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ADDRESSES

PAPERS

MINUTES

BY-LAWS

MEMBERSHIP

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PREFACE

This meeting, held July 13-15, 1969, in Atlanta, Georgia, was the first annual meeting of the American Peanut Research and Education Association, Inc. On February 21-22, 1957, a Research Conference was held in Atlanta, Georgia, attended by leaders of the peanut industry, research workers and educators. At that meeting it was recognized that a formal organization or association in some form was needed to promote research and education for the peanut industry. Following this Conference, the Peanut Improvement Working Group was formed as a cooperative effort between the USDA, the land grant colleges' research divisions, and the peanut industry.

The Peanut Improvement Working Group continued to function with the mission of improving quality in peanuts. In July, 1968, as a result of a lot of hard work and planning on the part of the members of the Peanut Improvement Working Group, it was decided that the complete interest of the industry, research workers, educators, and related agencies could be best served by the formation of the organization now known as the American Peanut Research and Education Association, Inc., functioning under a corporate charter issued in the State of Georgia in 1969 and in accordance with by-laws formally adopted by the members of the association and included as one of the items published in this journal.

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THE AGRICULTURAL SITUATION

by
Kenneth E. Frick,
Administrator of the Agricultural Stabilization and Conservation Service, U. S. Department of Agriculture

One of the problems with peanuts is that production has gone up faster than use - - and we therefore have a surplus. One of the reasons for this is a rapid rise in acre yields of peanuts – and this can be credited to those scientists and educators who are engaged in the improvement of this particular crop.

In other words, the people in this room have done a whole lot to make my job more difficult.

I can only say that, of the problems a Nation can have, this is one of the better kinds. It is far better than hunger, food shortage, or even uncertainty in food production. One of the measures of a Nation's success is the degree to which people take for granted the certainty of plenty.

The record of the last century shows clearly that research, education, and improved technology are the foundation for our bountiful food supplies. Our growing production reflects also the skill, ingenuity, and hard work of farmers as they reach for larger and more efficient production. This is one of the great success stories of history.

Peanuts are, certainly, a good example.

Over the past 15 years, production of peanuts has doubled even though the acreage harvested has gone down slightly. When you examine the economics of this, even in a general way, you find that most of the benefit for this advance has gone to consumers rather than to farmers.

In the middle 1950's (1954-57) the average farm price for peanuts was 11.7 cents a pound. For this year's crop, the announced support price for peanuts is 12.375 cents, but when you adjust this for changes in the value of the dollar, the 1969 price support rate comes down to 9.17 cents. This means that the "real farm price" for peanuts is now 22 percent below the 1954-57 level.

Thus it is plain that, as farmers have become more efficient, the consumer is a major beneficiary. This is true for agriculture generally. Scientific improvement, technical change, growing efficiency on the farm have made possible our plentiful supplies of farm commodities at low relative cost to the public.

Anyone reviewing the agenda for this three-day meeting would have to be impressed by the variety and complexity of the technical questions affecting peanuts. Multiply that by the number of other major commodities in America. Add in the people and companies who supply machinery, fuel, fertilizer, pesticides, and electricity, who store and market peanuts, who process and manufacture. Do this, and you recognize that farm production is a team proposition.

The producer, of course, plays a key position. It isn't an easy one. A producer of peanuts or of any other farm commodity today is a businessman. And there is no other business in which competition is more severe. Good management, efficient production, are essential for survival.

But other members of the team are also important.

The peanut sheller plays a key role. He must finance the purchase within a few weeks of an inventory to be milled and sold during a period of months ahead. Competition among shellers is extremely sharp.

The machinery manufacturer must provide equipment that will be more efficient in a volume-cost sense.

The food manufacturer's role in manufacturing, advertising, and selling a wider variety of better quality products is a key to continued growth of the industry. Products must meet quality levels and conditions unheard of 10 years ago.

The broker, to be successful, must keep abreast of industry-wide developments and problems.

The Federal-state inspector's role is a critical one in providing the basis for the pricing and the handling of peanuts in relation to quality and value of each lot.

The Federal, state and industry laboratory workers also have a critical role in determining quality factors.

The research worker and the educator continue to build and enlarge the foundation for progress over the years ahead.

I suspect there are other groups and activities represented here. They too are members of the team.

There can be no let up in the broad effort of the agriculture team to build and maintain a capacity to produce more food and fiber than is currently needed -- larger quantities, better quality, and lower cost. Without this capacity on farms and throughout the marketing structure, we would likely be plagued by deficiencies from place to place and from time to time. Besides, capacity at the 1970 level would be dangerously inadequate to fill demand at the 1980 or 1990 level.

Still our growing productive capacity and supplies give rise to issues that have not been resolved to our satisfaction. Let me put one issue as a question:

How can prices for farm commodities and farm income be maintained at fair and reasonable levels when the supply is larger than current demand?

The present farm program is an effort to deal with that question. It reflects a series of decisions over time, by the Congress. The main purpose of the program is to help producers of farm commodities obtain better prices and a larger income than they could expect without the program. In doing this it should bring about needed adjustment in the use of our agricultural production plant.

As I look toward the future with you this morning, I feel safe in predicting that researchers will continue to find ways to increase yields. A doubling of present yields may very well occur, along with a significant lowering of production cost. This accomplishment will be welcomed with almost unanimous pleasure and acclaim.

I said "almost unanimous." I'm sure the Administrator of ASCS will also approve the continued advance in peanut technology. But I hope you will forgive him if he feels just a twinge of selfish concern about the problems that rising yields cause for him. For the fact is that – while research advances are non-controversial -- the farm program decisions needed to deal with rising abundance are often controversial. They are achieved only after considerable argument and a goodly chorus of boos.

What does all this mean for the peanut portion of the farm program?

First, it indicates a continuing need for a program. Without a program average farm prices for peanuts would go down substantially from present levels. Net farm income from peanuts would fall. The economy of the entire peanut growing area would be adversely affected.

Second, it emphasizes the need for changes to reduce the cost of the program to the Government.

The peanut program is operated with a minimum acreage allotment and a minimum support price fixed by law. It is the only program for which this is true. If yields per acre continue to increase faster than food use, as seems likely, program costs will continue to rise. We believe there is urgent need to reduce these costs.

This Administration will encourage and support action to reduce program costs. At the same time we would like to maintain and improve net farm income from peanuts.

The Department and industry representatives, particularly producers, worked hard last year to determine the best way of changing the program. They were not quite able to come to agreement. Several of the state universities and extension services studied the situation, made recommendations, and assigned individuals to work actively with groups to find ways of improving the program. The effort ended after hearings on a bill before House and Senate Agricultural subcommittees. The bill was not reported to the full committees.

The major feature of the bill was the use of certificates as an administrative device to channel part of the crop into the primary food market and part to the secondary crushing-export market without troubles associated with two widely different price levels in the market. Shellers would bny peanuts for food use from producers at prices not less than announced support prices. In addition, they would purchase certificates from CCC at fixed prices on the same quantity of peanuts. Thus, shellers would buy all the peanuts to be milled for food use against the same "minimum" price level. They would have no opportunity to buy "surplus" peanuts from producers at prices lower than the prices for peanuts going for food use.

CCC would issue certificates to producers on each farm for a quantity of peanuts marketed from an acreage up to the farm acreage allotment. The certificates for each farm would represent its share of the national requirement for peanuts for "food use". The value of certificates to producers would vary upward with the reduction of the acreage of peanuts on the farm below the farm acreage allotment.

There were certain points on which grower representatives and the Department failed to come to agreement. At the Agriculture subcommittee meetings, manufacturers opposed the bill. Whether the differences existing last year could be resolved in order to permit industry-wide support of a certificate approach is uncertain. If there is to be constructive legislation on peanuts, industry-wide support will be needed.

An alternative means of changing legislation to reduce the cost of the peanut program to the Government would be to remove the present minimum acreage allotment. This would require some related changes but the total legislative "package" would be shorter and simpler than with the certificate approach.

The peanut program is a part of the farm program. The Secretary has affirmed that there is need for a farm program. We believe improvements can be made in the farm program now authorized by law. We will greatly appreciate your suggestions and your help in trying to find them. In the meantime, until improvements can be developed and adopted, we will carry on the farm program as it stands just as effectively as we can. We also will appreciate your continued cooperation in this effort.

It has become a bromide to say that agriculture is changing. Any scientist who works daily with the miracles of plant breeding is a partner of change. Any

educator acquainted with the progress in disease control and production -- not to mention the sciences of flavor and nutrition - - is aware of the magnitude of change in agriculture and food technology.

The changes in farming are measurable - - in pounds per acre, in protein content, and a hundred other ways depending on the commodity. Many other changes are measurable, too -- mechanization, the reduced number of farms, and the decline in sharecropping.

The Southeastern States have seen a revolution in farm production. States like Georgia that were once a cotton kingdom have shifted to a great diversity in agriculture and in industry.

In the last 1940's, Georgia farmers were harvesting over a million and a quarter acres of cotton -- reaching over a million and a half acres in 1949. This year -- twenty years later -- Georgia will harvest no more than 400,000 acres of cotton. In that time, peanuts have taken over as the leading cash crop. Livestock and poultry have also made great strides. Georgia and the Southeast have felt this change, and they have adapted to it -- successfully.

These changes have come gradually, visibly, fully documented by scientists, economists, sociologists, and the sales figures of seed and machinery and fertilizer companies. Farmers have dealt with these changes one by one -- by adopting new methods, shifting to different enterprises, or going out of farming altogether.

But the point I want to make is that these changes -- piling one on another -- have now transformed the nature of farming both as an economic sector and as a political factor. The changes in agriculture are no longer changes in degree; they now add up to an agriculture that is transformed -- economically and politically.

To those of us who deal in the political -- and by this I mean anyone in the area of Government policy -- has to face up to two facts:

First, Agriculture is now intergrated into the main current of the American economy. It is no longer possible to consider agriculture apart from its markets. It is no longer realistic to think of the farmer as a distinct part of the economy -- seperated from the consumers he serves and the suppliers who serve him.

Secondly, agriculture is no longer in control of farm policy development or decision. Farm policy is linked with -- and dependent upon -- other public considerations that are not really farm policy. I refer to the public's concern with hunger, rural poverty, and enviromental quality -- all related somehow to farming but appealing to different constituencies in Congress and among pressure groups.

In order to influence legislation important to farmers, agriculture's traditional supporters in Congress are being forced to ally with groups interested in these other causes. This fact is visible in just about every major Congressional vote important to farmers -- including the agriculture appropriations bills passed recently in Congress.

This loss of control by agriculture over its own legislative future has been visible just over the horizon for some time. But it fully arrived only within the past year. It was apparent in certain Congressional votes late last summer. It is even more apparent -- at least the basic problem is more apparent -- if you analyze the makeup of Congress in terms of the farm or non-farm character of the districts represented.

As recently as 15 years ago, 165 Congressmen out of 435 represented districts that had 20 percent or more of their residents living on farms. The present

Congress has only 49 Congressmen from districts made up of at least 20 percent farm people – about one of every nine Congressional seats.

Only 83 districts have as much as 15 percent of their residents living on farms. This is even more striking when you look at some individual states. Illinois, a great farming state, has only 3 districts above the 15 percent level of farm population – out of 24 Congressional districts. The State of Georgia has only two in this category -- out of 10 Congressional seats. My home state of California – which usually ranks either first or second in farm production -- does not have a single district where farm people make up as much as 15 percent of the population.

What all this means is that agriculture -- as a minority -- must join with other groups if it is to have a decisive influence on policy. We must be prepared to recognize the legitimate concerns of consumers, of the urban poor, of the by-passed and deprived people remaining in rural America. Not only must we recognize these concerns, we must be prepared to support sound programs directed at these problems.

We might also give some thought to the longer-term future of America's commercial agriculture. What kinds of farm programs can be developed that will permit farmers to make maximum use of the market – so that production finds its natural home, which is use. Can this be accomplished with a corresponding reduction in the farmer's dependence on the political arena for his livelihood?

This is a critical year in farm program development. The cotton and grain programs that were authorized in 1965 will terminate with the 1970 crops. The peanut program, as I have said, needs to be reconsidered in terms of effectiveness and cost. These questions are being considered now - and will likely get attention in the next session of Congress.

The next year will be interesting, to say the least. It will be, I believe, a decisive year for agriculture - as the Congress works to meld a great many problems and priorities into workable, and politically acceptable, farm programs. I hope you, as research people and educators, will feel that you are involved - because you are!

You are involved in the success of agriculture. You are involved, with all of us, in the need for farm policies that enable the farmer to share fully in that success and help him to deal with change as a fact of life in the Twentieth Century.

Thank you for the opportunity to be with you.

NEW USES AND PRODUCTS OF PEANUTS

by
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INTRODUCTION

Peanuts are an excellent source of food primarily because of the high protein content and high calorie content. Peanuts have been grown and consumed as food for many centuries in many countries, both as a raw product and prepared in a variety of ways. It is said that peanuts were known as early as 950 BC. They were introduced by the slaves to the United States, but were not extensively used until after the Civil War. The primary use for peanuts in the early years were for fattening farm animals, such as chickens, turkeys, and pigs. Peanut production and uses expanded rapidly after about 1900 when processing equipment was invented for many phases of peanut processing, that is, for use both on the farm and for manufacturing plants (roasting, blanching, salting, preparation of peanut butter, and automatic packaging machines). Also responsible for the expansion since 1900 is the peanut research conducted by federal agencies, State Experiment Stations, and industry.

Hundreds of products have been made from peanuts for both food and industrial uses. It is said that George Washington Carver has prepared more than 300 products from peanuts. Among the foods he prepared from peanuts were the mayonnaise, cheese, and chili sauce; and examples of the industrial products are, shampoo, bleach, linoleum, metal polish, adhesives, and plastics.

The three most important uses of shelled peanuts are; peanut butter (460 million pounds annually); salted peanuts (200 million pounds annually); and peanuts in candy (160 million pounds annually). About 55% of the edible shelled peanuts are used in peanut butter.

Peanut butter is a good example of the possibilities of the growth of a peanut product. Peanut butter got its start as a food for invalids because of its high nutritive value and also because of its high protein content, low carbohydrate, and palatability. Peanut butter was first prepared for this purpose by a physician in St. Louis, Mo. He was also the first to manufacture peanut butter commercially. At that time, the price of peanut butter was too high for general use and consequently its preparation in the home was recommended. Some of the simple equipment used in the home is illustrated in Dr. Woodruff's book (1) on "Peanuts, Production, Process and Products." Because of the widespread use of peanut butter in the home, it became a staple food, and commercial production was therefore encouraged. Peanut butter was first generally used for sandwiches and then quickly spread to other uses such as in candies and cookies. The per capita consumption of peanut butter increased steadily since 1900. Its more rapid growth has been since 1940 when research was conducted to improve the peanut butter by investigating the varieties of peanuts used in roasting, the effect of particle size, means of preventing oil separation, improving spreadibility, preventing sticking to the roof of the mouth, improving the shelf life, and developing formulas for use of peanut butters in other products.

Peanut butter is now available in three different textures. These are described by Dr. Woodroof as: (a) smooth – has a very even texture with no preceptible grainy peanut particles, (b) regular – has a definitely grainy texture with preceptible peanut particles not more than 1/16 inch in diameter, and (c) chunky – has partially fine and partially grainy particles with substantial amounts of larger than 1/16 inch in diameter.

Originally, peanut butter was made simply by grinding dry-roasted peanuts and perhaps adding salt. Many improvements have been made such as the use of hydrogenated fat, and other additives such as dextrose, corn syrups, flours, or glycerin to prevent oil separation, and lecithin or antioxidants to control acidity and perhaps other ingredients that manufacturers may consider secret. Peanut butters on the market today can vary appreciably as noted by the wide range of colors, flavors, and consistency of the available peanut butters. Also, there are variations in texture and the addition of flavors such as malt, orange, ham, and cheese.

Peanut butter competes with other spreads and sandwich fillers.

Peannt Candies. About 60% of all the nuts used in candies are peanuts. Examples of some candies in which peanuts are used are: peanut rolls (this has a soft nugget-like center, surrounded by a layer of blanched peanuts and covered with chocolate coating. It is the largest user of shelled peanuts in candy.); in chocolate bars; in peanut bars; as chocolate covered peanuts; and in peanut brittle. The composition of peanut candies varies widely, for example, the peanut brittle consists primarily of peanuts and sugar while other candies such as peanut roll bars contain peanuts, sugar, butter, cream, milk solids, egg solids, chocolate, starch, and flavoring and coloring ingredients. Peanuts and chocolate are two complimentary flavors. The composition of peanuts, and its desirable flavor and nutritional qualities (proteins, vitamins, and minerals), makes possible the use of peanuts in the preparation of numerous candies. Peanut products are used in more than 50 different kinds of candies.

In his book on peanuts, Dr. Woodruff gives the formulas for many peanut confections,. some of which are as follows: peanut butter fudge, peanut butter candy, potato peanut butter candy, peanut butter brittle, peanut krisp, peanut brittle, peanut caramel tops, molasses peanut chews, nugget toffee peanut chews, frappe molasses peanut kisses, basic fondant, frappe chocolate peanut fudge, special chewie peanut nugget, and divinity peanut kisses. And he also gives formulas for peanut candy desserts such as a peanut butter fudge sauce, peanut sundie sauce, peanut candy banana split, candy revel ice cream, rainbow peanut ice cream, peanut swirl popcicles, chocolate igloos, perfection parfait, party pudding, peanut dandies, peanut freckles, peanut carnival cookies, quick peanut pie, peanut candy crunch cookies, peanut candy frosting, chocolate peanut butter frosting, peanut petit fours, peanut loaf, peanut bakery sweets, such as apple peanut cake, peanut butter sticks, and peanut cake squares.

PEANUT PRODUCT RESEARCH CONTRACT

The purpose of a contract with the University of Auburn was to develop peanut products for use in preparation of fortification of foods to extend the usefulness of peanuts.

Blanched peanuts were subjected to selected roasting treatments to obtain partially roasted and fully roasted peanuts. From the raw, partially roasted and fully roasted peanuts, flours, meals and grits were prepared by defatting the peanuts to various residual oil levels by two different methods, that is, by screw pressing and by direct solvent extraction. The resulting products were tested for use in snack items and in numerous prepared foods which in turn were tested for flavor, color, odor, texture, and shelf life. Experiments were conducted to determine the feasibility of using these products in new peanut type food products such as bakery and confectionery goods, gruels, ice cream and other desserts, spreads, breakfast foods, snacks, gravies, stews, and as a substitute for meat products. The following is a brief summary of the results obtained:

1. Some degree of roasting is necessary since the raw peanut flavor tends to persist through to the final product. This raw peanut flavor can, however, be masked to some extent by the use of flavorings such as butterscotch and maple. Incorporation of prepared peanut materials in baked products showed that those obtained from peanuts roasted at about 310° F rated consistently higher in flavor, than those roasted at other temperatures.

2. Fine textured peanut flour prepared from screw pressed meals can be used in several products such as soups, spreads, puddings, dips, frostings, ice cream, confections and bread. The ice cream had an especially good peanut flavor.

3. Meals with the higher oil level can be used in some baked products, for example, in cookies and in heavier cakes, whereas peanut meals and grits with lower oil contents were unacceptable for incorporation into many products because of their retention of a gritty texture, even after being subjected to heat and moisture treatments.

4. In preparing muffins, peanut flours with the three lower levels of oil content, that is, six, twelve, and eighteen percent were substituted satisfactorily for up to about 45% of the wheat flour. This would more than double the protein content of the muffins.

5. A peanut flake product was developed which appears to have good possibilities as a high-protein breakfast food.

6. Extruded peanut products in the shape of chips, ribbons, and curls, have been prepared and show possibilities as a snack item.

7. Full fat peanut flours as well as flours containing up to 65% oil, that is, up to about 15% more than normally contained in the peanuts, were prepared by a double-drum drying procedure which was devised during the course of the research. Peanuts are ground to a paste to which water is added and the mixture thoroughly agitated prior to drum drying. More will be said about this later since Dr. Mitchell at Clemson University also produced a similar product and has published the information (2).

8. Experiments have shown that a series of new products using mixtures of peanut puree and fruit puree may be prepared in the form of instant dehydrated flakes by drum drying.

9. Shelf life tests on many of the resulting products show encouraging results. For example, prepared products such as nut bread mix, apple-sauce peanut cake mix, oatmeal raisin peanut cookie mix, and peanut chip cookies can be stored successfully for at least three months at 40° F. Peanut flours, including a peanut apple-sauce flour and meals produced by drum drying stored satisfactorily for

four months at room temperature. At the time this information was obtained, tests were still underway.

As you can see from the results of this research contract, there are many possibilities for development of new peanut products for both domestic and foreign consumption.

Mr. Hubert Harris, Professor at Auburn University, who had charge of this research contract, will participate in the discussion tomorrow afternoon and will present this information in more detail and will be available to answer any questions.

LOW-FAT PEANUTS

A low-fat peanut product (3), introduced commercially about three years ago, was developed at the Southern Regional Research Laboratory. It is now produced by at least three companies and we believe that it has possibilities of being a large volume item.

Either blanched or unblanched peanuts are hydraulically pressed to remove up to about 80% of the oil. The pressed distorted peanuts are expanded or "reconstituted" to their original shape and the size by immersing in hot water, either atmospherically or under pressure. Salting of the peanuts as well as addition of other ingredients can be accomplished during this expansion stage. The expanded peanuts contain up to about 35% moisture. These can be dried and roasted in one step using hot oil or hot air. When roasting in hot oil, only a small amount of oil is reabsorbed since the moisture in the peanuts is immediately converted to steam and while the steam is going out of the peanuts, the oil cannot go in. Salt and other flavoring ingredients can be added after the roasting step if so desired.

The low-fat peanut product can be produced with many different variations. For example, the calorie content can be varied by the amount of oil removed; different flavors can be added during the expansion stage or after roasting and the peanuts can be dry roasted or oil roasted; pressed peanuts prior to the expansion stage can be ground to flours having different tastes based on the treatment of peanuts prior to grinding, including the amount of oil removed and the degree of roasting. In addition to adding flavors during the expansion stage, vitamins and essential amino acids that are lacking in peanuts may be introduced to produce more nutritious products. This may provide a source of palatable protein for incurporation into the children's feeding program for developing countries.

There is also a good possibility for the exporting of pressed peanuts to developed countries for further processing to low-fat products. It is the pressing operation that requires the most expensive equipment and controlled operational techniques. Canadian processors have already shown interest in this area.

More recent work at the Laboratory has resulted in low-fat peanuts with improved texture and color. Also, research has been conducted to show the factors affecting the water solubles during the processing of pressed peanuts.

Many companies have been and are working on the development of variations of this low-fat peanut primarily in the area of improving texture and flavor.

Other peanut research at SURDD. Since 1940 there has been appreciable peanut research conducted at this Laboratory which has been directly or indirectly related to both edible products and nonedible products from peanuts.

Recently, peanut flour has been air classified (Table 1) to produce two fractions that averaged 72% protein and is generally referred to as a protein concentrate. This has potential use in meat products such as sausage. About 62% of the total material had this high protein content and the remainder averaged about 46% protein, which is still a high protein material. This high protein material had 7.4% moisture, about 10.5% nitrogen, and 2.4% fiber, 6.2% ash, and .5% residual lipids.

A product has been obtained from peanuts by extracting with ethyl alcohol. This product appears to be remarkably effective in controlling hemophilia bleeding in hemophiliacs. Peanut flour prepared from lightly roasted peanuts also proved effective in limited tests.

The bitter flavor of peanuts, primarily associated with the peanut germ or heart, was found to be due to the presence of saponins. These saponins have been isolated and characterized. Control of this bitterness could lead to improved quality of peanut products.

Equipment was developed for the continuous delivery of various materials required in the manufacture of peanut butter fortified with vitamin A. Research was also conducted on the effects of processing and storage on vitamin A incorporated into peanut butter.

Time does not permit to go into detail on the many other areas of research conducted at SU. I would like to just mention the titles of some of the papers that were presented and this will give you an idea of the research conducted.

Table 1. Air-Classification of Peanut Flour

	% of Whole	Protein, % 1/	H_2O%	Fiber, %
Original Flour	100	58.1	7.8	3.6
Fraction				
1	37.5	76.2	7.3	1.7
2	24.5	67.6	7.6	3.1
3	26.7	48.5	8.0	5.9
4	5.8	44.6	7.7	6.5
5	5.5	45.4	7.8	6.1

1/ Dry weight basis.

1. Peanut Protein for Industrial Use (several products produced from the meal and protein are described).

2. The Tahnins and Related Pigments in the Red Skins of Peanut Kernels

3. Peanut Protein Fibers: Pilot-Plant Scale Plant (This describes the construction and operation of a pilot plant for spinning fibers from peanut protein.)

4. Utilization Research on Peanut Meal and Protein (this article summarizes the research which has demonstrated that peanut meal and protein have many of the properties desired for making new food and industrial products.)

5. Fiber From Peanut Protein. 1. The Production and Properties of Sarelon

6. Skin Free Peanut Kernels

7. Production of Peanut Protein

8. Peanut Meal Plywood Glue (This article gives the specifications which have been established for a peanut meal suitable for use in preparing plywood glue. A formula is given as well as information concerning the behavior of glue under varying conditions of time and temperatures. The dry and wet plywood shear test and the measurement of viscosity show that the peanut meal glue of the formula given meets requirements established for casein and casein-type glues.)

9. Vegetable Protein Hydrates (A process was developed for preparing a vegetable protein hydrate from peanut protein.)

10. Ethanol Extractable Nonprotein in Material in Preparations of Peanut Protein (In this paper are given the steps for the preparation of a protein from solvent extracted meal and the nature and amounts of nonprotein constituents extracted by cold ethanol at the curd stage.)

11. The Role of Chemistry in Adapting Peanuts to New Uses (This paper describes products obtained from peanut protein, such as a wool-like fiber and several adhesive materials. Special procedures for solvent extraction of peanuts are described which result in essentially oil-free solvent-free meal containing high quality protein suitable as a source for these new and useful products.)

12. The Nutritive Value of Peanut Cake Meal Protein and Nonprotein Residue for Chicks (The nutritive value of peanuts meals, isolated protein fractions, and protein meal residues obtained by various processing methods is described and compared with soybean and cottonseed meals as the supplement in chick starting diets. The feeding experiments are described in detail and the results tabulated. Used as about one fourth of protein supplement in an otherwise adequate diet, peanut meals supported chick growth as well as commercial screw-pressed soybean meal and were only slightly inferior to commercial hydraulic pressed cottonseed meal.)

13. More Products from Peanuts (This paper is a review of the research at the Southern Regional Research Laboratory towards increasing the value of peanut meal and oil. Pilot-plant manufacture of peanut protein and its use in making a soft wool-like cream colored fiber and such adhesive products as plywood glue, rewettable glues, paper protein binders, and window shade sizes are described.)

14. Peanut Protein for Window Shade Sizes (This paper gives results of experiments which indicate the suitability of peanut protein for use as a sizing material in window shade manufacture and in similar applications. Cotton muslin sized with flexibility characteristics similar to those of samples sized with commercially available animal glues.)

15. Expansibility as Specific Volume of Stabilized and Unstabilized Peanut Butter.

16. Heat Capacity of Stabilized Peanut Butter

The more recent investigations ar SURDD aside from the development of the partially defatted peanuts included the studies of aflatoxin in peanuts and the study of basic information on seed proteins, wherein peanuts were chosen as the subject for much of this research. Both of these areas of research although not directly related to peanut products, play an important part in the development and attainment of suitable products. The work on aflatoxin has become an integral part of world-wide investigation of the mycotoxins in agricultural products. At SURDD standards containing known amounts of aflatoxins B1, B2, and G1 and G2 have been supplied to researchers in many parts of the world to aid them in their own investigations. Highly sensitive methods of analyses have been developed, some of which can be modified for application to other products. The analytical methods have been used and the quality control program put into effect voluntarily by the peanut industry in this country in cooperation with various other agencies. Several methods for the destruction or removal of aflatoxin have been developed and studies along these lines have been continued.

Investigations to obtain basic information on seed proteins, starches, and other substances are largely segregated into individual packages within the peanut kernels resulting in a high degree of partmentalization. Also, new information has been obtained on the enzyme systems within the peanuts. Investigations of the effects of heat on peanut protein reveals that protein deteriation can be measured by following the change in the epsilon-amino-lycine groups. This method is now widely used to measnre nutrutive values of proteins because results agree well with those of feeding tests.

The papers describing the above and other developments pertaining either directly or indirectly to peanuts and peanut products are listed in a publication entitled "Peanut Research, Southern Utilization Research and Development Division, New Orleans, Louisiana, 1942-1968" (4). In this publication there are more than 160 technical papers and patents listed.

OTHER PEANUT PRODUCTS

"Peanut snack" and "peanut spread" (5) are two products developed in the early 1950s under a research contract with the U. S. Department of Agriculture and the Georgia Agriculture Experiment Station. Peanut snack was prepared in several flavors and is a sliceable product, packaged in 8 oz. rolls. The peanut spread is a flavored and spreadable product packaged in an 8 oz. glass jar. It was hoped that the peanut snack would reach consumers other than those who use peanut butter regularly. It was prepared in three different flavors - orange, maple, and chili. The peanut snack was intended for serving in a wide variety of ways, especially as between meal snacks, or at afternoon teas or cocktail parties. It could be used as a confection, on salad plates, in sandwiches, in soups, topping for desserts, in pies, and in ice cream. Because the peanut snack included additives such as dextrose and dried milk and malted milk, it was a very nutritious product. The product had a firm consistency so that it would slice

easily, a texture that was smooth, yet free of gumminess and a flavor that was palatable and distinctive.

Peanut spread was prepared in a manner similar to that of the peanut snack with some modification so that the product would be spreadable. The peanut spread was prepared in three flavors - orange and maple, which were suitable flavors for the peanut snack, and chocolate. The spreadability of the peanut spread was superior to that of peanut butter and the flavor of the orange and maple was excellent according to reports received from taste panels.

Crisp peanut product. This is a new product(6) patented by R. J. Reynolds Tobacco Company and is prepared from dough that is formed from roasted blanched peanuts having an oil content of 20 to 30%. The dough is formed into thin pieces and fried.

Space food sticks. This is an energy food developed for the U. S. Aerospace Program under contract between the government and the Pillsbury Company. The product is cylindrically shaped, about one-half inch in diameter and four inches long. The base ingredient is peanut butter, and the product contains also sugar, corn syrup, food starch, sodium casenate, glycerine, oat flour, and gelatin. It is a tasty product.

Spray dried instant food. Indian researchers reported on studies on the spray-dried instant food based on peanut protein isolate and full-fat soy flour and fortified with methonine and certain vitamins and minerals. The product contains 26% protein and 18% fat. This instant food was pale green in color, reconstituted readily in water and organoleptically acceptable to a panel of judges.

Tasteless peanut protein. In 1963, Mr. Grindrod in England, reported a tasteless peanut-protein product (7) that was commercially produced in England. In the process, shock waves or impluses are applied to a stream of cold water carrying the fat material. The impluses, transmitted by the water, burst the cells in less than a second liberating the fat continuously, and with further processing a peanut "lipoprotein" is produced. This bland, spray-dried powder has absorptive and emulsification qualities that can form the basis for application in meat products, whipped toppings, baked goods, icings, sauces, soups, frozen desserts, and diet-aid products. Also by using a similar process, a more concentrated form of peanut protein is produced. This protein isolate contains 96% protein.

Peanut flours. The research on peanut flours conducted at Auburn University was mentioned earlier. Research on peanut flours in regards to both the production and used have been conducted by many organizations throughout the world. Numerous publications on the subject are available. Peanut flour is considered to be a protein concentrate because it contains about 60% protein. Food-grade quality peanut flour can be produced by either screw pressing or prepress solvent extraction methods, and also by direct solvent extraction. However, emphasis must be placed on the need for sanitary operating conditions. Although peanut protein is deficient, in two essential amino acids, that is lycine and methionine, this deficiency can be lessoned and corrected by mixing with other protein sources such as soybeans and dry skimmed milk.

Peanut flour can be used in many foods as pointed out earlier. One of the biggest problems in the utilization of peanuts as peanut flour is the cost of the flour in competition with other flour such as soybean as a source of protein. Mr.

Max Milner has reported that the major objectives of several world organizations in the protein-rich food programs are: to formulate the processing and quality guidelines for various acceptable protein concentrates, to foster recipe work, to conduct food product development and acceptability trials with these new supplements, and to assist governments in establishing facilities for the production and distribution of suitable and economical foods of this type. Examples of countries where a typical food containing peanut protein have been introduced are India, Nigeria, Uganda, Senegal, and Brazil.

SUMMARY

Peanuts are a good source of food. The search for new and better products from peanuts must continue to meet the increasing need for high-protein food products and also to meet the ever-present competition from other oilseed crops such as soybean and cottonseed. Competition is especially great in the field of food flour, protein concentrates, and protein isolates, because of the availability from these other vegetable protein sources and because of the cost of the original commodities, that is, peanut versus soybean and cottonseed. But, peanuts have a tremendous advantage from the standpoint of flavor and lack of toxic materials.

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PEANUT TASK FORCE REPORT

by
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The Peanut Task Force Report is a recommendation for peanut research, prepared by a group of State and Federal scientists and administrators concerned with peanuts, with the advice of certain industry advisors. It is a supplement to the National Program for Research in Agriculture (the "Long Range Study") prepared at the request of the Senate Appropriations Committee in 1966. The Peanut Task Force report evaluates the present research situation, and makes recommendations for needed research over the next 10 years. The report includes 26 specific problem areas and a manpower recommendation.

It is instructive to consider what the Peanut Task Force report is not. It is not a USDA or SAES financial document; it is not a statement of USDA or SAES official plans; it is not a budget document, nor is it a basis for requesting appropriations. It is neither a comparison of needs in peanut research with needs in other types of agricultural research, nor a comparison of research needs with other national objectives. It is not the "last word."

It is a recommendation as to needs for the next decade, as seen by the people comprising the Task Force at the time of their deliberations--1968.

The introduction to the report considers the place of the peanut industry in the agricultural and industrial economy of the country and in meeting food needs. Problems facing the industry include (1) the fact that production increases have recently out-paced consumption increases, (2) production costs, (3) cost of the Government program, and (4) mycotoxins. The latter topic was not assigned to the Peanut Task Force as a primary responsibility. However, members of the Task Force felt that it was so important that a special statement on need for mycotoxin research should be included. Mycotoxin problems were assigned to the Food Safety Force.

The 26 specific problem areas outlined were included in 12 Research Problem Areas (RPAs). Four main goals of the Long Range Study are included: (Goal II- Protection; Goal III - Production Efficiency; Goal IV - Utilization; and Goal V - Marketing Efficiency. Each problem is briefly summarized as to its scientific or operational nature. Several research approaches are then considered. Problem areas include protection from insects, diseases, and weeds; breeding, mechanization, and cultural practices; improvement of product quality and development of new products from peanuts; and marketing systems that are more efficient, both economically and physically. The need for objective measures of quality attributes is especially important in peanuts because the raw agricultural product undergoes less processing on the way to the consumer.

Copies of the report may be obtained from the Research Program Development and Evaluation Staff, Room 318-E Administration Building, U. S. Department of Agriculture, Washington, D. C. 20250

APPLIED RESEARCH AS AN EXTENSION ACTIVITY

by
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Each of us may have a little bit of difference in our thinking as tn what applied research is. My interpretation of the term is the application of basic research to on the farm practices. In Oklahoma we are establishing these applied research plots which I oftcn refer to as satellite stations in areas surrounding the research stations. The areas covered in our program include: weed and disease control, row spacing, seed size, varieties, fertility, and tensiometers as a means of telling when to irrigatc. There are several reasons for this. Many times the peanut producer will inake a remark such as, "this will work here on the station, but it won't work on my farm" or "this soil is different from mine".

The location of these plots is very important. The most important factors are:

1. A good cooperator
2. Located on a well traveled road
3. Located on soils that represent the area
4. The producers in the area want a plot

Extension's role in applied or adaptive research, as some call it, is varied due primarily to the commodity and its distribution over the state.

In Oklahoma, peanuts lend thenselves to this type of program because of their relatively high value per acre and even thnngh they are grown commercially in over half of the state, 16 counties contribnte more than 90% of the production.

These plots are set up in a randomized block design with three replications, so they can be statistically analyized. The replication adjacent to the road is marked with large signs so visitors can see what the different treatments are and their effect.

Field days or tours are held at timely intervals in conjunction with the plots. After harvest the information is compiled into a report and sent out to the cooperators, County Extension Directors, and local newspapers. This information is only used as back-up for research that has already been proved.

Information received from these plots not only gives the local producer more confidence in these results, it also gives the Extension Agronomist more confidence when he is presenting the information to a group.

According to Krantz and Hills' role of Extension in doing applied research in a report given last year at the annual meeting of the American Society of Agronomy, there is a increase all over the country in this type of activity. Projecting their study to 1975 it is indicated there will be even more participation in the area of applied research by Extension in the future.

Administrations' position on applied research is not too clear, or at least we hope it isn't. Up to now there has been more emphasis put on doing this type of research, but there has not been an appropriation made for funds to support these activities. We have been very fortunate in that the Oklahoma Peanut Commission and the Southwest Peanut Growers' Association has seen fit to underwrite this program.

BREEDING FOR NORTHERN ROOT-KNOT NEMATODE, MELOIDOGYNE HAPLA, RESISTANCE IN PEANUTS 1/

by
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INTRODUCTION

The Northern Root-knot nematode, Meloidogyne hapla Chitwood, is a destructive pest of peanuts, Arachis hypogaea L., in the United States. These small worms infect the roots, devitalize the plants, cause stunting, and reduce yield and market quality.

The use of nematode-resistant peanut varieties would greatly reduce these problems. We hope that through our cooperative efforts, useable nematode resistant or tolerant germ plasm may be indentified and incorporated into productive peanut varieties.

Developing effective screening procedures, aiding in screening peanut germ plasm for resistance and studying the biology and ecology of peanut nematodes are Dr. Charles Russell, Mr. Lou Morrison, and their graduate students.

Details of the screening procedures we use are described in the Peanut Improvement Working Group Proceeding, April 4-5, 1967, Dallas, Texas. More information about peanut resistance reactions to nematodes is found in a Ph. D. dissertation, Host-Parasite Relationships with Definition of Peanut Resistance to the Northern Rout-knot Nematode, Meloidogyne hapla, which was completed this year by Dr. Manolo Castillo, formerly a graduate student in the Department of Botany and Plant Pathology.

NEMATODE RESISTANCE SCREENING TESTS

Accessions Screemed

To date, 371 varieties, lines, hybrids, and introduction of peanuts and 33 accessions of wild species of Arachis have been tested for Northern Root-knot nematode resistance in Stillwater, Oklahoma, since 1958. During the last 10 years workers in other states have screened over 4,500 peanut lines, including 1,729 X-ray mutants, but they failed to find high levels of resistance to Northern Root-knot nematodes.

1/ *Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma. Approved for publication as Journal paper 1890, Oklahoma Agricultural Experiment Station.*

Moderate Resistance In Wild Species

We have found what is considered to be moderately good resistance in some of the wild species of Arachis. Their resistance has been confirmed by several tests conducted by the Oklahoma nematologists, using the criteria of gall ratings, nematode development within the galls, and the number of nematodes that could be recovered from the galls at the end of the test period. The better wild lines, ranked more or less in descending order of resistance, are P.I. 262286, P.I. 262841, P.I. 262814, and P.I. 262844. Tests have shown differences in reactions to different nematode races; however, P. I. 262286 continued to be significantly superior to other entries in most of these tests.

We still have much wild Arachis germ plasm to screen for resistance; and we have recently obtained seeds from Dr. Walton Gregory, North Carolina State University, of some additional wild accessions which we intend to test this year. In addition, there is more material of Arachis to be tested. Last summer, Dr. Ray Hammons and Dr. W. R. Langford collected wild and cultivated species in South America under the sponsorship of the New Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture.

Unfortunately, P.I. 262286, the accession with the most nematode resistance, belongs to the Rhizomatous section of Arachis, and it has not been hybridized successfully with any of the cultivated peanuts to produce fertile progeny. We and others have attempted this cross several times. Dr. Gregory, North Carolina State University, with whom we are in close communication, is working diligently on Arachis species cross-compatibility relationships. We are hopeful that embryo culture or the use of "bridge" crosses will bring success in this area and allow transfer of these resistant genes to the cultivated species.

Mild Resistance In Cultivated Peanuts

Differences in galling reactions and nematode development within galls have been noted in some of the cultivated lines of peanuts. These differences, however, are not as pronounced as in the best wild lines. The following varieties and lines, ranked more or less in descending order of resistance, have generally appeared to be superior to our conventional controls, Spantex or Dixie Spanish: F 416, NC4X, P.I. 288151, P.I. 295974, P.I. 295197, and P.I. 288169. It is interesting that Virginia, Runner, Spanish, and Valencia types are represented in the above lines.

HYBRIDIZATION OF MILDLY RESISTANT CULTIVATED PEANUTS

During the winter of 1967 several crosses were attempted among peanut lines and varieties that had shown mild nematode resistance reactions in previous screening tests. These crosses were made in an effort to intensify the small amount of resistance that is available in the cultivated species. Due to unfavorable conditions in the greenhouse or faulty crossing techniques, few hybrid seeds were recovered. These seeds were planted and grown into plants from which vegetative cuttings were made. The hybrid cuttings were rooted and tested for their galling reaction to nematodes in July of 1968. Our data is too meager to make general conclusions. We noted, however, that the cross between

F 416 (a Florida runner line which possesses the best nematode resistance we have observed in the cultivated species) and P.I. 288151 (a Spanish type) had the most resistance. However, a high level of resistance was not expressed in the F1. Later, another test, involving these same hybrids, was conducted by the nematologists. In their test there was no significant differences in galling reactions of any of the entries.

Evaluation of the F1 hybrids was made, to try to determine if this mild form of resistance is dominant or recessive. The little data that we have is not conclusive. Tests involving more crosses may reveal some information about resistance inheritance. Seeds are available of F2's of the above crosses and they are being tested now. If "true" resistance factors are involved in the crosses, we would expect some differential responses to be expressed in these segregating generations.

Additional crosses among the above lines and other favorable lines and varieties were made in 1968, and are being tested. Among these are crosses between F 416 and NC 4X, the two cultivated lines with the most resistance of the mild form. Resistance reactions of their progenies should be very interesting because the parents, although both are Virginia botanical types, are not closely related. F 416 is a Florida line with a complex ancestory. NC4X came from Dr. Gregory's X-ray irradiation program involving NC 4.

Crosses involving highly susceptible lines as well as resistant lines have been made also, and these should help us determine the mode of inheritance of mild nematode resistance, and whether or not progress in resistance intensification in cultivated species can be made. Additional crosses will be made as other lines, which appear to have potential nematode resistance, are identified.

F 416 has given the most favorable resistance reactions of any lines of the cultivated species of peanut that we have tested. Dr. Ray Hammons, Tifton, Georgia, suggested we test the parents of F 416, since one or more of these may have transferred the "resistance" factors to F 416. Dr. A. J. Nordan, University of Florida, kindly provided us with seed and information about F 416's parentage. Our test produced rather severe galling reactions and none of the lines appeared to have enough resistance to be useful in an intensive breeding program. All of the lines except Hawthorn Jumbo gave higher gall ratings than Spantex, our susceptible control. Hawthorn Jumbo is not a parent of F 416 but it was included because it is similar to Jenkins Jumbo. Jenkins Jumbo was not included in the test because we had no seed. A sister selection of F 416, F 416-2-3, gave poor resistance responses. Another test involving F 416 and Jenkins Jumbo will be conducted shortly. Unless the mild form of resistance that is found in some cultivated peanut lines can be greatly intensified by hybridization, or unless other sources of cultivated peanut germ plasm show more resistance than the present lines, little can be done to achieve progress in breeding for resistance with the cultivated types. It might be possible to induce some resistance by the use of chemical or irradiating mutagens. Our future studies will consider these methods.

INDIVIDUAL PLANT SELECTION FOR ROOTKNOT RESISTANCE

In 1967 we made several plant selections in farmers' fields that showed good infestations of nematodes. Two kinds of plants were chosen, those that appeared

more or less normal in growth (designated "resistant"), and those that were definitely stunted (designated "susceptible"). We had hoped that galling reaction comparisons of these two extreme plant types might reveal some differences in genetic resistance when these plants were grown under our standard test conditions. Cuttings made from these plants were rooted under a mist system in the greenhouse, inoculated with nematodes, and grown in a growth chamber. Included in this test for controls were Starr and Spantex rooted cuttings.

The results of the study indicated no statistically significant differences in galling among the two kinds of plant selections. The results obtained from the cuttings tended to confirm what we had suspected. Peanuts are highly self-pollinated and relatively homozygous; therefore, visual differences in peanut plants in the nematode fields were more likely due to differences in nematode populations around the individual plants than to genetic differences. Unfortunately this characteristic makes field selection of resistant plants very difficult.

THE ESTABLISHMENT OF THE FORT COBB NEMATODE PLOT

In order to have permanent access to an area for future peanut resistance screening tests where we can maintain uniform population levels of nematodes, we began to establish, in the spring of 1967, a nematode field plot at the Fort Cobb Peanut Research Station. Two methods of inoculation tomato plants from the greenhouse to hills spaced three feet by three feet. The other method consisted of larval inoculation by distributing a liquid suspension of nematode larvae over peanut seeds at planting time. We observed no differences in growth, and there were no significant differences in the yield of peanut pods taken from inoculated and uninoculated plots at the end of the 1967 season. Austrian winter peas were planted in the plots in the fall as a cover crop and new plantings of peanuts were made in the spring the following year. Striking differences in growth were noted early last season, and significant differences in pod yields were expressed. Air-dry pod yields for the inoculated and uninoculated plots were 828 and 2464 pounds per acre, respectively. Austrian winter peas were planted in these plots after harvest last fall and some nematode resistance screening trials will be conducted in the area this year.

Last year various peanut varieties were planted in the infected hill area by using a corn "jab" planter. The area consists of 28 rows with 32 hills per row. In some of these hills the krinkle-leaf variety, used as a susceptible control, was planted with the test variety to help ascertain if the hill was actually infected. After observing the plants during the growing season we evaluated each hill at harvest time by digging the plants and examining their root systems for galls. As we suspected, some hills were not infected. A record was made of these uninfected hills, and they will be reinoculated this year. We plan to do some field screening work in the area this year by utilizing the infected hills. Our procedure will consist of planting several seeds each of the variety or line to be tested along with the krinkle-leaf variety, and thinning to one plant of each in the seedling stage. Evaluation of the root system of both plants should help to establish actual differences in galling reaction and growth response, and help eliminate biased results due to "escapes". Additional areas of the field will be infected by inoculated transplants and by larval solutions this year.

We are trying to establish a nematode population in one of our greenhouse soil benches where nematode resistance screening tests can be conducted in the winter.

EMBRYO CULTURE

We are beginning to devote considerable effort to develop methods of artificially culturing peanut embryos, because we believe one of the keys to our being able to achieve hybrids between some of the wild species of Arachis and A. hypogaea may be through this method. Dr. Gregory and his colleagues have shown that barriers to achieving some of the crosses exist due to embryo abortion after fertilization has occured. According to him, the time at which the abortion occurs depends on the species involved in the crosses. Dr. Gregory is studying this phenomenon and he thinks that the abortion in Rhizomatous X A. hypogaea hybrids occurs fairly early in their development. Just why this abortion occurs is unknown but it is believed to be the "somatoplastic" type. Apparently the embryo aborts because of starvation due to malfunctioning of the endosperm which normally nourishes the young embryo. Embryo culture techniques, which involve embryo excision and transfer to artificial media under aseptic conditions with proper incubation environments, have been successfully employed to achieve wide crosses in some other crop plants. Embryo culture, therefore, seems plausible as a method of aiding our hybridization program.

Our approach, thus far, has been to try to develop some successful basic techniques for peanut embryo culture, and to transfer normal embryos of A. hypogaea from ovules of various stages of maturity to artificial media. When these techniques are sufficiently perfected they will be tried on the wild X cultivated species hybrids.

Thus far, the most promising results have been achieved with Randolph-Cox modified medium with the addition on 15% coconut milk. This medium seems to promote good shoot growth of excised embryonic axes from somewhat immature peanut seeds; but root growth in some cases has been less than optimum. We are still in the process of trying other modification of the medium.

Of considerable interest has been the artificial culture of some ovules of wild X cultivated hybrids where some scions of a wild species were grafted onto a cultivated variety. Pollen from the wild species was used to pollinate the cultivated variety that had the grafted scion. Some of these cultured ovules have shown signs of growth and have "greened" up. We are hopeful they will survive to "germinate" and produce seedlings. Whether or not the grafting techniques had any influence has not been determined.

PLANS FOR THE FUTURE

We plan to continue our screening work for Northern roo-knot nematode resistance and hope that we may begin to include screening tests with Pratylenchus brachyurus. This screening work will be done cooperatively with nematologist here at the Oklahoma Agricultural Experiment Station. It is hoped that they will continue to search for more rapid and efficient screening methods in order to speed this program.

We are now evaluating F2 hybrids from crosses of the mildly resistant cultivated lines, to determine if the resistance has been intensified. More hybrids will be made among these and other lines showing mild resistance if it appears that progress can be made in this manner. Results of these tests should aid us in determining its mode of inheritance.

We will continue to seek ways of achieving hybrids between A. hypogaea and the Rhizomatous wild species with good resistance. Since the Rhizomatous section appears to contain resistant genes to several peanut pests, it appears that a major contribution could be made by transferring these resistant genes into cultivated peanut varieties. We plan to continue this effort by using all available means, including embryo culture, grafts, bridge crosses, and autopolyploid induction. In the event that these crosses can be made, it may be necessary to resort to X-ray or similar procedures in order to eliminate undesirable linkage groups.

We hope to initiate some studies soon to try to induce nematode resistance in currently acceptable and productive peanut varieties by the use of chemical mutagens and radiation techniques.

DEVELOPMENT OF NARROW ROW PEANUT PRODUCTION SYSTEMS

by
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Peanut yields from research plots have been shown to be inversely related to row spacing, Stone, et al. 1* reported that peanut yields were more than doubled on dryland, and nearly doubled on irrigated land, when row spacing studies conducted in Texas,2 Arkansas,3 Mississippi,4 Alabama,5 and Georgia6 have also shown that peanut yield is increased with decreases in row spacing. This report deals with research directed toward development and evaluation of machinery suitable for narrow row peanut production on a field scale.

A commercially available planter was modified to facilitate planting of various row spacings on 40 inch wide beds. Disk openers with drag bars for covering the seed were mounted on the planter in such a way as to permit easy sideways adjustment. The opener units could be either removed completely or adjusted to any of eight predetermined positions across the planter width. Row spacing was determined by the number of opener units used and their respective location across the planter width. Eight individual seed hoppers with metering units were mounted above the openers.

Four 12 inch wide press wheels were mounted in tandem at the rear of the planter. The two front wheels were spread apart and the two rear wheels centered to permit packing the entire bed width. The front press wheels were also used to drive the seed metering units.

An irrigated plot at the Caddo Research Station and a dryland plot at the Perkins Research Station were planted during the first week in June, 1968 with the planter using Argentine regular sized seed. The land at both locations was prepared by moldboard plowing, fertilized at rates specified by soil analysis, and pre-emergence herbicide applied. The plots were springtoothed just prior to planting. Seven treatments with four replications were applied in a randomized block experiment design. The treatments were 2, 3, 4, 5, 6, 7, and 8 rows planted evenly spaced across a 40 inch wide flat bed. The row spacings were 34, 17, 11.3, 8.5, 6.8, 5.7. and 4.9 inches respectively. Wheel alleyways on 62 inch centers separated the beds.

Plant density was determined by actual plant population counts made at the two leaf stage. Figure 1 shows the relative differences between calibrated seed

**Numbers refer to appended references.*

Work reported here was supported in part by funds from the Oklahoma Peanut Commission.

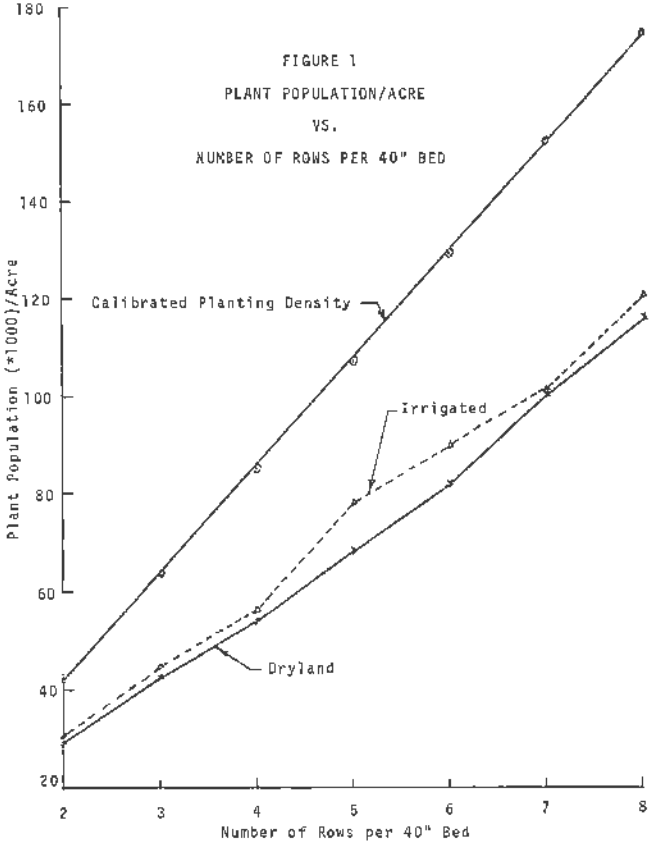


FIGURE 1
PLANT POPULATION/ACRE
VS.
NUMBER OF ROWS PER 40" BED
Plant Population (*1000)/Acre
180
160
140
120
100
80
60
40
20
Calibrated Planting Density
Irrigated
Dryland
2
3
4
5
6
7
8
Number of Rows per 40" Bed

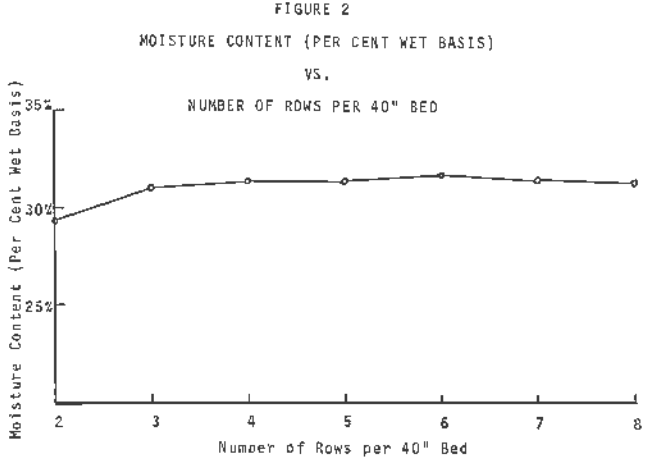


FIGURE 2
MOISTURE CONTENT (PER CENT WET BASIS)
VS.
NUMBER OF ROWS PER 40" BED
Moisture Content (Per Cent Wet Basis)
35%
30%
25%
2
3
4
5
6
7
8
Number of Rows per 40" Bed

drop (theoretical stand with 100% emergence) and actual plant population for irrigated and dryland conditions. No significant* differences in per cent stand were found among the treatments for either the dryland or irrigated plots. Irrigated plots averaged 69.6% stand as compared with the dryland average of 65.8%.

The irrigated plots were planted June 3, 1968 and dug October 11, 1968 with a commercial digger-shaker-windrower with modified blades. The trailing ends of standard 26 inch blades were altered by removing approximately four inches from the end of one and adding ten inches to the end of the other. The blades were mounted so that their cutting swaths overlapped, thus undercutting the entire bed surface. Sufficient space between the blade tips was maintained for trash clearance. Part of the dryland plot area was dug with the commercial digger, however, reported data relating to yield were taken from measurements of hand harvested quantities. Small plants tended to drop through the shaker bars and windrowing tines resulting in excessive loss and poorly formed windrows. The peanuts were combined in the usual way following a period of curing in the windrow.

Figure 2 shows the range of moisture content of the peanuts in the windrow after seven days curing time. Treatment 2, at 29.4 per cent average moisture content wet basis, was significantly less than the other treatments.

The total mechanical harvesting loss for each treatment was estimated by sampling the losses due to digging, shaking, and combining. A section of the windrow was set aside and the loose peanut pods on the soil surface collected. The upper three to four inches of soil was sifted to obtain the loss due to digging. The combine loss was collected from the same located area after that operation was completed.

Mechanical harvesting loss estimates are presented in Figure 3. Average digging and shaking losses were significantly less for two rows than for eight rows per bed. Increases in plant density may have caused more plant interference while digging, resulting in higher loss. Another possibility is that with increasing plant density, fewer pods were produced on each plant resulting in a more even distribution of pods across the bed width. The average unit force holding each peanut pod was thus increased for the evenly distributed plants as compared with the plants which had larger clusters of pods in a localized area.

Combine loss for two rows per bed was significantly greater than the loss of eight rows per bed. Although none of the other treatment mean differences were significant, the trend was for less combine loss at the higher row densities. The total loss was significantly less for treatment two than for treatment eight. The maximum total per cent loss of 6.5 per cent is within the range of average losses previously reported for Caddo County, Oklahoma.[7]

Samples of the harvested peanuts from the Caddo station were graded for per cent sound mature kernels, per cent other kernels, per cent sound splits, and per cent hulls. The treatment means for these parameters are presented in Figure 4.

Figure 5 presents the relative effects of row spacing on the value of peanut kernels. The value of irrigated peanuts was not significantly affected by row

**Refers to statistical significance at the 5 per cent level both here and throughout report.*

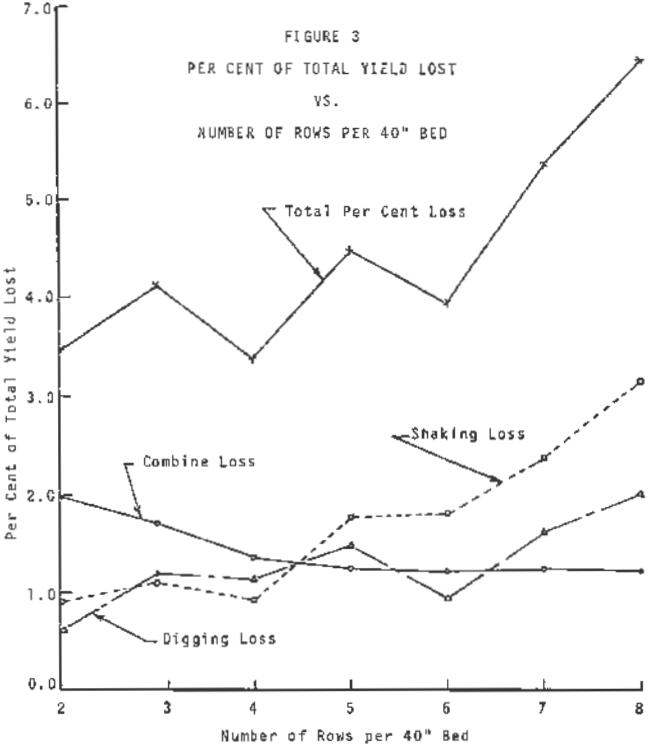
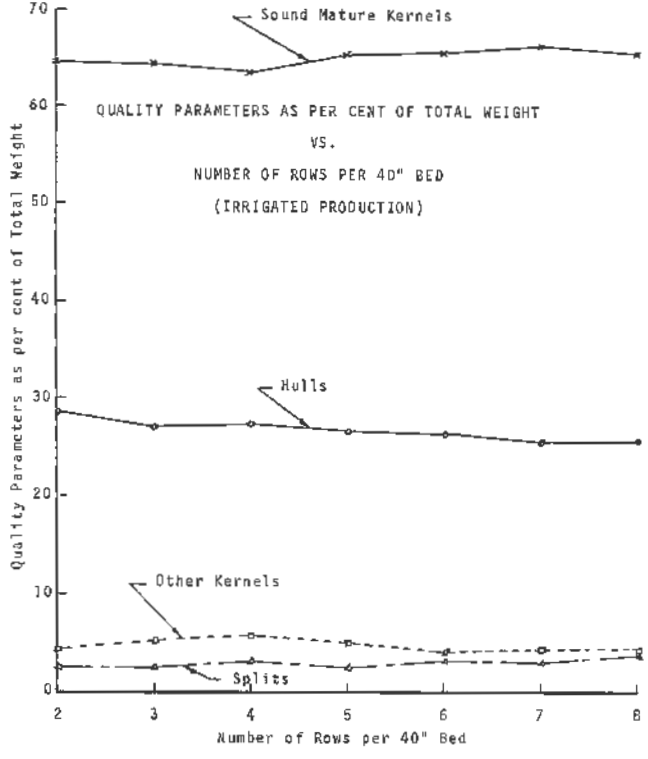


FIGURE 3
PER CENT OF TOTAL YIELD LOST
VS.
NUMBER OF ROWS PER 40" BED
Total Per Cent Loss
Shaking Loss
Combine Loss
Digging Loss
Per Cent of Total Yield Lost
Number of Rows per 40" Bed
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
2
3
4
5
6
7
8

FIGURE 4


Sound Mature Kernels
QUALITY PARAMETERS AS PER CENT OF TOTAL WEIGHT
VS.
NUMBER OF ROWS PER 40" BED
(IRRIGATED PRODUCTION)
Hulls
Other Kernels
Splits
Quality Parameters as per cent of Total Weight
Number of Rows per 40" Bed
0
10
20
30
40
50
60
70
2
3
4
5
6
7
8

spacing. Peanuts which were under stress due to lack of water, however, did lose value as row spacing was decreased. The major contributing factor toward reduced value with decreased row spacing was the increased percentage of other kernels.

A slight trend toward higher yields for narrow row spacings was apparent, however, this effect was not statistically significant for either dryland or irrigated conditions.

Table I is an itemized list of the production costs for irrigated and dryland narrow spaced peanuts. Machinery costs and labor have been combined by using custom rates applicable to the respective areas in Oklahoma.[8] Custom rates for harvesting, drying, and hauling were included in the analysis for dryland production even though the plots were harvested by hand.

Dollars per acre of various production costs are given in Table II and III. Hauling and drying charges include the variations in weight due to moisture content at combining time. Row spacing had no significant effect on the net return per acre for irrigated production. Decreases in row spacing for dryland conditions, however, produced significantly greater net losses.

FIGURE 5

VALUE OF PEANUT KERNELS, CENTS/POUND

VS.

NUMBER OF ROWS PER 40" BED

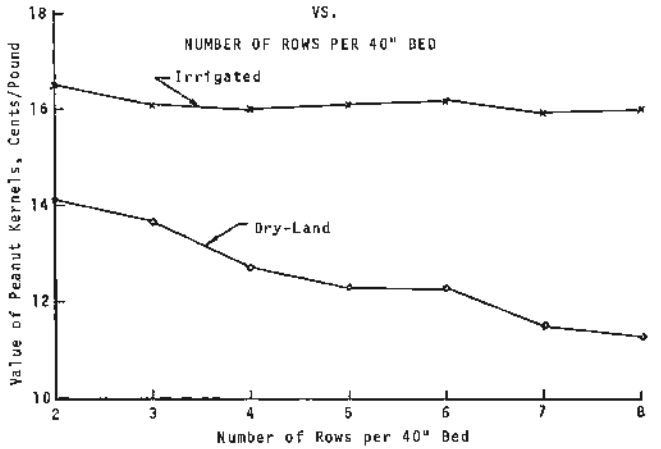


TABLE I

ITEMIZED PRODUCTION COSTS FOR NARROW SPACED PEANUTS

Item	Irrigated $/Acre	Dryland $/Acre
LAND PREPARATION:		
Plowing	3.00	3.00
Disk Harrowing	N.A.*	1.50
Spring Tooth	4.00	3.50
Treflan Material	4.00	4.00
Application	1.00	1.00
PLANTING:**		
Application	2.00	2.00
Fertilizer	10.00	10.00
CULTIVATION:		
Rotary Hoe	2.00	2.50
Leaf Spot Control	11.06	N.A.
IRRIGATION:	30.00	N.A.
HARVESTING:		
Digging-Shaking-Windrowing	4.00	5.00
Combining	14.00	13.00
TOTAL:	$ 85.06	$ 45.50

HAULING: $1.50 per 1000 pounds wet weight

DRYING: $4.00 per 1000 pounds wet weight

* Not Applicable
** Seed cost figured by 1200 seed/lb ÷ 31¢/lb * seeds/acre

TABLE II

PRODUCTION COSTS OF IRRIGATED PEANUTS
FOR VARIOUS ROW SPACINGS

ITEM	Number of Rows per 40" Bed						
	2	3	4	5	6	7	8
Seed Cost	10.98	16.51	22.10	27.60	33.30	39.30	45.00
Hauling	8.14	9.05	9.30	9.30	9.31	8.99	9.01
Drying	23.04	24.12	24.81	24.80	24.82	23.98	24.02
Total Cost of Production (Includes Machinery)	127.71	137.74	141.24	146.79	152.51	157.31	163.11
Gross Return	461.43	474.50	486.13	492.70	491.83	481.05	480.10
Net Return	333.72	339.76	344.89	345.91	339.32	323.74	316.99

TABLE III

PRODUCTION COSTS OF DRYLAND PEANUTS
FOR VARIOUS ROW SPACINGS

ITEM	Number of Rows per 40" Bed						
	2	3	4	5	6	7	8
Seed Cost	10.98	16.51	22.10	27.60	33.30	39.30	45.00
Hauling	1.00	1.12	0.97	0.91	1.08	0.96	1.00
Drying	2.65	3.00	2.58	2.43	2.86	2.55	2.68
Total Cost of Production (Includes Machinery)	61.13	67.13	72.15	77.43	83.74	89.30	95.20
Gross Return	70.41	76.99	62.24	56.22	66.28	55.93	57.31
Net Return	9.28	9.86	-9.91	-21.21	-17.26	-33.37	-37.89

CONCLUSIONS SUPPORTED BY THIS REPORT ARE:

1. Commercial digger-shaker-windrowers will require modification to permit digging dryland narrow row peanuts. The small plants tend to drop through the shaker bars and windrower tines. Digger blades, modified to undercut the entire bed surface, perform satisfactorily.

2. Decreases in row spacing tended to increase digging and shaking losses and reduce combine loss. Overall harvesting loss was comparable to previously reported values for Oklahoma.

3. Row spacing had no significant effect on the percentage of sound mature kernels and per cent sound splits for irrigated peanuts. The value of dryland peanut kernels was reduced as a direct result of decreased row spacing.

4. Some of the previous results reported were not substantiated by this study. Additional data will be necessary before any conclusion can be drawn regarding the advantages of the narrow row cultural practice for large scale field application.

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THE EFFECT OF LEAF SPOT CONTROL AND TIME OF HARVEST ON PRODUCTION OF SPANISH PEANUTS

by
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The problem of increasing production and quality of peanuts has received attention for a number of years. Various factors have been shown to affect the production and quality of peanuts. Reports and summaries have been presented at meetings of the Peanut Improvement Working Group and at meetings of the Southern Division of the American Phytopathological Society of results of tests conducted at the Texas A & M University Plant Disease Research Station at Yoakum, that have helped in increasing the gross and net dollar value of irrigated peanuts in South Texas. It is impossible to adequately summarize the results from the cultural and chemical tests that have contributed to this increase. Accurate records for the period from 1958 to 1968 on both yields and grades are available only from Frio County in South Texas. Some of these data are presented in Table 1. They show that the average yield per acre have changed from less than 1,000-pounds per acre in 1958 to approximately 2,500-pounds the last few years, a 2.5-fold increase. During the same period, there was an average increase of approximately 10-percent in the sound mature kernels. This increase in yield and grade resulted in increases in the gross income from slightly over 1,000,000 dollars in 1958 to an average of over 5,000,000 for the years 1966 through 1968.

Several factors have contributed to this increase in production such as changes in the cultural practices, proper use of pesticides, increased use of irrigation and also to the Starr variety. In this report, I want to mention one set of factors that has helped in this increase in dollar income to the peanut grower in South Texas, that is, by reducing the losses from Cercospora leaf spot and better timing of the peanut harvesting operations.

Cercospora leaf spots have frequently been the cause of premature harvesting, with reduced yields and grades of peanut. Nnmerous workers in the major peanut growing areas have repeatedly demonstrated that snlfur and sulfur-copper dusts and other fungicides can reduce the losses from leaf spots.

The value of controlling leaf spots and permitting the peanut to fully mature, has been demonstrated for a number of years at the Texas A & M University Plant Disease Research Station at Yoakum. There is no set formula that will determine when maximum production has been reached. In several tests maximum production may not have been secured, even though the peanuts were not harvested until they were 130-days old. The exact time to harvest the Spanish peanut for maximum production and highest quality is still an open question.

The data presented in Tables 2, 3, 4 and 5 may have some bearing on the preplexing problem of when to harvest Spanish type peanuts. Only a portion of the data from these many leaf spot tests are presented.

The data were obtained in small plot replicated and randomized tests in which the sprays were applied with a small piston pump sprayer, with a portable

Table 1: Production and value of peanuts in Frio County, Texas [1/]

Year	Av. Lbs/ Acre	Total Tons	Dollar Value Per Acre	Dollar Value Total
1958	819	577	$ 87	$1,222,516
1959	1068	700	105	1,376,282
1960	1290	837	134	1,740,970
1961	1553	1050	179	2,415,529
1962	1432	960	167	2,245,517
1963	2128	1620	256	3,887,093
1964	2320	1964	277	4,673,840
1965	2243	1960	247	4,312,129
1966	2605	2295	302	5,442,674
1967	2493	2116	289	4,908,528
1968	2455	2185	306	5,462,146

1/ Acreage and production figures were obtained from the Frio County ASCS Office in Pearsall. The dollar values were calculated from these production figures and the average grades as obtained from Mr. Morris Ridgeway of the Bain Peanut Company, Pearsall, Texas. The U.S.D.A. yearly price support chart was used to determine the dollar value per ton.

Table 2: The influence of leaf spot control and time of harvest on peanut production. 1964

Fungicide [1/]	Lbs/A/ Appli.	Lbs Nuts/A Days From Planting 111	Lbs Nuts/A Days From Planting 124	Disease Index [2/] Days from Planting 111	Disease Index [2/] Days from Planting 123
Dithane M45	1.5	2788	2897	8.2	7.8
Polyram	1.0	2557	3032	7.2	6.2
Tricarbamix	1.5	2544	2862	7.0	5.8
DU-TER	1.25	2466	2679	7.6	7.4
Check	0.0	2309	1603	2.6	1.1

L.S.D. @ 0.05: 405 lbs/A

1/ No. Applications - 6
2/ Disease index based on 1 - complete defoliation and 9 - no defoliation.

Table 3: The influence of leaf spot control and time of harvest on peanut production 1965

Fungicide 1/	Appli.	Lbs Nuts/A Days from Planting 116	123	130	Disease Index 2/ Days from Planting 116	126
Dithane M45	1.5	4125	4462	4585	8.9	7.2
Daconil 2787	1.5	3994	4114	4220	9.0	8.5
DU-TER	1.5	3471	3754	3683	8.6	6.2
Check	0.0	2679	1484	741	1.6	1.0

L.S.D. @ 0.05: 219 lbs/A

1/ No. applications - 8
2/ Disease index based on 1 - complete defoliation and 9 - no defoliation.

Table 4: The influence of leaf spot control and time of harvest on peanut production, 1966.

Fungicide 1/	Lbs/A/ Appli.	Lbs Nuts/A Days from Planting 116	124	131	Disease Index 2/ Days from Planting 116	130
Daconil 2787	1.5	3933	3785	4385	8.8	8.4
Dithane M45	1.5	4100	3538	3593	7.4	6.9
Polyram	1.5	4214	3340	3166	7.0	6.0
Sulfur dust	20-25	3905	3221	2976	7.1	6.5
Check	0.0	3344	2886	2712	3.9	2.3

L.S.D. @ 0.05: 358 lbs/A

1/ No. applications - 7
2/ Disease index based on 1 - complete defoliation and 9 - no defoliation.

Table 5: The influence of leaf spot control and time of harvest on peanut production, 1968.

Fungicide 1/	Lbs/A/ Appli.	Lbs Nuts/A Days from Planting 97	108	118	Disease Index 2/ Days from Planting 97	109
Daconil 2787	1.5	2115	2829	3128	9.0	8.9
Dithane M45	1.5	2154	2567	3038	8.4	7.5
Sulfur Dust	30-35	2181	2446	2439	7.9	6.6
Check	0.0	1726	1514	730	4.4	2.1

L.S.D. @ 0.05: 245 lbs/A

1/ No. applications - 6
2/ Disease index based on 1 - complete defoliation and 9 - no defoliation.

one-row boom, with four (4) TeeJet wide angle nozzles, adjustable as to arrangement and distance from the peanut plant. The pump pressure was usually in excess of 100 psi. In most tests the sprays were applied at the rate of 100-gallons per acre. The dusts were applied with a hand duster. The data in Tables 2 through 5 were obtained from multiple row plots, designed so as to have several harvest dates for each plot. Untreated buffer rows separated each multiple row test plot.

In most tests an attempt was made to time the first harvest so as to get the maximum production on the untreated check. A delay of 7 to 10 days was usually made for each succeeding harvest. In all of the tests reported in this paper, the untreated peanuts had the maximum yields on the first harvest, which ranged, depending on the year, from 97- to 116-days from planting. Each 7- to 10-day delay in harvesting the untreated plots frequently caused 50% or more reduction in yield. Yields on plots that had been adequately protected with fungicides increased or maintained the same level of yield with each delay in harvest, except in the test in 1966, Table 4. In the 1966 test, yields were unusually high even on the first harvest (116-days from planting) where treated plots averaged in excess of 4,000-pounds of nuts per acre. The check plots averaged 3344-pounds per acre on the first harvest in the 1966 test. Daconil in the 1966 test was the only material in which yields continued to climb with each delay in harvest. Leaf spot was not as severe in 1966 as it was in other years.

The last application of fungicide was usually made from 10 to 14 days before the first harvest. This emphasizes the point that application of fungicide may be discontinued from three to four weeks before harvest, if adequate protection has been obtained.

A summary of the data that have been obtained to date on time of harvest of peanuts, indicates that if leaf spot has been adequately controlled,. peanut harvest should be delayed several days beyond the normal 120 days from planting for maximum production of Spanish peanuts. In several tests, where leaf spot was controlled, each delay of 7- to 10-days increased production from 200 to 500-pounds of nuts per acre. It is readily acknowledged that factors other than leaf spot may determine when to harvest peanuts for maximum production. Pod and stem rots, nutritional factors, and other factors may determine when the proper time to harvest the peanut crop has arrived. In general, the condition of the entire plant should be considered in determining the best time to harvest Spanish peanuts. Spanish peanuts frequently have been left in the ground for 140- to 150-days from planting, with yields in excess of 5,000 pounds per acre.

INFLUENCE OF SEASONAL INSECT CONTROL ON THE INCIDENCE OF STUNT VIRUS IN PEANUTS 1/

by
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Peanuts stunt virus was first observed and identified in 1964 in North Carolina and Virginia and reported by Cooper (1966) and Miller and Troutman (1966). In 1966 peanut stunt virus was observed in four counties in North Carolina. Since 1966 stunt virus has been observed in isolated fields in our major peanut producing counties.

The virus is characterized by dwarfed plant, pale green to greenish yellow attenuated leaves and very small peauuts. Symptoms are more easily detected after mid-July. Invariably a few infected peanut plants may be found on the border of peanut fields adjacent to clover or clover-grass pastures but economic loss has been limited to a few fields. In 1968 only one field exhibited a high incidence of stunt. Approximately 15% of the plants showed stunt virus symptoms in this field located in Nash County, North Carolina.

Although white clover is believed to be the principal overwintering host for the virus in North Carolina (Hebert, 1967), the virus was recovered from 62 plant species mechanically inoculated in the greenhouse (Troutman, 1967).

Miller and Troutman (1966) reported successful transmission of the virus to peanuts by the green peach aphid Myzus persicae (Sulz.) in cage tests. Hebert (1967) reported that the virus was non-persistent and could be transmitted under cages by the spirea aphid Aphis spiraecola, the green peach aphid, and the cowpea aphid Aphis craccivora Koch, which Storey and Bottomley (1925) cite as a vector of peanut rosette in Africa.

Since peanuts are infested by a complex of insects in the field, tests were conducted to determine the effect of seasonal insect control on the incidence of stunt virus.

Methods

Insecticides were applied at planting time and at intervals during the season to control foliage and subterranean insects. Systemic insecticides phorate (Thimet) and Furadan (2,2 - dimethyl - 2,3 - dihydrobenzofuranyl- 7 N-methylcarbamate) were applied in the row at planting for seasonal control of sucking insects.

Timed applications of malathion were made for aphid control and carbaryl (Sevin) was applied to control the potato leafhopper. Diazinon was applied to control ants and soil insects.

Insecticide granules were applied with a granular row applicator except broadcast applications which were made with a cyclone seeder. Sprays were applied at the rate of 25 gallons finished spray per acre using a CO2 powered

1/ This research was supported in part by the USDA, ARS, Entomology Research, Grain and Forage Insects Branch under Cooperative Agreement No. 12-14-100-9047 (33).

sprayer with a 12-ft. wide boom. Plots were 30 ft. long and 4 rows wide in 1966, 8 rows wide in 1967, and 6 rows wide in 1968. Treatments were replicated three times.

Records were maintained on all numerically important insect species. Individuals of species that were numerous were recorded as the number per plant while other species were recorded as the number per row.

Results and Discussion

All insecticides significantly reduced aphid-attending ants, the cowpea aphid Aphis craccivora Koch and tobacco thrips Frankliniella fusca Hinds (table 1). Thimet and diazinon (EC) were more effective than malathion for ant and thrips control. There was no difference amoug the insecticides evaluated for aphid control.

Control of ants was based on active anthills because of the difficulty in counting ants where the greatest number would be in the soil. The aphid population was low in June and increased to a peak in July.

More plants were observed infected with stunt virus and yields were lower in plots where aphids, thrips, and ants were not controlled simultaneously and in plots where thrips control was poor (table2). Partial seasonal insect control with malathion resulted in more stunted plants and a lower yield than the untreated check. These data suggest that untreated plants with early season insect damage were less attractive to mid-season insects involved in virus transmission.

Thimet gave in excess of 93% control of thrips, 79% control of ants, 85% control of the cowpea aphid and 83 -92% control of the root aphid, Prociphilus erigeronensis (Thomas), when compared with the untreated check (table3). Diazinon provided good control of all insects except thrips and malathion controlled only the root aphid. Peanuts treated with Thimet or diazinon spray exhibited significantly less stunt virus than the untreated peanuts.

Similar results in insect control and reduction in stunt virus were obtained in tests conducted near Hollister in 1968 (table4). Insects were reduced with all insecticides except the broadcast application of granular diazinon. Most of the cowpea aphids recorded in the treated plots were observed on plants at the end of the row. Although the incidence of stunt virus was low in 1968 and stunted plants were widely scattered over the field, treated peanuts exhibited significantly less stunt virus than untreated peanuts.

Results of this three year investigation indicate that the potato leafhopper Empoasca fabae Harris and the root aphid P. eriqeronensis are probably not vectors of peanut stunt virus since good leafhopper control and good root aphid control did not affect the incidence of stunt. Systemic insecticides such as Thimet and Furadan provided season control of the insect complex on peanuts. Although insecticides reduced stunt virus in excess of 80%, they failed to eliminate stunt in peanuts. These results further suggest that stunt virus can not be completely eliminated from peanuts unless the vector or vectors are controlled outside of the peanut field.

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Storey, H. H. and A. M. Bottomley. 1925. Transmission of rosette disease of the groundnut. Nature 116:97-98.

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Table 1. Control of ants, aphids, and thrips in a peanut field with a history of stunt virus. Hollister, N. C. 1966.

Treatment[a]	Lb AI/acre	Avg. no./60 ft.[b] Anthills	Aphids	Avg. no.[c] Thrips	Aphids
Thimet G	1	0.3 a[d]	0.0 a[d]	9.0 a[d]	16.0 a[d]
Thimet G + Diazinon G	1 2	0.7 ab	0.0 a	6.7 a	7.3 a
Diazinon EC	4	0.3 a	1.0 a	42.0 b	3.3 a
Malathion EC	2	4.3 b	1.7 a	64.3 c	11.3 a
Untreated	-	15.0 c	15.0 b	140.0 d	261.3 b

[a] Thimet granules (G) applied with the seed at planting May 6. Diazinon (EC) and malathion (EC) applied as broadcast sprays on June 1. Diazinon granules applied July 7 in an 18-inch band over the row.

[b] June 13.

[c] Thrips/10 terminals on June 13 and aphids/20 plants July 7.

[d] Means followed by the same letter are not significantly different at the 5% level.

Table 2. Influence of insecticides on the incidence of stunt virus and yield of peanuts. Hollister, N. C. 1966.

Treatment[a]	Lb AI/acre	Avg. no. stunted plants/60 ft.[d]	Avg. grams peanuts/60 ft.[e]
Thimet (planting) + Diazinon (pegging)	1 2	2.7 a	6738.7
Thimet (planting)	1	15.3 ab	6435.3
Diazinon (EC)	4	6.7 a	5827.3
Diazinon G (pegging)	2	14.3 ab	6257.3
Sevin (WP)[b]	2	29.0 abc	6523.3
Sevin (WP)[c]	2	39.7 bc	4908.0
Malathion (EC)[b]	2	54.0 c	4473.3
Malathion (EC)[c]	2	34.3 bc	4748.3
Untreated	-	28.7 abc	5770.0

[a] At planting (May 6) and pegging (July 7).
EC = emulsifiable concentrate; G = granules; WP = wettable powder.

[b] One application malathion (June 1) and Sevin (July 8).

[c] Three applications malathion (June 1, July 25, and August 2) and Sevin (July 8, July 25, and August 2).

[d] Means followed by the same letter are not significantly different at the 5% level.

[e] Difference between means are not significant at the 5% level. Yields negatively correlated with stunt at 1% level ($r = -0.8208$).

Table 3. Effect of insecticides on the insect complex and incidence of stunt virus in peanuts. Hollister, N. C. 1967.

Treatment	Lb AI/acre	Avg. number[f/]				
		Thrips	Anthills	Aphids	Root Aphids	Stunted Plants
Thimet[a/] + Diazinon[b/]	1 + 2	13.0	14.0	1.3	20.7	1.7 a[g/]
Thimet G[a/]	1	7.3	13.3	5.7	9.3	2.3 a
Diazinon EC[c/]	4	59.0	11.3	1.0	5.7	2.7 a
Malathion EC[d/]	1	55.7	49.0	16.7	17.0	4.7 ab
Diazinon G[e/]	4	58.7	6.0	0.7	0.0	6.0 abc
Untreated	-	-	-	-	87.7	15.0 abc
Untreated	-	-	-	-	-	20.0 c
Untreated	-	184.0	63.0	34.7	121.0	18.3 bc

a/ Thimet applied in seed furrow on May 2.

b/ Diazinon granules applied at pegging July 11.

c/ Diazinon spray applied June 8 (broadcast).

d/ Malathion sprays applied June 8, June 20, July 11, and July 31.

e/ Diazinon granules applied June 7 (broadcast).

f/ Thrips/10 terminal leaves; anthills/60 ft. row; aphids/60 ft. row; root aphids/10 plants; stunted plants/60 ft. row.

g/ Means followed by the same letter are not significantly different at the 5% level.

Table 4. Influence of insect control on the incidence of stunt virus in peanuts. Hollister, N. C. 1968.

Treatment[a/]	Lb AI/acre	Avg. number[d/]			
		Leafhoppers	Anthills	Aphids	Stunted Plants
Thimet	1	77.7	9.0	82.7	0.0 a[e/]
Thimet	2	42.3	15.0	45.0	1.0 ab
Furadan	1	15.0	15.0	1.3	0.0 a
Furadan	2	19.7	8.7	31.3	0.7 a
Diazinon[b/]	4	234.7	6.7	53.7	0.3 a
Thimet + Diazinon[c/]	1 + 2	31.7	7.3	20.3	0.3 a
Furadan + Diazinon[c/]	1 + 2	2.7	4.0	14.0	0.7 a
Untreated 1	-	210.0	30.3	265.7	5.3 c
Untreated 2	-	174.7	61.7	704.3	2.3 abc
Untreated 3	-	207.0	36.7	819.3	4.3 bc

a/ Applied in-furrow at planting May 7, 1968.

b/ Broadcast June 11, 1968.

c/ Applied over the row in an 18-inch band July 18.

d/ Leafhopper damaged leaves/60 ft. row August 7; anthills/60 ft. row July 18; aphids/30 ft. row July 18; stunted plants/120 ft. row August 23.

e/ Analysis of variance by square root transformation. Means followed by the same letter are not significantly different at the 5% level.

DRYING SPANISH PEANUTS IN INVERTED WINDROWS UNDER DIFFERENT CLIMATIC CONDITIONS

by
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INTRODUCTION

Inverted windrow studies were conducted at Texas A&M University Research Stations at Yoakum and Stephenville, during the 1967 and 1968 harvest seasons. These field tests were conducted in early August and late October, respectively.

The objective of this study was to determine what effects drying peanuts in inverted windrows under different climatic conditions had on the following factors: (1) drying rate, (2) milling quality, (3) pod temperature, (4) mold development and (5) germination. Results from the inverted windrow tests were compared to those obtained from peanuts field dried in conventional windrows and peanuts dried with forced air. Peanuts in each type of windrow were partially dried in the field as well as completely dried. The different climate conditions resulted from the test locations. Peanuts harvested at Yoakum were dried under high ambient temperatures in August while those harvested at Stephenville were exposed to low ambient temperatures in the late fall. Both field drying conditions were typical of the climatic environments encountered in each of these peanut producing areas of Texas.

PROCEDURE

Peanuts used for the studies conducted at Yoakum were dug in August with a conventional 2-row digger. Peanuts which were dried in inverted windrows were placed in an inverted position by hand immediately after digging. Peanuts which were artificially dried on the vine were removed from the field and placed on the dryer before any significant reduction in moisture could occur.

A commercial digger-inverter unit was used to establish the inverted windrows for the tests at Stephenville. A conventional 2-row digger similar to the one used at Yoakum was utilized for the conventional windrow tests. All test treatments at both locations were replicated four times.

Pod temperatures were measured by placing thermocouples in the basal kernel of pods at several locations within each type of windrow. Each thermocouple was routed through several loose pods in order to minimize heat flow.

RESULTS

Drying Rate

Research conducted under unfavorable weather conditions at Yoakum in 1967 showed that peanuts dried faster in inverted windrows than those dried in conventional windrows, Figure 1. These conditions consisted of one rain measured at 0.11 inches accompanied by high humidity. The actual decrease in drying time occurred at the end of the unfavorable weather conditions. The

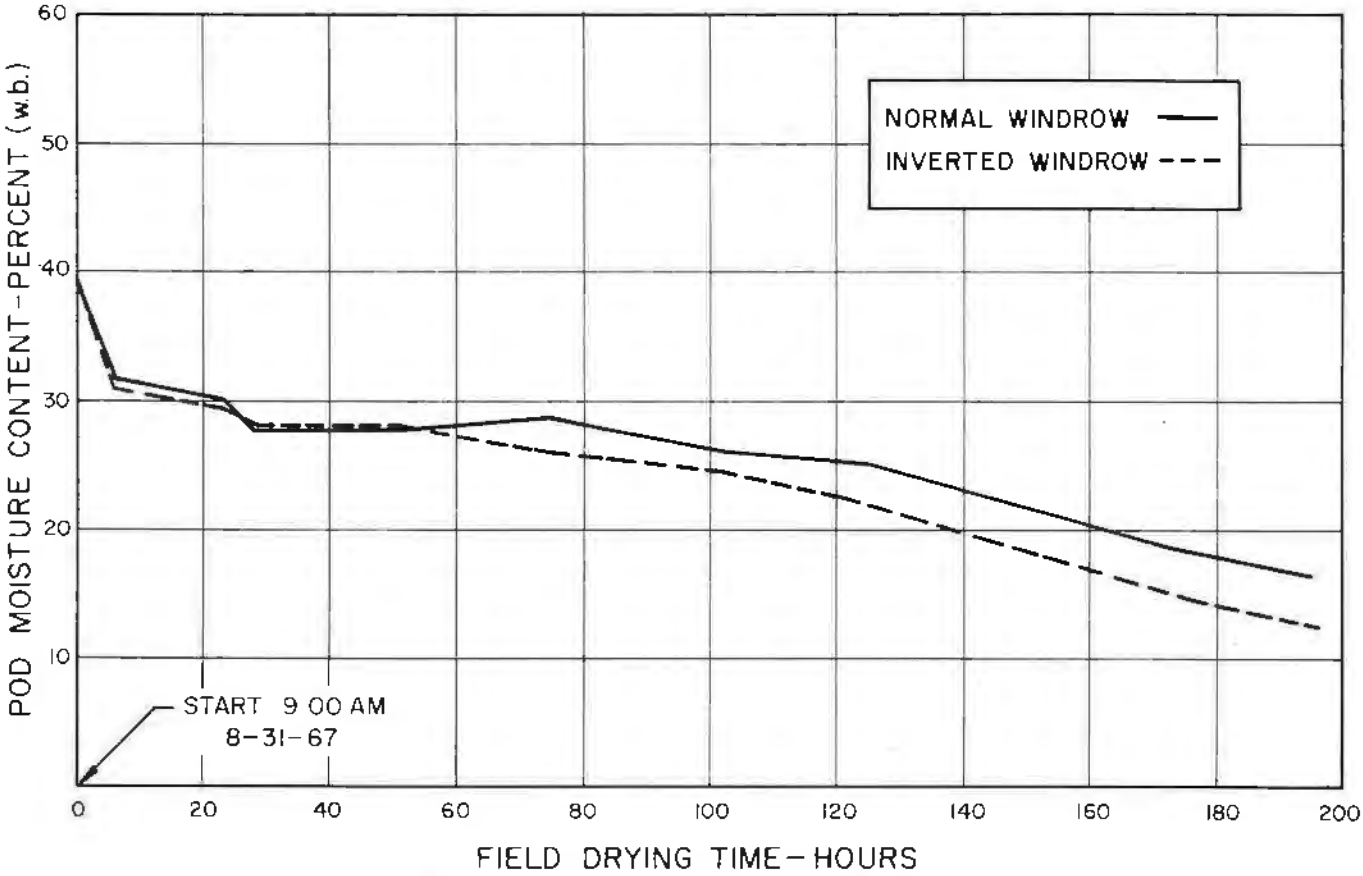


Figure 1. Relationship of pod moisture content to field drying time for peanuts harvested at Yoakum, Texas in 1967.

results obtained in 1967 may have been influenced to some degree by the ambient temperatures during the drying periods. Unfavorable weather conditions were encountered in the Stephenville tests without any significant difference being detected in the drying rates of conventional and inverted windrows down to a moisture content of 20 percent (w.b.), Figure 2. The weather conditions during these tests consisted of two rains totaling in excess of 0.38 inches and one snow fall measuring approximately 6 inches. One of the main differences in the conditions under which the tests were conducted was ambient-air temperatures. The average dry-bulb temperature during the Yoakum tests in 1967 was 75.1°F while the average was 52.6°F for the tests conducted at Stephenville in 1968. The maximum and minimum temperatures during the Yoakum test were 101 and 64°F, respectively, while the maximum and minimum temperatures at Stephenville were 86 and 23°F. It should be noted, however, that the peanuts in the Stephenville tests were not dried below about 20 percent moisture content due to the prolonged unfavorable weather conditions. Peanuts dried in inverted windrows may dry faster than those in conventional windrows from this moisture content down to a moisture level considered safe for storage, regardless of temperature.

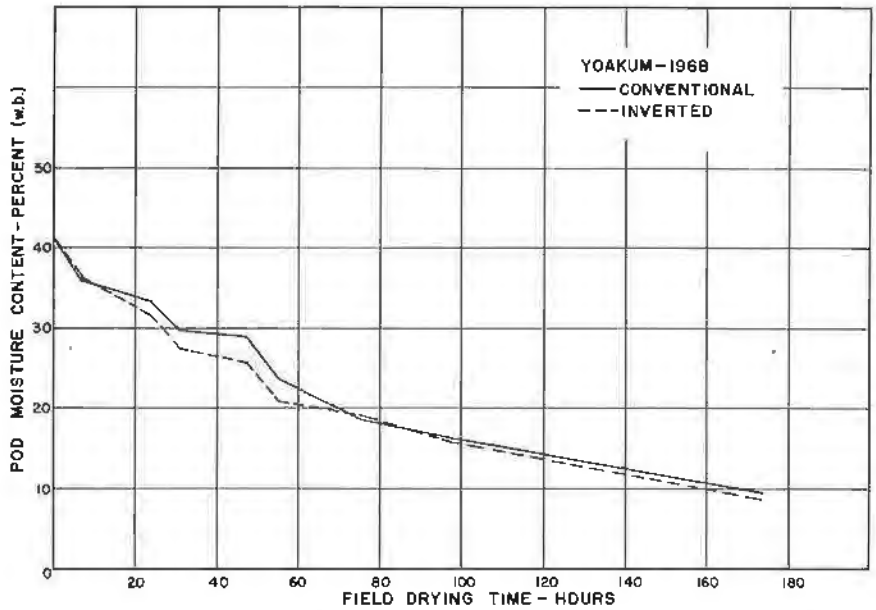
There was little difference in the time required to dry peanuts in inverted and conventional windrows when weather conditions were favorable for drying. This was shown in the 1968 Yoakum test, Figure 2. For example, after 174 hours of field drying the pod moisture contents were 9.4 and 8.7 percent for the conventional and inverted windrows, respectively.

Milling Quality

Results of milling quality tests conducted on the final samples of each treatment at both locations are given in Tables 1 and 2. The complete history of the peanuts in each test is shown under the treatment column.

Peanuts dried at Yoakum under high temperature conditions produced more sound splits during milling than those dried under low temperature conditions in the Stephenville tests. The percent sound splits ranged from 1.37 to 6.07 at Yoakum and 0.37 to 1.18 at Stephenville. Even though the moisture content at the time of shelling was lower for the peanuts dried at Yoakum, it is not anticipated that all the differences were due to moisture alone.

Results of statistical analyses at both test locations showed that the temperatures encountered during the drying period definitely affected the percent of sound splits during milling. The higher the temperature, or the increased drying rate associated with high temperature, the greater the percent of sound splits. The peanuts which were completely field dried at Yoakum had a significantly higher percentage of sound splits when analyzed at the 1 percent level than those which were partially field dried or dried with supplemental heat. There was no significant difference, however, in the sound splits of peanuts dried in conventional and inverted windrows. Freshly-dug peanuts dried with supplemental heat had 1.37 percent sound splits compared to 4.89 and 6.07 percent for peanuts completely field dried in conventional and inverted windrows, respectively. This difference was attributed to the higher pod temperatures encountered in the field drying tests due to radiation compared to temperatures resulting from drying with supplemental heat.



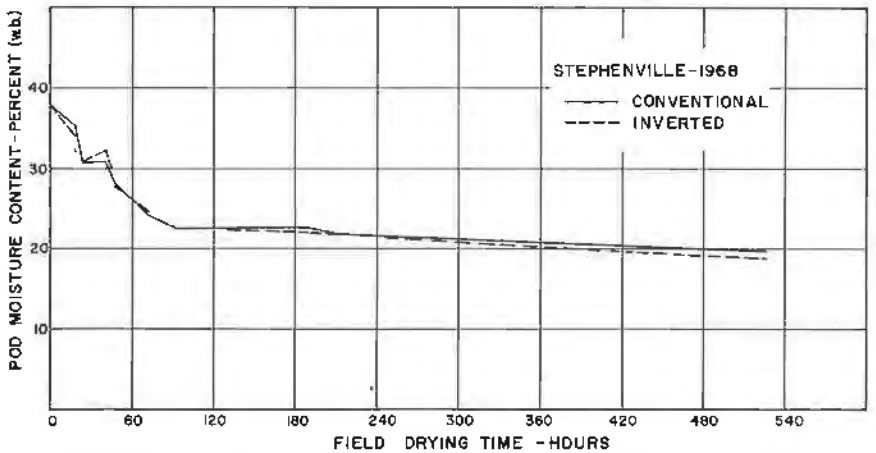


Figure 2. Relationship of pod moisture content to field drying time for peanuts harvested under two different climatic conditions in 1968.

TABLE 1. Results of Milling Quality Tests for Spanish Peanuts Dried in Conventional and Inverted Windrows at the Plant Disease Research Station - Yoakum, Texas - 1968

Treatment	Kernel Moisture Content When Shelled, Percent (w.b.)	Sound Mature Kernels, Percent	Sound Splits, Percent
Freshly-dug peanuts dried on the vine with supplemental heat for 77 hours, threshed and the drying completed in sacks with supplemental heat.	7.02	64.66	1.37
Peanuts partially dried in the field in conventional windrows for 97 hours, combined and dried in sacks with supplemental heat.	7.33	60.80	2.10
Peanuts partially dried in the field in inverted windrows for 77 hours, combined and dried in sacks with supplemental heat.	7.35	63.18	2.05
Peanuts completely dried in the field in conventional windrows (171 hours).	7.42	59.25	4.89
Peanuts completely dried in the field in inverted windrows (171 hours).	7.38	59.13	6.07

TABLE 2. Results of Milling Quality Tests for Spanish Peanuts Dried in Conventional and Inverted Windrows at Tarleton Experiment Station - Stephenville, Texas - 1968.

Treatment	Kernel Moisture Content When Shelled, Percent (w.b.)	Sound Mature Kernels, Percent	Sound Splits, Percent
Freshly-dug peanuts dried on the vine with unheated air for 96 hours, threshed and the drying completed in sacks with unheated air for 93 hours.	8.06	62.63	0.37
Peanuts partially dried in the field in conventional windrows for 70 hours, combined and stored in field overnight, and then dried in sacks with heated air for 72 hours (89°F).	7.96	60.66	1.18
Peanuts partially dried in the field in inverted windrows for 70 hours, combined and stored in field overnight, and then dried in sacks with heated air for 72 hours. (89°F)	7.83	59.86	7.08
Peanuts dried in the field in conventional windrows for 529 hours, combined and dried in sacks with unheated air for 32 hours.	8.95	59.29	3.45
Peanuts dried in the field in inverted windrows for 529 hours, combined and dried in sacks with unheated air for 32 hours.	8.63	60.99	0.47

A statistical analysis performed on the milling quality of peanuts dried at Stephenville showed a significant increase in sound splits at the 5 percent level due to drying treatments. A further analysis indicates that there was a significant increase in percent sound splits resulting from peanuts which were partially dried in the field compared to those dried in the other treatments outlined in Table 2. The major difference in these treatments was that the partially field dried peanuts were dried with heated air at 89°F after they were removed from the field. Consequently, it is again concluded that drying temperature, or rate, was the influencing factor in sound splits. Peanuts which remained in the field at Stephenville in inverted and conventional windrows for 529 hours before drying with unheated air had sound split percentages of 0.47 and 0.45, respectively. This was a non-significant increase over the 0.37 percent sound splits resulting from the freshly-dug peanuts which were dried with unheated air.

Pod Temperature

Results of the pod temperature tests are summarized in Tables 3 and 4. These results illustrate the effects of pod location in conventional and inverted windrows under different climatic conditions. The pod temperatures shown in Table 3 resulted from the favorable drying conditions occurring at Yoakum during the summer of 1968. Temperatures listed in Table 4 reflect the influence of cold, unfavorable weather conditions encountered at Stephenville in the late fall.

Pod temperatures cycled from near ambient conditions at night to levels in excess of dry-bulb temperatures during the daylight periods. These differences were much more pronounced at Yoakum due to the time of the year which peanuts were harvested. Under high intensity radiation conditions at Yoakum, average pod temperatures for both types of windrows during the daylight periods of 6 A.M. to 6 P.M. varied from 90.2 to 101.1°F, depending on the pod location in the windrow. The average temperature of the ambient air was 83.9°F during this period. These temperatures are compared to daylight period temperatures of 58.5 to 60.7 at Stephenville under the same windrow treatments but under colder less favorable drying conditions. The average ambient temperature during this period was 55.9° F.

The principal advantage to inverted windrows at Yoakum, as far as pod temperatures are concerned, appears to be the elimination of high temperature pods in contact with the ground. Pods which were in contact with the ground and exposed to direct sunlight in conventional windrows had an average daylight temperature of 101.1°F compared to the low 90's for the other pod locations. The pods which were in contact with the ground had a maximum temperature of 129°F while the maximum ambient temperature did not exceed 97°F. There was little difference in the temperature of pods in contact with the ground and the other pod locations at Stephenville. However, the daylight temperatures of pods touching the ground were higher than the ambient air, as shown in Table 4.

The 24-hour average pod temperatures, regardless of pod location or type of windrow, were always higher than the average ambient-air temperature under the high radiation drying conditions at Yoakum. There appeared to be no significant differences in these temperatures at Stephenville, however, The favorable drying conditions at Yoakum resulted in high maximum pod temperatures ranging from

TABLE 3. Pod Temperatures in Conventional and Inverted Windrows at the Plant Disease Research Station, Yoakum, Texas - 1968.

Pod Location	Day Temperature (6 AM-6 PM) °F	Night Temperature (6 PM-6 AM) °F	24 - Hour Temperature °F	Maximum Temperature During Test °F	Minimum Temperature During Test °F	Number of Hours Above 95°F
Conventional Windrow:						
Pod exposed to direct sunlight at bottom of windrow and in contact with the ground.	101.1	84.5	92.8	129	75	54
Pod at center of windrow.	92.2	82.9	87.5	115	75	51
Pod exposed to direct sunlight at top of windrow.	91.9	82.3	87.1	110	74	51
Inverted Windrow:						
Pod exposed to direct sunlight.	92.9	82.3	87.6	119	73	54
Pod shaded by an exposed pod.	90.2	81.8	86.0	112	73	51
Dry-bulb temperature of ambient-air - °F	83.9	80.7	82.3	97	72	9

TABLE 4. Pod Temperatures in Conventional and Inverted Windrows at Tarleton Experiment Station, Stephenville, Texas - 1968

Pod Location	Day Temperature (6 AM-6 PM) °F	Night Temperature (6 PM-6 AM) °F	24 - Hour Temperature °F	Maximum Temperature During Test °F	Minimum Temperature During Test °F	Number of Hours Above 95°F
Conventional Windrow:						
Pod exposed to direct sunlight at bottom of windrow and in contact with the ground.	59.2	49.7	54.5	97	31	3
Pod at center of win windrow.	58.5	48.5	53.6	90	27	0
Pod exposed to direct sunlight at top of windrow.	60.7	46.0	53.4	97	20	9
Inverted Windrow:						
Pod exposed to direct sunlight.	60.4	46.5	53.5	93	21	0
Pod shaded by an exposed pod.	58.8	48.8	53.9	89	28	0
Dry-bulb temperature of ambient-air - °F	55.9	49.3	52.6	86	23	0

110 to 129°F while the air temperature did not exceed 97°F. The number of hours which the temperature of pods at different windrow locations were above 95°F is given in Tables 3 and 4.

Mold Development

Results of fungal infestation studies conducted by Pettit and Tabor (1) showed that there was no difference in the degree of infestation of kernels harvested from the inverted and conventional windrows under the favorable drying conditions at Yoakum in 1968. Kernels from peanuts dried in inverted windrows had a fungal infestation of 14 percent compared to 10 percent for those dried in conventional windrows. The most satisfactory drying treatment at Yoakum was where the peanuts were dried with forced air during entire drying period. Only 5 percent of the kernels from this treatment were infested with fungi.

When peanuts were dried in unfavorable drying conditions, kernels collected from inverted windrows had less fungal infestation than those dried in conventional windrows. Results of tests from Stephenville showed that 16 percent of the kernels were infested while only 9 percent were in the inverted windrows.

Germination

Clark (2) found that peanuts dried in inverted windrows germinated better than those in conventional windrows when dried under favorable conditions at Yoakum. Peanuts dried in inverted windrows had a germination percentage of 89 compared to 81 for those dried in conventional windrows. Very little difference was observed between the types of windrows at Stephenville where the weather conditions were less favorable for drying. Peanuts dried in inverted windrows had 92 percent germination while those dried in conventional windrows had 91 percent. Peanuts which were dried with forced air without any field drying had 94 and 99 percent germination for the Yoakum and Stephenville tests, respectively.

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EFFECT OF WINDROW CONFIGURATION ON TEMPERATURE, DRYING RATE AND UNIFORMITY OF MOISTURE CONTENT OF PEANUTS

by

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Harvesting is one of the most critical operations in peanut production. The general practice of digging, shaking and windrowing results in a very rapid change in the environment of the peanut. From a relatively stable condition beneath the soil, it is suddenly subjected to highly variable conditions of moisture and temperature. Extremely high temperatures may result in too rapid drying or other detrimental effects. Prolonged high moisture may be conducive to the development of various molds which reduce quality. Under certain conditions, metabolites are produced by some molds which are toxic to animals. If these toxic metabolites, or mycotoxins, are present, the peanuts will be condemned and cannot be used as food for any animal, resulting in severe economic loss.

The conventional digger-shaker-windrower leaves the plants randomly oriented within the windrow. As a result, some peanuts may be in contact with the soil and exposed to the sunlight, others buried beneath the vine mass, and still others suspended within the vine mass but off the ground. Not only are different peanuts within the windrow subjected to various environments, but the entire windrow is subject to whatever weather conditions may exist. Thus, the ideal windrow would be one in which all peanuts in the windrow are subjected to the most ideal conditions.

Early investigations of windrow drying were not in complete agreement, probably partially due to climatic differences (1, 3, 4). There was an indication, however, that from a moisture loss standpoint, a windrow in which all nuts were exposed and off the ground might have some advantages.

Objective

The objective of this work was to determine the effect of windrow orientation on seed temperature, drying rate, uniformity of drying, peanut quality, aflatoxin development, and harvesting losses. The investigations are conducted by the AERD, ARS, USDA, Tifton, Georgia in cooperation with the Georgia Coastal Plain Experiment Station and the MQRD, ARS, USDA, Albany, Georgia. In this paper, only the effect of windrow configuration on temperature, drying rate and uniformity of moisture content will be discussed. The effect of these on peanut quality, aflatoxin development, and harvesting losses will be presented later.

Procedure

Three varieties of peanuts, representing the three major types of peanuts, Starr Spanish, Early Runner and Florigiant, were each planted on two different

Numbers in parentheses refer to appended references.

dates to provide different harvesting dates and weather conditions. The peanuts were produced by a local farmer, using recommended practices, which maintained healthy, vigorous plants up to harvest time. The studies, conducted over a three-year period, investigated primarily the effects of inverted and non-inverted, or random, windrows. The time of combining was at 0, 3, and 7 days after digging. The first year, the effect of clipping vine tops prior to digging was studied. For these peanuts, a rotary mower, with sharp blades, was used. The height of the mower was adjusted so that about half of the peanut top was removed.

A commercially available digger-shaker-windrower was used for all random windrows. The inverted windrows were formed by an experimental, chaintype inverter which left most of the peanuts above the vine mass. During the second year, a prototype inverter, which inverted the plant, but shook most of the pods down on or within the vine mass, was also studied.

In each of the windrow treatments, temperatures of the peanuts were measured by thermocouples inserted into the basal seed of each pod as described in earlier reports (2, 5). The categories selected for temperature measurement in the random windrow were: 1) peanuts in contact with the ground and exposed to the sun; 2) peanuts shaded by the vine mass and off the ground; and, 3) peanuts exposed to the sunlight and off the ground. Thermocouples were also inserted into the basal seed in the inverted peanuts. Each measurement was replicated four times and a recorder was programmed to read at 30-minute intervals during the day and at hourly intervals during the night.

In addition to the seed temperatures, ambient temperatures at different heights, both within and without the windrow, soil temperatures, black globe temperatures, and wet bulb temperatures, and solar intensity were recorded. A standard Weather Bureau rain-gage was used and rainfall recorded as of 8:00 A.M. daily.

Moisture samples, of approximately 500 grams, were hand-picked immediately after digging and each morning thereafter. From the random windrow, peanuts from three separate locations (exposed, shaded, and exposed and in contact with the ground) were taken. Samples were also collected from the combined peanuts. These peanuts were then dried and the moisture content calculated on a wet basis.

Results

The scheduled investigations provided for six harvests per year. During the first year, two harvests coincided and the instrumentation only allowed data to be collected for one. In each of the following years, data were collected on each of the six harvests, giving a total of 17 harvest dates and conditions for the three years.

Clipping tops prior to digging had very little effect on any of the factors being studied and this treatment was discontinued after the first year. The prototype machine to invert the windrow was used for only one year also. In the particular unit used, some difficulty was experienced in getting the unit properly adjusted as changes were made between peanut types. When properly adjusted for Spanish peanuts, it would not perform well with the Early Runner or Florigiant peanuts. The manufacturer picked up the unit at the end of the season and made

several changes. When properly adjusted, the prototype did a good job in turning the peanut tops down, leaving the pods either on top of the vine mass or shaken down within the top portion of the vines.

The peanuts which were harvested immediately after digging (0-day) had a wide range in moisture content, indicating the indeterminate nature of peanuts. It was generally much easier to combine peanuts just after digging than one or two days later. As the vine wilts, it goes through a "toughening" stage before it becomes dry and brittle. When combined in the wilted stage, the most aggressive setting on the breast springs had to be used. In addition, the stemming saws tended to load up with gum and it was difficult to separate the foreign matter from pods.

As would be expected, the widest range in seed temperature at any given time occurred in the random windrow. The range in pod moisture content varied much more in the random windrow than in the inverted windrow, as shown in Figure 1. The range between the wettest and driest samples at digging time was 10.1 percent. By the third day, the range was 14.6 percent and 2.3 percent, respectively, for the random and inverted windrows. On the sixth day, the range was 11.2 percent for the random windrow and 2.1 percent for the inverted windrow. It may be noted that, with rainfall occurring on each of the first three days, some drying did take place, with the inverted windrow drying both more rapidly and more uniformly.

Under conditions of reasonably good drying for the first two days and subsequent inclement weather, the range in moisture content is shown in Figure 2. The data shown here are based on the combine sample rather than the hand-picked sample. Since the sample size was 500 grams, it can be expected that there were both wetter and drier peanuts within the sample. Even with this levelling effect of sampling, the range in moisture content the day following digging was almost as great in the random windrow as it was when the peanuts were dug. The rainfall which occurred on the second, third and fourth days resulted in the peanuts in the random windrow still having a higher moisture content on the sixth day than on the second. On the other hand, except for the samples taken on the third day, the peanuts in the inverted windrow continued to dry somewhat. Thus, the inverted windrow appears to put the peanuts in a more favorable position during inclement weather.

The drying rate under what may be considered typical drying weather is shown by the curves in Figure 3. The Early Runner variety was dug one day later than the Florigiants. It may be noted, however, that the moisture content of the inverted Early Runners quickly dropped lower than the moisture content of the random Florigiants, even though the Florigiants had one additional day of exposure. Rainfall amounting to 0.01 inch on the seventh day caused a slight increase in moisture content. It appears that this slight shower caused a proportionately greater increase in the inverted than in the random windrow.

Figure 4 indicates that the moisture content under reasonably good drying conditions is about parallel for the two windrow types, with the inverted windrow drying slightly faster. When rain occurred, as on the last 4 days, the drying conditions appear to be somewhat more favorable for peanuts in the inverted windrow.

The relationship between vine and pod moisture is shown in Figure 5. It appears that, initially, the vines in the random windrow may dry faster. This is

probably due to the random windrow being generally spread out wider and a larger percentage of the vine being off the ground than the inverted windrow. By the third day, the vine moisture was essentially the same as the pod moisture. A slight shower prior to combining on the seventh day resulted in a noticeable increase in vine moisture content, whereas the pod moisture content remained lower than that of the previous day.

Figure 6 shows the relationship of location on temperature. Seed temperature at three locations, exposed and inverted, exposed and in contact with the ground (ground), and shaded within the vine mass (shady), may be compared with the soil surface and ambient temperatures. These data represent the most extreme temperatures encountered in the 17 harvests. The ambient temperature (Weather Bureau standard located near the field) reached a maximum of 100°+F. at about 1400 (2:00 P.M.). Shortly thereafter, clouds caused a very sharp decline in solar intensity and a resulting decrease in all temperatures except the ambient. It is interesting to note how much more rapidly the soil surface temperature and the seed temperature of the peanuts exposed to the sun and in contact with the ground rose than did the other temperatures.

The maximum temperature experienced by any of the peanuts was slightly over 130° F. This temperature was measured in the peanut in contact with the ground. At the same time, the peanuts exposed to the sun off the ground (exposed and inverted) were 120° F. Those shaded within the vines, but off the ground, reached slightly above 110° F.

Although the temperatures shown in Figure 6 are extreme, maximum temperatures of about 110° F. and 105° F. were commonly measured in the inverted and shaded peanuts, respectively. Seed temperatures in excess of 120° F. were not uncommon for peanuts exposed to the sun and in contact with the ground.

Conclusions

Based on results obtained, with the three major types of peanuts, over 17 separate harvest periods in 3 years, it appears that:

1) All peanuts in the either inverted or random windrows may reach temperatures in excess of those recommended for drying.

2) Peanuts in contact with the ground and exposed to the sun will reach higher temperatures.

3) Peanuts in inverted windrows dry more uniformly than those in random windrows.

4) Under good drying conditions, there is little difference in the drying rate between random and inverted windrows.

5) During periods of inclement weather and poor drying conditions, peanuts in inverted windrows dry faster.

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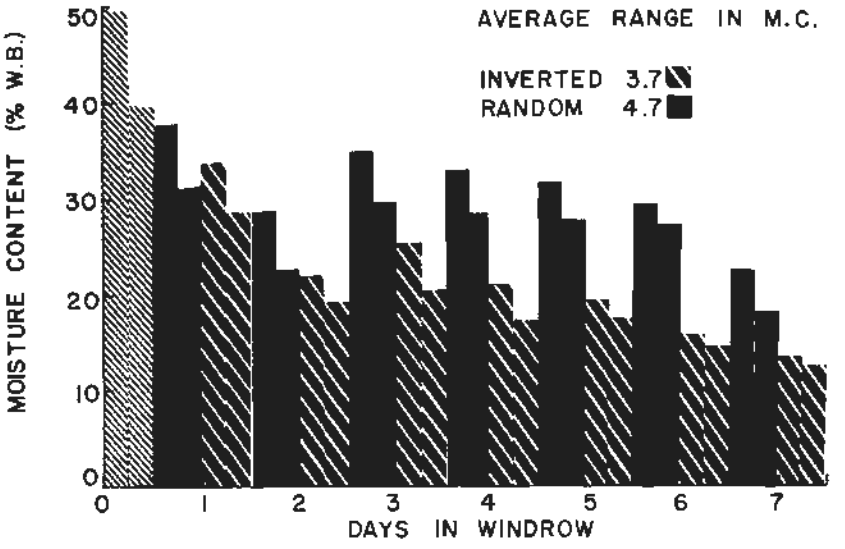
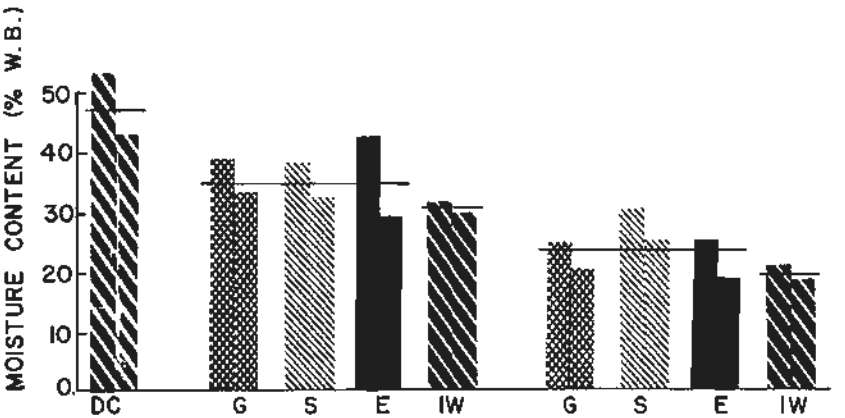


EFFECT OF WINDROW TYPE ON MOISTURE CONTENT
LATE RAIN



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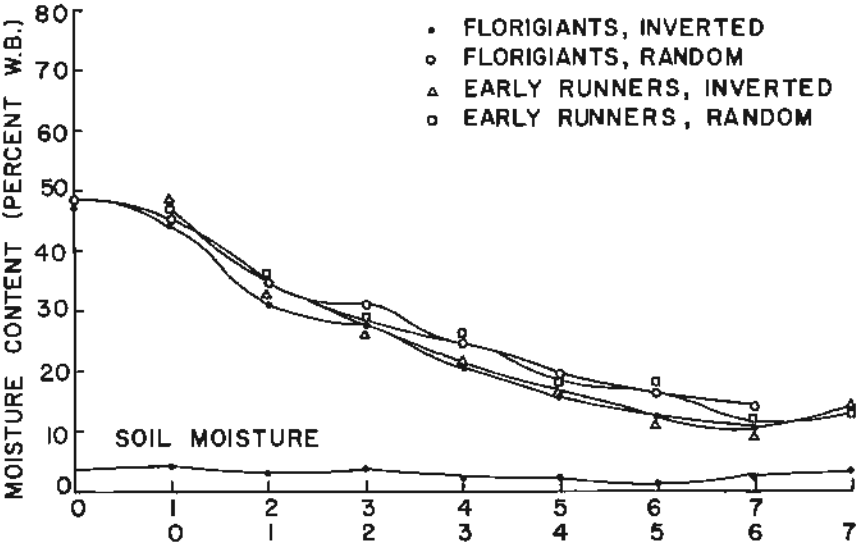
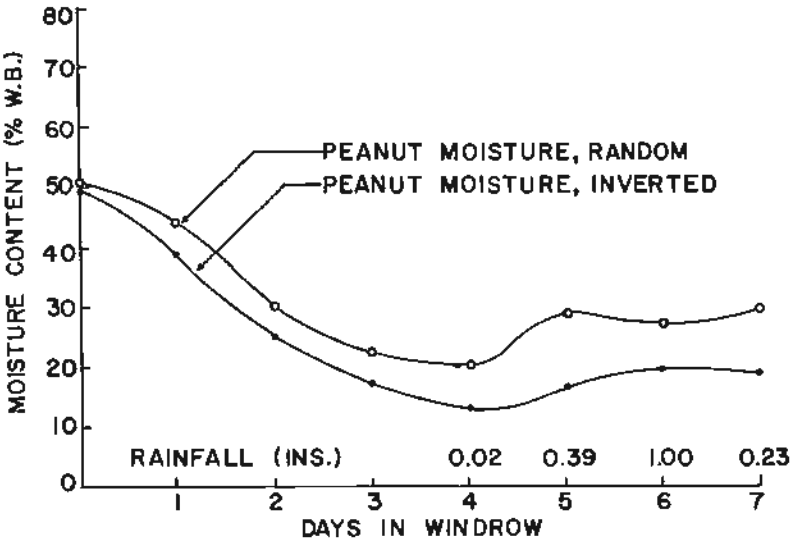
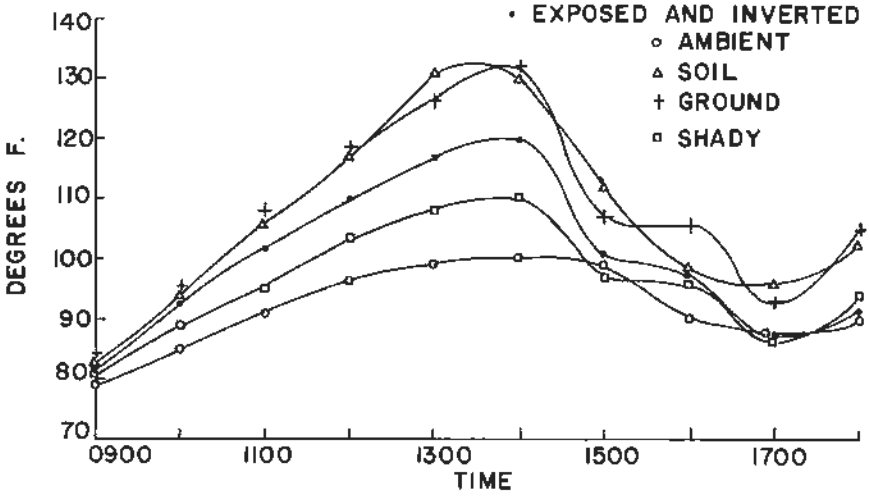


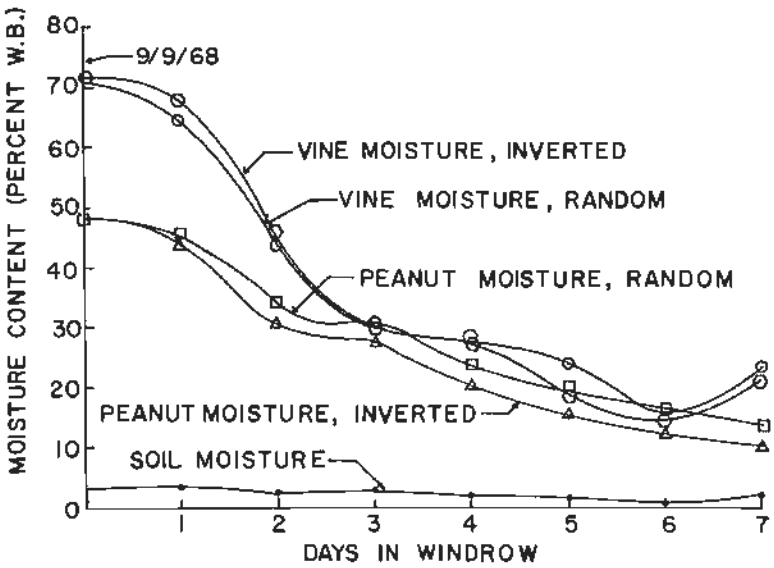
POD MOISTURE CONTENT RELATED TO WINDROW EXPOSURE



EFFECT OF RAINFALL ON PEANUT MOISTURE CONTENT



EFFECT OF LOCATION ON TEMPERATURE



EFFECT OF EXPOSURE ON VINE & POD MOISTURE CONTENT

AFLATOXIN INCIDENCE IN PEANUTS AS AFFECTED BY HARVESTING AND CURING PROCEDURES

by

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Harvesting and curing are critical links in the production of top quality peanuts. Proper curing in the field is dependent on weather conditions at the time of harvest, whereas bin or wagon drying allows the operator to control the curing conditions. Maintenance of quality, however, requires that drying capacity be equal to harvesting capacity. Insufficient drier capacity means that peanuts may be held for a period of time without proper drying. These peanuts are highly susceptible to mold growth and the accompanying mycotoxin contamination.

A common mold found in improperly dried peanuts is Aspergillus flavus. This mold is capable of producing aflatoxin, a toxin which at very low levels of contamination has been detrimental to the health and sometimes fatal to certain animals (1,4,5,6).

For the past three years, agricultural engineers with AERD, ARS, USDA at Tifton, Georgia in cooperation with the peanut quality research group of MQRD, ARS, USDA at Albany, Georgia, have been conducting experiments to examine how various harvesting and curing procedures affect the incidence of A. flavus and aflatoxin in peanuts. The tests were run using three varieties (Starr Spanish, Early Runner, and Florigiant) planted to give two harvest dates for each variety. These peanuts were grown using the recommended practices up to the time of harvest.

Holding Treatments

One series of experiments examined the effect on aflatoxin production when the peanuts were held under unfavorable drying conditions. To give a range of moistures, peanuts were combined in the field after 0, 3 and 7 days exposure in the windrow. These peanuts were placed in one foot cube boxes and subjected to the following treatments: 1) no air flow, 2) air flow at 1 cfm/ft3, 3) nitrogen atmosphere, and 4) carbon dioxide atmosphere. The peanuts remained in these treatments for 24, 48 or 72 hours. In addition to samples from these holding treatments, an initial sample was taken immediately after harvest and a sample was taken from conventionally dried peanuts. There were four replications of each treatment. After treatment, samples were dried in an oven at 160° F. and analysis made by the Market Quality Research Division laboratory at Albany, Georgia.

Numbers in parentheses refer to appended references.

Results

Field drying conditions were generally good. An exception was the first Spanish harvest which had rain on the third, fifth, sixth and seventh days in the windrow. This severely limited field drying and resulted in considerable mold and aflatoxin production in both initial and holding treatment samples far in excess of the other harvests. Some rain occurred early in the drying process of several of the remaining harvests but it had no noticeable effect on aflatoxin production.

Overall, only 2.5 percent of the 2160 holding treatment samples contained aflatoxin. However, in the first Spanish harvest with poor field drying conditions, 10 percent of the 360 samples showed some aflatoxin contamination.

TABLE 1 EFFECT OF WINDROW EXPOSURE ON AFLATOXIN CONTAMINATION IN HOLDING TREATMENTS - 1967

Days	Percent Samples with Aflatioxin			
	Spanish (1st)	Spanish (2nd)	Runner	Florigiant
	%	%	%	%
0	3	1	2	1
3	3	4	1	1
7	26	0	1	0

After 7 days in the windrow all but the first Spanish harvest had moisture contents below 20 percent (w.b.) and the second harvests of both the Runner and Florigiant peanuts had moisture contents below 10 percent. The first Spanish harvest, however, after being as low as 15 percent on the fourth day after digging, had a moisture content of 27 percent on the seventh day.

The data indicate that holding the peanuts under condition of high moisture for a period of time will make them more susceptible to aflatoxin contamination. Aflatoxin production, however, doesn't necessarily accompany mold growth. Nearly all of the holding samples showed some mold growth, much of it being A. flavus. Yet, in only a small number of these was any aflatoxin detected. Thus mold growth, while undesirable in itself, is not a positive indicator of aflatoxin.

Only the first Spanish harvest shows a clear distinction among the types of holding treatments. In general, the N2 and CO2 atmospheres tended to suppress aflatoxin production. These anaerobic atmospheres, however, did allow some mold growth and also developed a highly offensive odor making them unsuitable for edible purposes. Data in Table 2 also point out that aeration of the peanuts without drying does not stop aflatoxin production. Actually, it may even encourage more aflatoxin production than no air flow. This substantiates the results of 1966 experiments using various levels of air flow in which aflatoxin was found in the holding samples (3).

TABLE 2. EFFECT OF TYPE OF HOLDING TREATMENT ON AFLATOXIN CONTAMINATION 1967

Treatment	Percent Samples with Aflatoxin			
	Spanish (1st)	Spanish (2nd)	Runner	Florigiant
	%	%	%	%
No air flow	10	3	3	0
1 cfm/ft^3	15	0	2	1
Nitrogen	5	2	0	0
Carbon dioxide	1	0	3	1

Some of the peanuts developed aflatoxin contamination after only one day of holding under poor drying conditions (Table 3). There was some increase in number of samples with aflatoxin after the second day. Only the first Spanish harvest shows a definite trend, however, while the number of samples containing aflatoxin for the other harvests is too small to show a trend. Erratic trends can be attributed to difficulty in obtaining a representative sample. These data do indicate that even 24 hours without proper drying can result in aflatoxin contamination.

TABLE 3. EFFECT OF HOLDING TIME ON AFLATOXIN CONTAMINATION - 1967.

Hours	Percent Samples with Aflatoxin			
	Spanish (1st)	Spanish (2nd)	Runner	Florigiant
	%	%	%	%
0 (init. sample)	6	0	0	0
24	9	2	1	1
48	13	0	2	0
72	13	3	2	0
Conventional drying	1	1	0	0

High Humidity Treatments

Data from the 1966 field experiments indicated that aflatoxin was most prevalent in peanuts which had partially dried in the windrow and had then been subjected to rain and poor drying conditions (2). To accelerate the accumulation of data relative to the effect of the peanut moisture content on aflatoxin production, a laboratory experiment was set up in which peanuts with a wide range of moisture contents could be held under humid conditions.

Three humidity chambers were constructed in which conditioned air was constantly circulated through the samples. With continuous flow of conditioned air, the atmosphere around the samples remained relatively constant

and lessened the effect of a large number of samples which were absorbing or desorbing water to approach equilibrium with the air.

The air was conditioned by first saturating it at the desired dewpoint temperature. This air was then heated to the desired dry bulb temperature, giving a fixed relative humidity. Both dewpoint and dry bulb temperatures were controlled within 0.1° F. of the set point.

The relative humidities studied over the two seasons during which the chambers have been in operation ranged from 65 percent to 100 percent at temperatures of 85° to 90° F. Temperature and relative humidity for a given test were held constant. Samples of 250 grams of peanuts at various moisture levels, some dried in the windrow, others dried in the lab with unheated air, were first sprayed with tap water to rewet. They were placed in the humidity chamber for 5 days, then dried at 160°F. before aflatoxin analyses were made.

In addition to determining the effect of moisture content on aflatoxin production, one experiment considered effect of maturity. Peanuts were dug at 7 and 14 days (-7, -14) before the projected digging date (based on planting date), on that date, and at 7 and 14 days (+7, +14) after that date. These samples also were dried in the lab to various moisture levels before being subjected to the high humidity treatment.

Results

Approximately 11 percent of the samples subjected to the humidity treatments contained aflatoxin. Comparison of samples treated at the various relative humidity levels showed no significant difference among the range of relative humidities used (65 to 100 percent).

TABLE 4. EFFECT OF INITIAL MOISTURE LEVEL ON AFLATOXIN CONTAMINATION IN HIGH HUMIDITY TREATMENTS (1967-68)

Moisture	Percent Samples with Aflatoxin		
	Spanish	Runner	Florigiant
(% w.b.)	%	%	%
— 30	3	2	1
25-30	25	1	6
20-25	31	7	6
15-20	33	9	7
- 15	29	8	5
Overall Average	24	6	4

Peanuts with moisture content above 30 percent appeared to have less susceptibility to aflatoxin contamination than peanuts which had dried below 30 percent, then were rewet and held at high humidity. This indicates that a rain shortly after digging is not particularly harmful, but a rain after the peanut is

nearly dry, followed by poor drying, is likely to encourage aflatoxin production. Particularly harmful would be a rain in the evening, after the peanuts are partially dry, so that the peanuts would remain under highly humid conditions until morning. On the other hand, a rain in the morning followed by several hours of good drying conditions would not be likely to encourage mold growth and aflatoxin production.

In the samples subjected to the high humidity treatments, some mold growth occurred by the fifth day in the chambers at all levels of relative humidity. In most of these samples, A. flavus was present. Yet, in only a few of these samples was aflatoxin present. The physiological reason for this observation is not clear. Perhaps the right combination of temperature, moisture and time triggers a metabolic reaction within the peanut necessary for the production of aflatoxin by the mold.

Observation of the data from Table 4 shows that incidence of aflatoxin was considerably higher in the Spanish peanuts than in the other two varieties. It will be remembered from Table 1 that the first harvest of Spanish with poor drying conditions, had considerable aflatoxin while the other harvests (second Spanish, Runner and Florigiants) with more favorable drying had only a minimal number of samples with aflatoxin. In the high humidity tests, however, all peanuts were subjected to the same "weather" conditions, i.e., warm, humid conditions. Under these identical weather conditions, the Spanish peanuts had considerably more aflatoxin production than either Runner or Florigiant. Thus, with environmental conditions and moisture contents being equal, there appears to be a varietal difference in susceptibility to aflatoxin.

TABLE 5. EFFECT OF MATURITY ON AFLATOXIN CONTAMINATION IN HIGH HUMIDITY TREATMENTS - 1968.

	Percent Samples with Aflatoxin					
	Spanish		Runner		Florigiant	
Maturity*	1st	2nd	1st	2nd	1st	2nd
	%	%	%	%	%	%
-14	0	25	0	0	0	0
- 7	6	- -	0	- -	0	- -
0	9	53	3	22	3	5
+ 7	31	- -	6	- -	9	- -
+14	34	16	9	3	9	11

* Days before or after projected harvest date based on planting date.

An experiment was set up to determine if the variety difference shown above could, in fact, be due to different stages of maturity. The results showed that mature peanuts are more susceptible to aflatoxin contamination than those which are less mature. This trend was evident at all levels of initial moisture and in all three varieties. Speculating on a reason for these results, it is possible that as the peanut approaches maturity it produces some metabolic substance necessary for production of aflatoxin. Pinpointing the specific cause will need more work.

Conclusions

This research into the conditions during harvesting and curing has pointed out some practices which are conducive to aflatoxin formation. Results of the holding treatments showed that the use of anaerobic atmospheres did suppress aflatoxin production, but at the same time, allowed other molds to grow and produced a highly offensive odor. At the same time, aeration of the peanuts without drying did not suppress aflatoxin compared with peanuts held with no air flow. In fact, aeration may encourage aflatoxin development by replenishing the oxygen supply.

Results also showed that holding high moisture peanuts for as little as 24 hours without drying would allow aflatoxin to develop. Siminarly, peanuts in the windrow subjected to rain followed by poor drying conditions were more likely to develop aflatoxin than those which could dry immediately after a rain.

Peanuts with moisture content above 30 percent had less aflatoxin when subjected to high humidity conditions than those under 30 percent. Yet all the samples showed some mold growth at all moisture levels.

A striking difference was shown among varieties. Spanish peanuts had considerably more aflatoxin than either Runner or Florigiant. Also immature peanuts showed less susceptibility to aflatoxin contamination. This points to the possibility of some metabolic differences that tend to encourage (or suppress) aflatoxin production.

These results point to general practices which will decrease the incidence of aflatoxin contamination in peanuts. Windrow drying under good conditions is acceptable. However, if a rain occurs, particularly after the peanuts moisture has dropped below 30 percent, the peanuts should be combined and placed on a drier immediately to control aflatoxin production. Prompt drying is the best method available for eliminating aflatoxin contamination in peanuts.

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DRYING RATE OF VIRGINIA-TYPE PEANUTS IN RANDOM, DOWN AND INVERTED WINDROWS

by
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With the increased interest and apparent acceptability of peanut plant inversion in the windrow, the advantages and disadvantages of inversion are open for discussion. Studies have shown that inverting peanut plants may offer several advantages over the random windrow. Those most often discussed are faster and more uniform drying, less potential for deterioration and a potential reduction in harvesting losses. Only the potential drying advantage is discussed in this paper. Since the study was conducted at the Tidewater Research Station, the specific results are also limited to the peanut growing area near Holland, Virginia.

Procedure

In 1967 and 1968 daily moisture determinations were made as part of a field environment study on peanuts in the windrow. Three digging dates, spaced 2 weeks apart, and three types of windrows were studied each year. Peanuts in the random windrow were dug with a digger-shaker-windrower and reshaken with a separate shaker immediately after digging. Peanuts in the down and up (inverted) windrows were dug with the same digger without the windrow fingers. These windrows were shaken and placed in the desired orientation by hand.

For each digging date four replications of each windrow type were observed. Each replication consisted of an up, down and random windrow (two rows each) 52 ft in length and divided into 13 sub-plots 4 ft in length. A different sub-plot, assigned at random, was selected for each day.

Daily samples of peanuts (approximately 2 quarts) were hand picked from each replication and each windrow type for a period of 11 days after each digging date. Each sample was divided to provide duplicate samples for oven moisture determinations. The duplicate samples were placed in a forced air oven at 180°F for 3 days. Total moisture determinations per digging date were 288 (4 replications x 3 windrow types x 12 days x 2 duplicate determinations).

Peanut temperatures were also recorded as part of the field environment study. Copper-constantan thermocouples were inserted in seven peanuts in each windrow type and the temperatures were recorded once every 30 minutes.

In addition the weight of two small samples of peanuts was continuously monitored after each digging date in 1968. Two 400-gram samples of freshly dug peanuts were placed on a tray in a single layer depth and suspended approximately 1 ft above the soil surface. The trays were constructed of 1/2-inch hardware cloth. The weight of each sample was periodically recorded, once every 30 minutes.

* Numbers in parentheses refer to appended references.

ANALYSIS AND RESULTS

Drying Rates

The average daily moisture determinations with time for one digging date are plotted in Figure 1 for each windrow type. Each point represents the average of eight wet basis moisture determinations (duplicate determinations x four replications). Daily rainfall and the average soil moisture determinations are also shown. This plot is typical of the other five digging dates.

For all six digging dates, the up windrow consistently represents more rapid drying than either the down or random windrow. The quantification of the drying rate advantage requires consideration of several factors. Changing weather conditions, comparison on an unequal weight basis, and comparison of drying rates at unequal levels of moisture are some of the more important ones. Correlation of this drying rate data with recorded weather data has been initiated but is not complete at this time. The following analysis, which does not require the inclusion of weather data, was completed to permit the following comparison of the relative drying rates of the three types of windrows.

Recognizing that the drying conditions are not constant and that peanuts in the shell are nonhomogeneous with moisture gradients in the material during drying (1)*, the assumption was made that the rate of moisture loss is proportional to the amount of moisture present. This assumption may be represented by the equation,

$$\frac{dM}{dt} = - kM,$$

where M is the dry basis moisture content in percent, t is time in days and k is the proportionality constant. Integration of this equation yields

$$M = M_o e^{- kt}.$$

This equation is a simplified version of the drying equation discussed in Henderson and Perry (2). The simplification is a result of the above assumption. Even though this relationship is not entirely appropriate for field conditions, representation of the data by this equation was selected as a method to quantify the results without the inclusion of equilibrium moisture data and weather factors in the analysis.

To compute the values of k, the average moisture determinations were converted to dry basis moisture contents and plotted as shown in Figure 2. Only the first digging date in 1967 is shown. The solid lines were determined as the best fit for each windrow type by least squares regression on time and the logarithms of the moisture content. The slope of these lines is defined by k and the intercept by M_o.

A close examination of Figure 2 indicates disagreement between the assumed relationship and the observed data. As previously noted, the assumed relationship is not entirely appropriate for field conditions. The observed data in

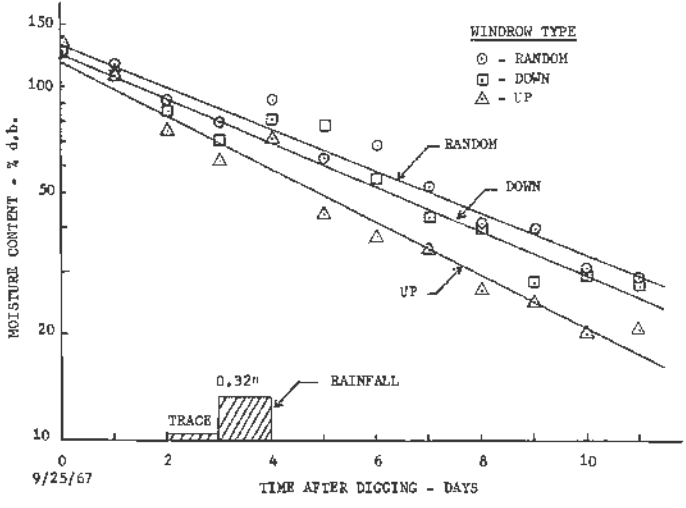

Figure 2. Dry basis moisture content with time after digging in three types of windrows for first digging date in 1967.

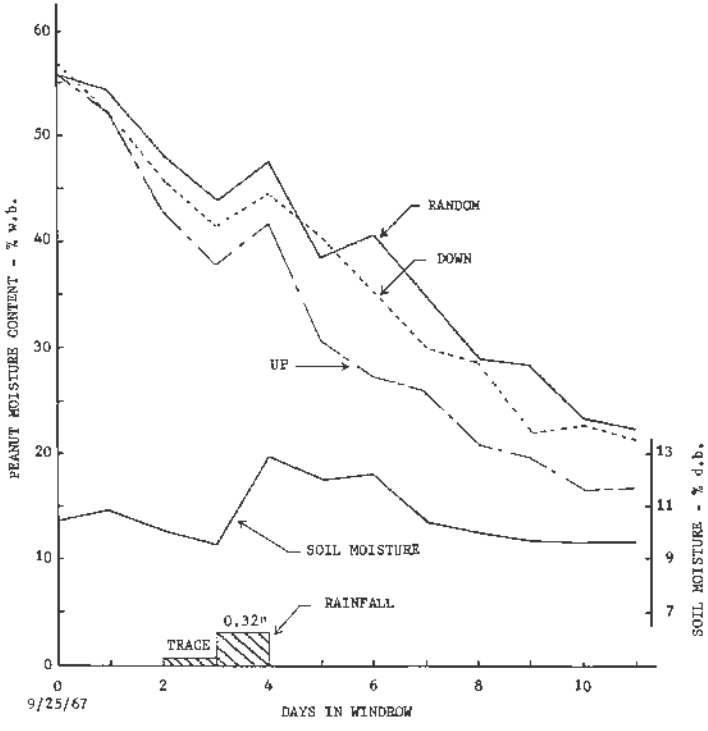

Figure 1. Peanut moisture content in three types of windrows, soil moisture content and daily rainfall for the first digging date, 1967.

Figure 2 reflect the effect of changing weather conditions (day to day variations, rainfall, etc.) with time and therefore were not expected to closely follow the assumed relationship. The results of similar regressions for all six digging dates are summarized in Table 1. These values of k indicate a faster peanut drying rate in the up windrow for each digging date when compared at the same moisture content. The variations in k and M_o between digging dates indicate the effect of different weather conditions. The near twofold variation in k indicates relatively good and poor drying conditions.

The relative drying rate for the up windrow and the random windrow may be obtained by dividing k_u by k_r within each digging date. As shown in Table 1, these ratios range from a high of 1.68 to a low of 1.14 with an average of 1.33. This average indicates a 33% increase in drying rate for the up windrow over the random windrow when compared at the same moisture content. The average ratio for the up compared to the down was 1.31, and the average ratio for the down compared to the random was 1.02. The latter indicates very little if any difference in drying rate between the down and random windrows.

Table 1. Regression coefficients for the equation $M = M_o e^{-kt}$ and the ratio of k_u/k_r for six digging dates.

Year	Digging	Windrow Type						Ratio
		Random		Down		Up		
		M_o	k_r	M_o	k_d	M_o	k_u	k_u/k_r
1967	1	1.31	0.137	1.23	0.143	1.18	0.175	1.28
	2	1.20	0.120	1.20	0.128	1.14	0.143	1.19
	3	0.94	0.084	0.93	0.087	0.83	0.113	1.34
1968	1	0.96	0.088	0.90	0.098	0.84	0.119	1.35
	2	0.94	0.077	0.84	0.076	0.92	0.129	1.68
	3	1.20	0.140	1.02	0.121	1.00	0.159	1.14

To interpret these results, consider two groups of peanuts and plants, one oriented as an up windrow and one as a random windrow. Each group contains an equal amount of peanut dry matter and each group contains the same amount of water, i.e. equal in moisture content. Under these conditions, these results mean that for every pound of water leaving the peanuts in the random orientation, 1.33 pounds of water will be removed from the peanuts in the up orientation. These results imply a 25% reduction in drying time for the up windrow when compared to the random windrow. For example, if peanuts in a random windrow require 8 days to dry to 35% moisture content, 6 days would be required for the same peanuts in an up windrow.

Uniform Drying

A direct measurement of the variability in peanut moisture contents was not made in these tests; however, two indirect measurements are available. Both indicate more uniform drying in the up windrow. Each of the daily moisture samples from each windrow type were divided into duplicate samples. The failure of these duplicate moisture determinations to be alike was indicative of experimental error and the failure of the samples to represent the true moisture content of the population. Since the experimental procedure was the same for all windrows, the magnitudes of the difference in the duplicate moisture determinations reflect the nonuniformity in peanut moisture content of their respective populations.

To quantify the differences in the duplicate moisture determinations by windrow type, the sum of the duplicate differences squared was computed for each windrow type across all digging dates. The square root of these sums divided by the square root of 2(N - 1) was computed as an index of the duplicate variation. This index was 0.799 for the up windrow, 1.028 for the random windrow and 1.094 for the down windrow.

Peanut temperatures are suggested as the second index of uniformity in the windrow. The variability of peanut temperatures within each windrow was greatest in the random windrow and least in the up windrow. This indicates a more uniform drying condition exists in the up windrow.

Thin Layer Field Drying

The weight of two small quantities of peanuts in a single layer depth was continuously recorded in 1968. The results of this record for the first digging date are summarized in Figure 3. The graph is a plot of the dry basis moisture content of each sample with time. The moisture content was computed from the weight record and the dry matter content of each sample. The dry matter content was determined at the end of the test period by drying each sample in an oven for 3 days at 180°F.

The points shown in Figure 3 represent the readings recorded at 4-hour intervals after conversion to dry basis moisture content. The dotted line was drawn to represent an average or general trend line. The trend line has the same shape for both samples; however, it was increased by a factor of 10% for sample No. 2 when compared to sample No. 1. The shape of this trend line and the day to night fluctuations are of considerable interest.

Since the weight record includes the weight of any dew formed on the peanuts and tray, the computed moisture content does not necessarily represent the true peanut moisture content at night. An extraneous 20-gram increase in weight results in an apparent increase in dry basis moisture content of approximately 10 percentage points. An apparent increase in moisture content must also occur during periods of rainfall.

For visual comparison, the daily moisture content determinations for the up windrow are shown in the plot of sample No. 2. They appear to agree quite well.

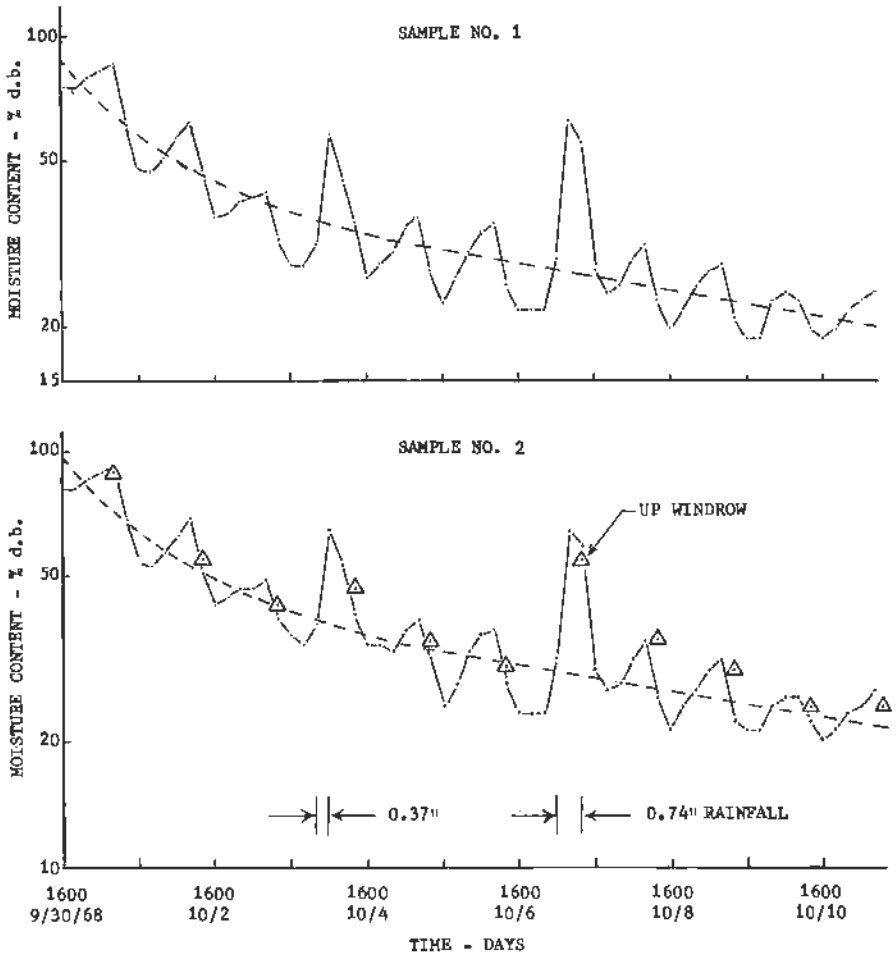

Figure 3. Moisture content with time for small single layer samples of peanuts exposed to field conditions, first digging date in 1968.

Discussion and Conclusions

Based on the analysis reported in this paper, the inverted windrow provides an increased drying rate over the random windrow of approximately 30% when compared at the same moisture level. The ratio of k_U/k_R varied from 1.14 to 1.69. The average ratio was 1.33. Based on this ratio, peanuts initially at the same moisture require 30% more time to dry to the same moisture content in a random windrow over that required in an up windrow. Very little difference was indicated in the drying rates between the random and down windrows.

Two indirect measurements indicate less variability in the moisture content of peanuts from up windrows. Moisture content differences between duplicate samples from the up windrow were consistently less than those from either the random or down windrow. The variability of peanut temperatures within a windrow was greatest in the random windrow and least in the up windrow.

The apparent day to night fluctuations in moisture content of the single layer peanut samples were substantial. For example, the weight record reflects a moisture content range of 17 to 24% from day to night after 8 days of exposure with similar fluctutations at other times. The data indicate a nonlinear relationship between the rate of moisture loss and moisture content. These data and the daily moisture determinations from the up windrow follow the same general drying curve and are for practical purposes at the same moisture content on the third day.

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RESULTS OF ADVANCED BIOASSAY OF PROMISING FUNGITOXIC COMPOUNDS FOR CONTROL OF MOLD FUNGI ON PEANUT PODS

by
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Aflatoxins, and probably other toxins, are sometimes produced in peanut pods as a result of development of mold fungi on incompletely-dried or rain-wetted pods after harvest. The pods are even more likely to contain toxins as a result of mold development during bulk storage in the interval preceeding final drying at a drying or processing plant. Because aflatoxins are highly toxic, and sometimes carcinogenic, to many warm-blooded animals, much research is being directed toward finding methods for prevention of toxin development in food and feed. A research proposal for evaluating food industry type antimicrobial agents, for efficacy in killing peanut pod fungi in agar plate tests and on peanut pods, was submitted to the USDA. A research grant was subsequently awarded to accomplish this work.*

Last year the results of preliminary bioassay tests were presented to this group (2). This report presents the results of additional screening tests and advanced testing of the more promising compounds.

Materials and Methods

The most commonly-isolated species of mold fungi found on peanut pods in Oklahoma (3), and some less frequently isolated species of special interest because of their mycotoxin-producing potential, were tested in agar plate bioassay techniques (Table 1). The chemical compounds tested were, for the most part, chemicals approved by the Food and Drug Administration for use on at least one fresh or processed food item. Most are non-toxic to mammals, volatile or biodegradable to non-toxic or utilizable products. Potential commercial use of a successful candidate is thereby greatly enhanced. The compounds are listed in Table 1. Agricultural fungicides were not tested because of possible residue contamination of kernels during shelling.

The preliminary bioassay test consisted of flooding colonies of test fungi, growing on a peptone-dextrose agar medium, with water dilutions of the non-gaseous chemicals for 20 minutes, draining off the solutions, cutting 7 mm discs out of the colonies with a sterile cork borer, and placing them on fresh agar for later determination of inhibition or kill. Toxicity of test gases was determined by exposing agar plate colonies of the fungi to the gases in test chambers consisting of modified gas-tight petri dish canisters. Dispensing of equal quantities of gas into the canisters was assured through the use of a flowmeter. The canisters were flushed free of air with a test gas for three

**ARS - 12 - 14 - 100 - 9197(34). This research is also funded by Oklahoma Agricultural Experiment Station Project S-1386.*

Table 1. Compounds evaluated in agar plate tests for control of certain peanut mold fungi* for USDA grant ARS-12-14-100-9197(34).

Acetic acid	Potassim meta-bisulfite
Aminobutane	Potassium nitrite
Ammonia	Potassium sorbate
Ammonium acetate	Propionic acid
Ammonium benzoate	Propyl paraben
Ammonium hydroxide	Sodium benzoate
Calcium hypochlorite	Sodium dehydroacetate
Calcium proprionate	Sodium deacetate
Chlorine	Sodium meta-bisulfite
Ethylene oxide	Sodium nitrite
Hydrogen sulfide	Sodium propionate
Methyl bromide	Sorbic acid
Methyl paraben	Sorbose
Lactic acid	Sulfur dioxide
Nitrous oxide	

***Alternaria tenuis, Aspergillus flavus, A. niger, Chaetomium globosum, Epicoccum nigrum, Fusarium moniliforme, F. oxysporum, F. solani, Penicillium sp., Rhizoctonia solani, Sclerotium bataticola, and Trichoderma viride.**

minutes and the plates were held in the test gas environment for varying times depending upon fungitoxicity. Discs were removed from treated colonies and plated as previously described. Initial observations for inhibition and measurement of colony diameters were made at 48 and 72 hours after planting depending upon the rapidity of growth of each particular species. Final determination of survival or kill was made at the end of one week. The average diameter of colonies growing from 10 treated discs were compared to those developing from check discs (treated with sterile tap water in the dilutions tests and with sterile air in the gas tests) to determine percent inhibition or death.

Because the ultimate object of this research is to find methods which would be applicable to treatment of peanut pods under field or processing plant conditions, long treatment periods were used in greater dilutions of the more promising non-gaseous compounds in the preliminary tests (ammonium hydroxide, sodium meta-bisulfite, sodium hypochlorite, calcium hypochlorite and acetic acid). Results of preliminary agar plate screening of most of the test compounds listed in Table 1 have been published in an abstract (1).

Results

In the preliminary 20 minute flooding tests, sodium hypochlorite, calcium hypochlorite, acetic acid and sodium meta-bisulfite were more fungitoxic than any of the other materials tested at the time. Since that time, preliminary testing of ammonium acetate, ammonium hydroxide and additional testing of the gases

(ammonia, chlorine, ethylene oxide, hydrogen sulfide, methyl bromide, nitrous oxide and sulfur dioxide) have been made. Ammonium acetate dilutions were ineffective. The results of advanced testing of sodium hypochlorite and calcium hypochlorite are presented in Table 2. The results of preliminary and advanced screening of ammonium hydroxide, acetic acid and the gases are presented in Tables 3 and 4. Ammonium hydroxide, acetic acid, sodium hypochlorite and calcium hypochlorite are highly fungitoxic at low concentrations. It was also demonstrated that the greater the concentration, the shorter the flooding time required to kill all of the test fungi. In the case of the gases, it was demonstrated that chlorine, ammonia and sulfur dioxide were highly effective in that order. Ethylene oxide, hydrogen sulfide and methyl bromide were moderately active. Nitrous oxide was ineffective.

Discussions and Conclusions

The results from preliminary and secondary screening tests have demonstrated the great effectiveness of acetic acid, ammonium hydroxide, sodium hypochlorite, calcium hypochlorite, chlorine, ammonia and sulfur dioxide for killing many species of mold fungi that can be isolated from moldy peanut pods. These materials will be tested on non-inoculated and inoculated pods in laboratory and field tests. Materials found to be effective in these preliminary field tests will be tested under semi-commercial field tests with prototype treating equipment. If these tests are successful, larger scale tests should be run. Eventually, commercially-applicable techniques and equipment could be the result of such research.

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Table 2. Fungitoxicity of hypochlorite compounds to 12 peanut pod mold fungi in agar plate tests flooded for one hour.

Fungi	Na O Cl				$Ca(OCl)_2$			
	1.05%		1.31%		1.2%		1.5%	
	1*	7	1	7	1	7	1	7
Alternaria tenuis	100	100	100	100	100	100	100	100
Aspergillus flavus	100	100	100	100	100	100	100	100
Aspergillus niger	100	100	100	100	100	100	100	100
Chaetomium globosum	93	70	100	100	89	20	100	100
Epicoccum nigrum	100	100	100	100	100	100	100	100
Fusarium moniliforme	100	100	100	100	100	100	100	100
Fusarium oxysporum	100	100	100	100	100	100	100	100
Fusarium solani	100	100	100	100	100	100	100	100
Penicillium citrinum	100	100	100	100	100	100	100	100
Rhizoctonia solani	100	100	100	100	100	100	100	100
Sclerotium bataticola	100	100	100	100	100	100	100	100
Trichoderma viride	100	100	100	100	100	100	100	100

*Initial measurements made to determine inhibition of growth made at 48 or 72 hours after treatment depending upon the rapidity of growth of each species. Determinations of kill made seven days after treatment.

Table 3. Lowest concentrations of ammonium hydroxide and acetic acid that killed all 12 test peanut pod mold fungi in agar plate tests.

Flooding period (minutes)	NH_4OH concentration	CH_3COOH concentration
20	12.5%	20.0%
30	10.0%	15.0%
60	10.0%	12.5%
90	5.0%	5.0%
120	----	5.0%
150	----	5.0%
180	----	2.5%

Table 4. Fungicidal activity of certain gases to 12 peanut pod mold fungi in agar plate tests.

Gas [a]	Shortest exposure regime that killed all, or most test fungi [b]	Fungi killed
Chlorine	1 min. flush + ½ min. hold	all
Ammonia	3 min. flush + 4 min. hold	all
Sulfur dioxide	3 min. flush + 4 min. hold	all
Ethylene oxide	4 min. flush + 20 min. hold	all
Hydrogen sulfide	4 min. flush + 180 min. hold	all
Methyl bromide	3 min. flush + 120 min. hold	all except *A. niger*
Nitrous oxide	None	None

[a] Flow rate = 2.00 CFH.

[b] Kill determined one week after exposure.

SCREENING PEANUT BREEDING LINES FOR RESISTANCE TO AFLATOXIN ACCUMULATION

by
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INTRODUCTION

The aflatoxins, a group of metabolites produced primarily by certain members of the Aspergillus flavus group, have received much attention since their discovery in 1961 (5, 7, 8). Agricultural products, including peanuts, may become contaminated by these metabolites during harvesting, storage, or transportation if conditions are favorable for these fungi to grow. Since the aflatoxins are acutely toxic and chronically carcinogenic to many animal species (1, 10), they represent potential public health hazards. Much emphasis has therefore been focused on the control or elimination of these fungi and/or their toxic metabolites from agricultural products (3). The best method of control is prevention. Recently, Kulkarni et al., (4) reported that the redseeded Asiriya Mwitunde variety was "tolerant" to aflatoxin production, and Snryanarayana Rao and Tulpule (9) reported that a peanut variety which they designated as U. S. 26 (P. I. 246388; a variety with white testa) was "resistant" to aflatoxin production. Since genetical inhibition of aflatoxin production would be an effective and practical method of prevention, we made a thorough investigation of these varieties (breeding lines).

Four breeding lines of peanut (Arachis hypogaea L.) were obtained from the collection maintained by R. O. Hammons (USDA-ARS), at Tifton, Georgia. These included two Asiriya Mwitunde sources (P. I. 268893 and 295170), P. I. 246388, and Starr (a Spanish type known to support aflatoxin production). A second source of P. O. 246388 was obtained from W. K. Bailey (USDA-ARS), of Beltsville, Maryland from an increase of seed received from India. Two aflatoxin producing isolates of A. flavus Link. were used to test these breeding lines for inhibition of aflatoxin production. We were not able to confirm the Indian reports, as both isolates of A. flavus produced aflatoxins on both sources of Asiriya Mwitunde and on both sources of P. I. 246388 (2). Working on the hypothesis that genetical inhibition might exist in other breeding lines we screened 20 additional lines, representing a wide range of genetic material, for inhibition of aflatoxin production. The preliminary results from these tests are presented in this paper.

Materials and Methods

Twenty breeding lines (representing a diversity of genetical material) were obtained from the collection maintained by R. O. Hammons at Tifton, Georgia and screened for inhibition of aflatoxin production as follows. Duplicate 50-gm samples of kernels of each line were weighed out and hydrated by soaking in 100

ml of distilled water for 10 minutes. After hydration, the kernels were placed on a wire mesh screen and inoculated with a spore suspension of an aflatoxigenic isolate of A. flavus (NRRL- 2999; Northern Regional Research Laboratory; Peoria, Illinois) and suspended above a volume of water in a closed plastic moist chamber. The inoculated samples were incubated for 7 days at room temperature (25-27 C), then quantitatively analyzed for total aflatoxins (B1,B2,G1, and G2) by thin-layer chromatography using the aqueous-acetone method (6). The data presented are the averages of the duplicate samples.

Results and Discussion

At least 40,000 ppb total aflatoxins accumulated in each line tested (Table I), thus, it is concluded that under our experimental conditions none of these lines inhibited the production of aflatoxins. It was observed that much of the fungal growth occurred along breaks or damaged areas in the skins.

It must be pointed out that these data are preliminary and that additional tests will be carried out on these lines using freshly dug pods which have not dehydrated.

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Table I. Aflatoxin accumulation in 20 breeding lines of peanut inoculated with Aspergillus flavus isolate NRRL-2999.

Breeding lines	Total aflatoxins[a] (ppb)
P. I. 244606 (Mwitunde II)	40,000 - 100,000
P. I. 268704 (Valencia)	"
Florigiant (Virginia)	"
Florunner (Runner)	"
Ga. C-32S (Arg. x Wild male)	"
T1759 (Purple seeded Valencia)	"
Argentine	"
Spanish 191-1	100,000 - 1,000,000
P. I. 221068 (Nambyquarae)	"
Virginia Bunch 67	"
Jenkins Jumbo	"
Early Runner	"
Southeastern Runner 56-15	"
Improved Spanish 2-B	1,000,000
Tennessee Red (Valencia)	"
Ga. C-31-201 (NC 2 x Wild male)	"
Ga. C-1-27 (Arg. x Small Spanish	"
P. I. 161307 (White Valencia)	"
Starr	"
NC 5	"

[a] Values are given as total aflatoxins ($B_1 + B_2 + G_1 + G_2$).

INSECT ABUNDANCE AND DISTRIBUTION WITHIN PEANUT SHELLING PLANTS

By
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Research on the prevention and control of insect infestation in peanuts is one of our major projects at the Peanut and Southern Corn Insects Laboratory at Tifton, Ga. To develop or augment an insect control program for peanut shelling plants, it is necessary to know the present status of the insect population under actual shelling plant or milling conditions.

During the 1968-69 shelling season, a study was conducted to determine stored-product insect abundance and distribution within 11 peanut shelling plants in the Southeast. All work of this nature is entirely cooperative with industry.

Materials and Methods

The study involved shelling plants of three major types. Selection of individual mills was based on histories of known cooperators, control or sanitation practices (U.S. Dept. Agr. 1961) and types of buildings. The following three types of shelling plants were selected:

Type 1 - Three-story wooden building with tin or sheet metal covering in which floors and walls are primarily wooden. The farmers stock cleaning equipment and shellers are located on the third floor, hand-picking or electric eye equipment for inspection of shelled peanuts is on the second floor, and the final separation and sacking equipment is on the first floor. Often a storage area or temporary warehouse is also located on the first floor.

Type 2 - Two-story wooden building with or without sheet metal covering. The shelling and sacking equipment is on the first level but in separate areas or rooms, and the hand-picking or electric-eye equipment is on the second floor. In some plants, the picking area is on the first floor and the sizing and separation equipment is on the second floor. These 2-story buildings were often built for other uses and later converted to shelling plants.

Type 3 - One-story steel and concrete building. The cleaning, shelling, picking, sizing, and separation equipment are separated by walls or partitions. In many cases, holding bins and sizing equipment may be on a second level above the first floor working area.

A diversity of shelling plants was used to determine whether structure, height, and age of shelling plant affect distribution, abundance and species of stored-product insects infesting peanuts.

Periodic sampling for detection of insects in operating peanut mills presents many problems. Our presence and method of sampling must not interfere with the normal milling operation since all plants are on a production basis.

Previous research indicated that peanuts placed in a shelling plant as bait traps were very attractive to stored-product insects and represented a method of survey. Trap samplings units (hereafter known as trap units), consisting of wooden trays of 32 1-pint samples of shelled peanuts, were placed in 11 shelling plants. They were located in areas where peanuts were shelled, hand-picked or examined by electric eyes, separated, and sacked for market, and in warehouses containing sacked peanuts. These trap units were exposed in the plant for 3 days during late summer, fall, winter, spring, and early summer. After exposure the units were maintained in a controlled environmental room at the laboratory for about 35 days when they were examined for insects. The 35-day period allowed time for eggs to hatch and insects to mature to a size to facilitate counting.

The 3-day exposure period was decided upon because: (1) shelled peanuts are normally held in the plant for 1 to 3 days awaiting grade certificate and sampling, (2) peanut mills often leave peanuts exposed in hoppers, bins, and equipment over a weekend, and (3) exposure of peanut samples to insects in an untreated plant usually resulted in 100 percent infestation in 3 days.

The trap units presented a method for survey of the mobile insects, but were not a good detector for insects living in the residual (deadstock) peanuts within the plant structure and machinery. Sampling of residual peanuts within operating mills presented more problems. Each plant was different, and, of course, the sanitation program practiced regulated the amount of deadstock material available for sampling. Insects hidden within machinery, walls, and floors often remained undetected unless the sampling coincided with periods of plant inactivity.

A number of places did, however, provide excellent sources for sampling peanut residues. A variety of elevators are used to move peanuts from one level and machine to another. Peanut debris often accumulates at the bottom of these elevators, in boots, in cups, and as spillage around the base. Peanuts accumulate as deadstock beneath sizing and separating equipment. The constant handling of peanuts often results in accumulations of peanut debris on equipment supports and braces, and this is even more noticeable when equipment is stacked overhead. Any wooden, double-walled structure accumulates peanuts after several months of use, and this is especially true for bins, floors, and walls. These accumulations are often the results of previous sweepings. In the sacking room, unless automatic weighing and sacking machinery is used, the final weight is adjusted by adding or removing peanuts with a scoop. This requires a holding receptacle or tub of peanuts near the scales, and these tubs invariably contain stored-product insects. Even when good housekeeping is practiced in shelling plants, the floor sweepings and peanut spillage often remain in the plants in sacks, buckets, or wheelbarrows, thus offering an excellent breeding source.

Results

Insects were attracted to the peanut trap units throughout the entire shelling season (Fig. 1). Peanut mills with poor or no apparent control programs always had a higher percentage of infested samples. At certain seasons of the year all trap samples were infested. Shelling plants had a higher concentration of insects at the beginning (fall) and ending (early summer) of the shelling season. Reduction in insect populations during the winter season was because of weather rather than improved sanitation and insect control practices. Plants with and without insect control had similar winter reductions in populations of mobile insects.

Trap units (Fig. 2) attracted fewer insects per kilogram than were found in deadstock samples (Fig. 3). Even plants with insect control programs had higher concentrations of insects per kilogram of residual peanuts than were collected from trap units in plants without insect control. This is understandable, since the peanut trap units were only exposed to insect for 3-day periods.

Over 20 species of insects were collected in the shelling plants. Five species--almond moth, Cadra cautella (Walker), Indian-meal moth, Plodia interpunctella (Hubner), red flour beetle, Tribolium castaneum (Herbst), merchant grain beetle, Oryzaephilus mercator (Fauvel), and corn sap beetle Carpophilus dimidiatus (Fabricius) -- represented 98 percent of the catch of mobile insects (Fig. 4). Eight species, the five just mentioned plus the cigarette beetle, Lasioderma serricorne (Fabricius), flat grain beetle, Cryptolestes pusillus (Schonherr), and spider beetle, represented 98 percent of the catch for residual insects (Fig. 5). The three latter species averaged less than 5 percent of the catch and therefore are not shown graphically.

The almond moth was the dominant insect and comprised at least 50 percent of the total insect catch for peanut trap units. Indian- meal moths and corn sap beetles usually were more abundant at the beginning and ending of the shelling season. More red flour beetles were caught in traps during winter and spring, when moth populations were at their lowest level.

Trends are difficult to see for the insects collected from residuals. Populations were often destroyed during mill cleanup or when shelling equipment was changed for use with a different type of peanuts. In residual peanuts, merchant grain beetles and red flour beetles made up a greater percentage of the catch than in trap units, with the exception of later summer the almond moth was the most abundant throughout the year and rivaled the almond moth in abundance.

Discussion

Stored-product insects are present in peanut mills during the entire shelling season. Five species, almond moth, Indian-meal moth, red flour beetle, merchant grain beetle, and corn sap beetle, comprise more than 95 percent of the insects found in shelling plants.

Structure, age, and height of shelling plant do not appear to affect the insect abundance. The major factor influencing their abundance is the amount of residual peanuts available as a breeding source. Plant age and structure is secondary. One of the mills having the fewest insects was a 30-year-old, 3-story wooden building. Insects were most abundant in the picking and sacking areas of shelling plants, where more shelled stock was exposed. Large amounts of dust are generated during cleaning and shelling, and this may affect insect abundance in the shelling area.

Peanut mills which showed fewer numbers of insects followed a regular sanitation and insect control program. This consisted of periodic cleaning of all elevators and equipment and the biweekly application of an aerosol to the entire plant. All floor sweepings and refuse collected were removed from the premises and destroyed by burning or burying. During the non-shelling season, a residual spray was applied to the floors, walls, and equipment.

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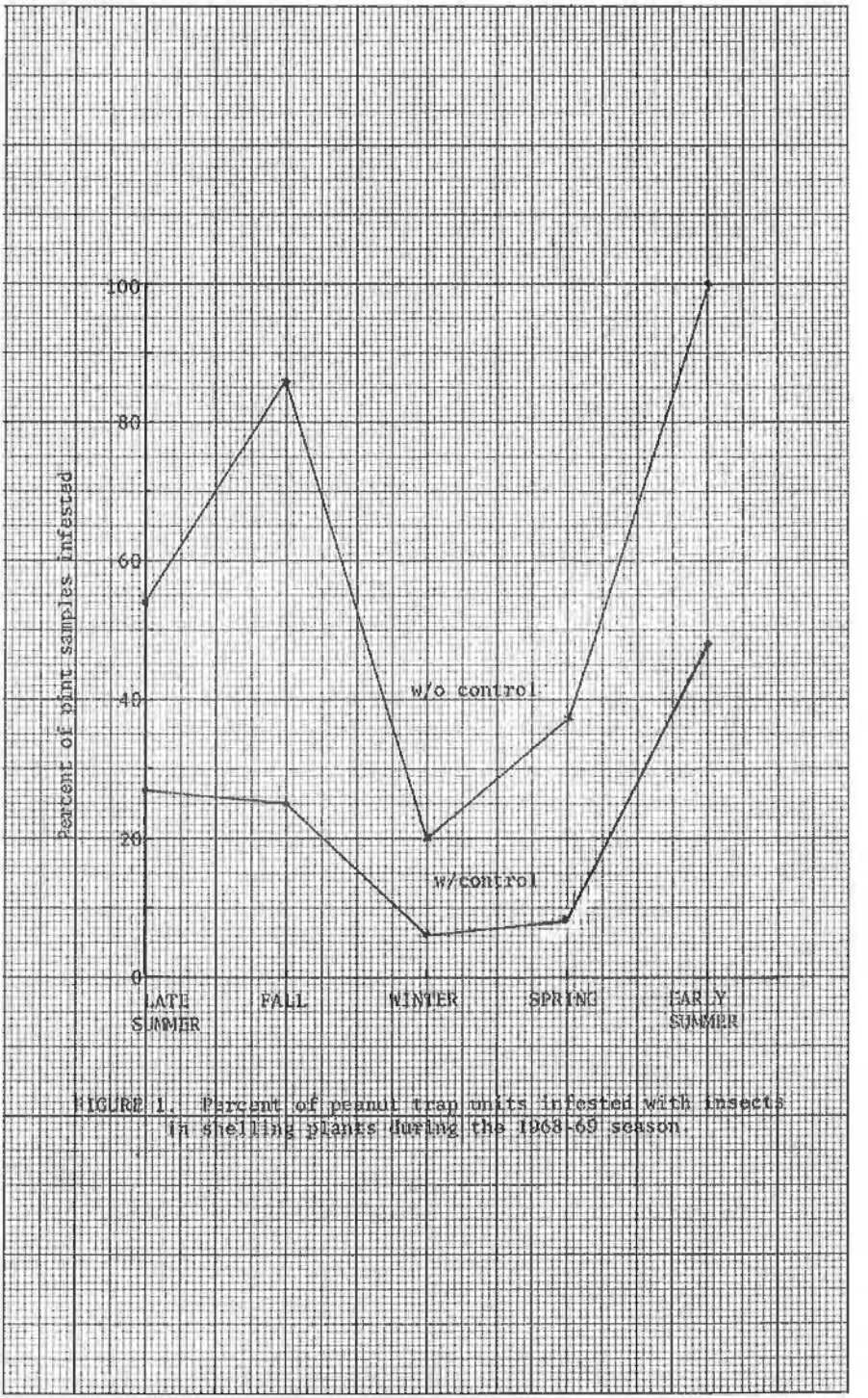

FIGURE 1. Percent of peanut trap units infested with insects in shelling plants during the 1968-69 season.

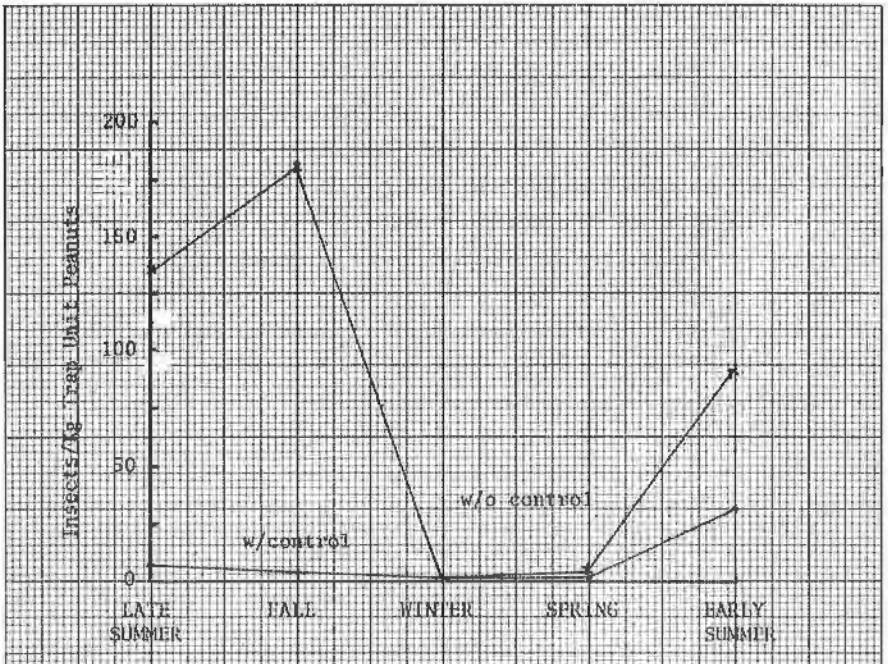

FIGURE 2. Number of insects attracted to peanut trap units in shelling plants during the 1968-69 season.

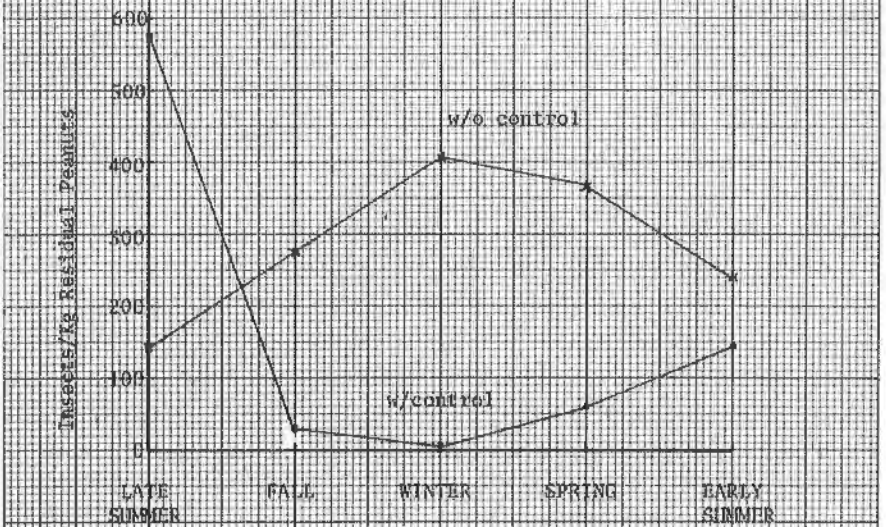

FIGURE 3. Number of insects collected from residual peanuts in shelling plants during the 1968-69 season.

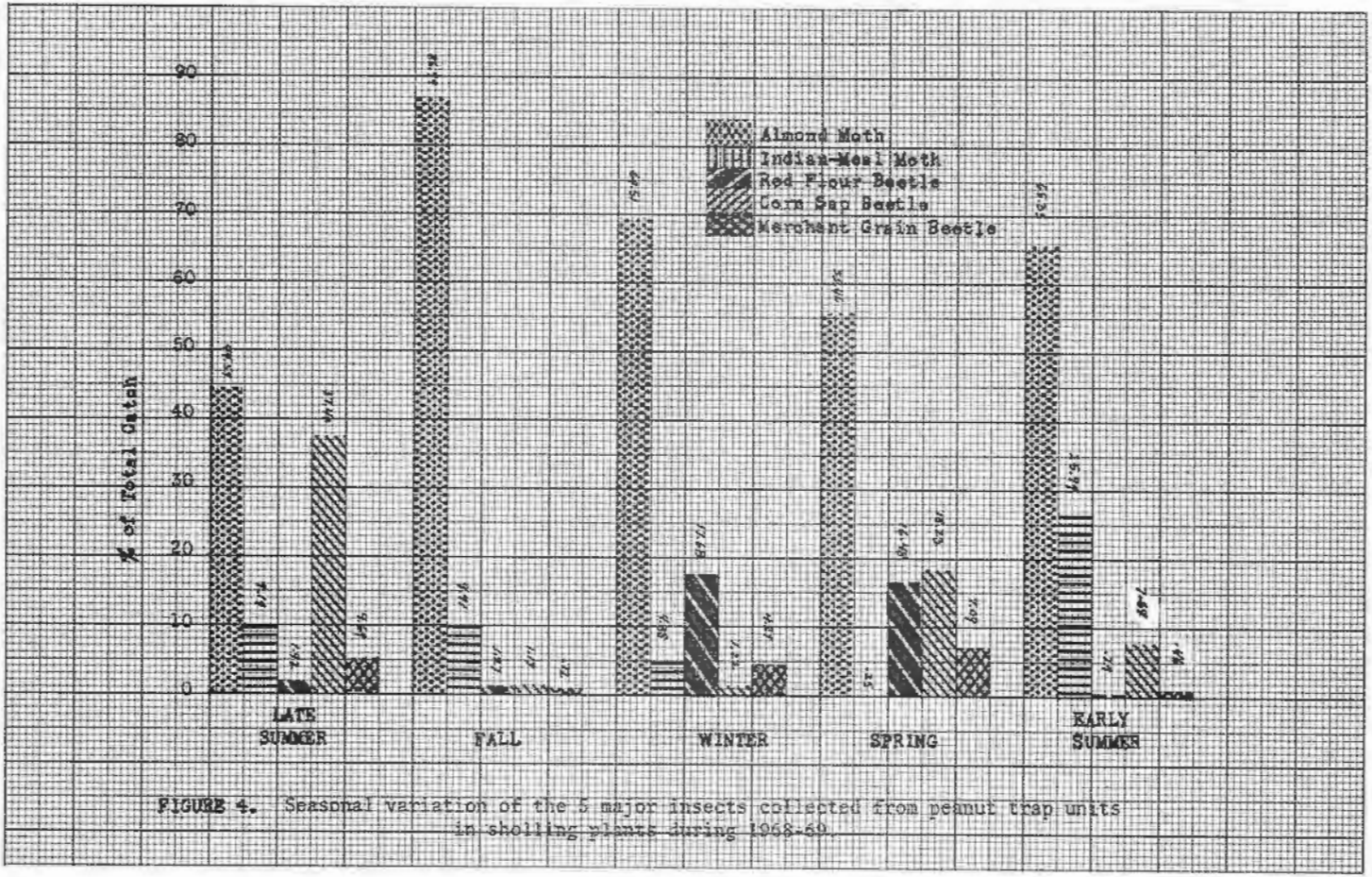

FIGURE 4. Seasonal variation of the 5 major insects collected from peanut trap units in shelling plants during 1968-69.

FIGURE 5. Seasonal variation of the 5 major insects collected from residual peanuts in shelling plants during 1970-71.

Estimation of Combining Ability Among Six Selections of Arachis hypogaea L. Representing Three Geographic Areas of Origin. I. Seedling Responses to Controlled Environment

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ABSTRACT

Six genetically divergent peanut lines from three geographic areas of South America were crossed in all possible combinations in 1968. Parents were represented by sequential and alternate branching patterns. To maximize genetic differences, seedlings tracing to each parent, each reciprocal F1 hybrid between parents, and each F1 hybrid within parental types were grown under controlled environments in the Phytotron at North Carolina State University. Temperatures were maintained at 86°F day and 79°F night while light regimens were 4000-4500 ft. c. Measurements were taken on several seedling characters including hours for seedling emergence, time of first leaf opening on cotyledonary laterals, leaf petiole length, plant height after 15 days, plant height after 23 days, growth rate, number of days to first flower, and green weight of plant over a 40-day period before plants were transferred to the greenhouse where fruit development was studied. Estimates of combining ability were made based upon diallel analyses of the data.

A Heat Unit Index for Virginia Type Peanuts. 1. Germination to Flowering

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ABSTRACT

While much research has been devoted to the development of maturity indices for peanuts, a method for defining optimum harvest dates has not been attained. In these investigations a base temperature of 56°F was determined for NC2 and NC5 Virginia type peanuts for the growth period from germination to 50% flowering. Average heat units of 774 and 729 were required for NC2 and NC5, respectively, to reach the 50% flowering stage of development. Average maximum-minimum air temperatures were found to be as satisfactory for estimating heat units as average hourly air temperatures or any one of several soil temperature readings made with a recording thermometer.

The Effect of Seed Size on Yield, Grade, and Vigor of Virginia Bunch Peanuts

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ABSTRACT

A field experiment was conducted during 3 crop years to evaluate the effect of seed size on vigor, yield and market grade off 'Virginia Bunch 46-2' arachis hypogaea. We included 10 classes, ranging in size from those passing through a 12/64" X 1" slotted screen, and counting 120 seed per ounce to those remaining on a 24/64" X 1" slotted screen, and counting 20 seed per ounce.

With only occasional exceptions, seedling emergence increased with increase in size of seed planted.

Four weeks after planting, plants from the largest seed were 4 times the dry weight of plants from smallest seed. At 8 weeks, plants from smallest seed were 52%, and at 12 weeks 74%, of dry weight of those from largest seed. In 1958, a season of adequate rainfall, plants from all seed classes were approximately equal in size at 12 weeks.

Yield differences associated with size of seed planted in 1959, were not significant. In 1957 and 1958, yield increased with size of seed planted. Yields were 2,680 to 3,332 pounds per acre in 1957 and from 3,015 to 4,874 in 1958, or increases of 652 and 1,859 pounds per acre, respectively.

Generally the percent extra large seed increased with increase in size of seed planted, and the same was true (but to a lesser extent) for seed riding a 15/64" X 1" slotted screen (market grade "sound mature kernels").

Although their performance was superior in every respect, the largest seed used (20/oz.) would be unobtainable for commercial planting. The next two sizes, 28/oz. and 35/oz., would be available as extra large seed, and the 45/oz. size would approximate mediums of the trade. The performance of 45's closely approached that of the 35's and 28's in every respect. This, together with generally poorer performance of the smaller seed, (those smaller than 52/oz.) suggests that mediums might be used advantageously for planting large-seeded Virginia type peanuts comparable to the cultivar used in this study. Extra large and No. 1's (61 and 70/oz.) could be diverted for other uses. Seed smaller than 70/oz. are not normally used for planting. The use of only mediums for planting would help insure a more uniform distribution of seed in the row at planting.

Comparative Nutrient Content of Main Stem Leaves of 15 Peanut Cultivars: P, K, Ca and Mg

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ABSTRACT

The upper leafy portions of the main stems of highly fertilized cultivars were sampled on July 9 and September 2, 1968, and the contents of P, K, Ca, and Mg subsequently determined. The P and K contents were highest in the July samples, whereas Ca and Mg, generally, were highest in the September samples. However, the Mg contents of the Spanish and Valencia cultivars were similar for both dates of sampling. The average % P, % Ca, and % Mg in the Spanish and Valencia tissue was lower than for the Virginia variety. Within samplings, % K was similar in all cultivars except Tenn. Red tissue which contained less K than the Spanish tissue.

The average % Ca in Va. 56R and N. C. 5 was higher than in Va. Bunch 46-2, Va. 61R, and Florigiant, but Florigiant was higher in % Mg than the other large-seeded cultivars. Among the small seeded Virginia cultivars, Early Runner, Dixie Runner and Southeastern Runner were higher in average % Ca and % Mg than Va. B67 and Ga. 186-28. The Starr, Spantex, Argentine, and Dixie Spanish tissue was higher in % Ca than Tenn. Red, whereas within this group of cultivars, Starr was highest in % Mg.

Average nutrient contents of the July samples were 0.30% P, 3.2% K, 1.0% Ca, and 0.45% Mg. The September samples contained 0.14% P, 2.0% K, 1.75% Ca, and 0.50% Mg.

Field Emergence Of Seed Peanuts As Affected By Digging Dates, Harvesting Methods, Fungicide Treatments, Planting Dates, And Planting Depths[1/]

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ABSTRACT

In the spring of 1968, exploratory investigations of the effect of certain production practices on the field emergence of seed peanuts were conducted at the Peanut Belt Research Station at Lewiston, North Carolina. Seeds were Virginia type peanuts of the NC-5 variety from the 1967 crop.

Emergence counts were found to decrease progressively (83, 80, 71%) with seed lots from digging dates of October 5, 12, and 19. Mean emergence of 80% from machine inverted seeds that were combined at 15% moisture using a low

cylinder speed did not differ significantly from that for stackpole cured lots. Mean emergence of 77% from seeds cured in a random windrow and combined at 30% moisture using a high cylinder speed was statistically less than that of machine inverted and stackpole cured lots. Cerecap treated seeds gave best emergence (82%), followed by Difolation (78%), Botran-Captan (77%), and Arasan 75 (74%). Differences in fungicide effects were more pronounced under adverse than under favorable conditions for germination and seedling emergence. Emergence of 73, 78, and 82% for plantings of April 26, May 7, and May 21 respectively, as well as increased emergence rates for the later plantings reflected the increasing favorableness of conditions for germination and seedling emergence. Average emergence of 81% for a 1½ in - planting depth was significantly higher than the 75% obtained for a 3-in planting depth. Differences between depths were most pronounced under adverse field conditions.

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SEED-BORNE DISEASE PROBLEMS ON PEANUTS

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ABSTRACT

A number of distinct diseases affect peanuts early in the growing season. When considered individually many of these diseases do not appear to be important. Collectively, however, they often are serious.

Of these, pre-emergence diseases have probably the most direct effect on stand establishment. Planted seeds and very young plants are subject to two types of diseases before emergence. The entire seed may be decayed, or the developing embryo of young plants may be attacked by saprophty or damping-off fungi. The organisms associated with pre-emergence diseases have not been extensively studied. Soil-borne parasitic and saprophytic fungi may decay seeds, especially if germination is delayed or if the seed is damaged.

Several years ago a relatively new pre- and post-emergence disease, caused by the fungus Aspergillus niger, developed into a serious problem in the Southeastern States. Damage from this disease necessitated replanting peanuts throughout southeastern Alabama in 1963 and 1964, with some fields showing as high as 90 per cent plant mortality. Although the disease develops on plants from germination to maturity, it is most important as it affects the initial stand. Infection apparently takes place through lesions in the seed coat and spreads from cotyledons to the stem. When plants approaching maturity are attacked, there is a general wilt. The disease is favored by conditions of high soil moisture, low fertility, poor soil texture, and continuous cropping to peanuts. Under Alabama conditions commercially available varieties show no specific resistance to the disease. Control recommendations include: avoidance of excessive seed injury, planting peanuts in rotation with corn, small grains or other grasses, and

seed treatment. Organic mercurials, applied at recommended rates to seed peanuts, have proved ineffective in controlling the disease since it has been shown that A. niger is tolerant of mercury. However, mercurial compounds used in combination with nonmercurial chemicals have proved effective in control of Aspergillus crown rot and other seed- and soil-borne diseases of peanuts as well.

Losses from pre-emergence diseases of peanuts may be reduced significantly by seed treatments. Properly applied seed fungicides will be effective against seed-borne parasites and saprophytes, and if germination is not unduly delayed by adverse weather conditions these fungicides will be effective also against soil-borne fungi. Most of the beneficial results of seed treatment of peanuts is due to prevention of decay prior to germination.

WHEN WILL MODERATE INCREASES IN LANDPLASTER RATE RESULT IN DECREASED LOSSES FROM POD ROT (POD BREAKDOWN) IN VIRGINIA PEANUTS?[1/]

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ABSTRACT

In 9 peanut growing seasons I obtained data from more than 20 field studies on pod breakdown (pod rot) of Virginia peanuts in which the standard rate of landplaster was increased in the range of 2X to 10X. After 1967, 16 studies with landplaster rate increases of 2X, 3X, and 4X were selected for detailed analyses. On these 16, 6 showed benefits classifiable as spectacular, 5 showed moderate benefits and 5 showed not notable benefits. Each study had a no landplaster check-- plots on which no landplaster was used.

Four of the 6 spectacular benefits were from tests in which 12% or more of pods in no landplaster checks were rotted at harvest. Three of the 5 not notable benefits were from tests with less than 8.5% of the pods rotted in no landplaster plots. This left the 5 moderate benefit tests, 2 of the spectacular benefit tests and 2 of the not notable benefit tests in a sort of pod rot "no-man's land" with harvest time pod rot counts of between 8.5% and 12% in check plots.

Interpretation by graphs of results of 6 selected studies strongly suggests 3 natural groups of fields as regards pod rot potentials and response to landplaster increases: 1) those with a high potential which will almost always give beneficial response to moderate increases in landplaster rate; 2) those with a low potential which almost never will give beneficial response to moderate increase in landplaster rate; and 3) those with an intermediate potential which may or may not give beneficial results from moderate increases in landplaster rate.

A 3-field test in 1968 suggests that it is possible to obtain a negative but accurate measure of the pod rot potential of particular fields, even those in the intermediate potential group. The prospects of a practical use of this negative disease factor remains to be investigated.

1/ *Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Research Division, Virginia Polytechnic Institute.*

PRELIMINARY EVALUATION OF PEANUT LINES FOR RESISTANCE TO THE SOUTHERN CORN ROOTWORM IN THE GREENHOUSE 1/

J. C. Smith & D. M. Porter
Assistant Professor of Entomology, Research Division, Virginia Polytechnic Institute, Holland, Virginia and Plant Pathologist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Tidewater Research Station, Holland, Virginia, respectively.

ABSTRACT

Thirty peanut lines, including Virginia, Spanish, and Valencia types, were subjected to known numbers of larvae of the southern corn rootworm (Diabrotica undecimpunctata howardi Barber) to determine varietal reaction. The technique employed laboratory reared rootworms in the second instar. Fifty rootworms were placed in bushel baskets each of which contained three peanut plants 90-110 days old. Larvae were allowed to feed for 7 days, then all fruit was removed and peanuts were inspected for injury. Degree of damage was not considered; any visible feeding scars caused a peanut to be classified as damaged.

We observed a differential response to feeding by rootworms in the 30 lines. Statistically different values were measured in the immature fruit with a range of 10-45% damaged fruit and a mean of 22%. Damaged mature fruit ranged from 8-31%, but differences were not significant. The variety, Argentine, which had shown a degree of resistance in the field test, had the most susceptible immature fruit of all lines tested. The line PI 262048, reported as resistant in field tests, likewise suffered high damage in the forced-infestation experiment. The reaction of these two lines lends support to the proposition that field resistance of Spanish and Valencia lines in Virginia is probly due to their early maturity and subsequent escape of the damaging rootworm generation.

The differential response in peanut lines observed by the authors is not believed to be an expression of maturity, and certainly was not due to an escape as can easily occur in the field tests. Campbell and Emery in North Carolina have reported a relatively high degree of resistance for lines NC 343 and NC 301. We also observed a difference in feeding response when rootworms were given a choice of lines. The factors involved in the differential reaction of peanut lines to attack, both in field and laboratory, are under further investigation. Lines that have shown the greatest promise of resistance are being rechallenged in the laboratory and greenhouse at both higher and lower levels of infestation.

1/ Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Research Division, Virginia Polytechnic Institute, Holland, Va.

THE EFFECTS OF FIELD EXPOSURE AND WINDROW TYPE ON MICROFLORA, ESPECIALLY ASPERGILLUS FLAVUS, ASSOCIATED WITH PEANUT FRUITS 1/

D. Morris Porter and F. Scott Wright
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ABSTRACT

Of 25,600 pieces of peanut shell and seed plated from sound mature pods of the cultivar Virginia 61-R, 49.2% gave rise to microorganisms after incubation. The isolation density of fungi and bacteria from shell and seed platings was 74.1% and 24.2%, respectively. The dominant fungi isolated from shells included Fusarium spp., Trichoderma spp., Chaetomium spp., Epicoccum spp. and Alternaria spp. The dominant seed microorganisms included A. flavus, Penicillium spp., Botrytis spp. and Fusarium spp.

Fewer fungi were isolated from pods that were windrowed in the up position (44.4%) than from the down windrow (52.4%). Fusarium spp., Trichoderma spp., Rhizoctonia spp., Epicoccum spp. and Botrytis spp. were isolated more frequently from the down windrow than from the up windrow. However, Chaetomium spp., Thielavia spp. and Alternaria spp. were isolated more frequently from the up windrow.

More fungi were isolated from pods that were windrowed for 12 days (59.8%) than those windrowed for 4 days (36.8%). Fusarium spp., Trichoderma spp., Epicoccum spp., Phoma spp., Botrytis spp. and Alternaria spp. were isolated more frequently after 12 days exposure than after 4 days. Others including Chaetomium spp., Thielavia spp. and Rhizoctonia spp. were isolated more frequently after 4 days exposure.

Incubation for 5 days after combining had little effect on the pod microflora.

The isolation density of A. flavus was low (3.7%) although pods were inoculated with this fungus immediately after digging. A. flavus was isolated more frequently from seed (4.9%) than from pieces of shell (2.4%). The isolation density of A. flavus from pods (shell and seed) windrowed in the down and in the up position was 4.5% and 2.9%, respectively. Isolates of A. flavus were obtained almost twice as readily from pods exposed for 4 days as from pods exposed for 12 days. Plating immediately after combining, or 5 days after combining, had little effect on the isolation frequency of A. flavus.

1/ Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Research Division, Virginia Polytechnic Institute, Holland, Virginia

EFFECT OF FULL AND RESTRICTED SUN EXPOSURE ON CURING PEANUTS[1/]

Aubrey C. Mixon and Paul A. Mott
Research Agronomist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and Advisory Agricultural Meterologist, Environmental Science Services Administration, U. S. Weather Bureau, U. S. Department of Commerce, Auburn, Alabama, respectively.

ABSTRACT

Green peanut pods, considered to be at optimum maturity from peanut plants, Arachis hypogaea L. 'Early Runner', were exposed to available and restricted sunlight until dried to 20, 15, 12, 9, or 7% seed moisture. Samples removed from sun exposures with seed moisture higher than 7% were dried to 7% average seed moisture in ambient-air forced-draft drying bins. Treatments were stored in closed containers at 75% relative humidity for 3 months before processing. The full-sun exposure treatment reduced germination of sound mature seed 1 year, and germination of sound immature seed all 3 years, as compared to restricted (50%) sun exposure. Exposure of pods to full sunlight reduced promptness with which both mature and immature seed germinated in a 25 C germinator. Greatest reduction in promptness of germination and total germination occurred in immature seed from the fully exposed pods. Each year the percentage of seed breakage upon shelling was greater for peanuts in available sun than for those in restricted sun treatments. In 2 out of 3 years, drying peanuts to 9 or 7% seed moisture, in available sun, resulted in a less desirable flavor of roasted ground, mature seed than of those dried to 20% moisture in full sun and then dried to 7% moisture in ambient air.

1/ Cooperative investigation of Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Environmental Sciences Administration, U. S. Weather Bureau, U. S. Department of Commerce, and The Alabama Agricultural Experiment Station.

QUALITY EVALUATION OF LOW-TEMPERATURE-DRIED PEANUTS

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Field Crops and Animal Products Research Branch
Market Quality Research Division
Agricultural Research Service
U. S. Department of Agriculture
National Peanut Research Laboratory
Dawson, Georgia

ABSTRACT

In cooperation with Transportation and Facilities Research Division, a 2-year study was made of the quality changes effected by 60°F and 40°F drying of peanuts, compared to drying at ambient and at 95°F temperatures. Other test variables included peanut variety (Starr Spanish, Early Runner, and Florigiant Virginia), air-flow rate (5, 10, and 20 cfm/ft^3), and location in drying bin (top, middle, and bottom third). Tests of quality included preference of flavor panel, corrected optical density of oil at 450 mu, refractive-index- determined iodine value of oil, free fatty acid content of oil, Hunter "L" reflected-color measurement of kernels and butter, and color-panel darkness-lightness ranking of peanut butter.

The following summary conclusions are tentative, pending further statistical analysis:

Flavor of low-temperature-dried peanuts was inferior to controls for each variety tested. Location in the bin was also important to flavor.

For each variety, optical density of the oil was less for controls than for low-temperature-dried nuts, less for 60°F treatments than for 40°F ones, and greater for bottom than for top location in bins.

Although treatment differences for iodine value were very small, values for Florigiant were less than those for Early Runner or Starr Spanish; values for Spanish were greater in 1967 than in 1968.

For each variety free-fatty-acid percentage was lower for controls than for low-temperature treatments. Values for bottom location were lower than those for middle, and middle, lower than top.

Controls of raw, roasted, and roasted-blanched kernels were darker than low-temperature-dried samples for each variety. Location in the bin was also important to kernel color.

Both Hunter "L" values and color-panel ranking showed control peanut butter generally darker than the low-temperature treatments. Location in the bin was also important to butter color.

It seems apparent, then, that flavor-panel and color-panel determinations of quality difference between controls and low temperature-dried peanuts were supported by a variety of accompanying objective measurements, and vice versa.

INFLUENCE OF CURING TEMPERATURE ON THE VOLATILE COMPONENTS OF PEANUTS

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ABSTRACT

Profiles of volatiles produced by peanuts cured at 22°, 35°, 45°, and 50° were analyzed in relation to evaluation of flavor and aroma by a taste panel. Three compounds were found that might indicate flavor deterioration. Content of acetaldehyde increased with each increase in curing temperature. Ethanol did not differ markedly among peanuts from the first three temperatures. Both these compounds, however, increased considerably between 45° and 50°C. Ethyl acetate was not detected in peanuts cured at 22°, showed only traces at 35° and 45°C, but was found in considerably quantity in samples cured at 50°C. The presence of ethyl acetate in the volatile profile from peanuts could indicate flavor deterioration. Increase in these three compounds were reflected by evaluation of flavor and aroma by the taste panel. All panelist detected differences between peanuts cured at 45° and 50° and between 22° and 50°C; all preferred those cured at the lower temperatures. Ratios between certain peaks (gas-liquid chromatography) also showed consistent trends that might be related to curing temperature.

EFFECT OF MATURATION ON THE VOLATILE COMPONENTS OF HIGH-TEMPERATURE CURED PEANUTS

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ABSTRACT

Changes in the volatile components of high-temperature-cured peanuts were evaluated, as possible quality indicies, by organoleptic and volatile profile analyses. Quantitative and qualitative changes were found between the early (4 to 6 weeks) and late (11 to 12 weeks) stages of maturity. Ethyl acetate, previously not detected in uncured peanuts, was found in all high-temperature-cured samples. Ethanol content did not change with maturity but was greater in a high-temperature- cured samples than the contents reported for uncured peanuts. Concentration of acetaldehyde, ethyl acetate, methyl formate, and in unidentified compound were highest in peanuts at 5 weeks of age and this sample gave an atypical off-flavor. Off-flavor in the samples decreased with maturity as judged by the taste panel. Activity of alcohol dehydrogenase in high-temperature-cured peanuts (4 to 7 weeks) was greater than in uncured samples. This activity might be involved in the formation of

ethyl acetate, acetaldehyde, and ethanol which probably contribute to typical off-flavor in high-temperature-cured peanuts.

CHANGES IN THE PEANUT VOLATILE PROFILE AND THEIR RELATIONSHIP TO ENZYME ACTIVITY LEVELS DURING MATURATION

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ABSTRACT

The profiles of volatiles from uncured kernels sampled weekly from the 6th to the 13th week after pegging were determined using gas-liquid chromatography and mass spectrometry. Total volatile production of the kernels reached a maximum at 8 weeks and then decreased rapidly to a minimum at 11 weeks. A slight increase at 12 weeks might be related to the transition between maturation and ripening of the peanut kernel. Observations beyond 12 weeks indicate a subdued decrease in total volatiles. Five major volatile components were identified: acetaldehyde, methanol, pentane, ethanol, and hexanal. Traces of acetone and pentanal also were detected. Except for hexanal, which first appeared at 8 weeks, all major components were present throughout maturation. Possible relationships between alcohol dehydrogenase and lipoxidase activities and the fluctuations in acetaldehyde, ethanol, pentane, and hexanal during maturation are discussed.

CHARACTERIZATION OF THIAMINE AND ITS DERIVATIVES IN THE PEANUT

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ABSTRACT

Several forms of thiamine probably exist in the raw peanut. About 65% of the total is unphosphorylated free thiamine, while 35% exists as phosphate esters, mostly thiamine monophosphate. A small portion of the thiamine is in the biologically active thiamine phyrophosphate or cocarboxylase form. No thiamine disulfides were detected. Thiamine-protein complexes very likely exist in the peanut. Sephadex gel filtration and dialysis experiments indicate that a small amount of thiamine is tightly bound, possibly in a covalent or ionic linkage. Protein precipitation by ammonium sulfate from a 1M NaCl extract of peanuts yielded 34% of the thiamine in the precipitate, indicating an affinity of the two components for association. Phosphoesterase action must be accounted for in any quantitative consideration of the chemical forms. (To be submitted to J. Agr. Food Chem.).

FORMULATION OF SAMPLING PLANS FOR THE DETERMINATION OF AFLATOXIN IN SHELLED PEANUTS

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ABSTRACT

A multiple sampling plan, called attribute sampling, was discussed as a method to determine if the mean level of aflatoxin in a lot of shelled peanuts exceeded a predetermined critical level. Assuming that the distribution of aflatoxin in a lot of peanuts may be approximated by the negative binomial distribution, the method of computing an operating characteristic curve for a multiple sampling plan was described. From the operating characteristic curve, a measure of both the consumer's and processor's risk can be evaluated. The operating characteristic curve for the sampling plan to be used by the peanut industry starting in fall 1969 was described.

GROUP DISCUSSION SUMMARIES

PEANUT QUALITY INVESTIGATIONS
FCAP, MQRD, ARD, USDA

C. E. Holaday
Leader, Peanut Quality Investigations

The Peanut Aroma and Flavor group had three people who made formal statements on "Peanut Aroma and Flavor." Mrs. Kay McWatters of the Georgia Agricultural Experiment Station, Experiment, Georgia discussed the factors involved in evaluating the flavor of peanuts; Dr. George Waller of Oklahoma State University, College of Agriculture, Agricultural Experiment Station, Stillwater, Oklahoma, discussed briefly some of the recent work on the identification of flavor constituents of roasted peanuts; Dr. Harold Pattee, Market Quality Research Division, ARS, North Carolina State University, Raleigh, North Carolina, described some of his recent work on GLC volative profile analysis as a means of quality control of raw peanuts.

Approximately 35 people attended the discussion. The participation was excellent as numerous questions were asked each speaker. I believe the discussion group approach is an excellent idea; however, I feel there should be a limitation on the number of speakers for a particular group. I attended one group which had 6 speakers and no one had sufficient time to discuss his subject adequately.

In my opinion the discussion group idea should be expanded. People appear to participate more at these informal gatherings.

WEED CONTROL DISCUSSION GROUP

Ben R. Spears,
Texas Agricultural Extension Service

Fifteen individuals, including State and USDA Research Staff, Extension Staff, chemical company representatives and one farmer participated in the weed control discussion group.

With Ben R. Spears, Texas Agricultural Extension Service, serving as discussion leader, short prepared statements were made by Ellis Hauser, Georgia Coastal Plain Experiment Station; C. N. Nolan, South Carolina Agricultural Extension Service; Gale A. Buchanan, Auburn University; O. D. Rudd, Virginia Polytechnic Institute; Benny Rogerson, North Carolina Agricultural Extension Service and Morris Merkle, Texas A & M University.

Points raised by the speakers and by others in attendance were discussed during approximately 40 minutes allowed for this purpose. Primary concern, common to all but one or two states, was the "Ecological Succession" (as termed by Dr. Hauser) of weed pests. Where crop rotations are feasible, it was cited that the use of herbicides on each crop would bruaden the assortment of weeds controlled and could minimize the ecological succession of weeds. Much of the discussion centered on broadleaved weeds that are tolerant to presently available preplant and preemergence herbicides and the need for cheap and effective postemergence herbicides. The results of herbicide tests were cited along with the potentials for clearances and possible recommendations Among those with promise for potential postemergence applications in several states was 2,4-DB.

There was active participation by all attending. It was felt that the discussion group approach was desirable and some good exchange on ideas and techniques occurred. However, the shortage of time limited exploration. It appeared that a more effective exchange could be obtained if more time was provided. Another alternative, though less desirable, would be to form still smaller groups that have common problem situations of peanut varieties, climate and weed species.

REPORT OF THE STORAGE AND HANDLING COMMITTEE

Ben M. Birdsong,
Leader Discussion Group B.

The American Peanut Research and Education Association held its first annual meeting July, 13, 14, and 15th at the Hilton Inn, Atlanta Georgia.

The Storage and Handling Committee met as scheduled in the Dogwood Room. Attendance was at full capacity with some standing room utilized. The purpose of the seminar was to stimulate discussion within the industry and to encourage free exchange of information with the technical people who attended our session.

Mr. W. A. Horton of Sessions Oil Mills, Enterprise, Alabama was the first speaker. He has quite a background of experience in the field of storage and handling of peanuts and spoke extemporaneously on the subject of storage,

insect and rodent control and in general outlined the procedures used by the milling industry in the Southeast.

We were also pleased to have with us Mr. L. M. Redlinger, USDA Entomologist located in Tifton who is in charge of insect problems in stored peanuts. This of course is a broad subject and considerable discussion followed both pro and con relating to this important area of discussion.

We also had a report from Reed Hutchison of the Dawson Laboratory who gave us a resume of the progress thus far and participated in a question and answer period relative to the USDA and its activities in the area of storage and handling It was particularly interesting to have Mr. Hutchison report that progress was being made and that in the next six to eight months the Dawson Laboratory should start to be a very effective instrument and of the great assistance to agriculture in general and the total peanut industry in the United States.

In summary, I would say that the people who attended the session which was a "full house" participated freely in the discussion and we actually went about 15 to 20 minutes overtime and finally since the room which was assigned to us was required for another session, we adjourned this meeting which I did feel was well received and of some meaningful benefit.

AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION
DISCUSSION GROUP
In
Agronomic Practices
Atlanta, Georgia
1969
A. H. Allison, Chairman

Each person on the panel gave a 7 minute presentation and we had approximately 8 minutes for discussion of each panelist's report immediately after his formal presentation. Visuals were used which added greatly to this discussion since it related agronomic practices in a given area to those practices actually being carried out by farmers in that area. All phases of agronomic practices and production management were discussed. Perhaps the 3 topics most discussed were:

1. Herbicides. (Probably should be included in agronomy)
2. The role of nitrogen in peanut nutrition.
3. The role of calcium in peanut nutrition.

Approximately 27 attended this session.

PEANUT VARIETY AND BREEDING DISCUSSION GROUP

By
Astor Perry
Extension Peanut Specialist
North Carolina State University

In the peanut variety and breeding discussion group, reports were heard from each major peanut producting state on the variety situation in the state, changes anticipated in the variety picture in the near future, and breeding techniques beiug used. The following reported for the various states:

Alabama	Aubrey Nixon
Florida	A. J. Norden
Georgia	R. O. Hammons
North Carolina	Johnny Wynne
Texas	Charles Simpson
New Mexico	David Hsi
Virginia	Morris Alexander
Private Industry	J. E. Harvey, Goldkist Peanuts

The attendauce was approximately 25 and the interaction between the speaker and the audience was excellent. One of the questions raised concerned the use of the backcross method. The general comment was that it had beeu used rarely because so little was known about what constitutes desirable characteristics in peanut varieties. It was pointed out, however, that this method was used successfully in Senegal to obtain resistance to the rosette disease.

The participants in the peanut variety and breeding discussion group felt that discussion groups were the highlight of the entire APREA program because it gave people with the same interest and opportunity to exchange ideas in an appropriate educational setting.

SUMMARY OF DISCUSSION GROUP ON PEANUT INSECTS

R. L. Robertson
Extension Entomologist
Discussion Leader-
"Peanut Insects"

Summaries of peanut insect problems as well as research and extension activities in states represented were given by the following:

Dr. W. V. Campbell, Entomologist, North Carolina State University

Mr. W. C. Rhodes, Entomologist, University of Florida

Mr. Loy Morgan, Entomologist, Coastal Plains Experiment Station, University of Georgia

Dr. John Smith III, Entomologist, Tidewater Research Station, Virginia Polytechnic Institute

Mr. Ben Spears, Extension Agronomist (Peanuts) Texas A & M University

After each summary the floor was open for questions and for comments from anyone present.

Approximately 25 persons, other than formal participants were present for most of the session.

Comments from several persons present were favorable. They indicated that informal discussion groups such as this was one of the most valuable sections of an excellent meeting.

MANUFACTURING EQUIPMENT DISCUSSION GROUP

Peter J. Tiemstra
Director of Research & Quality Assurance
Swift Grocery Products Co.

We were happy to have Mr. Raymond Micras and Mr. Homer Holland discuss Electronic Sorting Equipment as pertains to peanut processing. In addition, Mr. H. H. Underwood discussed continuous sampling. Both of these are extremely important to the problems the industry faces in producing aflatoxin-free products.

In addition, Mr. James Tebay discussed Nuclear Magnetic Resonance as it pertains to measuring fat in peanuts and peanut products.

We are disappointed that there were not more of our manufacturing and processing friends in attendance to take advantage of the information and participate in the discussion.

REPORT OF DISCUSSION GROUP ON HARVESTING AND CURING

A. J. Lambert
Discussion Leader

Approximately forty people attended the discussion group on harvesting and curing. Formal three to five minute statements relating to recent developments on harvesting and curing were made by the following: Dr. William F. Lalor --

Dr. William F. Lalor	Alabama
Dr. John M. Troeger	Georgia
Dr. James H. Young	North Carolina
Myron D. Paine,	Oklahoma
Dr. James L. Steele	Virginia

In addition, W. T. Mills, Lilliston Corporation; R. S. Hutchison, AMS, USDA; and Dr. J. L. Butler, ARS, USDA were asked to make informal statements. It was necessary to limit discussion on various phases of harvesting and curing to insure that all areas were covered. Fortunately, the last on the program, the curing phase, generated the most discussion. Interest centered around new ideas and concepts of drying. Time was extremely limited for a thorough discussion of possible new drying concepts.

Briefly, in informal presentations, comments included the report of a study of cylinder design in Alabama in cooperation with Lilliston Corporation. In Georgia, research is in progress on the inverter and on curing with emphasis on taste studies. North Carolina is doing research in basic areas to determine

equilibrium moisture content and the rate of attaining equilibrium. In Oklahoma, research was reported on the design of a vacuum drying process and the relation between mold growth and short duration storage conditions. In Virginia, research is being conducted on nearly all phases of field harvesting and artificial drying especially as related to physical and mechanical problems of peanuts.

A concluding statement emphasized continued educational effort and expressed the opinion that adoption of presently known procedures for mechanically harvesting and curing peanuts will result in a quality product. However, the desire to reduce field losses, damage, drying time, and mold growth potential are ample reasons to continue research programs.

SUMMARY
DISCUSSION GROUP - PEANUT PRODUCT RESEARCH CONDUCTED AT FIRST ANNUAL MEETING OF APREA

By
James J. Spadaro

The participation of those in attendance was considered excellent in that most of the approximately 35 persons present took part in the discussion with great interest and enthusiasm. Question, answers, and comments continued vigorously for 15 minutes beyond the scheduled one hour, i.e., from 4:15p.m. to 5:30 p.m., at which time the meeting was terminated by the discussion leader. It is my impression that every one present liked the discussion group approach very much and that they all benefited from the presentations and discussions that followed.

As discussion leader I briefly outlined the peanut research activities at the Southern Regional Research Laboratory in New Orleans, and pointed out that at least two of the speakers would discuss peanut product research at their respective universities.

Formal statements of 5 to 10 minutes each were made by the following speakers:

1. Dr. Jack H. Mitchell, Jr., Department of Food Science, Clemson University, Clemson, North Carolina. He discussed the development of products such as the full fat peanut flakes.

2. Mr. Hubert Harris, Department of Horticulture, Auburn University, Auburn, Alabama, brought numerous samples of peanut products and discussed their developments.

3. Dr. Sexton, Corn Products Co. emphasized the need for considering the economics in product research, in costs of raw material and in marketing of new products.

4. Mr. Bill Horton, Sessions Company, Inc., Enterprise, Alabama, discussed the need for research on the utilization of peanut hulls.

5. Dr. J. G. Woodroof, (retired) Georgia Experiment Station, Experiment, Georgia, related the overall need for increased research on peanuts. He also called on Mrs. Kay McWatters to discuss her work on new peanut products.

6. Mr. Lewis Branscomb, Gold Kist Peanut Growers, Graceville, Florida, discussed the subject of manufacture of peanut flour.

MINUTES OF THE BUSINESS MEETING, PIWG
July 16, 1968 - Norfolk, Va.

The meeting was called to order at the Golden Triangle Motel, Norfolk, Virginia, at 7:50 a.m., July 16, 1968, by Chairman D. L. Hallock.

The attached agenda of the meeting was adopted.

The minutes of the Annual Meeting, April 4, 1967; and the minutes of the PIWG Executive Committee Meeting, July 10, 1967, were approved.

The Treasurer's report was approved.

Chairman of the Publications Committee, W. K. Bailey, reminded the meeting that proceedings of the meeting would be printed and requested that all manuscripts be delivered to him by August 1, 1968. He also asked that summaries of papers be made and given to him for publication in Peanut Research.

T. C. Campbell asked if summaries of the group sessions would be published and Chairman Hallock said they would if prepared by the session leader.

C. R. Jackson asked who would handle publication of the proceedings. He mentioned the problems associated with distribution of the proceedings and said policies and arrangements should be decided upon to facilitate proper distribution.

W. K. Bailey stated that proposed changes in the organization should remedy most of the problems referred to by Dr. Jackson.

S. W. Lee stated that he did not feel it was the function of PIWG to supply information to foreign countries.

C. T. Wilson reported on progress toward revision of the Book "The Peanut - The Unpredictable Legume." Dr. Wilson stated that forms had been distributed requesting suggestions for chapters and authors in the revised book. He announced that J. S. Sugg had asked him to proceed with preparations for publication and not worry about financing.

A. L. Harrison stated that herbicides should be covered in the book.

C. T. Wilson asked that the suggestion be made on the form which had been distributed.

D. A. Emery, Chairman of the Committee on Peanut Quality, named the members of the committee and discussed the objectives and history of the committee. He listed four important quality factors which the committee felt should receive special attention - maturity, milling quality, flavor and blanchability. He stated that standardized measurements for these factors should be developed. He also made suggestions for work that might be used as goals by the new committee on quality. (A copy of the report is attached.)

No further old business was brought before the meeting.

Chairman Hallock presented the proposed new set of by-laws as prepared and recommended by the PIWG Executive Committee.

C. T. Wilson discussed the history of PIWG and the relationship of the proposed American Peanut Institute to PIWG. He stated that the original goals of PIWG would be continued in the new organization and that there would no longer be any need for PIWG. He said the meeting of PIWG did not have the power to discontinue PIWG. He suggested that the organizations which sponsored PIWG be contacted and told that the need for PIWG had ceased to exist after formation of the new organization.

E. L. Sexton moved that the proposed by-laws and recommendations for formation of the American Peanut Institute be approved.

A. H. Allison seconded the motion.

G. F. Hartnett discussed the title of the organization. He stated that the word "institute" does not define the purpose of the organization and suggested the title "American Peanut Research and Development Institute."

W. M. Birdsong, Jr., felt that the name should indicate the intent of the group. He said he felt that the word "institute" indicated that it was the top peanut organization in the U. S. while he felt that the name should indicate it was subservient to, not above, the National Peanut Council.

C. T. Wilson suggested the title - American Peanut Research and Education Association. He stated that the organization should not in any way be subservient to the National Peanut Council but should be completely independent.

Louis Feinstein suggested the name - American Peanut Science Association.

Max Hinds suggested the title - National Peanut Research and Education Association.

D. H. Willard stated that the word "national" creates some confusion in foreign countries since they do not relate the work to the United States.

P. J. Tiemstra suggested that we wait until the next meeting to make a definite decision on the name.

S. A. Watson moved that we accept the name proposed by Dr. Wilson.

A. H. Allison seconded the motion and it carried.

W. T. Mills asked if it would be possible for a representative of the equipment industry to be represented on the board of directors.

Chairman Hallock said that it would be under Article VIII, Sections la, lb, lc.

C. T. Wilson referred to Article IX, Section lb, which states that the nominating committee would attempt to balance out membership on the board and provide for representation of all groups of the industry.

D. H. Willard suggested a change in Article VIII, Section lh, to cover related industries but no motion was made.

A question was raised from the floor about definition of the term "full time student."

R. S. Matlock asked if the term covered graduate assistants.

R. W. Howell stated that the rules for election seemed indefinite.

Chairman Hallock read sections 2 and 3 of Article III. section 3.

C. T. Wilson suggested a change in Article VII, section 3. The Officers and directors nominated by the nominating committee or from the floor shall be elected by members in attendance at the annual meetings. (last sentence of section to remain.)

R. S. Matlock seconded the motion.

C. T. Wilson corrected the wording to read - The officers and directors shall be elected by the members in attendance at the annual meeting from those nominated by the nominating committee or from the floor.

R. W. Howell stated that the last sentence of Article VII, Section 3 implied that other officers would be paid.

The question was called for and the motion carried.

R. S. Matlock discussed the requirements from ex-officio membership.

J. F. McGill suggested that the name of the organization be discussed and considered before the next meeting in hopes of getting a name better suited for the organization.

R. E. Pettit suggested American Peanut Society as an appropriate name.

Chairman Hallock stated that this name had been considered previously.

W. G. Conway called for the question.

N. D. Davis mentioned the concern about dues to be charged this membership.

Chairman Hallock stated that the question had been called for and further discussion was out of order.

The request for question carried with 44 for, and 13 against.

The motion to accept the proposal for the establishment of the American Peanut Research and Education Association and the by-laws as amended, carried unanimously.

S. A. Watson stated that the provision for only one paper per meeting by a member may not be wise at this time.

J. G. Porterfield asked who would receive proceedings and if the membership dues would cover the cost of the proceedings.

C. T. Wilson pointed out that the membership would receive a copy of the minutes of the proceedings of each meeting.

Chairman Hallock interpreted this to mean that the proceedings, including the papers presented at the meetings, would be furnished the members.

S. A. Watson stated that it seemed appropriate to comment on this requirement for dues and discussed the need for funds to operate the organization.

G. B. Duke, Chairman of the Nominating Committee, presented the following slate of officers for the American Peanut Research and Education Association. President, N. D. Davis; President-Elect, David Moake; Executive Secretary-Treasurer, Curtis R. Jackson; State Employees Representative, A. H. Allison; U. S. Department of Agriculture Representative, J. W. Dickens; Peanut Industry Representatives, Ross Wilson, Robert R. Pender, Peter J. Tiemstra.

C. R. Jackson stated he would be willing to serve as Secretary-Treasurer, until a full-time person could be employed.

Chairman Hallock asked for nominations from the floor.

S. W. Lee moved that nominations be closed and the slate of officers be elected by acclamation.

W. M. Birdsong, Jr., seconded the motion, which carried.

Chairman Hallock introduced the new officers and directors present.

S. A. Watson stated that if written summaries of discussion groups were prepared they would be published in the proceedings.

The meeting was turned over to Incoming-President, N. D. Davis, who adjourned the meeting.

Submitted by J. W. Dickens
Secretary-Treasurer of PIWG

MINUTES OF THE REGULAR BUSINESS MEETING OF THE AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION HILTON INN, ATLANTA, GEORGIA, JULY 15,1969

President Davis opened the meeting at 8:30 a.m. A quorum was present.

The Executive Secretary-Treasurer read the minutes from the PIWG meeting of July 1968. The minutes were approved by the membership.

The Executive Secretary-Treasurer read portions of his report to the Board of Directors. He gave the financial statement (included as Appendix I to these minutes). The financial statement was approved by the membership.

L. Atkin asked that PIWG minutes be duplicated and be kept in the files to be available to all members. J. Sugg suggested that the minutes be published. Atkin put his request in the form of a motion that the PIWG minutes be published in the Proceedings. R. Howell seconded. The motion was passed.

J. Sugg, Chairman of the Publications and Editorial Committee, gave the report for the committee. This report is included as Appendix II to these minutes. The report of this committee was approved by the membership.

P. Tiemstra gave the report of the committee on Peanut Quality. This report is attached as Appendix III to these minutes. The report was approved by the membership.

R. Howell questioned the Regional Variety Test portion of the report. Peter Tiemstra amplified the report on this point stating that this applied to the quality features listed in the committee report.

A. H. Allison gave the report of the Public Relations Committee. This report is attached as Appendix IV of these minutes. The report was approved by the membership.

J. Sugg asked that each corporation on the membership list have a designated representative. A. Allison replied that this had been requested when membership was solicited.

D. Moake gave the report of the Program Committee. This report is attached as Appendix V to the minutes. The report was approved by the membership.

W. Conway gave the report of the Nominating Committee. He called attention to the provisions of the By-laws whereby only certain officers and directors are to be elected each year. The Nominating Committee suggested to the membership: For President, D. L. Moake, for President- Elect, J. W. Dickens; for Executive Secretary-Treasurer, Leland Tripp; and for USDA representative, D. J. Banks. Discussion followed as to the duties of the office of Executive Secretary-Treasurer and the compensation for these duties. Conway stated that Tripp had agreed to serve for one year without compensation, after which the Board of Directors should consider some stipend. He further stated that the secretarial help and supplies used by the Executive Secretary-Treasurer would be paid for by APREA.

The membership was asked for additional nominations from the floor. There were no nominations from the floor and D. Willard moved the nominations close and that the nominations of the Nominating Committee be accepted. The motion passed.

New officers and members of the Board of Directors are listed in Appendix VI to these minutes.

New officers and members of the Board of Directors are listed in Appendix VI to these minutes. (In this publication Appendix VI has been deleted and this list is published in its entirety on page three.)

The Executive Secretary-Treasurer recognized the generous services of Mrs. Kay McWatters, Assistant Food Scientist at the Georgia Station, who served as official hostess for the meeting. He further recognized the services of Mrs. Dolores Wilson, Secretary at the Georgia Station in Experiment, for her tireless efforts for APREA and her kind help in registering the membership at the Annual Meeting. Mrs. B. Z. Roberts was also recognized for her help at registration.

The Executive Secretary-Treasurer reviewed several motions that had been passed by the Board of Directors at their meeting on July 13. These were: establishment of a fiscal year, adoption of the Charter, designation of authorized signatories, designation of a depository, and arrangements for investment of surplus funds.

The President clarified for the membership the intent of the Board of Directors, action on investment of surplus funds.

The President thanked the officers, committee chairmen, and members of APREA for their help during the preceding year. He expressed particular gratitude to David Moake for his tireless efforts in arranging the program.

J. Mobley expressed thanks to the organizations listed in the program for underwriting the cost of coffee breaks and the breakfast. He reminded the membership that display space will be available at each meeting for companies who wish to display equipment.

L. Atkin moved that a standing committee be appointed on sampling methods. R. Howell seconded. M. Hinds suggested that this work be done under the Qnality Commttee. L. Atkin withdrew from his motion the word "standing" and P. Tiemstra indicated that the Quality Committee could handle the consideration of sampling methods. L. Atkin stated that he believed it could not be handled as a general matter in the Quality Committee but that a specific committee or sub-committee was needed. The motion, as amended, was passed.

P. Tiemstra reported to the membership that courses are available in statistics and that such courses might be held at the beginning or end of a regular APREA meeting. He asked that any of the membership who are interested contact him.

There being no further business the meeting was adjourned at 9:55 a.m.

Curtis R. Jackson
Executive Secretary-Treasurer
American Peanut Research and
Education Association

APPENDIX I

IV Financial Statement as of June 30, 1969 for the year July 1968-June 30, 1969.

1. Income

a. Transfer from PIWG		$1119.34
b. Membership (183) in the following categories:		
Sustaining 13.	$1,300.00	
Organizational 52.	1,300.00	
Individual 115	575.00	
Student 3	6.00	
		3181.00
c. Annual meeting contribution		90.00
d. Receipt for sale of 1967 proceedings		2.00
Income, Total		$4,392.34

2. Expenditures

Check #100 - Beck, Goddard, Owen & Smalley, Attorneys, for incorporation	$ 346.78
Check #101 - Southern States Printing Co., for ledger, staples, envelopes	16.30
Check #102 - Georgia Experiment Station, for By-Laws supplies, and postage through 12/30/68.	61.08
Check #103 - Hensley Office Equipment Co. for rubber stamp and receipt book	4.93
Check #104 - Southern States Printing Co., for envelopes	5.67
Check #105 - Elkco Printing Co., for programs	55.31
Check #106 - Hensley Office Equipment Co. for Convention badges	4.59
Expenditures, Total	$ 494.66

3. Balance on haud June 30, 1969

Income -	$4,392.34
Expenditures -	494.66
Balance	$3,897.68

APPENDIX II

REPORT OF THE PUBLICATIONS COMMITTEE
APREA
Hilton Inn, Atlanta, Georgia,
July 15, 1969

Gentlemen:

(1.) The Proceedings of the 1968 PIWG and APREA meeting held in Norfolk, Virginia, encountered printing problems and at the last word from the printers should be in the mail to the members of APREA during the last half of July, 1969.

(2.) The publication of the Proceedings of this, the first meeting of APREA, will be published as soon as possible after the Publications Committee can meet during the first part of August, 1969. The Board authorized publication of the Proceedings without waiting on delinquent papers.

(3.) The publication, RESEARCH, which has been printed and distributed by the National Peanut Council will continue to be published and distributed by the National Peanut Council, with an APREA credit line during the next year.

(4.) The revision of the book, THE PEANUT - THE UNPREDICTABLE LEGUME, is proceeding under the guidance of Dr. Coyt Wilson at a satisfactory rate with all chapter authors selected and currently preparing their chapters. The initial draft deadline for manuscripts is October 1st and hopefully publication activities will proceed as rapidly as possible thereafter, with the publication date as early as possible in 1970.

(5.) Copies of Proceedings of past PIWG meetings have been secured and are on file, as a depository, in the office of the Executive Secretary of the North Carolina Peanut Growers Association, P. O. Box 409, Rocky Mount, North Carolina. Those copies on file are:

Research Conference I Atlanta, Georgia Feb. 21-22, 1957 2 copies	Research Conference III Auburn, Alabama July 9-10, 1964 4 copies
Research Conference II Raleigh, N. C. Aug. 13-15, 1962 11 copies	Research Conference IV Tifton, Georgia July 14-15, 1966 1 copy
Proceedings, PIWG Stillwater, Oklahoma July 29-31, 1963 2 copies	Proceedings, PIWG Dallas, Texas April 4-5, 1967 160 copies

Parties interested in purchasing the 1967 Proceedings may purchase them at the rate of $2.00 per copy. All other copies on file in the Depository will be on a restricted use basis. Individuals interested in the use of these copies should contact Joe S. Sugg, Executive Secretary, North Carolina Peanut Growers Association, who is currently in charge of the depository.

Respectfully submitted,

Joe S. Sugg, Chairman
Dr. Coyt Wilson
Wallace Bailey

PUBLICATIONS COMMITTEE

APPENDIX III

REPORT OF THE PEANUT QUALITY SUB-COMMITTEE OF THE AMERICAN PEANUT RESEARCH & EDUCATIONAL ASSOCIATION

The 1967-68 Sub-Committee, the last one to serve under the auspices of the PIWG, suggested four specific recommendations for exploration:

1. To develop standard methods for evaluating the four major areas of maturity, milling quality, flavor and blanchability.

2. Determine optimum levels or minimal standards for these four criteria.

3. Study feasibility of developing regional varietal programs as is being done in the Virginia, N. C. area.

4. Complete a list of industries willing to participate in such programs.

We have surveyed the literature for suitable methodology in the four proposed areas. Tentatively, we have accepted the spectrocolorimetric method of oil color as a measure of maturity and the CLER method for measuring the organoleptic quality of flavor. In addition, the procedures of sampling, expressing the oil from a sample and roasting a sample for flavor analysis have been prepared.

In the write up of the methods, we have established a standard format one feature of which is to describe the expected variation one would expect. In time, we would also hope to see acceptable limits given where possible. The committee recommends that the two tentatively accepted methods be submitted to a calaborative study to determine the variability before final acceptance is made. Thus, it will be possible to evaluate the methods as to their objectivity, ease of handling and applicability.

The problem areas of milling and blanchability do not have suitable methodology to be able to accept one at this time. We urge Federal and State agencies that have money, to conduct research in peanut evaluation to consider these areas as worthwhile endeavors.

We do not wish to leave the impression that the solution of these four problems will dismiss the responsibilities of this committee. They will form the basis on which further methodology can be built. Oil quality such as Iodine value and fatty acid composition are relatively simple extensions of the present methodology which can be preformed and should be considered in establishing the acceptability of new varieties.

This committee did not feel well enough informed to try and establish standards for varietal standards. In fact, some of the committee have reservations as to whether such standards should be established or not. First, what kind of yard stick can be used? Is it sufficient to compare a new variety against an established one and, if so, where should the "standard" variety sample be obtained? It would be preferable to establish object methods with built-in scales to allow scalar standards, but in many instances, such as organoleptic evaluations, this is practically impossible. Second, who should set the standards?

The committee felt that in some instances, it may be wise to have a "referee" who could distribute samples to a "committee" which would evaluate them and return their opinions to the referee who, in turn, would give the consensus opinion of the group. This could be done for each segment of the industry, i.e., grower, sheller and manufacturer. Third, the value that should be placed on each quality characteristic should not be equivalent. For instance, manufacturers would require flavor as a critical criteria that must be met. On the other hand, they would have little interest in yield, although this will have an effect on the economics and be a vital indirect factor. Furthermore, candy manufacturers, salters or peanut manufacturers have different acceptance criteria particularly on blanchability or skin slippage and it would be folly to withhold a variety if one of these groups found it unsuitable while the others would use it. In any case, these problems will have to be studied by the committee in the future.

The committee is recommending to the board that one individual in each of the three major peanut growing areas be assigned to instigate a regional varietal evaluation program. Since the Virginia - North Carolina area already has such a program, this would be a prime example as to how it can be effected in the other areas.

Specifically we recommend the following action for the Peanut Quality Committee in the coming year: 1. Appoint an editor for the methods. These should be put into standard form on loose leaf paper ready for distribution.

2. Run collaborative studies on the two methods tentatively accepted to determine the variability and applicability.

3. Try to obtain suitable methodology for milling and blanching quality characteristics.

4. Further, discuss quality standards and how these can best be implemented for the good of the industry.

Respectfully submitted,

P. J. Tiemstra, Chairman
J. W. Dickens
D. A. Emery
E. Harvey
C. E. Holaday
V. F. McGill
A. Perry
E. L. Sexton
L. D. Tripp

APPENDIX IV

REPORT OF THE PUBLIC RELATIONS' COMMITTEE
of the
AMERICAN PEANUT RESEARCH and EDUCATION ASSOCIATION
Hilton, Inn, Atlanta, Georgia
July, 1969

First of all, I think it would be well to explain how the first (original) membership list for solicitation was made. First of all, we took the mailing list of the Research Newsletter published or assembled by Mr. Wallace Bailey of U.S.D.A. and listed all of the names on his list and then cross referenced it with the 1968 PIWG and prior memberships. We came up with a total list of potential members, and to whom solicitation letters were mailed, of 792 persons. The Public Relations' Committee, who served with me were as follows:

(1) Dr. Jim Butler
Coastal Plains Experiment Station
Tifton, Georgia

(2) Mr. Dean Carter
Planters Peanuts
Division of Standard Brands
Suffolk, Virginia

(3) Mr. D. H. Harden
G.F.A. Peanut Association
Camilla, Georgia

(4) Mr. William T. Mills
Lilliston Corp.
Albany, Georgia

(5) Mr. Syd Reagan
Southwestern Peanut Shellers Assoc.
Dallas, Texas

The total list of 792 persons was divided up equally among these members and they sent out letters to each person on their list at their own time and expense. From the 792 persons solicited, we received 187 members prior to the time of the first conference of the APREA. Of this 187, 13 were sustaining memberships($100), 52 were organizational memberships ($25), 119 individual memberships ($5) and 3 student memberships ($3). At the end of the meeting, we have a total of 210 memberships. The chairman of the committee then recognized all companies (13) who took sustaining ($100) memberships.

I would ask all members who have an opportunity to solicit memberships, to receive them and do so as frequently as possible; to accept the money for same and remit it to the current chairman of the Public Relations' Committee, so that

he can permanently record the names of the individuals and then he will in turn pass this money on to the Executive Secretary-Treasurer.

The chairman of the Public Relations' Committee then told the membership that there were some people present for whom no addresses were listed, and that in the event any of these individuals did not receive copies of the proceedings of the Association's meeting in Atlanta, then they should call this to the attention of the Executive Secretary or the President for the coming year.

In conclusion of this report, let me say that we are always saddened by the passing of our colleagues and friends since the last meeting. At this time, as chairman of the Public Relations' Committee, I would like to recognize the untimely death of three loyal, dedicated and long time workers and friends of the peanut industry. They are as follows:

Dr. B. B. Higgins, Georgia Station, Experiment, Ga. Pioneer peanut breeder who developed 6 varieties of peanuts and contributed to concepts of disease control.

Mr. K. T. Holley, Georgia Station, Experiment, Ga. Chemist who spent most of his professional life studying the chemical attributes of quality and flavor of peanuts.

Mr. W. J. McKimmey III, a prominent young Georgia peanut grower and son of Mr. W. J. McKimmey, Chairman of the Georgia Peanut Commodity Commission.

Mr. Chairman, let the records of the American Peanut Research and Education Association show our sorrow for the untimely deaths of these three friends and it is the recommendation of this committee that an appropriate letter of expression be presented to their families.

Respectfully submitted,

A. H. Allison, Chairman
Public Relations' Committee

APPENDIX V

FIRST ANNUAL MEETING OF AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION

Program Planning Committee Report
July 15, 1969,
The Hilton Inn
Atlanta, Georgia

Mr. President:

I would like to express thanks to the following people who were responsible for this meeting.

The Board of Directors who set the guidelines that we are following.

The following four people who have knowledge of this organization and are interested in its success. Dr. Sydney Reagan, W. G. Conway, Ben Birdsong, and Jim Shuhan.

The Program Planning Committee is one of the hardest working committees of any organization. If you have never served on this committee than you cannot imagine the number of hours and the amount of energy required.

The following are responsible for this meeting and I would like for them to stand as I call their names:

W. K. Bailey,
James Earl Mobley,
Curtis Jackson,
Dan L. Hallock,
Sydney C. Reagan,
Norman Davis
J. Frank McGill,
P. J. Tiemstra,

Thank you, gentlemen, for a job well done.

We have a special tribute to a man who for years has worked long and well for PIGW and now the APREA. If you need a job done this man immediately says, "I will do it." Mr. Wallace Bailey, please stand up. Thank you for your time, loyalty and hard work.

Mr. Bailey's assistant has been a tremendous help during this meeting and we thank .

The Board of Directors has designated San Antonio, Texas as the number one choice for the 1970 Meeting.

Thank you,

David L. Moake,
Pres. Elect

TRIBUTE TO DR. NORMAN DAVIS

By: David L. Moake
July 15, 1969
Atlanta, Georgia
The Hilton Inn

The American Peanut Research and Education Association will be ever indebted to our now past President Dr. Norman Davis for his leadership and time during the first full year of life for our organization. His efforts and energies have helped provide many of the basic foundations for future activities of the APREA to keep the peanut industry informed concerning Research, Progress and Direction. Thank you, Dr. Davis.

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

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Corn Products Company
Research and Development
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Bayonne, N. J. 07002
Attn: Daniel Melnick, Vice-Pres.
Product Research & Quality Control

Derby Foods, Inc.
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Chicago, Illinois 60632
Attn: P. J. Tiemstra,
Director of Research

Lilliston Corporation
Albany, Georgia 31701
Attn: William T. Mills

Oklahoma Peanut Commission
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Madill, Oklahoma 73446
Attn: William Flanagan, Exec. Secy.

Opp Peanut Company, Inc.
Opp, Alabama 36467
Attn: W. Y. Walton

Pender Peanut Corporation
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Hershey, Pennsylvania 17033
Attn: George D. McClees, Vice-Pres.

Seabrook Blanching Corp.
Tyrone, Pennsylvania 16686
Attn: C. B. Smith

Stevens Industries
Dawson, Georgia 31742
Attn: Tom Chandler, Jr.

Turner Sales and Supply
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Luther Turner

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Peanut Butter Manufacturers Assn.
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M & M/Mars
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Mrs. Martha Harwood

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Alford Refrigeration Warehouse
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Attn: William L. Grady, Vice-Pres.

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Cerritos, California 90701

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Circus Foods
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Dothan Oil Mill Company
P. O. Box 458
Dothan, Alabama 36301
Attn: J. H. Bryson, Jr.

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Chicago, Illinois 60630
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Attn: L. Q. Hines, Sr.

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Attn: Jack L. Fox, Gen. Mgr.

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and Director of Research

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Camilla, Ga. 31730

Georgia Agricultural Commodity
Commission for Peanuts
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Executive Secretary

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Tom Huston Printing Company
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Attn: Weyman McGlaun, Mgr.
Peanut Purchasing and Selling

Institute deRecherches
Huiles et Oleagineux
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Director of Peanut Department

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Attn: Foil W. McLaughlin
Director in Charge

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Raleigh, N. C. 27607
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N. C. Peanut Growers Assn., Inc.
P. O. Box 409
Rocky Mount, N. C. 27801
Attn: Joe S. Sugg

Oklahoma Crop Improvement Assn.
Oklahoma State University
Stillwater, Oklahoma 74074
Attn: Ed Granstaff, Secy-Mgr.

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Southwestern Peanut Growers Assn.
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