Members - On March 1, 1970, eighteen (18) Organizational Members had not renewed their membership. Sixteen (16) were contacted by letter and seven (7) subsequently renewed.

Individual Members - On March 1, 1970, sixty-two (62) Individual Members had not renewed their memberships. Fifty-five (55) were contacted by letter or by personal contact and thirty-seven (37) subsequently renewed their memberships.

Student Members - On March 1, 1970, one (1) Student Member had not renewed his membership.

In addition to these contacts, made by the chairman, each committee member was furnished a list of members who had not renewed and was requested to contact those they represented on the committee and those they knew personally.

A March reminder will evidently be required to remind members to renew memberships. On March 1, 60% of our members had not renewed. As of July 11, 1970, only 14% had not renewed. We anticipate some of these re-joining at this meeting.

III. Financial Support Recognition - At the January 19, 1970, Board of Directors Meeting the Public Relations Committee was requested to prepare Certificates for the Sustaining and Organizational Members to express the Association's appreciation for the generous financial support they have provided, which accounts for 78% of our income.

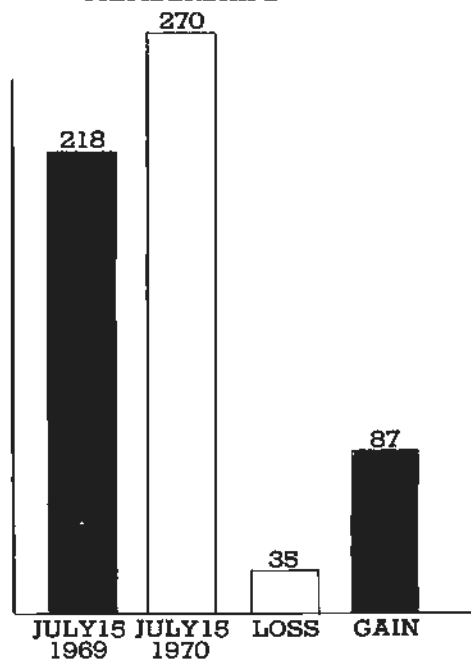
The Certificate was prepared and mailed to the President on July 2 for his signature and distribution.

IV. Summary - Many additional people can justify membership in APREA because of the value it has to offer. The value of APREA must be positively presented to these busy people before they will join. This committee is about the right size, but the segment representation has not proven to be functional. Overall results have been satisfying, but greater efficiency can be achieved.

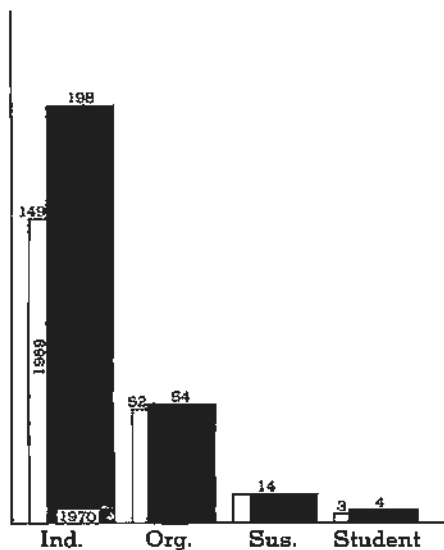
Respectfully Submitted,

William T. Mills
APREA - Chairman
Public Relations Committee

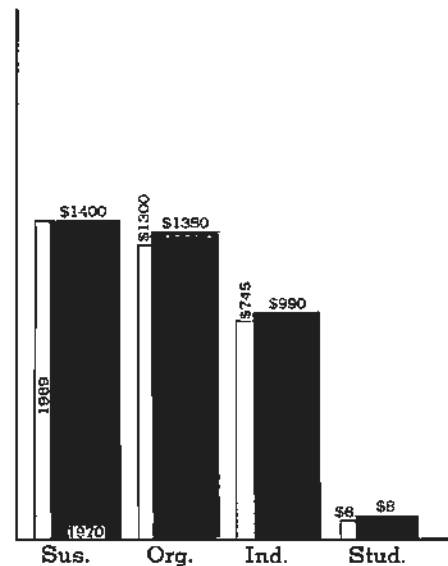
APREA MEMBERSHIPS



APREA MEMBERSHIPS



FINANCIAL SUPPORT



APPENDIX VI

APREA PROGRAM REPORT

Committee Members

Lawton E. Samples
Hubert C. Toalson
Luther H. Turner
David L. Moake
Leland D. Tripp
Ben R. Spears
Fred R. Cox
J. W. Dickens, Chm.

SUNDAY AFTERNOON, July 12

- 1 - 5 Registration - information for families - hospitality -- Porch
- 2 - 4 Committee Meetings
 - Peanut Quality - Room 321
 - Public Relations - Room 332
 - Publications - Room 330
 - Finance - Room 332
- 7-10 Board of Directors Meeting -- Room 330

MONDAY, July 13

- 8-5 Registration - information for families - hospitality -- Porch

GENERAL SESSION - David L. Moake, Presiding -- Peraux

- 9:00 President's Welcome - David L. Moake
- 9:10 Increasing role of the consumer in regulation of the food industry - Howard F. Harris
- 9:40 Role of the Peanut Administrative Committee in the peanut industry - Robert R. Pender
- 10:10 Coffee - Coke Break -- Anacacho
- 10:30 - 12:10 a.m. Two Concurrent Sessions

Session 1. Coyt T. Wilson, Presiding -- Peraux

- 10:30 Shelling and storage of partially dried peanuts - James T. Davidson, Jr., Paul D. Blankenship and Reed S. Hutchison.
- 10:50 Effects of drying, storage gases and temperature on development of mycoflora and allatoxins in stored high-moisture peanuts. G. L. Barnes, G. L. Nelson, B. L. Clarey, H. B. Manbeck and Y. C. Mosely.

- 11:10 Diversion program for farmerstock peanuts with high concentrations of aflatoxin - J. W. Dickens and J. B. Satterwhite.
- 11:30 Comparing the observed distribution of aflatoxin in shelled peanuts to the negative binomial distribution - T. B. Wtaker, J. W. Dickens and R. J. Monroe.
- 11:50 Peanut Hulls: The growing need for new markets and research - W. M. Birdsong, Jr.

Session 2. Wallace K. Bailey, Presiding -- El Tejano

- 10:30 Cytological investigations in ARACHIS as aids to peanut variety improvement - Donald J. Banks
- 10:50 Estimation of combining ability in ARACHIS HYPOGAEA L. 11. Field performance of F-1 hybrids. - J. C. Wynne, D. A. Emery and P. W. Rice.
- 11:10 Evaluation of selected peanut lines for resistance to the southern corn rootworm in the greenhouse - J. C. Smith and D. M. Porter.
- 11:30 Peanuts: from breeding line to variety in Virginia and North Carolina - R. Walton Mozingo.
- 11:50 The relationship of growth habit and row pattern on yield and market grade of three Virginia peanuts - Morris W. Alexander.
- 12:10 Lunch

Discussion Groups - Charles E. Simpson, Coordinator

	Subject - Room	Leader
1:30	Peanut aroma and flavor - Navarro	W. E. Livingston
	Weed Control - El Tejano	T. E. Boswell
	Disease and nematode control - Anacacho	K. H. Garren
	Peanut seed standards - Peraux	R. P. Moore
3:00	Peanut Irrigation - Navarro	L. E. Samples
	Storage and handling - El Tejano	W. A. Horton
	Agonomic practices - Anacacho	A. H. Allison
	Varieties and breeding - Peraux	A. J. Norden
4:30	Peanut insects - Navarro	P. J. Hamman
	Protecting the environment during processing - Anacacho	J. C. Roe
	Harvesting and curing - El Tejano	F. S. Wright
	Mycotoxins - Peraux	U. L. Diener
7 - 8	Social Hour - Anacacho	

TUESDAY, July 14

- 8 - 12 Registration - information for families - hospitality -- Porch
7:20 Buffet Breakfast - Business Meeting - David L. Moake,
Presiding
Committee Reports
Finance - D. L. Hallock
Publications - J. F. McGill
Peanut Quality - C. E. Holaday
Program - J. W. Dickens
Public Relations - W. T. Mills
Nominations - H. E. Pattee
Election of Officers

10:00 - 12:00 a.m. Two Concurrent Sessions

Session 3. L. H. Turner, Presiding -- Peraux

- 10:00 The effect of peanut temperatures on damage during shelling,
shelling efficiency and rate of shelling - Freddie P. McIntosh,
James S. Davidson, Jr. and Reed S. Hutchison.
10:20 Mechanical damage to farmerstock peanuts conveyed with
bucket elevators - Whit O. Slay and Reed S. Hutchison.
10:40 Insect removal from infested farmerstock peanuts during
shelling - Jerry A. Payne, L. M. Redlinger and James S.
Davidson.
11:00 Stability of the peanut proteins to heat and organic solvents -
Robert L. Ory, N. J. Neucere, Rattah Singh and Allen J. St.
Angelo.
11:20 Effects of storage time and conditions on peanut volatiles -
Harold E. Pattee, John A. Singleton and Elizabeth B. Johns.
11:40 Number of samples tasted vs. flavor response - Jack L. Pearson.

Session 4. Ben R. Spears, Presiding -- El Tejano

- 10:00 The effect of Alar on peanut yield and quality -- L. L. Hodges
and Astor Perry.
10:20 Response of Florigiant and Virginia Bunch 46-2 peanuts to
TIBA in Virginia - D. L. Hallock and M. W. Alexander.
10:40 A zinc nutritional study of peanuts (*ARACHIS Hypogaea* L.) -
R. V. Quintana, W. B. Anderson, Carl Gray and J. S. Chapin.
11:00 Effect of seed rates and multiple rows per bed on peanut
production under irrigation - A. L. Harrison.
11:20 Seed dormancy of peanut varieties - John E. Bear and W. K.
Bailey.
11:40 Regulation of germination of peanut seeds - Darold L. Ketring.
12:00 Lunch
1:30 Panel discussion - If you were director of peanut research --
Peraux - Moderator, W. G. Conway, Manufacturers - Lawrence

Atkin, Shellers - J. B. Roberts, Producers - Floyd King.

2:45 Coffee - Coke Break -- Anacacho

3:00 - 5:30 Two Concurrent Sessions

Session 5. Lawton E. Samples, Presiding -- Peraux

- 3:00 Mechanisms for picking peanuts from oriented plants - J. L. Butler, F. S. Wright, E. J. Williams.
- 3:20 Peanut in-field harvesting losses in North Carolina - E. O. Beasley.
- 3:40 Development of experimental equipment to separate green immature peanuts - George B. Duke.
- 4:00 The effect of picking aggressiveness on combine damage to peanuts - Kenneth M. Penuel and William F. Lalor.
- 4:20 Conditioning peanuts in a fluidized bed prior to drying with heated air - N. K. Person, Jr. and J. W. Sorenson, Jr.
- 4:40 Design of controlled humidity chambers for studying equilibrium moisture properties of peanuts - J. M. Troeger and J. L. Butler.
- 5:00 The moisture content relationship of mature and immature peanuts - Paul D. Blankenship and Reed S. Hutchison.

Session 6. Ross Wilson, Presiding - El Tejano

- 3:00 Tetrazolium insights into peanut seed quality - R. P. Moore
- 3:20 Plant emergence and yield of Virginia type peanuts as affected by seed quality - Gene Sullivan.
- 3:40 Characteristics of RHIZOCTONIA isolates from peanuts - Ruth Ann Taber and Robert E. Pettit.
- 4:00 The effects of pentachloronitrobenzene upon populations of lesion nematodes in Spanish peanuts - T. E. Boswell.
- 4:20 Efficacy of chemicals for control of aflatoxins in peanut pods - D. K. Bell and Ben Douppnik, Jr.
- 4:40 Factors affecting peanut production and utilization in West Pakistan - David C. H. Hsi.

WEDNESDAY, July 15

7:00 AM - Leave hotel for field trip to Frio County - Hubert C. Toalson in charge.

Peanuts are almost ready for harvest. Irrigation systems are in operation. The Frio County Peanut Producers Association sponsors this air-conditioned bus trip and provides lunch. Peanut growers from the area are our guides. You will be back in time to catch a 2:30 flight from the airport. Do not miss this opportunity for a guided tour of a peanut production area in south Texas.

1:00 Arrive back at hotel. MEETING ADJOURNED.

APPENDIX VII

The Nominating Committee wishes to submit the following list of nominees for your consideration:

President Elect - William T. (Bill) Mills
State Employee's Representative - Allan J. (Al) Norden
Production Representative - Russell C. Schools

These individuals have been contacted and expressed a willingness to serve in the position to which they have been nominated. We would appreciate your consideration of these individuals. Should you have other individuals you wish to nominate for these positions please contact them, obtain their consent, and place them in nomination at the business meeting. Your active participation in the election will be appreciated.

Respectfully submitted,

A. L. Harrison
James E. Mobley
George W. Morrow
Harold E. Pattec, Chairman Nominating Committee

APPENDIX VIII

President	J. W. Dickens Market Quality Research Division Agricultural Research Service, USDA North Carolina State University Raleigh, N. C. 27607
Immediate Past President	David L. Moake 519 Lookout Drive San Antonio, Texas 78228
Executive Secretary- Treasurer	Leland Tripp Extension Crop Specialist Oklahoma State University Box 1008 Stillwater, Oklahoma 74074
President-Elect	William T. Mills Lilliston Corporation Box 407 Albany, Georgia 31702
U.S.D.A. Representative	D. J. Banks Agronomy Department Oklahoma State University Stillwater, Oklahoma 74074
Administrative Advisor	Coyt T. Wilson, Director Agriculture and Life Sciences Virginia Polytechnic Institute Blacksburg, Virginia 24061
Executive Secretary USDA Oilseed and Peanut Research Advisory Committee	Max Hinds, Executive Secy. USDA Oilseed and Peanut Research Advisory Committee, RPDES, U. S. Dept. of Agriculture Washington, D. C.
State Employees Representative	A. J. Norden Associate Agronomist 309 McCarty Hall University of Florida Gainesville, Florida 32601
Industry Representative (Production)	Russell C. Schools Executive Secy. Virginia Peanut Growers Assn. Capron, Virginia 23829

Industry Representative

Robert Pender
Pender Peanut Corporation
Greenwood, Florida 32443

Industry Representative

Wayne Livingston
Research Laboratory
Derby Foods, Inc.
3327 West 48th Place
Chicago, Illinois 60632

**To be named by the chairman
of the Board of Directors
of the National Peanut
Council**

Edward Sexton
Corn Products Co.
99 Avenue "A"
Bayonne, N. J. 07002

**President National Peanut
Council**

DeVoe H. Willard
National Peanut Council
1120 Connecticut Ave., NW
Washington, D. C.

BY-LAWS
of
AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION

Article I. Name

Section 1. The name of this organization shall be "AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION".

Article II. Purpose

Section 1. The purpose of the Association shall be to provide a continuing means for the exchange of information, cooperative planning, and periodic review of all phases of peanut research and extension being carried on by State Research Divisions, Cooperative State Extension Services, the United States Department of Agriculture, the Commercial Peanut Industry and supporting service businesses, and to conduct said Association in such manner as to comply with Section 501 (c) (3) of the United States Internal Revenue Code of 1954 and Acts amendatory thereto. Upon the dissolution of the Association, all of the assets of the Association shall be transferred to an organization whose purposes are similar to those of this Association or to such other charitable or educational organization exempt from Federal income tax under the provisions of Section 501(c) (3) of the United States Internal Revenue Code of 1954 and Acts amendatory thereto as the directors may appoint provided that no director, officer or member of this organization may in any way benefit from the proceeds of the dissolution.

Article III. Membership

Section 1. The several classes of membership which shall be recognized are as follows:

(a.) Individual memberships: Individuals who pay dues at the full rate as fixed by the Board of Directors.

(b.) Organizational memberships: Industrial or educational groups that pay dues as fixed by the Board of Directors. Organizational members may designate one representative who shall have individual member rights.

(c.) Sustaining memberships: Industrial organizations and others that pay dues as fixed by the Board of Directors. Sustaining members are those who wish to support this Association financially to an extent beyond minimum requirements as set forth in Section 1b, Article III. Sustaining members may designate one representative who shall have individual member rights. Also, any organization may hold sustaining memberships for any or all of its divisions or sections with individual member rights accorded each sustaining membership.

(d.) Student memberships: Full-time students that pay dues at a special rate as fixed by the Board of Directors. Persons presently enrolled as full-time students at any recognized college, university or technical school are eligible for student membership. Post doctoral students, employed persons taking refresher courses or special employee training programs are not eligible for student membership.

Section 2. Any member, participant, or representative duly serving on the Board of Directors or a Committee of this Association and who is unable to attend any meeting of the Board of such Committee may be temporarily replaced by an alternate selected by the agency or party served by such member, participant, or representative upon appropriate written notice filed with the president or Committee chairman evidencing such designation or selection.

Section 3. All classes of membership may attend all meetings and participate in discussions. Only individual members or those with individual membership rights may vote and hold office. Members of all classes shall receive notification and purposes of meetings, and shall receive minutes of all Proceedings of the American Peanut Research and Education Association.

Article IV. Dues and Fees

Section 1. The annual dues shall be determined by the Board of Directors with the advice of the Finance Committee subject to approval by the members at the annual meeting. Minimum annual dues for the four classes of membership shall be:

- a. Individual memberships: \$5.00
- b. Organizational memberships: \$25.00
- c. Sustaining memberships: \$100.00
- d. Student memberships: \$2.00

Section 2. Dues are receivable on or before January 1 of the year for which the membership is held. Members in arrears on April 1 for dues for the current year shall be dropped from the rolls of this Association provided prior notification of such delinquency was given. Membership shall be reinstated for the current year upon payment of dues.

Section 3. A \$5.00 registration fee will be assessed at all regular meetings of this Association. The amount of this fee may be changed upon recommendation of the Finance Committee subject to approval by the Board of Directors.

Article V. Meetings

Section 1. Annual meetings of the Association shall be held for the presentation of papers and/or discussions, and for the transaction of business. At least one general business session will be held during regular annual meetings at which reports from the executive secretary-treasurer and all standing Committees will be given, and at which attention will be given to such other matters as the Board of Directors may designate. Also, opportunity shall be provided for discussion of these and other matters that members may wish to have brought before the Board of Directors and/or general memberships.

Section 2. Additional meetings may be called by the Board of Directors either on its own motion or upon request of one-fourth of the members. In either event, the time and place shall be fixed by the Board of Directors.

Section 3. Any member may submit only one paper as senior author for consideration by the program chairman of each annual meeting of the Association. Except for certain papers specifically invited by the Association president or program chairman with the approval of the president, at least one author of any paper presented shall be a member of this Association.

Section 4. Special meetings or projects by a portion of the Association membership, either alone or jointly with other groups, must be approved by the Board of Directors. Any request for the Association to underwrite obligations in connection with a proposed special meeting or project shall be submitted to the Board of Directors, who may obligate the Association to the extent they deem desirable.

Section 5. The executive secretary-treasurer shall give all members written notice of all meetings not less than 60 days in advance of annual meetings and 30 days in advance of all other special project meetings.

Article VI. Quorum

Section 1. Until such time as the membership association reaches 200 voting members, 20% of the voting members of this Association shall constitute a quorum for the transaction of business. When the membership exceeds 200, a quorum shall consist of 40 voting members.

Section 2. For meetings of the Board of Directors and all Committees, a majority of the members duly assigned to such Board or Committee shall constitute a quorum for the transaction of business.

Article VII. Officers

Section 1. The officers of this organization shall be:

- a. President
- b. President-elect
- c. Executive Secretary-Treasurer

Section 2. The president and president-elect shall serve from the close of the annual general meeting of this Association to the close of the next annual general meeting. The president-elect shall automatically succeed to the presidency at the close of the annual general meeting. If the president-elect should succeed to the presidency to complete an unexpired term, he shall then also serve as president for the following full term. In the event the president or president-elect or both should resign or become unable or unavailable to serve during their terms of office, the Board of Directors shall appoint a president or both president-elect and president to complete the unexpired terms until the next annual general meeting when one or both offices, if necessary, will be filled by normal elective procedure. The most recent available past president (previously PIWG chairman) shall serve as president until the Board of Directors can make such appointment. The president shall serve without monetary compensation.

Section 3. The officers and directors shall be elected by the members in attendance at the annual general meeting from nominees selected by the Nominating Committee or members nominated for this office from the floor. The president-elect shall serve without monetary compensation.

Section 4. The executive secretary-treasurer may serve consecutive yearly terms subject to re-election by the membership at the annual meeting. The tenure of the executive secretary may be discontinued by a two-thirds majority vote of the Board of Directors who then shall appoint a temporary executive secretary to fill the unexpired term.

Section 5. The president shall arrange and preside at all general meetings of the Board of Directors and with the advice, counsel, and assistance of the president-elect and secretary-treasurer, and subject to consultation with the Board of Directors, shall carry on, transact and supervise the interim affairs of the Association and provide leadership in the promotion of the objectives of this Association.

Section 6. The president-elect shall be program chairman responsible for development and coordination of the overall program of the educational phase of the annual meetings.

Section 7. (a) When and if this Association becomes a corporation, the executive secretary-treasurer shall countersign all deeds, leases and conveyances executed by the Association and affix the seal of the Association thereto and to such other papers as shall be required or directed to be sealed. (b) The executive secretary-treasurer shall keep a record of the deliberations of the Board of Directors, and keep safely and systematically all books, papers, records, and documents belonging to the Association, or in any wise pertaining to the business thereof. (c) The executive secretary-treasurer shall keep account for all monies, credits, debts, and property, of any and every nature, of this Association, which shall come into his hands or be disbursed and shall render such accounts, statements, and inventories of monies, debts, and property, as shall be required by the Board of Directors. (d) The executive secretary-treasurer shall prepare and distribute all notices and reports as directed in these By-laws, and other information deemed necessary by the Board of Directors to keep the membership well informed of the Association activities.

Article VIII. Board of Directors

Section 1. The Board of Directors shall consist of the following:

- (a.) The president
- (b.) The most immediate past president (formerly PIWG Chairman) able to serve
- (c.) The president-elect (elected annually)
- (d.) The administrative advisor representing the directors of the Southern State Research Divisions
- (e.) The executive secretary of the USDA Oilseed and Peanut Research Advisory Committee
- (f.) State employees' representative - This director is one whose employment is state sponsored and whose relation to peanuts principally concerns research, and/or educational, and/or regulatory pursuits.
- (g.) United States Department of Agriculture representative - This director is one whose employment is directly sponsored by the USDA or one of its agencies and whose relation to peanuts principally concerns research, and/or educational, and/or regulatory pursuits.
- (h.) Three Private Peanut Industry representatives - These directors are those whose employment is privately sponsored and whose principal activity with peanuts concerns: (1) the production of farmers' stock peanuts; (2) the shelling, marketing, and storage of raw peanut; (3) the production or preparation of consumer foodstuffs or manufactured products containing whole or parts of peanuts.

(i.) A person oriented toward research - to be named by the chairman of the Board of Directors of the National Peanut Council.

(j.) The executive secretary-treasurer - non-voting member of the Board of Directors who may be compensated for his services on a part - or full-time salary stipulated by the Board of Directors in consultation with Finance Committee.

(k.) The president of the National Peanut Council - a non-voting member. (The 5 directors listed in parts f, g, and k shall draw lots to determine which directors will serve 1-year, 2-year or 3-year term, initially. Succeeding terms of these directors shall be for 3 years on a staggered basis.)

Section 2. The Board of Directors shall determine the time and place of regular and special meetings and may authorize or direct the president to call special meetings whenever the functions, programs, and operations of the Association shall require special attention. All members of the Board of Directors shall be given at least 10 days advance notice of all meetings; except that in emergency cases, three days advance notice shall be sufficient.

Section 3. The Board of Directors will act as the legal representative of the Association when necessary and, as such, shall administer Association properties and affairs. The Board of Directors shall be the final authority on these affairs in conformity with the By-laws.

Section 4. The Board of Directors shall make and submit to this Association such recommendations, suggestions, functions, operations and programs as may appear necessary, advisable, or worthwhile.

Section 5. Contingencies not provided for elsewhere in these By-laws shall be handled by the Board of Directors in a manner they deem desirable.

Article IX. Committees

Section 1. Members of the Committees of the Association shall be appointed by the president and shall serve 2-year terms unless otherwise stipulated. The president shall appoint a chairman of each Committee from among the incumbent committeemen. The Board of Directors may, by a two-thirds vote, reject Committee appointments. Appointments made to fill unexpected vacancies by incapacity of any Committee member shall be only for the unexpired term of the incapacitated committeeman. Unless otherwise specified in these By-laws, any Committee member may be reappointed to succeed himself, and may serve on two or more Committees concurrently but shall not hold concurrent chairmanships. Initially, one-half of the members, or the nearest (smaller) part thereto, of each Committee will serve one-year terms as designated by the president.

a. Finance Committee: This Committee shall include at least four members, one each representing State-, and USDA-, and two from Private Business - segments of the peanut industry. This Committee shall be responsible for preparation of the financial budget of the Association and for promoting sound fiscal policies within the Association. They shall direct the audit of all financial records of the Association annually, and make such recommendations as they deem necessary or as requested or directed by the Board of Directors. The term of the Chairman shall close with preparation

of the budget for the following year, or with the close of the annual meeting at which a report is given on the work of the Finance Committee under his Chairmanship, whichever is later.

b. Nominating Committee: This Committee shall consist of at least three members appointed to one-year terms, one each representing State-, USDA-, and Private Business - segments of the peanut industry. This Committee shall nominate individual members to fill the positions as described and in the manner set forth in Articles VII and VIII of these By-laws and shall convey their nominations to the president of this Association on or before the date of the Annual Meeting. The Committee shall, insofar as possible, make nominations for the president-elect that will provide a balance among the various segments of the Industry and a rotation among Federal, State, and Industry members. The willingness of any nominee to accept the responsibility of the position shall be ascertained by the Committee (or members making nominations at general meetings) prior to the election. No person may succeed himself as a member of this Committee.

c. Publications and Editorial Committee: This Committee shall consist of at least three members appointed for indeterminate terms, one each representing State-, USDA-, and Private Business - segments of the peanut industry. This Committee shall be responsible for the publication of the proceedings of all general meetings and such other Association sponsored publications as directed by the Board of Directors in consultation with the Finance Committee. This Committee shall formulate and enforce the editorial policies for all publications of the Association, subject to the directives from the Board of Directors

d. Peanut Quality Committee: This Committee shall include at least members; one each actively involved in research in peanut - (1) varietal development-, (2) production and marketing practices related to quality-, and (3) physical and chemical properties related to quality-, and one each representing the Grower-, Sheller-, Manufacturer-, and Services - (Pesticides and Harvesting Machinery, in particular) segments of the peanut industry. This Committee shall actively seek improvement in the quality of raw and processed peanuts and peanut products through promotion of mechanisms for the elucidation and solution of major problems and deficiencies.

e. Public Relations Committee: This Committee shall include at least seven six members, one each representing the State-, USDA-, Grower-, Sheller-, Manufacturer-, and Services-, segments of the peanut industry. This Committee shall provide leadership and direction for the Association in the following areas:

(1) Membership: Development and implementation of mechanisms to create interest in the Association and increase its membership.

(2) Cooperation: Advise the Board of Directors relative to the extent and type of cooperation and/or affiliation this Association should pursue and/or support with other organizations.

(3) Necrology: Proper recognition of deceased members.

(4) Resolutions: Proper recognition of special services provided by members and friends of the Association.

Article X. Divisions

Section 1. A Division within the Association may be created upon recommendation of the Board of Directors, or members may petition the Board of Directors for such status, by a two-thirds vote of the general membership. Likewise, in a similar manner a Division may be dissolved.

Section 2. Divisions may establish or dissolve Subdivisions upon the approval of the Board of Directors.

Section 3. Divisions may make By-laws for their own government, provided they are consistent with the rules and regulations of the Association, but no dues may be assessed. Divisions and Subdivisions may elect officers (chairman, vice-chairman to succeed to the chairmanship, and a secretary) and appoint committees, provided that the efforts thereof do not overlap or conflict with those of the officers and Committees of the main body of the Association.

Article XI. Amendments

Section 1. Proposed amendments to these By-laws must be submitted to the Board of Directors whose recommendation will then be considered at the next regular annual meeting of the Association except as provided in Section 2.

Section 2. Amendments shall be adopted only when a majority of those holding individual membership rights vote and then only by the vote of two-thirds of those voting. If a majority of the individual members are not in attendance at the first regular annual meeting following announcement of proposed amendments, the executive secretary-treasurer shall mail to all such members of the Association ballots concerning such amendments. Members shall be allowed thirty days to return mailed ballots after which the vote of those returning such ballots shall be binding subject to the regulations above. Failure of a majority of the members to return their ballots within the allotted time denotes rejection of the proposed amendment.

Section 3. Proposed amendments slated for adoption or rejection must be brought to the attention of members either by letter or through Association publications at least thirty days prior to consideration for final adoption.

Adopted at the Business Meeting of the
Peanut Improvement Working Group,
July 16, 1968, Norfolk, Virginia

MEMBERSHIP LIST
AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION

July 1970

SUSTAINING MEMBERSHIPS

Anderson Peanut Company
P.O. Box 1335
Andalusia, Alabama 36420
Attn: JOHN W. ANDERSON

Birdsong Storage Company
Lock Drawer 1400
Suffolk, Virginia 23434
Attn: BEN M. BIRDSONG

Corn Products Company
Research & Development
99 Avenue A
Bayonne, N. J. 07002
Attn: DANIEL MELNICK, Vice-Pres.
Product Research & Quality
Control

Derby Foods, Inc.
3327 West 48th Place
Chicago, Illinois 60632
Attn: P. J. TIEMSTRA,
Director of Research

Paul Hattaway Company
Ormar Heights
P.O. Box 669
Attn: R. F. HUDGINS, Sec.-Treas.
Cordele, Georgia 31015

Lilliston Corporation
Box 407
Albany, Georgia 31702
Attn: WILLIAM T. MILLS

Oklahoma Peanut Commission
Box D
Madill, Oklahoma 73446
Attn: WILLIAM FLANAGAN,
Exec. Secy.

Peanut Butter Manufacturers &
Nut Salters Assn.
807 Jefferson Bldg.
1225 Nineteenth St., N.W.
Washington, D. C. 20036
Attn: JAMES E. MACK

Peanut Craftsman
M & M/Mars
P.O. Box 326
Albany, Georgia 31702
Attn: MRS. MARTHA HARWOOD

Pender Peanut Corporation
P.O. Box 38
Greenwood, Florida 32443
Attn: ROBERT PENDER

H. B. Reese Candy Co., Inc.
Hershey, Pennsylvania 17033
Attn: GEORGE D. McCLEES
Vice-President

Stevens Industries
Dawson, Georgia 31742
Attn: C. M. CRUIKSHANK

Seabrook Blanching Corp.
Tyrone, Pennsylvania 16686
Attn: C. B. SMITH

Turner Sales & Supply
P.O. Box 847
Tifton, Georgia 31794
Attn: LUTHER TURNER

United States Gypsum Co.
101 South Wacker Drive
Chicago, Illinois 60606
Attn: H. W. DAVIS

ORGANIZATIONAL MEMBERSHIPS

Alabama Peanut Producers Assn.
P.O. Box 1295
Dothan, Alabama 36301
Attn: JAMES EARL MOBLEY

Alford Refrigeration Warehouse
P.O. Box 5088
Dallas, Texas 75222
Attn: WILLIAM L. GRADY,
Vice-Pres.

All American Nut Company
16901 Valley View
Cerritos, California 90701
Attn: WILLIAM V. RITCHIE, Pres.

Bain Peanut Company
P.O. Box 7427, Station A
San Antonio, Texas 78207
Attn: KENNETH SCOTT

Brown Mfg. Company
Ozark, Alabama 26260
Attn: PAUL BROWN

A. H. Carmichael Company
Brokers & Manufacturer's Agents
Shelled Peanuts
2353 Christopher's Walk, N.W.
Atlanta, Georgia 30327
Attn: BROADUS CARMICHAEL

Circus Foods
Division of U.S. Tobacco Co.
P.O. Box 3630
San Francisco, Calif. 91419

Jack Cockey Brokerage Co.
P.O. Box 1075
Suffolk, Virginia 23434
Attn: JOHN COCKEY, JR.

Denison Peanut Company
Denison, Texas 74020
Attn: GEORGE MORROW

Dothan Oil Mill Company
P.O. Box 458
Dothan, Alabama 36301
Attn: J. H. BRYSON, JR.

Farmers Fertilizer & Milling Co.
P.O. Box 265
Colquitt, Georgia 31737

Fisher Nut Company
2327 Wycliff St.
St. Paul, Minnesota 55114
Attn: LOUIS R. SMERLING

Frito-Lay, Inc.
Research Division
900 No. Loop 12
Irving, Texas 75060
Attn: B. W. HILTON, Vice-Pres. &
Director of Research

General Foods Corp.
250 North Street
White Plains, N. Y. 10602
Attn: J. J. SHEEHAN

Georgia Agricultural Commodity
Commission for Peanuts
110 East Fourth Street
Tifton, Georgia 31794
Attn: G. P. "PETE" DONALDSON,
Executive Secy.

GFA Peanut Association
Route 19 South
Camilla, Georgia 31730
Attn: D. H. HARDEN, Manager

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