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KEYNOTE ADDRESS

by

E. T. York, Jr.

Chancellor State University System of Florida

It is a great personal pleasure to be with you today to participate in this 10th Annual Meeting of the American Peanut Research and Education Association.

I feel very much at home here, because among this group are some of my former students and many former colleagues from my North Carolina, Alabama, and University of Florida days.

With a Georgia peanut farmer in the White House, it has become somewhat fashionable to try to claim some relationship with the peanut industry--and I am going to join the crowd. I hope my claims are legitimate ones, however. Indeed, my first professional experience after graduate school was in peanut research at North Carolina State. And while in North Carolina, I bought and operated a farm in Edgecombe County, involving a modest peanut operation.

As a result of these two experiences, I think I know, first hand, some of the problems in peanut research as well as in commercial production. I am no longer a bona fide peanut farmer, as my good friend Representative Wayne Mixson is--or a peanut scientist or educational specialist, as most of you are. However, I could take you to my garden west of Gainesville and show you 4 rows of the prettiest Florunner peanuts one could ever expect to see. Incidentally, these peanuts are about ready for boiling.

Speaking of boiled peanuts, I have to confess that I had never tasted a boiled peanut until I came to Florida and discovered what Floridians had known all along--that boiled peanuts are truly one of God's greatest gifts to mankind. We hope that those of you who may have missed this part of your education can be introduced to boiled peanuts before you leave the state. You should not be deprived of this treat any longer.

When I went to North Carolina State as a peanut Agronomist in 1949, the first task handed me by my department chairman, Dr. Bill Colwell, was to write a chapter for a book to be entitled, "The Peanut--The Unpredictable Legume." My chapter was to deal with soil properties, fertilization, and soil fertility.

Of course, I had tremendous credentials to write such a chapter: the fact is, I hardly knew what a peanut plant looked like. The only positive thing about the assignment was that I had a completely open mind on the subject. Or to be honest, I had a completely blank mind. Obviously, I did not have all the answers; indeed, I had none of them.

But I did welcome a chance to make a thorough review of the literature as a basis not only for writing the chapter, but also to provide the background necessary to begin a research program.

My writing, in no respect, represented a literary masterpiece. However, the review of literature did provide a number of very firm impressions.

First, it became obvious why the peanut was labeled "The Unpredictable Legume." While substantial progress was being made at that time in increasing the yields of other crops, average yields of peanuts then were the same as they had been as early as accurate records were available. For some reason, peanuts were not responding to the improved cultural practices which were revolutionizing corn and cotton production about that time.

In fact, in 1947 the average yield in North Carolina was 1,030 pounds. The yield average in the late 20's and early 30's was 1,022 pounds. Nationally, the average yield in 1947 was 646 pounds, some 40 less than the 10 year average in the late 20's and early 30's.

Furthermore, as one examines the research data, there was frequently no readily predictable pattern of response to various cultural practices.

All of this gave rise to the "Unpredictable" label. However, the more we studied the literature the more we began to suspect a reason for this lack of predictability. We wrote the following in the summary to our chapter in the book: "A study of soil fertility investigations with peanuts reveals a multitude of inconsistencies. Many workers have indicated that the peanut plant is quite unpredictable in its response to fertilization. While such would often appear to be the case, it seems that many of the apparent anomalies associated with the fertilization of peanuts have arisen through failure to evaluate fully the environmental conditions under which the experiments were conducted."

Or to put it another way, it began to appear that one of the basic principles we all learned in elementary plant physiology was contributing to the unpredict-

ability of peanuts. I am speaking of the principle of limiting factors, where any one of a number of factors affecting production might impose a ceiling on that production--no matter how favorable other factors might be.

These limiting factors could, of course, be any one of several nutrients, moisture, plant population, genetic makeup of the plant, diseases, insects, nematodes, etc. There frequently seem to be many uncontrolled and unevaluated environmental factors contributing to this unpredictability.

We concluded the chapter with this thought: "Even though direct response to fertilization may not be pronounced, it is reasonable to expect increased yields of peanuts through the introduction of better varieties, by the more effective control of diseases and insect pests, and through the adoption of better cultural practices such as the use of closer spacing."

I have never claimed any prophetic powers. However, it has been interesting to go back and read this chapter, perhaps for the first time in 28 or 29 years, and see what we wrote in light of what has transpired since that time.

Obviously, yields have increased very significantly. As a result of a combination of improved varieties, better fertility, disease, insect and nematode control, higher plant population, improved weed control, and better cultural practices generally.

In the late 1940's and early 1950's many states greatly expanded their research efforts with peanuts. Furthermore, interdisciplinary or team approaches were developed, involving agronomists, plant breeders, plant pathologists, entomologists, weed control specialists, agricultural engineers, and so on.

In our research, we attempted to reduce the number of variables which might affect production. For example, in a soil fertility study, we applied the very best known disease and insect control measures so that these factors were not limiting the response to fertility treatments.

Furthermore, in cooperation with the Extension Service, we launched a major series of research/demonstration plots across the peanut belt, putting together the best known practices to date--introducing one variable at a time to measure and demonstrate the effect of that variable when other factors were constant and, hopefully, not limiting.

The second year I was in North Carolina, 1951, we put out a number of such research/demonstration plots and obtained some very significant increases in pro-

duction. Then as we talked about these results before grower groups, we would frequently get the response--"Oh, yes, you can do that on research plots--but it cannot be done on a farmwide basis."

Our timing was good in that we bought our own farm in the winter of 1950 and planted our first peanut crop in the spring of 1951, using the same combination of production practices we were employing in our demonstrations. Our farmwide yields that first year were three times the average production on that farm for the previous five-year period. At least we had proven to ourselves that significant farmwide increases could be achieved by the application of the then known best practices.

Research and demonstrations similar to those in North Carolina were also being conducted in other states across the peanut belt with similar results. You know the rest of the story.

The unpredictable legume became quite predictable after all. Significant yield responses were obtained from various practices where other factors were not seriously limiting production.

It became obvious that substantial increases in yields could be obtained even with the old established varieties. However, a number of states launched major peanut breeding programs which significantly raised the production ceiling potentials and have paved the way for some major increases in yields. Mechanization research has revolutionized production and harvesting practices and have contributed greatly to more efficient operations.

Frankly, I had not followed very closely the progress made by the peanut industry in recent years. I was, therefore, amazed to discover what has happened in terms of increased production as I went back recently and reviewed the official USDA production statistics.

Prior to the middle of the 20th century, there had been essentially a static yield situation since the earliest period in which yields were kept of peanut production.

However, beginning in the early 1950's yields began to increase, slowly at first, but gaining momentum over the next 2 to 3 decades. For example, in the 10-year period from 1947-57, average yields nationally increased from 646 to 970 pounds, an increase of 50% or an average increase of 5% annually.

By 1967 national yields had reached an average of 1,765 pounds--an increase of 173% above the 1947 level, or an average increase of 8.65% annually for the 20-year period.

By 1976 national average yields had grown to 2,465 pounds--an increase of 282% since 1947 or an annual increase of 9.7% for the 29-year period.

Some states have experienced an even larger increase during this period. For example, Florida's yields grew from 660 pounds in 1947 to 3,000 pounds in 1976--an increase of 335% or an average annual increase of 12.4%.

There are many ways in which one might compute the economic significance of such gains. Let me try a very simple approach, using Georgia as an example.

If Mr. Carter and his fellow peanut growers had made the same yield per acre in 1975 as was produced in Georgia in 1945, using total acreage grown and prices received in 1975, Georgia peanut farmers would have sold only \$70 million worth of peanuts in 1975 instead of the \$345 million they actually realized.

This \$275 million bonus to Georgia peanut growers is some measure of the value and contribution of peanut research and education programs to Georgia farmers alone.

Or we can make a similar computation for the national scene. The total U.S. peanut crop in 1975 sold for \$771 million. Assuming the same acreage planted and the same price levels in 1975 but yield-per-acre at the 1945 level, peanut growers would have sold a \$194 million crop.

One could contend that research and education efforts contributed to greater production with a monetary value of some \$577 million annually in 1975.

This truly a phenomenal success story. Most of you here today have helped to write that story. You have helped to make such an impressive record of achievement and progress possible.

You are due far more credit than we could possibly reflect in these remarks.

What has been accomplished with this crop emphasizes again the significance and value of research and related educational efforts. As I look at what has been done with peanuts, I am reminded of the words of David Sarnoff, former president of RCA who said: "Whatever the mind of man can conceive, the miracle of modern science can make a reality."

The accomplishments with peanuts should also remind us of the absolute necessity for a strong national commitment to research in all areas.

If past experience is to guide our planning for the future, we cannot doubt the significance of research, both basic and applied. Over the past century, such research, both industrially and educationally based, has provided the major technological breakthroughs that have improved the economic well-being of our nation and the quality of life for our citizens. The investment in research--in the bringing together and supporting of creative and highly trained minds in universities, in business, and in industrial laboratories--has kept our country competitive in many fields of endeavors.

As our national investment in research has dropped over the past 15 years, other nations with stronger commitments to research have begun to overtake us in world markets and gain on us in living standards. Even the People's Republic of China has declared its intention to overtake us in several fields within the next decade by massive investment in basic and applied research.

If we are to build for our society's future, we must reaffirm our commitment to the kind of research that produced the greatest century of progress in the history of mankind--to the kind of research that has revitalized the peanut industry in this country in the lifetime of most of us in this room.

We commend you for what you have done and wish you continued success.

A PEANUT FARMER - LEGISLATOR VIEWS THE PEANUT INDUSTRY

an address by

The Honorable Wayne Mixson

The Florida House of Representatives

I appreciate very much a chance to come and visit with you a little while. I've been at this peanut business a long time, and I know about those 600 pound averages. I remember the excitement of having made 1000 pounds per acre all the way through; and it hasn't been but a very few years ago before I remember the extreme excitement of having made a ton to the acre all the way through in peanut yields. That was really something to talk about! From then to where we are now after we got Leonard Cobb to move over to my county, Leonard is the county agent; I'm still above the state average. So you're doing good by me, and I appreciate it very much.

Peanut growing is very exciting to me. It's the only thing I've done in the last few years that's kept me alive and enables me to help feed those old cows. I'm a cowboy. I've got a big breeding cattle herd. The last four or five years I've fed half of that herd to the other half to try to keep them going. All of you who are in the cattle business know about that experience, but peanuts have been a real consistent crop. All of you have worked to make it that way, enabling us to pay our bills. I personally would like to say thank you to everyone who helped breed this peanut, and we welcome all of you from all of the other states to Florida. You've all done so much to help this great industry, and its very important to our state also.

It is very difficult to get urban-oriented legislators to understand the necessity and importance of agricultural research. In order to get continued financing for research it's necessary to keep up this kind of productivity and make these people understand that the benefits of this research are passed on to the consumers themselves.

We were asking at the national level to make sure that they put a high priority on agricultural research funds, so we can match them and get the job done. However, I don't think we've succeeded altogether in that respect, but if we could just get the story over to what this means to the industry, the consumer and to the American position as a superior agricultural producing nation of the

World. The value of the dollar in the international market is tied to what we do in agriculture in this day and time.

I have a clipping here that came from the associated press. It came from Gainesville only last week. Professor Woodruff, has written a book on America's impact on the world. The book states that an economic historian says the world-leading initiative in economic affairs has been wrested from the United States because of the petroleum situation; but that the United States has an ace up its sleeve; and that's agriculture. Not nuclear missiles, but agriculture might prove to be the ace card in the American deck said this author.

We know that all the world is beginning to understand the role of American agriculture and its productivity and what we've accomplished. As I see it, as to how we're going to keep this up is how well we continue to solve some of the problems, and research is the answer.

People are beginning to question big government. Proposition 13 came up, and people ask questions about what are you doing and where are you spending all this money. People envision government not as a friend but an enemy in many respects. I like to envision government as being the partner of people and trying to do things that are necessary to carry on commerce. The role of government is assisting people to do things that they need to do in order to carry on commerce and industry in this country. There isn't a better example of this kind of partnership than right here in this audience. There's not only the governmental arm but the close cooperation with the industry, the processors and all of you that supplied the chemicals and so forth. This ought to be the way we use government: working in partnership with us.

Agriculture is going to be our money in the international area; that we do have to depend on. It's the only area of superiority. You know we aren't superior in producing electronic gadgetry, we aren't superior in producing automobiles, why even the barbed wire that we use to fence our farm comes from somewhere else; but we are superior in the production of agricultural commodities and are beginning to be recognized for that all over the world.

You asked me to say something about the peanut industry and its relationship to the legislature in Florida. Let me just simply sum it up by saying that Florida is a very rapidly urbanizing state. We're one of the fastest growing

urban states in the nation, but we're also a rapidly growing agricultural state. We actually dug and sold from the soils of Florida last year about 4 billion dollars worth of agricultural products. This four billion dollar industry projects itself into a 12 or 14 billion dollar industry in Florida and employs about 1/3 of the people in our state. It becomes a more stable industry in many respects than our tourism or our industrial complex. Our economic well-being is dependent upon keeping these 20 or 30 or 40 thousand commercial farmers in production and utilizing our resources to employ our people and give a stability to the employment level in this state. You know of Florida's tourism. We're industrial to some extent. But less than one half of our jobs in relationship to the national average are created in the industrial sector, so we are very highly dependent on agriculture.

People have been concerned with water. They are concerned with our use of pesticides, they're concerned with whether or not we're going to have enough labor. There are those who would suggest that agriculture ought to fold up and fade from the picture and leave Florida to be developed as a recreational state and not agricultural. We know this is not possible. We know that agriculture not only contributes to the economic stability of our state, but it's also very important to the environment.

A study that was requested by the Speaker of the House of Representatives about 3 or 4 years ago challenging my Committee on Agriculture to make a determination whether or not agriculture was going to be a part of the growing industry in the state of Florida. We called on IFAS to help us, and wrote a report to give to the legislature, and mind you there are very few of us in the legislature of Florida that have anything to do with the production aspect of agriculture. There aren't many farmers as such, but we were able to so document this report to certify that we are not only a part of the economic solution to our state; but also a part of the environmental solution.

We're good conservationists. We are providing ways to handle our urban waste by distributing it on massive areas of land in our forest production and also in crop production. We also keep the land open in Florida; we keep the fresh air; we keep green things growing; and we provide recreation and outdoor game and birds and fishing. We contribute to the beauty and the natural scenery of our

state. If we stay in agriculture, we keep large areas of land open and green for future generations. All of these things are important to our state. I think we have set the ground work and the foundation for a continuing development of agriculture in Florida.

ABSTRACT

In 1977, arginine maturity index (AMI), methanolic extract, seed/hull ratio and shellout methods of determining peanut maturity were compared. Florunner peanuts were used in the study and were sampled 7 times at weekly intervals beginning 125 days after planting. Calculated yield and dollar return per acre were highest on the fourth and fifth sampling dates. AMI determined on the first three sampling dates accurately predicted optimum digging dates. The fourth and only other sampling date generally recommended by the developers of AMI predicted a date later than the optimum period for digging. The methanolic extract method accurately predicted optimum digging dates on sampling dates 2, 3 and 4 but generally predicted dates later than optimum on succeeding sampling dates. Light transmittance of the methanolic extract and arginine content were lowest when yield and dollar return were highest. Seed/hull ratio (fresh weight) was about 2.0 on optimum digging dates, and the corresponding dry weight ratio was 3.7. The shellout method indicated that approximately 80% of the pods on the plants were mature from the second through the sixth harvests.

INTRODUCTION

The indeterminate nature of peanuts dictates that at any time after fruit set, peanuts at various stages of maturity may be found on the plant. Highest dollar return per acre is achieved when the greatest proportion of high-quality, sound-mature fruit are on the plants at harvest time. Recently, methods to predict optimum digging date have received much attention. Two objective methods, Arginine Maturity Index (AMI) (6, 7, 8) and Methanolic Extract (ME) (1,5), have been proposed. AMI has received more scrutiny through testing than ME as it was proposed several years earlier. The latest method proposed is based on the seed/hull weight ratio. This method consists of the Fresh Weight Maturity Index (FMI) and Dry Weight Maturity Index (DMI) as determined by seed/hull weight ratio of fresh and dried peanuts, respectively (4). FMI and DMI are objective, as AMI and ME methods are, in that all peanuts from a plant are used; however, for the FMI and DMI, a subjective determination is involved in that very immature peanuts are weighed as hulls. This determination, based on the physiological maturity classification scheme developed by Pattee and coworkers (2, 3), is simple. Peanuts at or beyond the stage characterized by cracks in the internal pericarp tissue are separated into seed and hull, and those too immature to have such cracks are weighed with the hulls. FMI and DMI have not been tested sufficiently; hence, a seed/hull ratio that is consistently indicative of maximum yield has not been determined. The purpose of testing this method currently in Georgia is partly to determine that ratio. The Shellout Method, probably the most widely used method of maturity determination, is a subjective determination of seed maturity based on hull and seed coat characteristics of some of the peanuts on a plant.

These four maturity methods were compared on Florunner peanuts grown in Georgia

in 1977. This paper is a progress report on those comparisons.

MATERIALS AND METHODS

Florunner peanuts were planted in a modified 36 in row pattern, 32 in between center middles and 40 in between wheel middles. Conventional cultural practices were applied. A randomized block design was used with four replicates in the 1.7-acre plot. Beginning 125 days after planting (DAP), the plot was sampled 7 times at weekly intervals. Samples were taken for the 4 methods and two-row beds on either side of the randomly selected sampled rows were machine dug for yield and dollar-return-per-acre calculations. All sample plants were carefully removed from the soil with a digging fork, and pods pulled or falling off were recovered. In each replication, 3 plants were taken for ME, 2 plants for shellout, 4 plants for FMI/DMI and 7-9 plants for AMI. The plants were taken at intervals of approximately 30 feet on the 125 foot rows. Careful attention was given to separation of individual plants as indicated. All plants were transported to the laboratory in plastic bags where peanuts were hand picked, washed and towel dried.

AMI was determined by Waters Agricultural Laboratory, Camilla, Georgia using standard AMI procedures (6, 7, 8). Sample analysis began within 3 hr of digging and within 1 hr of removal of the peanuts from the plants.

ME was determined on peanuts from all 3 plants in a replication. They were ground in methanol (2 ml per gram) for 2 minutes; and the mixture was immediately cooled by refrigeration for 15 min and filtered (Schleicher and Schuell No.597). Light transmittance of the extract was determined with a Bausch and Lomb Spectronic 70 spectrophotometer calibrated for 100% transmittance with methanol at 450 nm. Optimum digging date was predicted from the data by use of a predicting curve developed and supplied by C. E. Holaday, National Peanut Research Laboratory, Dawson, Georgia.

Individual peanut samples were retained in closed, small plastic bags until separated into seed and hull for FMI and DMI. Most samples were assayed the same day; however, samples refrigerated overnight in the plastic bags were no different from those assayed the same day. Holding the samples in other than a moisture-proof bag would lead to erroneous results in FMI. All peanut pods were opened, and those at or beyond the maturity stage characterized by cracks in the white internal pericarp were separated into hull and seed. Less mature pods with no such cracks were placed with the hulls. FMI was determined as the weight of the seed divided by the weight of the hulls. Samples used for FMI were dried with forced air at room temperature for 7 days and reweighed; then DMI was calculated in the same manner. Drying for 3 hr at 130 C after the 7-day period had no significant effect on mean DMI.

In the shellout method, small, obviously immature (soft, watery) peanuts were excluded. The others were opened and examined for any tan to brown coloration inside the hull. Those with color were classed as mature, those still white were classed as immature. Percentage of mature pods was determined for 8 plants per sample date.

RESULTS AND DISCUSSION

Information and data on peanuts grown in the test plot appear in Table 1.

Table 1 - Maturity Methods Comparison, 1977

No.	Sample Date ^{1/}	Lb/Acre	\$/Acre	AMI	AMI Date	ME %T	ME Date	FMI Seed/Hull	DMI Seed/Hull	Shell Out
1	9/1	3601.4 A	744.54 A	144.5 A	9/25	73.8 A	9/18	1.59 A	3.05 A	67.3 A
2	9/8	4054.9 BC	848.44 B	118.0 B	9/26	69.7 AB	9/21	1.74 AB	3.27 AB	76.6 B
3	9/15	4452.0 DE	951.56 CD	100.3 C	9/29	65.8 B	9/24	1.95 BC	3.61 BC	80.4 BC
4	9/22	4693.5 EF	997.01 DE	104.5 BC	10/7	65.1 B	9/30	1.94 BC	3.69 C	79.6 BC
5	9/29	4810.1 F	1022.95 E	78.3 D	10/4	64.1 B	10/6	2.15 C	3.67 C	80.4 BC
6	10/6	4338.4 CD	911.89 BC	112.8 BC	9/20	65.9 B	9/27	2.47 D	4.13 D	80.6 BC
7	10/13	3977.6 B	850.05 B	106.3 BC	9/28	66.3 B	10/4	2.79 E	4.76 E	87.2 C

^{1/} First sampling date was 125 days after planting.

AMI = Arginine Maturity Index, AMI date = predicted digging date

ME = Methanolic Extract, %T = Percent light transmittance at 450 nm, ME date = predicted digging date.

FMI = Fresh Weight Maturity Index, DMI = Dry Weight Maturity Index

Shellout = percent mature pods

Numbers in a column followed by the same letter are not significantly different (5% level, Duncan's New Multiple Range Test).

Maximum yield and dollar return per acre were highest on the 4th and 5th sampling dates. Yield increased to a maximum, which lasted for at least 7 days and then declined. This points out that exact-day accuracy of prediction is not required of any method.

AMI

On the first three sampling dates, the AMI predicted dates were all within the maximum-yield period. AMI was lowest on the date of maximum yield; however, the date predicted from this value was about 1 week later than the maximum-yield period. Developers of the method emphasize that no predictions be made in the Southeast and Southwest with AMI values of less than 100 or after the minimum value has been reached. The method generally involves sampling at 125 DAP and 14-21 days later using the first estimate to predict the digging date. If the two values are in good agreement, they are averaged (personal communication, C. T. Young). According to the results of this study, such an approach would provide good results. A drastic change in weather may change the duration of the high-yield period by several days, and this must be taken into account on a prediction made 2 weeks before actual digging date. The fourth AMI sample resulted in a prediction later than the optimum-yield period. Although data beyond the optimum-yield period is academic, once the minimum AMI is reached, the calculated number of days to harvest, instead of being added to the sample date, are subtracted as on sample dates 6 and 7.

ME

Harvest dates predicted from the ME for sampling dates 2, 3 and 4 were correct, and the predicted date based on the first sampling was approximately 4 days early. Percentage light transmittance tended to decrease until the 5th sampling date and then increase; however, the mean values for the second through the seventh sampling dates were not significantly different (5% level, Duncan's New Multiple Range Test). Further study is indicated to determine whether differences would be significant if more plants per sample are analyzed. On sample dates 6 and 7, as with AMI, once the minimum percent light transmittance was reached, the predicted days to harvest were subtracted from the sample date.

FMI/DMI

Changes in both FMI and DMI during the sampling period were significant. A ratio of about 2 for FMI and about 3.7 for DMI corresponded generally with the maximum-yield period. Further study is necessary to determine whether these relationships will be the same in other crop years. The 3.7 DMI value is in relative agreement with that determined for Florunner peanuts grown for similar periods in North Carolina in 1974 and 1975 (4).

Shellout Method

The shellout method indicated no significant change in percentage of mature pods between sampling dates 2-6. All peanuts classed as mature had some tan-brown color inside the hull. The number of small immature pods excluded in this method generally decreased with time. This number, though not used to calculate percentage of mature pods, is often considered as an added information factor. The shellout method provides useful information on peanut maturity, but use of the strict

results obtained, as shown here, at times may lead to erroneous conclusions.

These comparisons for 1 year provide inconclusive information on each method. No method tested appeared to be completely accurate. Ideally, a peanut maturity method should provide an adequate prediction 1-3 weeks before the optimum-yield period and not vary substantially in prediction thereafter.

Predictions based on AMI and ME taken during the high-yield period generally failed to substantiate previously predicted optimum digging dates. However, the prediction based on ME taken in the early part of the high-yield period was acceptable. The predicting efficiency of the methods tested were generally adequate; however, determination of the occurrence of optimum maturity was not satisfactory.

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Isolation and Evaluation of Rhizobium from Arachis Nodules Collected in South America. T. J. Schneeweis, G. H. Elkan, J. M. Ligon, J. C. Wynne, and T. G. Isleib, Departments of Microbiology and Crop Science, North Carolina State University, Raleigh N.C. 27650.

ABSTRACT

Arachis nodules collected in South America during 1976-77 by Gregory *et al.* presented a unique opportunity to obtain Rhizobium from previously uncollected areas. Germplasm collected in conjunction with these root nodules has become an integral tool in the study of nodulation and nitrogen fixation in Arachis. A description is given of the procedures used for the isolation and evaluation of native peanut rhizobia. Bacterial strain testing is currently underway to elucidate nodulation potential of the Arachis germplasm collection available at NCSU. Results are indicating that such studies will optimize nitrogen-fixation potential through host or strain selection for temperature and other environmental stress factors.

INTRODUCTION

The peanut is now cultured on a global basis and has become the world's third most important grain legume crop (3). Considering the importance of this crop, it is surprising that relatively little work has been done to better exploit the peanut-Rhizobium symbiosis. While peanuts are susceptible to nodulation by numerous, naturally occurring rhizobia of the cowpea group, the presence of such nodules does not assure effective nitrogen fixation (10,11). Effective rhizobia, once the need for inoculation is established, must be able to compete in the local environment. This requires bacteria able to flourish under a wide range of field conditions, and is considered the primary selection criterion for useful Rhizobium isolates (6). Inherent in this property is the ability to compete in nodule formation and, to survive and multiply in soil. Additionally, promising rhizobial strains should be able to resist stress such as soil temperature, have pH tolerance, pesticide tolerance, and nodulate in the presence of combined nitrogen (2).

The exploration of Arachis germplasm in South America by Gregory *et al.* (4) was reported at these meetings last year. During 1976 and 1977, collections were made through the Gran Pantanal in western Brazil, central Bolivia, northern Argentina, through Paraguay to the southern Pantanal. Realizing that these plant collections presented the opportunity to obtain Rhizobium from previously uncollected areas, nodules were collected from Arachis and a few other legumes. Since nodule-forming bacterial isolates can be traced in ancestry to a germplasm collection as well as a geographical area, a unique opportunity exists to study the Arachis-Rhizobium symbiosis.

This paper describes the techniques and protocols used to isolate native peanut rhizobia which will be tested in our strain selection program.

METHODOLOGY

We established that nodules could be collected in 7.5 ml plastic vials containing anhydrous calcium chloride covered with a cotton plug. The space above the cotton plug served as a collection chamber for the nodules. These vials were returned to Raleigh for bacterial isolation. Since the nodules were desiccated to prevent decomposition, it was necessary to first undergo a rehydration procedure. Nodules were rehydrated in sterile water for four hours at 5°C. After that time, they were aseptically dissected and a nichrome wire used to streak some of this tissue on yeast extract mannitol agar (7) in previously poured petri plates. Cultures were incubated at 28°C and examined daily for raised mucoid colonies typical of rhizobia. These colonies were

restreaked until pure cultures were obtained. It should be pointed out that although no surface sterilization of nodules was carried out, fungal and actinomycete contamination presented no obstacle in the overall success of our strain isolations. Using these techniques, 234 bacterial isolates representing 78 germplasm collections were obtained.

The genus Rhizobium is identified by the ability to incite nodules on roots of leguminous plants. Although Rhizobium classification relies on the plant affinity concept, some legume species are known to be broadly promiscuous and therefore useful for authentication of Rhizobium. Macroptilium atropurpureum (Siratro) was used for primary screening of these isolates. Using the method of Wacek and Brill (8), these small seeded legumes were grown in 30 ml serum bottles capped with plastic bags. After 21 days in a growth chamber, the roots were examined for nodulation. Those strains capable of nodulating Siratro were carried forward in a greenhouse test for the ability to form effective nodules on peanuts. NC 2 was grown in modified Leonard jar assemblies (9) and inoculated with one of the South American rhizobial isolates. After six weeks, plants were examined for nodulation. The acetylene reduction technique was used to estimate nitrogenase activity (1,5). The results of this greenhouse nodulation study are shown in Table 1. Uninoculated controls were unnodulated with no nitrogenase activity.

Tables 2 and 3 summarize the plant collections from which authenticated rhizobial cultures have been isolated. Additional testing is continuing and will add new strains to this list. Further information concerning the taxonomic position of these collections will be added in the future. Such collection information is imperative if international exchange of germplasm and rhizobial strains are to realize their full potential.

Bacterial strain testing is currently underway to elucidate nodulation potential of the Arachis germplasm collection available at NCSU. Phytotron studies are being conducted to explore the feasibility of optimizing nitrogen fixation potential through host-strain selection for temperature and other environmental stress factors. Preliminary evidence indicates that host genotype as well as bacterial strain differences do exist in the peanut-rhizobium symbiosis (11). With this fact in mind, it is critical that plant breeders work with microbiologists in achieving higher yields through enhanced biological nitrogen fixation.

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Table 1. Results of greenhouse nodulation test of South American Rhizobium isolates. Arachis hypogaea (cv. NC 2) was the test host.

Strain ₁ Number	Plant ₂ Color (REP 1,2)	Nodule ₃ Number (REP 1,2)	Nodule Size ₄ (REP 1,2)	$\mu\text{MC}_2\text{H}_4$ /HR ² (REP 1)	$\mu\text{MC}_2\text{H}_4$ /HR ² (REP 2)	MEAN $\mu\text{MC}_2\text{H}_4$ /HR ²
1.2	1, 1	1, 1	3, 3	1.047	1.570	1.308
1.8	1, 1	0, 1	- , 2	0.209	0	0.104
1.10	1, 1	1, 1	3, 3	1.972	2.373	2.172
1.12	2, 2	2, 1	2, 3	0.750	0.733	0.742
1.15	1, 1	1, 0	1, -	0	0	0
3.1	3, 3	3, 2	3, 3	15.648	17.901	16.774
3.2	2, 3	3, 2	3, 3	17.404	12.272	14.838
6	3, 3	2, 2	3, 3	6.595	5.519	6.057
7.1	1, 2	2, 2	3, 3	10.707	5.089	7.898
7.2	2, 2	3, 3	2, 3	5.304	5.683	5.494
22.4	1, 2	2, 2	2, 2	2.408	0.907	1.658
23.2	1, 2	3, 3	2, 2	4.372	9.389	6.880
23.3	1, 2	3, 3	2, 2	5.376	6.738	6.057
23.4	2, 1	2, 3	2, 1	2.548	3.420	2.984
42.2	1, 1	3, 2	1, 1	0	0	0
43.3	3, 3	2, 3	2, 2	5.412	10.295	7.854
56	3, 3	3, 3	2, 3	12.519	24.697	18.608
56.1	3, 3	2, 3	2, 3	5.053	18.564	11.808
56.2	2, 3	3, 3	3, 2	19.890	18.398	19.144
62	2, 1	2, 2	3, 3	6.774	2.757	4.766
68.3	1, 1	1, 2	1, 1	0	0	0
70	3, 3	2, 2	3, 3	10.954	9.224	10.089
70.1	3, 3	2, 3	2, 2	13.178	12.601	12.890
71	1, 2	3, 3	2, 3	17.901	17.213	17.557
77.3	2, 1	1, 0	1, -	0	0	0
83	3, 3	2, 2	2, 2	2.705	9.142	5.924
83.1	3, 3	2, 3	2, 1	5.125	11.778	8.452
83.2	2, 3	2, 2	2, 2	3.727	8.730	6.228
92	2, 2	2, 3	2, 2	12.601	27.017	19.809
93.1	1, 2	1, 2	3, 3	1.117	10.789	5.953
99.2	1, 2	3, 3	3, 2	1.222	3.799	2.510
120	1, 1	3, 2	2, 1	0.192	0.052	0.122
120.1	1, 1	3, 2	1, 1	0.140	0.035	0.088
120.2	1, 1	3, 3	1, 1	0.087	0.070	0.078
123	2, 3	2, 2	2, 2	2.984	3.226	3.105
123.1	3, 3	3, 2	2, 2	6.164	4.444	5.304
134	3, 3	2, 2	2, 2	4.301	5.519	4.910
134.1	2, 3	2, 3	3, 2	5.340	14.825	10.082
146.1	2, 2	3, 3	3, 3	15.978	19.558	17.768
146.2	3, VOID	3, VOID	3, VOID	18.896	—	18.896
178	3, 3	3, 2	2, 2	11.366	6.774	9.070
181	2, 3	1, 2	2, 2	0	10.542	5.271

¹Numbers preceding decimal refers to vial number.

²Plant color code: 1 = yellow
2 = green
3 = dark green

³Nodule number code: 0 = 0
1 = 1-10
2 = 11-100
3 = over 100

⁴Nodule size code: 1 = small
2 = intermediate
3 = large

Table 2. ORIGIN OF RHIZOBIUM STRAINS FROM WILD ARACHIS SPECIES

<u>Vial No.</u>	<u>Isolated From</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Elevation</u>	<u>Soil Description</u>	<u>Date Collected</u>
1	<u>Arachis</u> sp.	19°02'S	56°39'W	80-100 m	light sandy soil	12/7/76
3	<u>Arachis</u> sp.	20°22'	56°58'	100-200 m	red, black soil weathered from limestone	12/11/76
6	<u>Arachis</u> sp.	25 km W of Mburucya				12/26/76
7	<u>Arachis</u> <u>diogoi</u> Hoehne	17°40'	57°45'	0-100 m	reduced argillaceous soil and calcareous gravel	12/6/76
22	<u>Arachis</u> <u>helodes</u>	16°03'	57°13'	170 m	brown sand	12/17/76
23	<u>Arachis</u> sp.	-	-	-	calcareous origin	12/17/76
56	<u>Arachis</u> sp.	24°4'	65°24'	1565 m	dark alluvial gravel	3/30/77
59	<u>Arachis</u> sp.	23°4'	63°53'	350-400 m	alluvial reddish sand	4/2/77
62	<u>Arachis</u> sp.	22°51'	63°56'	350 m	sandbank of alluvium	4/4/77
70	<u>Arachis</u> sp.	21°41'	63°45'	1000 m	light brown, alluvial clay-loam-gravel	4/8/77
71	<u>Arachis</u> sp.	21°41'	63°44'	870-1000 m	light red alluvial sandy loam	4/8/77
83	<u>Arachis</u> sp.	20°17'	63°28'	900 m	light brown sandy loam	4/14/77
93	<u>Arachis</u> sp.	17°19'	63°18'	350 m	deep sand in "matorral"	4/20/77
99	<u>Arachis</u> sp.	15°44'	63°05'	250 m	brown to gray alluvial soil	4/27/77
120	<u>Arachis</u> sp.	26°22'	57°05'	ca. 65 m	deep white sand banks	6/16/77
123	<u>Arachis</u> sp.	25°23'	57°16'	ca. 175 m	light-colored sand	6/17/77
134	<u>Arachis</u> sp.	22°15'	56°28'	ca. 210 m	light sand	6/24/77
136	<u>Arachis</u> sp.	22°23'	56°27'	ca. 220 m	brown sandy soil	6/24/77
178	<u>Arachis</u> sp.	21°34'	57°15'	ca. 225 m	red iron-gravel and gran- ite boulders-"cerrado"	6/29/77
181	<u>Arachis</u> sp.	21°30'	57°01'	ca. 350 m	brown sandy gravel loam	6/29/77

Table 3. ORIGIN OF RHIZOBIUM STRAINS FROM CULTIVATED PEANUTS

<u>Vial No.</u>	<u>Isolated From</u>	<u>Area Collected</u>	<u>Soil Description</u>	<u>Date Collected</u>
77	Colorado Chico del Palmar (red seeds)	Cototo, 10 km E of Villa Montes		4/11/77
92	Overo Colorado Blanco (grande	Saavedra, Sta. Cruz	dark, black loam	4/19/77
138	Overo	Puento de Mataral, Sta. Cruz		4/25/77
146	Overo	Valle Abajo, Mairana		4/28/77
150	Palido	Teneria - Aiquile, dept. Cochabamba	brown sandy loam	4/29/77
151	Sara Mani	Mesa Rancho - Aiquile	medium heavy, dark brown	4/29/77

ABSTRACT

Several studies were conducted to evaluate the potential for increasing nitrogen fixation of the peanut (*Arachis hypogaea* L.) by selecting (a) host plants with enhanced nitrogen-fixing capacity, (b) more effective rhizobial strains, and (c) specific host-strain combinations.

Significant variation in nodulation and nitrogen-fixing activity among both cultivated and wild peanut genotypes and among strains of *Rhizobium* was found in the phytotron, greenhouse and field. No significant host plant-strain interaction was demonstrated but the number of rhizobial strains-host genotype combinations tested in these studies was limited.

It can be concluded from these studies that biological nitrogen fixation for the peanut can be increased by selecting for both effective strains and more efficient host plants. The potential for increasing nitrogen fixation by selecting for specific host-strain combinations is still under investigation.

INTRODUCTION

Peanuts (*Arachis hypogaea* L.) will grow and yield better (7, 14), produce better quality seed (15) and produce higher seed protein and oil content (3) if inoculated with proper nitrogen-fixing bacteria. Only the cowpea cross-inoculating group of rhizobia are symbiotic with peanuts. Of this group, some strains infect and form symbiotic relationships with peanuts more efficiently than others (2).

Several researchers have suggested that efficient strains should be identified and used to inoculate peanut fields (5, 12, 13, 17). Unfortunately effective strains are not always able to survive in and colonize soil into which they are introduced (13, 15) or compete with native strains for infection sites (4, 8).

Not only can nitrogen fixation be increased by using *Rhizobium* strains that are effective in fixing nitrogen, but the selection of more efficient host plants could significantly increase nitrogen fixation. The first report of nodulation variability of a host plant to rhizobia was by Vorhees (16). Differences in nodulation among peanut genotypes in the field were first reported by Duggar (9) in 1935. He found that a Virginia (var. *hypogaea*) runner developed more large and more total nodules than a Spanish line. Duggar (10, 11) and Albrecht (1) both reported increases in nodulation of a Spanish but not a Virginia line when the lines were inoculated with single and mixed strain cultures. Burton (5) showed differences in nitrogen accumulation among peanut cultivars grown in the greenhouse. 'Florunner', a small-seeded Virginia type, was consistently higher in nitrogen content than three Spanish cultivars after inoculation with pure strains of *Rhizobium*.

Development of specific strain-host plant combinations has also been proposed as a method to increase nitrogen fixation. Although it has been well documented that host-strain interactions occur in several crop plants, specific symbiotic relationships have not been exploited (6). Furthermore, interactions of the peanut host plant and specific, effective strains of rhizobia that would increase nitrogen fixation has not been demonstrated.

The objectives of our research at North Carolina is to explore the possibilities of increasing the nitrogen fixed by the peanut by (a) selection of more efficient host genotypes, (b) selection of more efficient rhizobial strains, and (c) selection of specific host-strain combinations. This paper will briefly review some of the preliminary findings of our research.

Variation of Host Plants

Host plant differences in nodulation response to the native rhizobia found in North Carolina peanut fields have been observed. From the more than 250 genotypes either rated for nodulation or for which actual nodule counts have been made, a general trend of genotypic differences in nodulation is apparent (Table 1). Genotypes of the Virginia botanical variety are more heavily nodulated when grown in North Carolina soils than either genotypes of Spanish or Valencia origin although there is considerable genotypic variation within a botanical variety. The degree of nodulation was established by assigning a rating of 5 for heavy nodulation, decreasing to 1 for slight nodulation. The nodulation rating for several U.S.A. improved Virginia cultivars was 3.7 compared with a 2.1 for several U.S.A. improved Spanish cultivars.

Table 1. Nodulation rating for host genotypes grown at Clayton, NC in soil containing native rhizobia

Botanical variety	Genotype	Nodulation ^a
Spanish	Starr	1.45
	Tammur 74	2.25
	Spanhoma	2.25
	Spantex	2.40
	Argentine	2.10
Valencia	Tennessee Red	2.80
	New Mexico Valencia	3.15
Virginia	Florigiant	4.90
	Early Bunch	4.30
	NC 6	3.75
	NC 5	4.35
	NC 4	3.90

^aNodulation rated with 1 = few nodules; 5 = heavy nodulation.

It is also apparent that the species of section *Arachis* are poorly nodulated (Table 2) when compared with cultivated peanuts. Nodulation of the diploid species was significantly lower than the tetraploids *A. monticola* and the cultivars 'NC 2' and Florigiant. The degree of nodulation and nitrogenase activity (measured by the acetylene reduction technique) were significantly correlated ($r = 0.85$) for the diploid species. Thus, increasing the nodulation of these species would probably increase the amount of nitrogen fixed. Genotypes of cultivated peanuts have also shown variation for both nodulation and nitrogenase activity when grown in the field (Table 3). Nodulation and nitrogenase activity is most often highest for Florigiant. Similar results have been found in phytotron and greenhouse studies (Tables 4 and 5).

In one field study which was sampled throughout the growing season, seven genotypes were found to significantly vary in activity (Table 6). Sampling dates were also significantly different but there was not a significant interaction of genotypes and sampling dates. Nitrogenase activity was extremely low until fruiting. Activity increased for all genotypes but decreased at varying times for the different genotypes. Activity was also low at 83 days due to drought stress. In this particular study both nitrogenase activity and nodulation were greatest for A2 and Florigiant (Table 3).

This variation in nodulation and nitrogenase activity among peanut genotypes has been found to be heritable and subject to selection (Isleib, unpublished). In a diallel cross of 10 diverse peanut genotypes, general combining ability for nodulation and nitrogenase activity was significant for the F₁ generation in the greenhouse and the F₂ generation grown in the field. Thus selection of genotypes with increased nitrogen-fixing ability offers an opportunity for enhancing nitrogen fixation and is being pursued in present studies.

Table 2. Average number of nodules per plant for species of section Arachis including cultivated peanuts

Genotype	Ploidy level	Nodule count ^a
K9484 Corduroy (<u>A. batizocoi</u> Krap. et Greg.)	2n	263
GKP10038 s.l.	2n	352
GKP10017 (<u>A. cardenasii</u> Nom. nud.)	2n	147
<u>A. monticola</u> Krap. et Rig.	4n	1436
K9484 (<u>A. batizocoi</u> Krap. et Greg.)	2n	312
GKP10038 l.l.	2n	480
K7988 (<u>A. duranensis</u> Nom. nud.)	2n	375
Florigiant	4n	2474
NC 2	4n	1655
	LSD (.05)	271

^aCounted at harvest on October 6.

Table 3. Nodulation and nitrogen fixation of seven peanut genotypes in field, Clayton, NC

Genotype	N ₂ fixation rate ^a	Nodule ^b number	Nodule ^c efficiency
A ₁ (Valencia)	6.2	95.3	.10
A ₂ (Valencia)	7.9	367.7	.05
B ₁ (Virginia)	7.6	99.0	.11
B ₂ (Virginia)	5.8	25.7	.25
C ₁ (Spanish)	3.1	46.6	.12
C ₂ (Spanish)	3.1	108.2	.06
Florigiant (Virginia)	13.3	378.7	.09
	LSD (.05)	110.1	.06

^a μ M C₂H₄/hr/plant; mean of three sampling dates.

^bMean of three sampling dates.

^c μ M C₂H₄/hr/nodule.

Table 4. Nodulation and nitrogen-fixing activity for six peanut genotypes grown at 30/26 C in phytotron

Genotype	N ₂ fixation rate ^a	Nodule count ^b	Nodule size ^c
A ₁ (Valencia)	3.1	292	2.06
A ₂ (Valencia)	2.8	341	2.00
B ₁ (Virginia)	1.7	338	1.56
C ₁ (Spanish)	2.2	220	2.00
C ₂ (Spanish)	2.0	303	2.19
Florigiant	2.4	458	2.25
LSD (.05)	0.8	85	0.38

^aMean of 17, 34 and 51 days sampling; $\mu\text{M C}_2\text{H}_4/\text{hr/plant}$.

^bNodule count at 17 days.

^cSize rated with 1 = small, 3 = large; mean of 34 and 51 days sampling.

Data averaged over four *Rhizobium* strains.

Table 5. Nitrogen-fixing activity for six peanut genotypes grown in greenhouse

Genotype	Nitrogen fixation rate*
A ₁ (Valencia)	5.2 c
A ₂ (Valencia)	7.1 b
B ₁ (Virginia)	4.3 c
C ₁ (Spanish)	5.1 c
C ₂ (Spanish)	5.6 bc
Florigiant	9.1 a

^a $\mu\text{M C}_2\text{H}_4/\text{hr/plant}$; mean over four strains and three sampling dates. Means with different letters significantly different at 5% probability.

Table 6. Nitrogenase activity of seven peanut genotypes harvested during 1977 growing season at Clayton, NC

Genotype	Nitrogenase activity ($\mu\text{M C}_2\text{H}_4/\text{hr/plant}$)									Mean
	Days after planting									
	41	62	69	80	83	109	124	138	150	
A ₁	.93	1.13	1.92	13.86	8.76	26.47	14.82	6.30	3.30	8.60a-c*
A ₂	.13	.36	1.13	11.36	5.66	18.89	14.92	21.37	11.58	9.49a
B ₁	.24	.28	.31	4.26	2.72	13.14	14.31	6.94	6.41	5.40a-d
B ₂	.46	.03	.50	1.76	.70	8.82	15.35	9.87	4.40	4.82b-d
C ₁	.29	.65	.57	3.53	2.85	7.61	6.20	2.08	6.71	3.51d
C ₂	.29	.83	1.11	7.12	3.98	9.13	8.75	5.92	3.74	4.54cd
Florigiant	.13	.91	.87	10.05	1.28	18.09	19.96	14.53	16.31	9.12ab
Mean	.35e	.60e	.91e	7.40cd	3.71de	14.59a	14.47ab	9.57bc	7.49cd	

*Means with different letters are significantly different at 5% level, Duncan's multiple range test.

Variation of Rhizobium Strains

Variation among Rhizobium strains for nodulation and nitrogenase activity has been found in phytotron, greenhouse and field studies (Tables 7-11). Nodulation, nitrogen-fixing activity and nodule size were all significantly different for strains at 30/26 C in the phytotron (Table 7). Similar results for strains of rhizobia were found in greenhouse studies where nodulation, nitrogen-fixing activity, nitrogen content of the shoot and plant color difference were significant (Table 8).

Table 7. Differences among rhizobial strains for nitrogen-fixing ability at 30/26 C in phytotron

Strain	N ₂ fixation rate ^a	Nodule count	Nodule size ^b
32H1	2.5	230	2.26
3G4b20	2.8	270	2.05
176A34	2.0	506	1.45
176A22	2.5	204	2.19
LSD (.05)	.6	69	.31

^aMean over six genotypes and 17, 34 and 51 day-old samples.

^bRated with 1 = smallest and 4 = largest nodules.

Table 8. Nitrogen-fixing data for rhizobial strains in symbiosis with NC 4 grown in greenhouse

Strain	No. of ^a nodules	Nitrogenase ^b activity	Nitrogen content (%)	Color ^d
176A22	66	10.03	3.8	1.5
42B2	46	2.54	2.5	2.6
32H1	63	7.88	3.6	1.5
176A34	40	7.29	3.3	1.6
32Z3	35	6.47	2.3	2.6
Uninoculated	0	0	1.6	3.0

^aNC 4 harvested after 49 days.

^b $\mu\text{M C}_2\text{H}_4/\text{hr/plant}$.

^cPercent nitrogen in plant top.

^dRated with 1 = dark green, 3 = pale yellow.

Strain differences for nodulation and nitrogenase activity in the field where native rhizobia are present has also been demonstrated (Tables 9-11). Strain 176A34 produced greater nodulation than an uninoculated control when 48 genotypes were evaluated in a field where peanuts had been grown previously (Table 9). Nitrogenase activity for nine strains and an uninoculated control applied to Florigiant and sampled five times during the growing season produced significant differences (Table 10). Strain 3G4b21 had higher activity than the uninoculated control at every sampling date. It is also interesting that strain 42B2 was low in activity in both greenhouse and field studies. Nodulation was equal to or greater than the uninoculated control which was also heavily nodulated (Table 11). These data indicate that rhizobial strains can be identified that will effectively nodulate and fix nitrogen in symbiosis with peanuts. Furthermore, preliminary findings suggest that these strains can infect peanuts in the field in the presence of native rhizobia. Thus further studies to utilize more effective Rhizobium strains are continuing.

Table 9. Differences in nodulation for nine *Rhizobium* strains applied in suspension to peanuts in field at Rocky Mount, NC

Strain	Nodulation rating ^a
3G4b20	2.81
176A34	3.10
176A22	3.07
3G4b5	3.06
3G4b4	3.07
3G4b21	2.98
42B2	3.06
32H1	2.93
32Z3	3.04
Uninoculated	2.89
LSD (.05)	.17

^aMean over 48 genotypes replicated twice. Rated 1 = little, 5 = heavy nodulation.

Table 10. Variation in nitrogenase activity for nine strains applied in suspension to peanuts in field at Rocky Mount, NC^a

Strain	Sampling date					Mean
	8/15	8/19	8/24	9/12	9/20	
3G4b20	49	70	64	69	28	56.0
176A34	45	50	61	49	20	45.0
176A22	52	60	68	65	30	55.0
3G4b5	49	52	74	61	32	53.6
3G4b4	58	50	73	48	30	51.8
3G4b21	55	71	69	74	33	60.4
42B2	44	47	45	49	18	40.6
32H1	38	50	71	66	39	52.8
32Z3	37	56	56	62	26	47.4
Uninoculated	48	51	54	64	26	48.6
Mean	47.4	55.6	63.6	60.6	28.3	51.1
LSD (.05) sampling date =	8.29		LSD (.05) strain =	11.76		

^a $\mu\text{M C}_2\text{H}_4/\text{hr/plant}$ for Florigiant.

Table 11. Nodulation of cultivar Florigiant by nine strains of rhizobia and native rhizobia in field at Rocky Mount, NC

Strain	Nodulation rating ^a
3G4b20	5.0
176A34	4.5
176A22	5.0
3G4b5	5.0
3G4b4	5.0
3G4b21	5.0
42B2	5.0
32H1	5.0
32Z3	5.0
Uninoculated	4.5

^aNodulation rated 1 = little, 5 = most for Florigiant.

Host-Strain Specificity

Although several studies have been conducted, no specific host-strain combinations which maximize nitrogen fixation have been found. In general we have found strains to be either relatively effective or ineffective over a range of genotypes for both nodulation and nitrogen-fixing activity. Similar results have been found for host genotypes as illustrated by the data in Table 12. Strain RP182-13 was effective for both genotypes while strain 3G4b9a was ineffective for both genotypes. More diverse strains are now being evaluated in an effort to identify specific host-strain combinations that maximize nitrogen fixation.

Table 12. Nitrogen-fixing data for six host-strain combinations grown in the greenhouse

Strain	Genotype	Nodule number	Nitrogenase ^a activity	Plant ^b color	Plant ^c weight
32H1	NC 4	44	6.26	4.0	2.69
	Argentine	32	3.08	3.8	2.14
3G4b9a	NC 4	3	0	3.0	1.95
	Argentine	0	0	1.2	.69
RP182-13	NC 4	67	8.71	4.0	3.04
	Argentine	40	3.22	3.8	2.03

^a $\mu\text{M C}_2\text{H}_4/\text{hr/plant}$.

^bRated with 1 = yellow, 4 = dark green.

^cDry weight in g.

CONCLUSIONS

Based on preliminary studies, it appears that selection of more efficient host plants or more effective rhizobial strains can be used to increase nitrogen fixation of the peanut.

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1 Amino acids, Oil and Protein Content of Some Selected Peanut Cultivars

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4
5 ABSTRACT

6 In the continuing search for a high methionine peanut line, seeds
7 of a number of different peanut selections and cultivars were obtained
8 from the peanut breeders. The analyses of peanut seed samples showed
9 46.0 to 52.6 percent oil and 22.58 to 28.22 percent total protein.

10 The three essential amino acids which are deficient in peanuts,
11 lysine, methionine and threonine, had respectively a range of 2.14 to
12 3.83, 0.35 to 0.99 and 3.83 to 4.97 as percent of protein.
13 Highest amount of lysine was observed in UF 77117, however, the highest
14 level of methionine was observed in UF 77315 and Huallaga (PI 393522).
15 Other essential amino acids not deficient in peanuts, isoleucine,
16 leucine, phenylalanine and valine, showed very little variability
17 between the samples.

18 INTRODUCTION

19 Peanut seeds although high in oil and total protein content, are
20 deficient in some essential amino acids such as methionine, lysine,
21 threonine, and tryptophan (5). However, methionine and lysine are a
22 major concern because they occur at such low concentrations in peanut
23 seeds.

24 The various attempts to increase the methionine content of peanut
25 seeds include: methionine supplementation (2), blending of peanut
26 products with other high methionine plant proteins (6), plant tissue
27 culture techniques (4), increasing the urease content of the peanut seed

(7) and finally, breeding high methionine cultivars.

This paper reports a survey of some selected peanut cultivars for their oil, protein and amino acid composition. Hopefully, some of these cultivars can be used in breeding high methionine peanut lines.

MATERIALS AND METHODS

The peanut seed samples were first oven-dried at 70C for 48 hr and then extracted for oil by the Fosslet method (3). The total protein was obtained by analyzing the defatted peanut meal for nitrogen by micro-Kjeldahl's method (1) and then multiplying by a factor of 5.46.

The amino acid composition of the defatted peanut meal was obtained by hydrolyzing the samples for 18 hrs at 110 C (8), followed by analysis on a JBOL-6AH automated amino acid analyzer.

RESULTS

The analyses of peanut seeds for moisture, oil and total protein are shown in Table 1. The percent protein contents have been arranged in decreasing order. The percent moisture was calculated to determine if there was any significant variability in the moisture content of seeds obtained from different sources. However, most of the samples had a moisture content of 2 to 3 percent.

A negative correlation ($r = -0.85$) was obtained between the oil content and the percent total protein. The highest oil content was recorded in UF 77303 and the lowest in UF 77312. The average oil content of the 19 samples varied from 22.58 to 28.22 percent. UF 77312, Early Bunch, NC-Fla 14, UF 77112, and New Mexico Valencia A had appreciably higher protein content than the other cultivars listed in Table 1.

The composition of the essential but deficient amino acids in

Table 1 Analyses of Peanut Seeds

Sample Description	Percent of whole peanut seeds (oven-dry weight basis)		
	moisture	oil	protein
UF 77312	3.13	46.00	28.22
Early Bunch	3.60	47.00	27.29
NC-Fla 14	2.80	49.20	26.75
UF 77112	2.88	47.60	26.28
New Mexico, Valencia A	2.10	48.60	25.99
PI 268689 Sel G 169	2.32	49.00	25.96
Huallaga	1.90	51.40	25.92
UF 77301	3.33	50.00	25.48
Virginia Bunch 67	3.10	49.20	25.41
Florunner	2.28	47.80	24.97
Tifton-8	2.10	47.80	24.92
Makula Red	1.88	50.40	24.73
UF 77313	2.74	49.20	24.61
Dixie Runner	2.09	49.00	24.19
UF 77311	3.10	49.60	24.14
UF 77113	3.77	49.20	23.96
UF 77303	3.62	52.60	23.61
UF 77315	2.85	48.80	22.94
UF 77117	3.09	49.20	22.58

^a Values are averages of duplicate samples.

Table 2. Composition of the Essential Amino Acids (Deficient) in Whole Peanut Seeds

Sample Description	Percent of Protein		
	lysine	methionine	threonine
UF 77312	3.56	0.67	4.39
Early Bunch	3.49	0.74	4.33
NC-Fla 14	3.58	0.85	4.38
UF 77112	3.73	0.61	3.94
New Mexico, Valencia A	2.50	0.68	4.75
PI 268689 Sel G 169	2.37	0.63	3.83
Huallaga	2.27	0.97	4.34
UF 77301	3.54	0.67	3.93
Virginia Bunch 67	2.52	0.51	4.97
Florunner	3.78	0.67	4.19
Tifton-8	2.14	0.35	4.06
Makula Red	2.73	0.90	4.88
UF 77313	3.00	0.85	4.21
Dixie Runner	3.93	0.84	4.33
UF 77311	3.81	0.51	4.42
UF 77113	3.56	0.69	4.04
UF 77303	3.80	0.77	4.24
UF 77315	3.20	0.99	4.24
UF 77117	3.83	0.66	4.41

^a Values are averages of triplicate runs.

Table 3. Composition of the Essential Amino Acids (Not Deficient)
in Whole Peanut Seeds

	Percent of protein			
	isoleucine	leucine	phenylalanine	valine
UF 77312	3.18	6.51	5.22	3.60
Early Bunch	3.18	6.38	5.19	4.21
NC-Fla 14	3.29	6.41	5.43	4.63
UF 77112	3.22	6.29	5.08	4.07
New Mexico, Valencia A	3.27	7.33	5.24	4.63
PI 268689 Sel G 169	3.55	6.54	5.32	4.28
Huallaga	3.36	7.78	5.42	4.68
UF 77301	2.78	6.02	4.96	3.36
Virginia Bunch 67	3.72	7.25	5.48	4.56
Florunner	3.19	6.42	4.98	4.02
Tifton-8	3.26	7.51	5.43	4.72
Makula Red	3.69	7.12	5.28	4.55
UF 77313	3.13	6.50	5.22	4.23
Dixie Runner	3.76	5.71	n.d.	4.19
UF 77311	3.10	6.48	5.32	3.83
UF 77113	3.15	6.06	5.17	4.11
UF 77303	3.08	5.72	4.68	3.76
UF 77315	3.04	6.63	5.40	4.04
UF 77117	3.08	6.42	5.14	3.80

^a Values are averages of triplicate samples.
n.d. = not determined.

1 peanut seeds is shown in Table 2. Threonine values are very close to
2 the ideal amino acid composition and therefore, its deficiency is not
3 as severe as that of methionine and lysine. Huallaga, Makula Red,
4 UF 77315, UF 77313, and NC-Fla 14 had high levels of methionine as
5 compared to the others listed in Table 2. The lowest methionine content
6 was noted in Tifton-8 and Virginia Bunch 67. High lysine was observed in
7 UF 77117 (lowest in protein and average oil content), UF 77312
8 (lowest in oil but highest in total protein). Dixie Runner, UF 77211,
9 Florunner, UF 77303 were also found to have a higher lysine content
10 (Table 2).

11 The other essential amino acids not deficient in the peanuts,
12 isoleucine, leucine, phenylalanine, and valine, showed little
13 variability between the samples (Table 3).

14 Discussion

15 In order to increase the methionine content or any other deficient
16 amino acid, the simplest way is to add it in free form to food products.
17 Also, peanut meal can be blended with other methionine rich plant
18 proteins. Such supplementations do raise the levels of the deficient
19 amino acids but introduce odd flavors, colors and solubility problems
20 (2). The other approach is to develop new peanut plants capable of
21 producing high methionine proteins by plant tissue culture techniques.
22 Experiments are underway in this laboratory to investigate this
23 possibility.

24 Another novel approach to increase methionine has been reported in
25 soybeans by Polacco (1976). Since urease has higher methionine levels
26 than other seed proteins, an increase in the amount of urease will
27 result in higher methionine levels. Urease activity of the soybean

1 leaf tissue was increased 10 to 20 times by adding 25mM urea to the
2 culture media. We have also initiated some preliminary experiments to
3 study the effects of urea on the peanuts, both in tissue culture and
4 in the field.

5 It is evident from the tables 1, 2, and 3 that there is little
6 variation between 19 cultivars as far as deficient amino acids are
7 concerned. Furthermore, the amino acid composition of the peanut seed
8 varies from year to year depending upon the types and amounts of the
9 fertilizers added and the weather conditions during the growing season.
10 An effort is now being made to obtain seeds from as many diversified
11 sources as possible to identify those cultivars which may have high
12 methionine and lysine contents.

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ABSTRACT

With consideration by electric utilities of time-of-day metering for determining electric rates, this research was initiated to determine the effects of interrupting air flow on the drying rate and milling quality of peanuts. The results of one year's experiments show that air flow can be interrupted 25% of the time for peanuts with an initial moisture content (m.c.) of up to 30% (wet basis), without decreasing the rate of drying. Interruption of air flow 50% of the time resulted in no reduction of the drying rate for initial m.c. of up to 25%. Interrupting air flow 75% of the time did reduce the drying rate. Cycling periods up to 8 hours showed no effect on drying rate. Milling quality differences were not significant among any of the air flow interruption treatments.

INTRODUCTION

Peanuts are normally harvested by removing them from the ground at 45 to 50 percent moisture content (m.c.) (wet basis (w.b.)), allowing them to dry in the windrow to 20 to 30 percent m.c., then combining and further drying them to below 10 percent m.c., with forced, heated air. Current recommendations are that a minimum air flow rate of $12.5 \text{ m}^3/\text{min}/\text{m}^3$ of peanuts be maintained throughout drying for peanuts with m.c. up to 25 percent. Above this moisture level, air flow rates should be increased.

As demand for electricity rises, utility companies are considering time-of-day metering whereby electrical rates for peak demand hours (for example, 10 A.M. to 10 P.M.) will be 2 to 10 times the rates for off-peak hours. A peanut producer cannot interrupt air flow for the entire peak demand period without encouraging mold growth in the peanuts. He may, however, be able to periodically interrupt air flow for short times without affecting drying rate or quality, and yet reduce electrical demand for running the fans, as well as reduce fuel consumption for heating the air.

This paper is a progress report of the first year of a study to determine the effect of periodical air flow interruption (AFI) on the drying rate and quality of peanuts. The study was conducted by the U. S. Department of Agriculture, Science and Education Administration, Federal Research, at Tifton, Georgia, in cooperation with the Georgia Coastal Plain Experiment Station at Tifton.

EQUIPMENT

Experiments were carried out in two phases. In the first phase the feasibility of a wide range of AFI procedures was determined. Peanuts were dried in small boxes (0.3- x 0.3- x 0.3-m deep) with perforated metal bottoms. The boxes were placed on a plenum that supplied heated air. Air in the plenum was heated with electric resistance heaters and its temperature was thermostatically limited to 35°C. Heaters were sized to allow a temperature rise of up to 8°C above ambient conditions. Air flow was set at $15 \text{ m}^3/\text{min}/\text{m}^3$ of peanuts. Fan and heaters were periodically interrupted by a time clock. There were two replications for each treatment.

After the first phase indicated feasibility of AFI procedures on small lots of peanuts, the second phase was initiated to determine the applicability of these procedures to larger lots of peanuts. In the second phase, peanuts were dried in model bins (0.6- x 0.6- x 1.2-m deep). Depth was the same as in a conventional wagon dryer by only 1/28th of the volume. Air was heated with liquified petroleum gas (LPG), the same fuel used in conventional dryers. Air temperature was thermostatically limited to 35°C, and the LPG pressure at the burner was set to limit the rise in drying air temperature to 8°C. Rate of air flow was 15 m³/min/m³ of peanuts. Time clocks periodically interrupted the fans and burners. The second-phase treatments were not replicated.

PROCEDURE

Peanuts were partially field cured before each drying test. Moisture samples were taken at the beginning and end of each test. Moisture was determined by drying 250-g samples in a forced draft oven at 130°C for 12 hours.

In the first phase, with small boxes, drying rate was determined by weighing the boxes twice daily. Temperatures of the plenum air and of the peanuts were recorded hourly. At the end of each test, milling quality was determined on four samples from each treatment by use of the Federal-State grading procedure.

In the second phase, samples for m.c. determinations were taken from the tops of the bins twice daily. At the end of each test, samples were taken from the top and bottom of each bin. Temperatures of the air in the plenum and of the peanuts at 0.3-m and 0.9-m depths were recorded hourly. Samples for milling quality determinations were taken from both the top and bottom of the model bins at the end of drying. Moisture content and milling quality were determined as in the first phase.

AFI cycling periods ranged from 1 to 8 hours. Air flow was interrupted for 25, 50, or 75 percent of the drying cycle period in respective tests. Fig. 1 shows some typical AFI treatment patterns. All results from interruption of air flow were compared with results from normal drying in which air flow was continuous. In some of the tests, air flow was interrupted only during peak demand hours (10 A.M. to 10 P.M.), then continuous air flow was resumed during off-peak hours (10 P.M. to 10 A.M.). Drying of a sample was terminated when the m.c. dropped below 10 percent. Actual drying time to reach 10 percent m.c. was determined by interpolation of the m.c. data. Overall drying rate was then calculated for the time required to dry the sample to 10 percent m.c.

Milling quality results were statistically analyzed with an analysis of variance using a randomized block design for each test. Significance was tested using an F-test at the 10 percent level of significance. (Ostle, 1954).

RESULTS

Results of the air flow interruption tests are summarized in Tables 1 and 2. The relative drying rate (the ratio of the AFI treatment to the continuous air flow treatment within a given test x 100) is shown to facilitate comparison of results.

TREATMENT	
PERIOD	%OFF

CONTINUOUS

1 25

8 25

1 25

1 75

CONTINUOUS DURING
OFF PEAK HOURS

TIME OF DAY

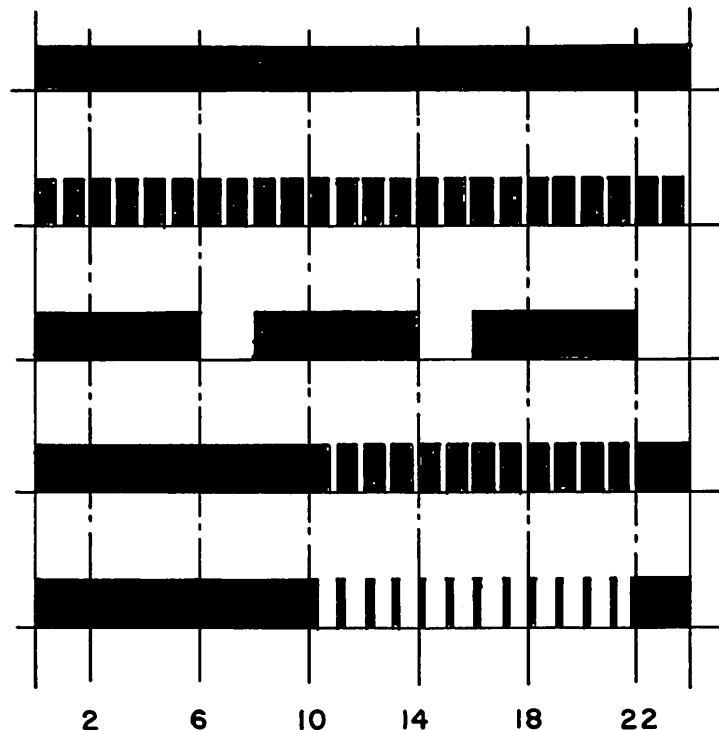


Fig. 1 Typical On-Off Patterns for AFI Treatments

Table 1. Summary of Results from Interruption of Air Flow Through Peanuts in Small Boxes

Sample No. (Test-Treatment)	Treatment		Initial m.c. % w.b.	Drying Rate m.c. %/hr.	Relative Drying Rate ^{1/}	Splits ^{4/} %
	Period hr.	Time off %				
1-1	1	25	20	0.150	97	2.0
1-2	2	25	20	0.120	78 ^{2/}	1.7
1-3	4	25	20	0.162	105	1.6
1-4	8	25	20	0.149	97	2.1
1-5	Continuous		20	0.154	100	1.7
2-1	1	25	25	0.246	106	3.5
2-2	1	50	25	0.228	98	2.4
2-3	2	50	25	0.246	106	3.1
2-4	4	50	25	0.225	97	2.8
2-5	Continuous		25	0.232	100	3.2
3-1	1	25 ^{3/}	19	0.207	116	5.0
3-2	1	50 ^{3/}	19	0.184	103	4.2
3-3	2	50 ^{3/}	19	0.176	99	3.8
3-4	4	50 ^{3/}	19	0.188	106	4.1
3-5	Continuous		19	0.178	100	4.2
4-1	1	25	17	0.179	96	4.3
4-2	1	75	17	0.159	85	3.6
4-3	2	75	17	0.196	105 ^{2/}	4.3
4-4	4	75	17	0.156	84	3.3
4-5	Continuous		17	0.186	100	5.2

^{1/} Ratio of AFI drying rate to continuous drying rate within a given test x 100.

^{2/} Malfunctioning thermostat

^{3/} Intermittent air flow 10 A.M. to 10 P.M., Continuous air flow 10 P.M. to 10 A.M.

^{4/} Basis for milling quality determination

Table 2. Summary of Results from Interruption of Air Flow Through Peanuts in Model Bins

Sample No. (Test-Treatment)	Treatment		Initial m.c. % w.b.	Drying Rate m.c. %/hr.	Relative Drying Rate ^{1/}	Splits ^{2/}	
	Period hr.	Time Off %				Top %	Bottom %
5-1	1	25	24	0.276	96	2.4	5.0
5-2	1	50	26	0.296	103	3.7	5.0
5-3	2	25	25	0.296	103	2.6	4.9
5-4	Continuous		25	0.288	100	2.2	4.8
6-1	1	25	17	0.252	112	4.5	6.0
6-2	1	50	17	0.238	95	4.2	5.1
6-3	1	50 ^{3/}	16	0.214	95	3.3	5.5
6-4	Continuous		16	0.226	100	5.3	4.6
7-1	1	25	30	0.265	97	3.4	3.5
7-2	1	50	30	0.246	90	2.6	3.7
7-3	1	75 ^{3/}	32	0.183	67	1.7	2.3
7-4	Continuous		31	0.273	100	2.4	2.4

^{1/} Ratio of AFI drying rate to continuous drying rate within a given test x 100.

^{2/} Basis for milling quality determination

^{3/} Intermittent air flow 10 A.M. to 10 P.M., Continuous air flow 10 P.M. to 10 A.M.

Drying Rate

The data indicated that air flow can be interrupted for 25 percent of the time without appreciably reducing the drying rate of peanuts with an initial m.c. of up to 30 percent. Increasing the cycling period of AFI (Tests 1 and 5) did not affect drying rate, although one sample (1-2) had a lower rate of drying than the continuous treatment because of a malfunctioning heater thermostat.

Interrupting the air flow 50 percent of the time (Test 2) did not decrease the drying rate for peanuts with up to 25 percent initial m.c. At 30 percent initial m.c., a 50-percent interruption (Sample 7-2) tended to reduce the drying rate.

Interrupting air flow 75 percent of the time appreciably reduced the drying rate (Tests 4 and 7). As in the preceding tests, increasing the cycling period of the AFI did not affect the drying rate. Sample 4-3 dried faster than the other samples in Test 4 because of a malfunctioning heater thermostat.

The pattern of 12 hours of intermittent air flow followed by 12 hours of continuous air flow did not affect drying rates or peanuts with an initial m.c. of up to 19 percent (Tests 3 and 6). At 30 percent initial m.c. and 75 percent AFI, however, some continuous drying was necessary. Sample 7-3 failed to dry until air flow became continuous.

Milling Quality

The percentage of sound split kernels, a measure of milling quality, was not statistically significant among treatments within the tests. Significant differences in split kernels did occur among tests because of varying field and harvesting conditions before the drying tests.

The percentage of split kernels was significantly higher in samples from the bottoms of the model bins than in samples from the tops in some of the tests. In none of the tests was the percentage of split kernels from the tops of the bins significantly higher than those from the bottoms of the bins.

Temperature

The temperature of the peanuts approached the temperature of the air within a few hours. When air flow ceased, the peanuts maintained the temperature, with little decrease, for several hours. Fig. 2 shows the temperature pattern for Sample 6-2, recorded at 30-minute intervals. Recording was continued after drying was completed to follow the drop in peanut temperature.

DISCUSSION OF RESULTS

The outcome of this experiment indicated that intermittent air flow is feasible for drying peanuts. Drying of agricultural materials can generally be divided into two stages. (Hall, 1957). At high moistures, the differences in vapor pressure between the kernel interior and the surface is high, so moisture moves rapidly to the surface. The rate of drying can then be limited by the rate at which moisture is removed from the kernel surface. At this stage of drying, the air flow rate will affect drying rate.

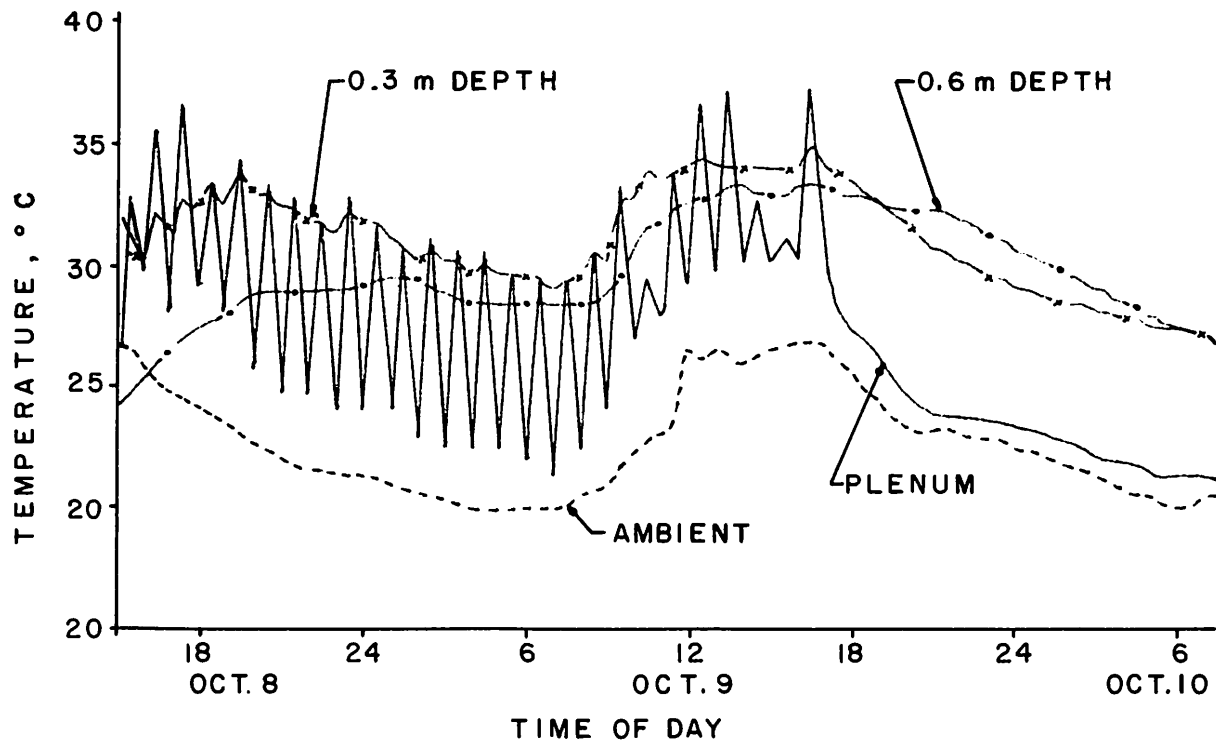


Fig. 2 Temperature pattern in motel bin with 3 min on - 30 min off air flow cycle (Sample 6-2).

As the moisture level in the kernel decreases, the drying rate decreases and moisture movement from the interior to the surface of the kernel becomes the limiting factor affecting the drying rate. At this stage, a periodic movement of air to remove any accumulation of moisture in the void spaces and to maintain the temperature of the peanuts will maintain the overall drying rate. When the air flow ceases, the temperature of the peanuts can be maintained with little loss for several hours because of their low thermal conductivity (Suter et al, 1975).

SUMMARY

The results of one year's experiments indicated that peanuts can be successfully dried by periodically interrupting the air flow. For peanuts with an initial m.c. of up to 30 percent, an interruption of air flow 25 percent of the time did not reduce the drying rate or adversely affect quality. For peanuts with an initial m.c. of up to 25 percent, an interruption of air flow 50 percent of the time did not reduce the drying rate or adversely affect milling quality. Interrupting the air flow 75 percent of the time did reduce drying rate but did not adversely affect quality.

These tests will be repeated over several seasons to fully validate the results and to further explore limitations in the cycle period and percentage of air flow interruption, the effect of initial m.c. and the effect of continuous air flow during off-peak hours.

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Reducing Energy Consumption During Conventional Peanut Drying. Paul D. Blankenship, National Peanut Research Laboratory, Dawson, GA, and Victor Chew, USDA-SEA-FR, University of Florida, Gainesville, FL.

ABSTRACT

This study is being conducted to determine the effects of periodic dryer cycling (on, off) on total drying time, gas and electricity consumed, and electrical demand during conventional peanut drying. Full size, commercially available wagons with rear-air-entries and 5.07 metric horsepower (Mhp) (5 horsepower (hp)), vane-axial, gas-fired dryers were used in the tests. Florunner peanuts ranging in moisture content (m.c.) from 13 to 33 percent were dried. Based on one year's results, dryers may be shut off for as much as one-third of the time without significantly increasing total drying time. Gas consumption was reduced an average of 21%; electricity, 32%.

INTRODUCTION

Artificial drying of peanuts requires tremendous expenditures of gas and electrical energy. Because of the large seasonal requirements for peanut drying, commercial electricity suppliers have instituted yearly billing based on many dryer operators' maximum monthly demand. Reduction in energy requirements for drying peanuts is economically desirable for both dryer operators and electrical energy suppliers. But to be accepted by the peanut industry, methods for energy reduction during drying must not significantly increase total drying time.

Recent research (1, 2) has shown that dryer cycling significantly reduces electrical demand during curing of high-quality tobacco. Curing time, however, was longer. Peanuts can be satisfactorily dried in 0.3-meter (m) (1-foot) depths with short exposures to heat when combined with mixing, tempering and aerating (3). However, peanuts are usually dried in 1.2-to 1.5-m-deep (4- to 5-ft) static beds.

This study is being conducted to determine if periodic dryer cycling can be used in conventional peanut drying to decrease energy consumption without significantly increasing drying time. This paper reports the results of one year's research. A similar study on a laboratory scale is being conducted in conjunction with this research by the U.S. Department of Agriculture, Science and Education Administration, Federal Research in Tifton, Georgia.

MATERIALS AND METHODS

This study was conducted in 1977 at the Parrott, Georgia peanut drying, cleaning and receiving station owned by Stevens Industries, Inc.

Florunner peanuts for each series of tests were dug, windrowed with inverters, dried in the windrows for 1 to 7 days, and then harvested with a combine. Seven 4.3 m x 2.4 m x 1.4 m (14 ft x 8 ft x 4 1/2 ft) Peerless ^{1/} rear-air-entry drying trailers were level filled with the peanuts and transported to the drying facility where a Model 153 5.07 Mhp (5 hp), single-trailer Peerless propane gas-fired dryer

^{1/} Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture and does not imply its approval to the exclusion of other products that may also be suitable.

was attached to each trailer. Cycle timers were installed to facilitate periodic starting and stopping of the dryers. Hour meters were attached to both the burner and fan circuits of each dryer. The operating schedules for the seven treatments are shown in Table 1. Ten series of the tests were conducted.

Table 1.—Dryer control test design and actual performance

Treatment no.	Dryer operation schedule		Planned fan time reduction	Actual fan time reduction <u>1/</u>	Standard deviation
	On	Off			
	Minutes		%	%	%
1	10	5	33.3	33.2	0.7
2	40	20	33.3	32.3	1.6
3	11.25	3.75	25	25.8	3.3
4	45	15	25	24.2	1.6
5	12	3	20	20.1	0.3
6	48	12	20	20.3	2.6
7 (control)			on continuously	0	0

1/ Mean of 10 tests.

Manufacturer's rated airflow rate for the dryers was 305.6 cubic meters per minute (10,790 cubic feet per minute) at a total static pressure of 2.54 cm (1 inch) of water. The drying air temperature [35° C (95° F) or lower, 11° C (20° F) maximum temperature rise] was controlled with cycling-type flame controls on each dryer. Plenum temperature was measured next to the plenum wall directly opposite trailer air entry. Gas pressure was adjusted as required at each dryer by ambient temperature change to maintain flame operation during 50% of dryer operation time.

Electrical energy consumption of each dryer was measured by using standard watt hour meters with demand scales. Gas consumption was determined from weight loss of individual propane tanks for each dryer. Initial and final moisture contents of the peanuts were determined by oven drying 250 grams of shelled kernels at 130° C for 3 hours and calculating m.c. based on weight loss. Start-up time for each treatment in a test series varied less than 5 minutes. Artificial drying was stopped when the m.c. of the peanuts reached 11 to 12 percent as determined by a Steinlite PT-2 moisture meter.

RESULTS AND DISCUSSION

The efficacy of the dryer controls for maintaining planned operating schedules during the tests is shown in Table 1. Mean fan time reductions were within 1% of the test design; however, some variation did occur.

The meters used to record electrical demand measure demand over a 30-minute period. Instantaneous motor start-ups (no more than two per 30 minutes) did not significantly increase the measured demand. To reduce total electrical demand at a drying facility by dryer cycling, the operation of each dryer would have to be scheduled. Each dryer would be shut off periodically so that a minimal number of dryers would be operating at any given time. The reduction in total demand would approximate the percentage of dryers not operating.

The average initial m.c. of the seven trailer loads of peanuts used for each test series is shown in Table 2. The initial m.c. of most peanuts artificially dried by industry falls within the range we investigated. The measured test responses of total drying time, electricity used and gas used were correlated with initial m.c., but not with final m.c. or initial and final weights.

Table 2.--Average initial m.c. of the peanuts used in each test series

Test series no.	Initial m.c.	Standard deviation
	<u>%</u>	<u>%</u>
1	29.2	1.0
2	21.3	0.8
3	16.6	0.6
4	13.8	0.7
5	30.2	1.2
6	22.3	1.1
7	24.0	0.7
8	32.5	1.2
9	19.5	1.9
10	21.5	1.0

The mean drying times and electricity and gas used for drying the trailer loads of peanuts with the different treatments are shown in Table 3. Only treatment 1 had a mean drying time significantly longer than that of the control (1.88 hours longer). The control required significantly more electricity than any other treatment, and required from 33.3 to 49.2 liters (ℓ) (8.8 to 13.0 gals) more gas than did the other treatments.

Table 3.—The average initial moisture contents, drying times, and electricity and gas used for drying trailer loads of peanuts with the different treatments ^{1/}

Treatment no.	Average initial m.c.	Average drying time	Average electricity used	Average gas used
	<u>%</u>	<u>Hrs</u>	<u>KWH</u>	<u>Liters</u> (<u>Gals</u>)
1	22.7	25.0 a ^{2/}	83.9 c,d	168.4 b (44.5)
2	22.8	23.3 a,b	78.6 d,e	171.5 b (45.3)
3	23.1	23.9 a,b	89.8 b,c	182.1 b (48.1)
4	23.3	24.4 a,b	74.6 e	184.0 b (48.6)
5	22.9	23.1 b	75.0 e	168.5 b (44.5)
6	22.4	23.5 a,b	92.6 b	181.7 b (48.0)
7 (control)	23.4	23.1 b	115.1 a	217.4 a (57.5)

^{1/} Means of 10 test series.

^{2/} Values in each column followed by the same letter are not significantly different at the 0.05 level according to Duncan's New Multiple Range Test.

Linear prediction equations correlating total drying time and peanut initial m.c. were developed for each drying treatment. Similar equations were developed for electricity used, gas used, and total energy costs. Electricity costs were calculated as 0.07 dollar per KWH; gas as 0.087 dollar per ℓ (0.33 dollar per gal). Correlation coefficients for the developed equations were all greater than 0.85. Calculated values for three levels of initial m.c. for each treatment are presented in Table 4.

Table 4.--Predicted values of total drying time, electricity used, gas used, and total energy costs at three levels of moisture for each treatment

Treatment no.	Initial m.c.	Total drying time	Electricity used	Gas used		Total energy cost per trailer
	<u>%</u>	<u>Hrs</u>	<u>KWH</u>	<u>Liters</u>	<u>(Gals)</u>	<u>\$</u>
1	15	9.2	30.3	55.6	(14.7)	6.97
	22.5	24.6	82.8	166.2	(43.9)	20.38
	30	40.0	135.2	276.7	(73.1)	33.59
2	15	4.5	15.0	34.4	(9.1)	4.05
	22.5	22.6	76.5	176.8	(46.7)	20.77
	30	40.8	138.0	318.7	(84.2)	37.45
3	15	5.8	21.8	60.2	(15.9)	6.77
	22.5	22.6	85.0	162.0	(42.8)	20.07
	30	39.3	148.3	263.4	(69.6)	33.35
4	15	7.0	21.5	52.6	(13.9)	6.09
	22.5	22.8	69.8	172.2	(45.5)	19.90
	30	38.6	118.1	291.4	(77.0)	33.68
5	15	6.2	20.0	65.5	(17.3)	7.11
	22.5	22.2	72.3	163.5	(43.2)	19.32
	30	38.3	124.6	261.5	(69.1)	31.53
6	15	7.3	29.4	61.7	(16.3)	7.44
	22.5	23.6	93.2	182.8	(48.3)	22.46
	30	40.0	157.1	304.3	(80.4)	37.53
7 (control)	15	5.7	30.3	43.5	(11.5)	5.92
	22.5	21.2	105.8	198.7	(52.5)	24.73
	30	36.7	181.3	353.9	(93.5)	43.55

Predicted drying time for the control was at least 1.6 hrs shorter at 30% initial m.c. than any of the other treatments; at 22.5% initial m.c., at least 1 hr shorter. At 15% initial m.c., calculated drying time for treatment 2 (33% off) was 1.2 hrs shorter than for the control. Predicted drying time for treatment 5 (20% off) was no more than 1.6 hrs longer than the control at any of the three levels of moisture. The data in Table 4 indicate that airflow must be continuous for maximum moisture removal at higher moisture levels, but not at lower moisture levels. Even though continuous dryer operation at the higher moistures dried the peanuts faster than any of the cycling treatments, none of the drying times predicted for the cycling treatments were more than 4.1 hrs longer than for the control. For all

cycling treatments, predicted electricity use per trailer of peanuts dried was less than or equal to that for the control at all three moistures. The control required more gas per trailer at and above 22.5% initial m.c. Treatment 2 required less gas than the control at all three moisture levels.

Predicted total energy costs for all treatments at the three levels of moisture are also shown in Table 4. Treatment 2 was the only cycling treatment lower in energy costs than the control at all levels of moisture.

CONCLUSIONS

Use of dryer cycling can effectively reduce electrical demand, dryer operation time and energy expenditure in artificially drying peanuts that have mid and low initial moisture contents. Total drying time for the peanuts will not be greatly increased.

Electrical demand at drying facilities can be reduced as much as one-third by using a 40 min. on, 20 min. off dryer cycle. Dryer operation should be carefully scheduled so that only two-thirds of the dryers are operating at any particular time. Also, one on-off cycle per hour is as satisfactory as four.

Further research is planned in this area to determine if there are more advantageous dryer cycling techniques.

ACKNOWLEDGEMENTS

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We also thank the following NPRL personnel who contributed ideas and time to this research: Robert A. Tennille, William G. Ferguson, C. T. Bennett, and Daryl E. Walden, engineering technicians.

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Relationship Between Method of Incorporation and Effectiveness of Two Nematicides Against the Peanut Root-Knot Nematode. H. Ivey, R. Rodriguez-Kabana, and H. W. Penick, Auburn Univ., Auburn, AL

Effect of method of incorporation on relative effectiveness of phenamiphos (Nemacur 15G) and fensulfothion (Dasanit 15G) against the root-knot nematode Meloidogyne arenaria was studied in a field test with 'Florunner' peanuts. At planting nematicides were applied in a 14 in. band at 3 lb a.i./A. Nematicides were either left unincorporated, incorporated 5-6 in by single pass of a disk, or incorporated 1-2 in by spring activated tines. Plots consisted of 2-row (36 in center) X 30 ft and each treatment received eight replicates arranged in a randomized complete block design. DBCP (Fumazone 86 EC) at 1 gal/A was chiseled in at planting (two chisels/row) for comparison. Yields from plots with fensulfothion were not significantly different ($P = 0.05$) from that for the control. Phenamiphos treatment resulted in yield increases over the control of 92%, 76%, and 50% for 1-2 in incorporation, no incorporation, and 5-6 in incorporation, respectively. The only phenamiphos treatment that significantly reduced the number of larvae of M. arenaria in the soil determined at harvest, was the tine-incorporated treatment. Lowest numbers of the larvae in the test were in DBCP-treated plots. Yields from DBCP treated plots were 155% higher than the control plots.

Comparison of Liquid and Granular Formulations of Ethoprop for Control of Root-Knot Nematodes in Florunner Peanuts. J. M. Hammond and R. Rodriguez-Kabana, Auburn University, Auburn, AL.

The relative effectiveness of 2 formulations of the nematicide ethoprop (Mocap 10G, Mocap 6EC) against the root-knot nematode (Meloidogyne arenaria) was evaluated in a field test with Florunner peanuts. The granular formulation was applied at planting in a 14-inch band at rates of 0, 2.2, 4.5, and 9.0 kg ai/ha; the liquid formulation was sprayed with a banding nozzle in a volume of 159 l/ha. Both materials were incorporated with a disk. Plots consisted of two rows (.9 m) x 9.1 m and there were 8 replications per treatment in a randomized complete block design. The experiment included a 9.3 l/ha treatment with DBCP (Fumazone 86 EC) applied at planting using 2 chisels per row. All ethoprop treatments increased yields significantly ($P = 0.05$) above the control; however, the lowest rate was inferior to other ethoprop treatments. Differences between formulations at each rate were not significant. Maximal yields were obtained with the 2.2 and 4.5 kg ai rates; the 9.0 kg rate (EC formulation) evidenced some phytotoxicity and reduced yields. All ethoprop treatments were significantly inferior to yields obtained with DBCP. Significant reductions in the number of larvae/50 cm³ soil, determined at harvest, were evidenced only to DBCP treatments. Results indicate that granular or liquid formulations of ethoprop perform equally against M. arenaria.

Effectiveness of Ethylene Dibromide (EDB) and Chloropicrin-EDB Mixtures Against Root-Knot Nematodes in 'Florunner' Peanuts. Peggy S. King, R. Rodriguez-Kabana, and J. G. Starling, Auburn Univ., Auburn, AL.

EDB (Soilbrom 90 EC) and EDB-chloropicrin mixtures of 27% (Terra-0-Cide 72-27) or 45% (Terra-0-Cide 54-45) chloropicrin were evaluated in field experiments with 'Florunner' peanuts for control of the root-knot nematode Meloidogyne arenaria. Fumigants were chiseled in at planting; two chisels/row, 6 in apart. Soilbrom 90 EC and Terra-0-Cide 72-27 were applied at rates of 0.5 to 4.0 gal/A, and Terra-0-Cide 54-45 at 0.75 and 1.50 gal/A. Performance of these nematicides was compared to that of DBCP (Fumazone 86 EC) applied at 1 gal/A and with that of a no treatment control. Plots were 2 row (36 in center) X 30 ft, replicated eight times, and arranged in a randomized complete block design. Peanut yields increased significantly with Soilbrom 90 EC and Terra-0-Cide 72-27 in the range of 0-2 gal/A. Yields for Terra-0-Cide 54-45 were highest for the 1.5 gal/A rate; both rates being significantly above the control. Yield comparisons between fumigants applied at 1 gal/A rate revealed a 126%, 97% and 93% for Soilbrom 90 EC, Terra-0-Cide 72-27, and DBCP, respectively. The yield response to Soilbrom 90 EC was significantly higher than for the other 2 fumigants. All fumigants, irrespective of rate, significantly reduced the number of M. arenaria larvae/50 cm³ soil (determined at harvest).

Efficacy of At-Plant and Additional At-Pegging Applications of Nematicides for Control of Meloidogyne arenaria on Peanut. D. W. Dickson and R. E. Waites, University of Florida, Gainesville, Florida 32611.

Two separate experiments were conducted on peanuts to compare at-plant application with at-plant plus additional at-pegging application of nematicides. The investigation was conducted in a field heavily infested with M. arenaria in 1976 & 1977. DBCP (9.0 lb a.i./acre) injected at-plant 8 inches deep in-the-row with two chisels spaced 8 inches apart per row was used as a standard, and untreated plots served as controls. Nonfumigant nematicides, aldicarb, ethoprop, fensulfothion, phenamiphos and UC-21865 were applied in a 12-inch band at-plant and incorporated with a rolling cultivator to a depth of 2-4 inches. One treatment, aldicarb was applied directly in the seed furrow at time of planting. Additional applications of the nonfumigants were applied at-pegging (first bloom) in a 14-inch band directed over the peanut vines. DBCP (at-plant) plus aldicarb (at-pegging) was the most effective treatment in both years. This treatment resulted in highly significant yield increases over the untreated controls of 264 and 55% in 1976 & 1977, respectively. The addition of aldicarb at-pegging increased yields 18 and 25% over DBCP alone in 1976 & 1977, respectively. The addition of aldicarb at-pegging increased the yield 40% over the single at-plant application of aldicarb in 1976. Additional applications of non-fumigant nematicides applied at-pegging increased yields from 2 to 25% over their single at-plant application in 1977. These studies show that additional at-pegging nematicide treatments increase peanut yields in soil infested with M. arenaria.

Control of Sclerotinia Blight of Peanuts with DPX4424. D. M. Porter, USDA, SEA, Suffolk, VA.

Sclerotinia blight, caused by Sclerotinia sclerotiorum, is a serious peanut disease. Losses in Virginia in 1976 to this disease were estimated at \$3 million. A new experimental fungicide, DPX4424, was compared with benomyl for control of Sclerotinia blight. DPX was applied at 1.12 (1X) and 2.24 (2X) kg a.i./ha. Benomyl was applied at 1.12 kg a.i./ha. There were four applications at 14 day intervals with low pressure (30 psi) in 205 liters H₂O/ha. On September 19 the disease index, DI=0 (lowest) to 5, for untreated and benomyl-treated plots was 2.40 and 1.50, respectively. The DI in 1X and 2X DPX-treated plots was 0.11 and 0.01, respectively. On October 6 the DI for untreated, benomyl, 1X and 2X DPX-treated plots was 2.90, 2.70, 0.15 and 0.01, respectively. Pod yields per ha (October 20) were: untreated, 3157 kg; benomyl, 4020 kg; 1X DPX, 5987 kg; and 2X DPX, 6063 kg. Value per ha was; untreated, \$1364; benomyl, \$1767; 1X DPX, \$2727; and 2X DPX, \$2811. The number of sclerotia/100g soil was: untreated 28, benomyl 17, 1X DPX three, and 2X DPX one. Radial growth of S. sclerotiorum on media not amended and amended with benomyl (1 µg/ml) was 75 and 14 times greater, respectively, than on media amended with DPX (1 µg/ml). Growth rate on media amended with 0.25, 0.50, 0.75 and 1.0 µg/ml DPX was 1.3, 0.7, 0.4 and 0.2 mm/day, respectively.

Sodium Azide Offers Some Promise for Control of Cyliandrocladium Black Rot (CBR) of Peanuts. B. Aaron Womble and Kenneth H. Garren, PPG Industries, Knightdale, NC and USDA, SEA, Suffolk, VA.

Analyses of combined results for 1976 and 1977 showed reductions in readily discernible infection of four varieties of peanuts by Cyliandrocladium crotalariae and increases in fruit yield of these varieties which could be attributed to use of sodium azide (Na Azide). Treatments were: 1. Na Azide preplant, incorporated (PPI) at 34 kg a.i./ha. 2. Trt. 1 + 13 kg a.i./ha Na Azide over row (OR) at mid-season. 3. Na Azide PPI at 17 kg a.i./ha. 4. Trt. 3 + 13 kg a.i./ha Na Azide OR at mid-season. 5. Na Azide 13 kg a.i./ha OR at mid-season. All five Na Azide treatments significantly reduced discernible infection in the combined results, but only trt. 1, the higher PPI rate, gave significant increases in yield over the untreated check. There was some phytotoxicity from all OR applications. Two of the test varieties are resistant and two are susceptible to CBR, but there were no indications of correlations between treatment, variety, and yield. In 1977, a very dry season, there was very little development of readily discernible CBR infection. Yet, in 1977, for trt. 1, the percentage increase in fruit yield over untreated check was 21 and 23 for resistant 'Spancross' and 'NC 3033' and 20 and 23 for susceptible 'Florigiant' and 'NC 17'. This indicates that there was a drought-response-type of root and fruit damage by CBR which was not measured by counts of dead plants but which was reduced by use of Na Azide.

Factors Initiating Epidemics of Southern Stem Rot (White Mold) Disease of Peanuts.
M. K. Beute, and R. Rodriguez-Kabana, North Carolina State University, Raleigh,
N. C., and Auburn University, Auburn, Ala.

Previous workers using sclerotia of Sclerotium rolfsii produced in sterile culture report that wetting of sclerotia by rain was a major stimulus to germination. The present study indicated that wetting of sclerotia produced in field soil did not enhance germination unless other stimulants were also present. Field sclerotia germinated and grew profusely, however, in the presence of dried green peanut stems and leaves but not in the presence of field-decomposed peanut debris. When vigorously growing peanut stems or leaves were detached and used in germination tests, no stimulation of sclerotia germination or of growth occurred. Dried green leaves from cultivars 'Florissant', 'Florunner', 'NC 2', 'NC 3033', and a Spanish selection (C₂) all stimulated sclerotial germination equally. Other cultural characteristics of these individual cultivars, however, include early senescence and tendencies to defoliate readily, both of which are correlated with respective susceptibility rankings of the cultivars to S. rolfsii. Our results suggest that the time and quantity of defoliating leaves, which are both genetically determined and influenced by leafspot incidence, irrespective of individual stimulatory capacity, are major determinants in S. rolfsii infection of specific peanut cultivars.

A Method for Determining Numbers of Sclerotia Produced by the Southern Blight Fungus Sclerotium rolfsii. R. Rodriguez-Kabana and M. K. Beute, Auburn University, Auburn, Ala. and N. C. State University, Raleigh.

Natural sclerotia of Sclerotium rolfsii do not germinate unless stimulated by certain volatile components of the host plant. A common stimulant, methanol, was used to develop a method for determination of numbers of sclerotia in field soil. In the method, 50 gms of air-dried, sieved (1 mm mesh) soil were spread evenly over a 13.5 cm diam sieve with 1 mm mesh fiberglass screen that was covered with a Whatman No 2 filter paper. The sieve was then placed inside a large petri dish cover containing 12.5 ml of 1% (v/v) aqueous methanol. The soil was allowed to imbibe the solution until it was evenly moist. The sieve was then placed in a dessicator over a 5 cm diam petri dish containing 10 gm of BaO₂ covered with water to provide O₂ and remove CO₂. The sealed dessicator was maintained at room temperature. After four days the dessicators were opened and the number of white colonies of S. rolfsii on the soil surface counted. The method is 100% effective of viable sclerotia. The optimal amount of soil per sieve area is 0.35 gm/cm² or lower. Enclosure of the sieves in polyethylene bags instead of in dessicators with BaO₂ is equally effective. Larger amounts of soil can also be used by spreading the soil over larger sieves or perforated pans provided that the critical soil area ratio is not exceeded. This method will permit establishment of accurate estimates of yield loss to S. rolfsii prior to planting of peanuts.

Establishment of the seed-hull weight ratio as a maturity index for peanuts and the postulation that the index may serve as an estimator of optimum harvest dates for yield and dollar-return have prompted the studies here reported. Statistical analysis of variation among the individual plant and among riffle-divided bulk samples suggests that the necessary sample size is four (4) plants per sample. The coefficient of variation among samples from early harvest (8/23/77) was significantly higher than among samples from late harvest (10/18/77). The seed-hull maturity index was found to change significantly with harvest dates at both Lewis-ton and Rocky Mount, N. C. Location effects and cultivar effects were also significant. The location effects suggest different maturation rates were occurring at the two locations. The significant differences between cultivars suggest that seed-hull maturity index values will have to be established for each cultivar. Although a linear increase in yield and the maturity index across harvest dates is very encouraging, one cannot draw firm conclusions regarding the potential use of the maturity index as an estimator of optimum harvest dates until a maximum yield level is reached in North Carolina. Appropriate modification in the design of future studies will enable the acquisition of such data.

Arginine maturity index will be compared to the above methods.

Comparison of Maturity Tests on Three Peanut Cultivars in South Texas. A. M. Schubert and C. L. Pohler, Texas A&M University, Plant Disease Research Station, Yoakum.

'Tamnut-74', 'Florunner', and 'Florigiant' were used to evaluate the performance of maturity tests in South Texas. Tests used were the arginine maturity index (AMI), fresh seed-hull weight ratio (FMI), dry seed-hull weight ratio (DMI), methanolic extract, and internal pericarp color (from grade samples). Five harvests were made to identify optimum harvest time.

FMI was found to be unsatisfactory; it was more variable than DMI and strongly dependent on weather conditions and sample handling. DMI appears to show promise; values increased at each sampling date. However, yields did not peak during the sampling period; so, a clear evaluation was not possible. AMI indicated digging dates before the higher yields were reached in all cultivars. Dates indicated by the methanol extracts were very ambiguous. Shellout indicated a more productive harvest time than did AMI in Tamnut, but was no better on Florunner and Florigiant. These findings indicate that none of the tests performed better than the traditional shellout (internal pericarp color) method.

The Effect of Digging Time on Seed-Size Distribution of Florunner Peanuts. E. Jay Williams, James I. Davidson, Jr., and James L. Butler, USDA, SEA, FR, Coastal Plain Experiment Station, Tifton, and National Peanut Research Laboratory, Dawson.

Seed size distribution data were obtained for Florunner peanuts for six different weekly digging dates in 1976 and for seven different weekly and four 10-day digging dates in 1977. Seed size data for each harvest date were fitted to both the normal and logistic distribution models. Analysis of the data showed that the logistic distribution model fitted the experimental data better than the normal distribution model. Except for the earliest digging dates, the logistic distribution model provided an excellent fit to the seed size distribution data (0.8 to 2.1 percent average absolute deviation). The shape of the seed size distribution plots as characterized by the standard deviation, skewness, and kurtosis showed very little variation even for different harvest dates and different crop years. Mean seed size varied with digging date, location, and crop year. The stability of the shape of the seed size distribution curve is an important finding, because seed size distribution for a lot of peanuts can be estimated from a minimum of screening data. Such estimates and use of the logistic size distribution model should prove valuable in marketing peanuts under the new peanut marketing program. Use of theoretical distributions such as the logistic and normal will also be helpful in characterizing the seed size distributions of other peanut cultivars.

Identification of Volatiles From Enzymic Reaction Products by Direct Gas Chromatography/Mass Spectroscopy. Allen J. St. Angelo and Michael G. Legendre
Southern Regional Research Center, New Orleans, Louisiana.

Lipoxygenase, prepared from Virginia-type peanuts, was used to catalyze the oxidation of linoleic acid and methyl linoleate to form the C-9 and C-13 hydroperoxides. These reactions were then monitored by rapid unconventional direct gas chromatography/mass spectroscopy. An aliquot of the enzymic reaction mixture, without prior time-consuming extraction or chemical modification, was secured directly into the heated or nonheated (room temperature) injection port system. When the reaction mixtures were analyzed at room temperature, only hexanal was found; however, at elevated temperatures, five major and several minor compounds were identified. The predominant compounds identified were pentane, hexanal, 2-pentyl furan, trans-2-cis-4-decadienal, and trans-2-trans-4-decadienal. These decomposition products not only show that the enzyme attacks at both the C-9 and C-13 positions, but also indicate the origin of the compounds identified.

Instrumental Methodology for Predicting Potential Flavor Quality of Roasted Peanut Products. G. L. Linthicum, J. D. Tallant, H. P. Dupuy, and R. O. Hammons,
Southern Regional Research Center, New Orleans, La., Georgia Coastal Plain Experiment Station, Tifton, Ga.

Details are given of a preliminary objective method for evaluating potential flavor quality of roasted peanut products from direct gas chromatographic analysis. Less than 1 g of raw ground peanut material is required. Eight of 109 experimental genotypes evaluated by this rapid technique may not produce acceptable roasted peanuts. Data sets of 12 chromatographic indices from 61 flavor-scored samples were tentatively used as a reference data base. Six indices found useful to predict potential flavor quality were acetaldehyde, ethanol, acetone, propanol, pentanal, and hexanal. The indices rejected for predictive purposes were pentane, hexane, benzene/crotonaldehyde, N-methylpyrrole, toluene, and hexanol/xylene. Methods, limitations, and progress will be discussed.

Instrumental Analysis of Volatiles in Air- and Nitrogen-Packed Peanut Butter. Sara P. Fore, G. S. Fisher, M. G. Legendre and J. I. Wadsworth, Southern Regional Research Center, New Orleans, La.

Air- and nitrogen-packed samples from the same production lot of peanut butter were stored in the dark at ca 25°C for one year and analyzed periodically by direct gas chromatography. The ratio of methylbutanal to hexanal was consistently higher in nitrogen-packed than in equivalent air-packed samples, and decreased throughout the storage period for both types of samples. Correlation coefficients, significant at 0.1%, were -0.99 for nitrogen-packed and -0.96 for air-packed samples. A total of 35 volatile components of peanut butter were identified by combined direct gas chromatography/mass spectrometry, and another six were tentatively identified.

Effects of Freeze Damage on the Volatile Profiles of Raw Peanuts. Mona Brown, H. P. Dupuy, and Walton Mozingo, Southern Regional Research Center, New Orleans, and Virginia Polytechnic Institute and State University, Suffolk.

Preliminary studies show that peanuts exposed to freezing temperatures while still on the ground exhibit quantitative changes in the volatile profiles obtained by direct gas chromatography. In severely damaged peanuts, large increases in methanol, acetaldehyde, ethanol, dimethylsulfide, crotonaldehyde, hexanal, and hexanol were observed. The possibility of using the chromatographic technique to estimate the extent of freeze damage in raw peanuts was investigated. Problems of grading, sampling for chromatographic analysis, and flavor evaluation of freeze damaged peanuts will be discussed.

Evaluation of Ethalfluralin for Weed Control in Peanuts. B. J. Brecke, W. L. Currey, and D. W. Gorbet, University of Florida.

Weed control in peanuts (Arachis hypogaea 'Florunner') with ethalfluralin [N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine] was evaluated during 1976 and 1977 at the Agricultural Research Center (ARC), Jay, and the ARC, Marianna, Florida. Ethalfluralin was applied, either as a preplant incorporated (PPI), preemergence (PRE), or "at cracking" (AC) treatment. Herbicide activity was determined by visual weed control ratings and by the resulting peanut yields.

Ethalfluralin provided excellent control of crabgrass (Digitaria sanguinalis) and goosegrass (Eleusine indica) regardless of the time of application. Broad spectrum weed control and the highest yields, however, were obtained only when the PPI ethalfluralin treatments were followed with alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide) plus dinoseb (2-sec-butyl-4,6-dinitrophenol) + naptalam (N-1-naphthylphthalamic acid) AC or when a program including benefin (N-butyl-N-ethyl- α,α,α -trifluoro-2,6-dinitro-p-toluidine) PPI followed by ethalfluralin + dinoseb + naptalam AC was utilized. Both programs resulted in weed control and peanut production comparable to that obtained with the standard recommendation of benefin PPI plus alachlor + dinoseb + naptalam AC.

A Comparison of Low and High Level Management Peanut Farming Operations in Comanche, Texas. D. S. Moore, C. E. Hoelscher, and J. S. Denton, Texas Agricultural Extension Service, Comanche and Stephenville, Texas.

Approximately 70% of the peanuts produced in Central Texas are farmed under dryland conditions. The average yield for Comanche County is less than 1500 lbs. of peanuts produced per acre. Factors contributing to these low yields are dry weather, high populations of the lesser cornstalk borer, and the lack of crop rotation.

By 1981, a grower producing dryland peanuts with a farm average of 1200 lbs./acre will net from -\$14.00 to +\$45.00 per acre under the current new farm program. These figures include a 6% inflation rate and are dependent on whether the allotment is owned or leased and whether or not the full allotment is planted. Likewise, a producer farming irrigated peanuts with a farm average of 2250 lbs./acre will net between -\$21.00 to +\$96.00 per acre depending on the factors previously mentioned.

Since dry weather is the major limiting factor in peanut production in this area, and assuming that farm yields will not increase at a significant level to offset the present farm program, an alternative to increase net income is to decrease production inputs. Comparisons of different farm management levels conducted by the Comanche County Peanut Pest Management Program indicate that many producers are not realizing a significant return for dollars invested in pesticides. Future program strategies are to evaluate the application of minimum production inputs for peanuts farmed under both dryland and irrigated conditions.

Lesser Cornstalk Borer: An Alternative Sampling Technique. Davy Jones and Max Bass. Zoology-Entomology Department, Agricultural Experiment Station, Auburn, Alabama.

A hand search method of sampling lesser cornstalk borer populations in peanuts was compared with a can pit-fall trap method in three different fields. The correlation between the number of larvae greater than 1.2cm long caught in cans and observed by the hand search method was highly significant ($R^2 = .643$).

The average R^2 value for the correlation between trap catch of larvae greater than 1.2cm long and the number of days since the last .1" rain was .073. The average R^2 value for the correlation between trap catch of larvae greater than 1.2cm long and maximum temperature was .26. These data indicate that temperature has a greater influence on trap catch than does soil moisture.

The can trap method offers advantages of less human error, less observer time involved, and enables sampling following rainy weather.

Interactions of Pesticides and Twospotted Spider Mites on Peanuts. W. V. Campbell. North Carolina State University, Raleigh.

Pesticides applied to peanuts to control diseases and insects may interact to cause an increase in the population of twospotted spider mite Tetranychus urticae Koch. Mite outbreaks are pesticide induced; that is, if no pesticides are applied to peanuts, mites fail to develop.

Pesticides differ widely in their effect on the twospotted spider mite. The post-emergence herbicide Butyrac (2-4 DB) and the growth regulator Kylar (succinic acid) have a neutral effect on mites. Some fungicides cause a higher rate of mite increase than insecticides. When selected fungicides and insecticides are combined, mite outbreaks occur. Du-Ter (fentin hydroxide) or Copper Count (ammonical copper) have not caused mite outbreaks when used for seasonal control of leafspot. Since all fungicides do not cause an adverse interaction, a pesticide program may be selected that will reduce the probability of a mite outbreak.

Interaction of Pesticides and Peanut Varieties in Relation to Insect Pest Populations. Loy W. Morgan and James W. Todd, Coastal Plain Experiment Station, University of Georgia, Tifton, GA

Twelve experiments were conducted from 1965 through 1977 at the Georgia Coastal Plain Experiment Station, Tifton, on plant/pest/pesticide interactions. Effects of variety or plant introduction and pesticide applications on insect damage and yield were recorded along with general population trends of pest species. Significant differences have been detected in damage levels inflicted by lesser cornstalk borer, Elasmopalpus lignosellus (Zeller); southern corn rootworm, Diabrotica undecimpunctata howardi Barber; and tobacco thrips, Frankliniella fusca (Hinds) on cultivars, plant introductions and breeding lines. Additionally, differential feeding response to the three market types of peanuts, runner, Spanish and Virginia, have been found in corn earworm, Heliothis zea Boddie; tobacco thrips, F. fusca; and potato leafhopper, Empoasca fabae (Harris). Insect damage levels also varied among the market types with different pesticide combinations and schedules. These results will be discussed in detail along with other considerations which must be made in implementation of pest management programs on peanuts.

Provisioning With Pre-Paralyzed Hosts to Improve Parasite Effectiveness: A Pest Management Strategy for Stored Commodities. David A. Nickle and D. W. Hagstrum, USDA-ARS Insect Attractants Lab, Gainesville, FL.

Bracon hebetor is a parasite of the almond moth, Ephestia cautella. The potential for utilizing paralyzed Ephestia larvae to manipulate parasite populations was studied under stimulated warehouse conditions (5.9 x 5.9 x 2.4-m rooms). Peanuts in three rooms were infested with almond moths. Numbers of moths in parasite and parasite-plus-paralyzed host treatments were 5- and 10-fold lower, respectively, than those in the control.

Effect of Leafspot and Artificial Defoliation on Photosynthesis of Peanut Canopies.
K. J. Boote, J. W. Jones, G. H. Smerage, C. S. Barfield, and R. D. Berger, Institute of Food and Agricultural Sciences, University of Florida, Gainesville.

Defoliating insects and Cercospora leafspot are major yield-reducing pests of peanuts. To evaluate the effects of these pests on photosynthesis under field conditions, we measured apparent canopy carbon exchange rate (CER), $^{14}\text{CO}_2$ assimilation, and light intercepting characteristics of intact, artificially-defoliated, and leafspot-infected canopies. Canopy CER was measured in mylar field chambers during 2 to 5 min periods during which CO_2 was sampled with syringes for analysis by infrared gas analyzer. Light interception, leaf area distribution, and $^{14}\text{CO}_2$ uptake were measured for 3 canopy layers. Leaf punches from randomly-sampled leaves in each layer were solubilized and analyzed for ^{14}C uptake per cm^2 .

The upper 42% of the leaf area intercepted 74% of the incident light and accounted for 63% of the $^{14}\text{CO}_2$ uptake by the intact canopy. Removing 25% of the leaf area index ($\text{LAI}=3.1$) reduced $^{14}\text{CO}_2$ uptake 30% and canopy CER by 35%. Severe leafspot-infected peanuts had 20% as much LAI, but fixed only 15% as much $^{14}\text{CO}_2$ and 6% as much net CO_2 as disease-free canopies. Photosynthesis of diseased canopies was reduced more than in proportion to LAI lost, because Cercospora reduced CO_2 uptake per unit of remaining leaf area. The data suggests that modeling effects of insect defoliation and disease on canopy CER requires not only the LAI damaged, but the amount, location, and photosynthetic effectiveness of leaf area remaining.

Three diploid species ($2n = 20$) of the generic section *Arachis*--*Arachis* (series *Perennes*) *villosa* Benth., *A.* (series *Perennes*) *cardenasii* Krap. et Greg. (*nomen nudum*), and *A.* (series *Annuae*) *duranensis* Krap. et Greg. (*nom. nud.*)--were crossed in a diallel. The behavior of the chromosomes during Metaphase I in pollen mother cells was analyzed. The most frequent association noted was 10_{II} . Cells with $9_{II} + 2_I$ were noted in all hybrids. The frequency of this association, however, was below 9.0% in all cases. It is concluded that the three species have very similar genomes. It is proposed that these genomes be designated as a single genome, the A genome. It can also be concluded that chromosomal barriers preventing transfer of genetic material between these three diploid species are small.

At present the diploid species of the section *Arachis* appear to provide the most available source of alien germplasm for the improvement of the cultivated peanut, *A. hypogaea* L. ($2n = 40$). An understanding of the behavior of the chromosomes of the entire section is necessary for efficient utilization of the wild species in improving the cultivars.

Cytological Analysis of *Erectoides* x *Arachis* Intersectional Hybrids. H. T. Stalker, North Carolina State University.

Wild species of the genus *Arachis* are potential sources of germplasm for improvement of *A. hypogaea* L. The cultigen hybridizes with other members of sect. *Arachis*, but apparently not with more distantly related species. Complex sectional hybrids, sect. *Erectoides* ($4n$) x sect. *Arachis* ($2n$), appear to be the most likely bridge between many of the wild species and *A. hypogaea*. Two diploid taxa of sect. *Erectoides*, GKP10034 (PI 262142) and GKP9841 (PI 262278), and their resulting amphidiploid after colchicine treatment were observed cytologically. One $4n$ plant thus created was crossed with two diploid species of sect. *Arachis*, HLK410 (PI 338280) and K7988 (PI 219823). Stipule length and leaf shape were the most useful morphological traits for identifying intersectional hybrids. Offspring of sect. *Erectoides* ($4n$) x sect. *Arachis* ($2n$) crosses had 30, 31 or 32 chromosomes. Usually 10 bivalents plus 10-12 univalents, respectively were present in microspores. Trivalents were also observed in a few cells of all euploid and aneuploid intersectional hybrids. Since few multivalents were observed in the colchicine-treated sect. *Erectoides* x sect. *Erectoides* hybrid plant, many of the bivalent chromosome associations are probably homologies between members of the two sections. Based on the observations, gene transfer between sections *Erectoides* and *Arachis* may be possible.

The Probable Sources of *Arachis hypogaea* Genomes and Some Implications in Peanut Breeding. J. Smartt - University of Southampton, W. C. Gregory, M. Pfluge Gregory, and P. M. Ressler - North Carolina State University.

The peanut is allotetraploid with $2n = 4x = 40$. One genome (A) is characterized by a small chromosome pair absent in the other (B). All known diploid species of section *Arachis* have A genomes except *A. batizocoi*. Fertility of hybrids between A genome species is high with regular meiosis; however hybrids obtained between A genome species and *A. batizocoi* are sterile with irregular meiosis. Doubling chromosome complement might restore fertility as an allotetraploid (cf. *A. hypogaea*). The most likely sources of *A. hypogaea* genomes are *A. cardenasii* and *A. batizocoi*. Both are Bolivian in origin and *A. cardenasii* strongly resembles *A. hypogaea*. Although *A. batizocoi* is cytologically unique in section *Arachis*, uncollected wild species may have similar karyotypes. Differentiation between A and B genomes is apparently structural rather than genic. In breeding it could be difficult to maximize expression of desirable characters where these are not dominant. Development of suitable chromosome substitution techniques or induction of chromosome segment exchange by ionizing radiation might be helpful.

Differential Reaction of Peanut Genotypes to Web Blotch. O. D. Smith, D. H. Smith and C. E. Simpson. Texas Agricultural Experiment Station, Texas A&M University, College Station, Yoakum, Stephenville, respectively.

Web blotch (*Phoma arachidicola* Marasas, Pauer & Boerman) was the predominant foliar disease in two peanut (*Arachis hypogaea* L.) yield tests including Spanish, Runner and Virginia type entries. Adult plant reactions to infection were measured as the percentage infected attached leaflets (IAL) and the percentage defoliation (DEF). The test means and genotypic ranges for the eleven entries in the 1976 test were: IAL, 20.5 (7.8 - 35.9); DEF, 29.3 (5.2 - 45.9); and IAL plus DEF, 50.5 (13.7 - 72.4). IAL and DEF values were high for the Spanish entries and low for 'Florunner'. Intermediate values were recorded for GK-3 and 'Florigiant'. Differential infection was also noted in a 1974 test and the relative resistance of eight entries included in the two tests were similar. The generally late maturing, more resistant, Virginia botanical type entries in the 1976 test yielded 62 percent more than the Spanish entries. This is two to three times the difference in yield between these two groups of entries in other tests with lower levels of web blotch.

Reaction of Peanut *Arachis hypogaea* L. Genotypes to two *Cercospora* Leafspot Diseases. Teddy Monasterios, L. F. Jackson and A. J. Norden, University of Florida, Gainesville.

One hundred eighty peanut genotypes, including introductions from various countries were evaluated in 1977 field plantings for resistance to leafspot caused by *Cercospora arachidicola* and *Cercosporidium personatum*.

In the present investigation, disease progress was monitored by taking weekly lesion counts from random samples of leaves from each plot. Twice during the season lesions caused by *C. arachidicola* were differentiated from those caused by *C. personatum* and the average number of lesions per leaflet calculated. The genotypes exhibited a differential reaction to the two pathogen species. Fourteen entries had very few lesions caused by *C. arachidicola*, ten entries had very few lesions caused by *C. personatum* and fifteen entries had low numbers of both types of lesions. The genotypes FESR-5-1-B-b4, FESR-5-2-B-b4 and NC 3033 showed the fewest number of lesions caused by *C. arachidicola*, while PI 203395, PI 203397, PI 261893-2-1-1-B, PI 261893-2-1-3-B, PI 261893-2-1-4-1-2-B and PI 261906-1-1-1-1-2-B-B showed the fewest number of lesions caused by *C. personatum*.

Screening Methods and Further Sources of Resistance to Peanut Rust (*Puccinia arachidis* Speg). P. Subrahmanyam, R. W. Gibbons, S. N. Nigam and V. R. Rao, ICRISAT, Hyderabad, India.

Peanut germplasm and breeding material is being tested for resistance to rust at ICRISAT, India. During the rainy season natural infection is heavy and uniform. In the dry season material is being screened under irrigation using an infector row system. A screenhouse method using detached leaves can be used at any time of the year.

The resistance of the cultivars Tarapoto (PT 259747) and PI 298115 has been confirmed and from the germplasm collection several other cultivars, mostly of the Valencia type, show promise as new sources of resistance. Several *Arachis* species have so far given an immune reaction to rust using the detached leaf technique.

In 1973 a new method of harvesting and curing breeder's seed peanuts in Virginia was sought. Four objectives needed to be met: 1) reduce the labor requirement, 2) maintain a high level of germination, 3) maintain varietal purity at 100%, and 4) reduce the risk of frost damage. Three possible harvesting and curing methods were studied. The traditional stackpole-stationary picker method satisfied the latter three objectives, but not the first. The windrow-combine method satisfied the first two objectives, but not the last two. The green harvesting method satisfied all objectives. The experimental equipment and curing procedures for green harvesting had been developed, but not tested on a large scale for seed production. This method has been used in Virginia to produce breeder's seed of three peanut varieties ('Florigiant', 'VA 72R' and 'VA 61R'), since 1973. The labor requirement compared to the stackpole method has been reduced, satisfactory levels of germination and varietal purity have been obtained, and the risk of frost damage has been reduced.

Fungi Associated With Stem and Pod Rot Diseases of Peanut in Egypt. M. M. Satour, M. A. Abdel-Sattar, A. A. El-Wakeel, E. A. El-Akkad, and L. A. El-Ghareeb. Plant Pathology Res. Inst., Agric. Res. Center, Giza, Egypt.

Fields in 11 governorates were surveyed. Stem rot is a minor problem in Egypt. In severe infection it does not exceed 8.0%. More than 21 genera of fungi are associated with this disease. The most prevalent are Aspergillus (56%), Fusarium (44%), Rhizoctonia (27%), Penicillium (25%), Pythium (12%), and Rhizopus (12%). Some new stem rot pathogens were found in this survey. Pod breakdown (pre-harvest pod rot) is a severe problem, ranging from 19% to 78% at harvest. Fungi associated with pod breakdown were similar to those associated with stem rot, but there were differences in prevalence, being Fusarium (65%), Aspergillus (43%), Rhizoctonia (32%), Penicillium (21%), Botryodiplodia (15%) and Rhizopus (14%). After storage for 6-8 months the percent of pod rot ranged from 48% to 94% in 1975 and from 69% to 96% in 1976. Some 22 genera of fungi were isolated from these rotted pods. The most prevalent were Fusarium (53%), Penicillium (26%), Rhizopus (22%), Aspergillus (17%), and Rhizoctonia (7%). Storage pod rot is increasing every year. This may be due to uncontrolled conditions during harvesting, drying, and storage. Farmers irrigate their fields 1-3 days before harvesting to minimize pod loss in soil. Then pods are not adequately sun dried and usually contain more than 20% moisture. Peanut lots are stored outdoors in sacs in direct sunlight where high temperatures and humidity can occur.

A Correlation Between the Amount of Soluble Amino Compounds in the Testae of Peanuts and Colony Development of Inoculated *Aspergillus flavus*. Vera L. F. de Souza, Jaime Amaya-Farfan, Antonio S. Pompeu, and Clyde T. Young. Universidade Estadual de Campinas (Brazil); Instituto Agronomico de Campinas (Brazil); and North Carolina State University.

The possible link between the level of water-soluble amino compounds (AC) in the testae of peanuts and the ability of inoculated spores of *Aspergillus flavus* to develop on the surface of hand-shelled seeds was further examined. Nearly five hundred entries of the germplasm bank of the Agronomic Institute of Campinas, Brazil, were sampled for the determination of soluble AC by a previously reported method. Such levels ranged between 24 and 419 μ equivalents of glutamic acid per gram of testa. Seeds of those entries containing either less than 50 or more than 250 μ eq GLU/g in the testae were inoculated with spores of *A. flavus* NRRL 6108 and incubated at 28°C for seven days in order to observe fungal development. Four entries among those with low AC content had less than 10% infection while 20% infection was the ceiling of that group. All entries with high levels of AC were infected to a large extent.

Laboratory Technique for Assessing Efficacy of Fungicides for Control of *Cercospora* and *Cercosporidium* Leafspots of Peanut. R. H. Littrell and June B. Lindsey, University of Georgia, Coastal Plain Station, Tifton.

Florunner peanut leaflets naturally infected with *Cercospora* or *Cercosporidium* were collected from field plots on September 30, 1977. *Cercosporidium personatum* developed to epidemic proportions even though a recommended fungicide was applied on a 14-day schedule. A technique was developed to assist in developing more effective controls. Approximately 25 infected leaflets were collected, transported to the laboratory, washed in running tap water, soaked in 1 to 10 dilution of sodium hypochlorite for 10 seconds, and blotted dry. Fungicide suspensions were prepared based on recommended dosages per acre in 10 gallons of water. Leaflets were dipped in test chemicals and allowed to dry before placing in plastic moist chambers maintained at 28 C for 5 days under continuous light. Individual lesions were examined for sporulation and conidia viability was determined by transferring directly from sporulating lesions to water agar and incubating for 24 hours. Fentin hydroxide (Du-ter) failed to prevent sporulation of *Cercospora* or *Cercosporidium*. The addition of flowable sulfur to this fungicide resulted in 100% reduction in sporulation of *Cercospora* and approximately 40% reduction with *Cercosporidium*. Other materials tested were flowable sulfur, chlorothalonil, and Kocide 404S.

Isolation of Benomyl Tolerant Strains of *Cercospora arachidicola* and *Cercosporidium personatum* at One Location in Texas. D. H. Smith, R. E. McGee and L. K. Vesely. Texas A&M University, Texas Agricultural Experiment Station, Plant Disease Research Station, Yoakum, Texas 77995.

Although benomyl has been used for control of certain foliar diseases of peanuts in Texas since 1970, we are unaware of any documented episodes in grower fields where benomyl failed to control the principal target pathogens, i.e., *Cercospora arachidicola* (C. A.) and *Cercosporidium personatum* (C. P.). A plausible explanation for this result is that Texas peanut growers have applied benomyl either in combination with another fungicide or as part of a spray schedule where other fungicides were applied at periodic intervals. However, at the Plant Disease Research Station, foliar sprays of benomyl alone have been evaluated in small plot field tests since 1967. Because of this long term history of benomyl usage, we began to monitor the incidence of benomyl tolerant isolates of C. P. and C. A. in 1976. A benomyl amended (5 ppm) agar technique was used. In a 1976 foliar fungicide test, the incidence of benomyl tolerant C. A. isolates was 44.1, 12.5 and 51.5% after peanut foliage was sprayed five times with benomyl, chlorothalonil and unsprayed, respectively. In another 1976 test the level of C. P. benomyl tolerant isolates was 14.7% after three applications of benomyl and 10.3% in the unsprayed plot. During 1977 the percentage of benomyl tolerant C. A. isolates was 94.8 after five applications of benomyl as compared with 46.3 for the unsprayed plot. The incidence of benomyl tolerant isolates of C. A. in a second 1977 test was 96.6% after five applications of benomyl as compared with 42.4% in the unsprayed plot.

Comparison of data developed from the late-season drought of 1976 with the early-season drought of 1977 demonstrates the role of irrigation water in intensifying peanut disease, as well as the time of water application in relationship to disease severity. In 1976, peanut leafspot was increased slightly when plots maintained under a standard 14-day chlorothalonil program were compared for disease severity. However, when irrigation water was applied early in the season (1977), leafspot-induced defoliation was 50% greater than in the nonirrigated control. The authors feel that disease increased as a result of the development of additional leafspot infection periods, and also by increased weathering of foliar fungicides. Results from 1977 indicated a greater effect of irrigation on end-of-season leafspot levels, partially because the irrigation water was applied earlier, allowing inoculum potential to reach a high level much earlier. The high level of leafspot inoculum found early in the season expressed itself as much higher levels of defoliation late in the season.

Damage caused by Sclerotium rolfsii was also evaluated in each of the two years of this study. Irrigation consistently was correlated with increased damage from S. rolfsii. The early season drought of 1977 did have one outstanding effect; virtual elimination of S. rolfsii damage in the dry land peanuts under study. Possible explanations of this phenomenon will be discussed.

Practices in Growing New Plant Introductions at the Southern Regional Plant Introduction Station. Grover Sowell, Jr. and R. O. Hammons, USDA, SEA, Experiment, Ga. and Tifton, Ga.

All new peanut plant introductions received in 1978 at the Southern Regional Plant Introduction Station, Experiment, Ga., are being grown according to guidelines based on suggestions by pathologists, entomologists and breeders. The guidelines are designed to prevent the introduction and establishment of new peanut diseases and include the following provisions:

- (1) Seed is examined for evidence of pathogens or insects.
- (2) Seed is treated with a fungicide and planted in peat pellets.
- (3) Isolations are made from any diseased plants, plants showing symptoms of virus infection are indexed.
- (4) Seedlings are transplanted to a field at least 1/2 mile (0.8 km) from other peanut plants.
- (5) Plants are examined by a plant pathologist a minimum of 4 times during the growing season.
- (6) Plants with symptoms other than those caused by established organisms are pulled up and autoclaved.

Physiology of Peanut Seeds that Received Subfreezing Temperatures While in the Windrow. D. L. Ketring, USDA-SEA, Texas A&M University, College Station, Texas.

During October, 1976, peanuts drying in the windrow in North Texas were subjected to subfreezing temperatures. Questions arose as to the effect of this exposure on germination of the seeds. This research was done to answer some of these questions. Freshly dug, high-moisture (30-40%) peanuts were subjected to an overnight low temperature of about -7°C in the field. Samples of the subsequently cured and handshelled peanut seeds were tested for germination, emergence, ethylene and carbon dioxide production and certain enzyme activities. Laboratory germination was 42%, greenhouse emergence 32% and most of the seeds that germinated grew at a slow rate. Control germination and greenhouse emergence of seeds that did not receive this exposure were 96% and 100%, respectively. At their maximum rates, ethylene and carbon dioxide production were reduced 77 and 36%, respectively. Mean enzyme activities measured from protein extracts of the seeds were reduced, but they were not always significantly different from the control. However, isocitric lyase activity, which depends on de novo protein synthesis, was significantly less than the control. Thus, low temperature exposure of high-moisture peanut seeds interfered with initial biochemical and developmental processes which determine seedling growth. One of these processes was new protein synthesis.

Screening of Peanut Germplasm for Emergence Following a Chilling Stress. Gary R. Ablett and J. W. Tanner, University of Guelph, Guelph, Ontario.

Date of planting studies using the cultivars presently available have shown that early planting results in reduced plant populations. This study was conducted to determine if there existed, in the peanut germplasm collection, lines which had ability to germinate, emerge and produce acceptable stands following an early planting date. In 1976, approximately 3,400 peanut lines were sown at two dates of planting. The early planting date, April 21-22, ensured that all lines were exposed to a chilling stress. In spite of this chilling stress, approximately 500 lines exhibited 80-100% emergence. The number of lines to be evaluated in 1977 was narrowed to 108 on the basis of sound mature kernel weight for the first planting date. The selection criteria was aimed at identifying those lines which were early maturing, suffered little or no chilling damage, and produced good stands. Again, two planting dates were used in 1977. The early planting date caused a reduction in stand in some of the lines, while no reduction occurred in others. Fifteen lines had populations which were essentially identical at both dates of planting. Three of these lines exceeded the best check line, 'New Mexico Valencia A', in pod yield for the first planting date.

Callus Growth and Root Organogenesis in Peanut Tissue Cultures. A. L. Guy,
T. C. Bleen and S. K. Pancholy, Florida A&M University.

Tests were conducted on the three peanut cultivars 'Early Bunch' (EB), 'Florunner' (FR) and 'NC-F1-14' (NC) to determine their relative abilities to generate callus tissue in culture. Sterile cotyledon fragments from each cultivar were placed on Murashige and Skoog medium containing various supplements including agar and phytohormones. Callus growth rates were measured by aseptic weighing every 15 days for a 60 day period. The relative rates of callus growth for these cultivars was EB>NC>FR. This order also reflects the order of maturation of these varieties in the field and trials are in progress in an attempt to further test this correlation.

Under these same conditions of callus growth, de novo organization of root meristematic regions and concomitant root development occurred on approximately 20% of EB calluses, less than 8% of NC calluses and 0% of FR calluses. The addition of the metabolically inert sugar mannitol (30g/L) to the supplemented culture medium greatly increased root meristem organization to more than 75% of EB calluses, nearly 50% of NC and 46% of FR.

Isolation and Evaluation of Rhizobium from Arachis Nodules Collected in South America. T. J. Schneeweis, G. H. Elkan, J. M. Ligon, J. C. Wynne and T. G. Isleib, North Carolina State University.

Selection of effective strains of Rhizobium compatible with peanut (Arachis hypogaea L.) germplasm could enhance biological nitrogen fixation. Rhizobium strains isolated from nodules collected in South America during 1976-77 by W. C. Gregory and others from Arachis germplasm provides a unique collection of rhizobial isolates. A protocol is described for collecting, preservation, isolation, purification, authentication and evaluation for effectiveness of these Rhizobium strains. Using these techniques 232 bacterial isolates from 78 germplasm collections were obtained. The isolates were authenticated by the production of nodules on siratro (Macroptilium atropurpureum). Testing of these isolates is currently underway to elucidate their nodulation and nitrogen-fixing activity on Arachis germplasm. Phytotron studies are being conducted to explore the feasibility of optimizing nitrogen fixation through host-strain selection at adverse temperature and other environmental stress factors.

Quantitative Genetic Aspects of Nitrogen Fixation in Peanuts. T. G. Isleib, J. C. Wynne, G. H. Elkan and T. J. Schneeweis, North Carolina State University.

Several studies have demonstrated genotypic variation among peanut cultivars for both nodulation of roots and nitrogenfixing ability. This variation is of potential use to breeders interested in increasing nitrogen fixation in peanuts.

Ten peanut cultivars from five South American gene centers were crossed in full diallel. Analysis of data from the F_1 and F_2 generations provided significant estimates of variance components due to general combining ability (GCA) for nodule number and size, nitrogenase activity and several other characters. Some traits exhibited maternal and reciprocal effects in the F_1 , but these effects did not persist in the F_2 . Significant estimates of GCA variance indicate that selection for increased nitrogen fixation in this population should be effective.

Plant Stand and Root Development in Relation to Combine-Harvested versus Hand-Harvested Seed. R. C. Roy, G. Ablett and J. W. Tanner, Crop Science Dept. University of Guelph, Guelph, Ontario.

Poor stands have been a recurring problem in peanut production field trials in Ontario. In addition, a significant proportion of the plants were observed which had twisted abnormal roots. This latter phenomenon had been reported to be increased by mechanical injury to the seed and chilling stress during germination. It had been further reported that progeny from normal-rooted plants showed a decreased tendency towards producing abnormal-rooted types. In growth chamber and field studies, using hand-harvested seed from three cultivars, normal-rooted plants produced the same number of normal and abnormal roots as did abnormal-rooted plants and a random selection of plants. In the same three cultivars, combined seed, from the same field, produced significantly fewer normal-rooted types and significantly greater abnormal root types. A commercial seed lot of one of the cultivars produced an even greater number of abnormal root types. In two other trials, hand harvested seed of the same four cultivars was compared to commercial seed of the same four cultivars. In both tests, hand harvested seed produced essentially twice the final stand and almost twice the yield. Obviously damage arising from mechanical operations associated with commercial seed production can greatly affect final yield.

Effect of Plant Density on Growth, Yield and Grade of Spanish Peanuts. J. N-O. Azu and J. W. Tanner, Crop Science Department, University of Guelph, Ontario.

There have only been a few studies conducted on the response of peanuts to various plant densities in Ontario. The effect of five plant densities (2.77, 4.88, 11.34, 25.51 and 102.04 plants/m²), sown in a square pattern, on growth, yield and grade was studied in Delhi, Ontario during 1975 and 1976. The growth conditions were generally better in 1975. Increase in density resulted in reduction of the vegetative and reproductive characters examined on per plant basis, while these characters were increased on unit area basis. Reproductive growth ceased earlier under the highest density (102.04 plants/m²), but this did not result in highest yield or % SMK. Individual seed weights and pod and seed yields/ha were generally higher in 1975 and the yield response to density was more dramatic in 1976, when the level of production was lower. The best yields during both years were obtained in the medium and high densities (11.34 and 25.51 plants/m²). Shelling % and % SMK were higher under the marginal growth conditions of 1976 and during each year, they were not affected by changes in density, with the exception of the highest density in 1975, which had reduced values due to excessive formation of immature pods and seeds.

Response of Peanuts in Virginia to Several Sources of Manganese. D. L. Hallock.
Virginia Polytechnic Institute and State University, Suffolk.

Manganese deficiency in peanuts is becoming more widespread in Virginia. Several sources of Mn and methods of application were investigated. It is likely that responses to applied Mn were tempered by dry weather.

Generally, peanut productivity was lower from Mn soil treatments (11.2 kg/ha or less) banded on or in the row than from foliar treatments. Foliar-only treatments were as effective as when combined with band treatments at planting in which more Mn was applied (3.36 vs 13.4 kg/ha). However, productivity was below potential levels. Manganese oxide was somewhat less effective than sulfate.

Water Use and Yield of Peanuts on a Well-drained Sandy Soil. L. C. Hammond, K. J. Boote, R. J. Varnell, and W. K. Robertson, University of Florida, Gainesville.

Peanut plants are drought tolerant because of deep rooting and a water supply-related flexibility in time of flowering and fruiting. We used various conservative water management treatments over a three-year period to determine water use and yield response of peanuts growing on deep, well-drained, sandy soils. In general, yields were not reduced by droughts of short duration unless the seasonal water use was less than about 50 cm. In 1977, pod yields were 2260, 3000, and 3820 kg/ha with approximately 33, 40 and 46 cm of water, respectively. Rooting depths were on the order of 200 cm with a density of 1.5 cm/cm^3 in the 0-30 cm zone and 0.1 to 0.40 cm/cm^3 at greater depths. Tensiometers and neutron meters showed that water extraction continued during prolonged drought at depths below the shallow irrigated surface soil layer. These findings have water-conserving implications in irrigation scheduling strategies for peanuts.

The Effect of Irrigation, Inoculant Type and Nitrogen Fertilizer on Nitrogen Fixation and Yield of Spanish Peanuts. V. M. Reddy and J. W. Tanner, Crop Science Dept. University of Guelph, Guelph, Ontario.

Experiments were conducted during 1976 and 1977 comparing: irrigation versus no irrigation; no inoculant, peat I inoculant, peat II inoculant and granular inoculant (peat II and the granular formulations contained the same strains of Rhizobium); and 0 kg N/ha, 25 kg N/ha, 50 kg N/ha 25 + 25 kg N/ha and 100 kg N/ha. Nitrogen fixation was estimated at two-week intervals by means of the acetylene reduction technique. Irrigation increased nitrogen fixation and yield. All three inoculants produced increases in nitrogen fixation and yield, however, the peat II and granular formulations produced higher N fixation rates and yields than did the peat I formulation. Fertilizer nitrogen applied at planting times did not increase the yield and had no effect on nitrogen fixation of the uninoculated peanuts; the split application of nitrogen fertilizer did increase the yield. In the inoculated plots, fertilizer nitrogen decreased nitrogen fixation and yield.

Amino Acids, Oil and Protein Content of Some Selected Peanut Cultvars. S. K. Pancholy, A. S. Deshpande and S. Krall, Florida A&M University.

In the continuing search for the high methionine peanut line(s) seeds from at least 100 different lines and cultivars were obtained from the peanut breeders. The analyses of these peanut seed samples showed a range of 42-54% oil, with an average of 49.5%. The protein percentage varied from 43.5 to 56.8 for the fat-free peanut meal. The average protein content was 48.5%. Amino acid methionine showed variations from 0.31% to 1.20%, tyrosine 2.9%-3.9%, and lysine 3.27% to 3.82% for fat-free peanut meal.

Some common cultivars such as Florunner, Early Bunch and NC-Fla 14 had respectively 47.8, 48.8, and 49.2% oil and 50.77, 47.41 and 56.79% protein in defatted peanut meal. The methionine concentration for Florunner, Early Bunch and NC-Fla 14 was 0.67, 0.74, and 0.85 percent respectively. Early Bunch had a higher proline content as compared with the other two cultivars. However, no significant differences were found in other amino acids.

The Amino Acid Content of the U.S. Commercial Peanut Varieties. Clyde T. Young, North Carolina State University and Ray O. Hammons, University of Georgia Coastal Plain Experiment Station.

The 37 varieties of commercial peanuts (*Arachis hypogaea* L.) were grown in experimental plots in Tifton, Ga. during the 1973 season. The seeds were selected for a homogeneously mature state and analyzed for moisture, protein (20.3-30.4%), oil (44.8-56.3%), arginine maturity index (18.5-43.5) and amino acid content. The range for amino acid content, expressed as grams of amino acid per 100 grams of total amino acids were found to be: aspartic acid 11.38-12.04; threonine 1.88-2.30; serine 4.76-5.32; glutamic acid 20.69-22.00; proline 3.94-4.66; glycine 5.46-7.18; alanine 3.05-3.78; cystine 0.46-1.19; valine 3.97-4.64; methionine 0.77-1.01; isoleucine 3.42-3.61; leucine 6.54-6.81; tyrosine 4.94-4.90, phenylalanine 5.00-5.60; histidine 2.91-3.31; lysine 3.05-3.81; and arginine 11.39-12.81. Statistical treatment of the data will be presented.

Relatedness of "Jenkins," "Hawthorne" and "Storers Jumbo" Peanuts. Clifton F. Savoy, Dianna Stoker and S. K. Pancholy, Florida A&M University.

In a continuing study and characterization of peanut seed protein, twelve samples of the "Jenkins Jumbo" peanut line were examined along with "Hawthorne" and "Storers Jumbo" to determine possible relatedness. In addition, an attempt was made to collect information pertaining to the geographic location (Tifton, Georgia and Gainesville, Florida) and year (1962, 1969, 1973, 1975, and 1976) of cultivation.

Analytical testing included 2-mercaptoethanol, SDA-polyacrylamide gel electrophoresis (SDS-PAGE) to determine protein electropherogram pattern and group classification, acid hydrolysis to determine the amino acid composition, and nitrogen-microKjeldahl digestion and titration using a 5.46 conversion factor to approximate percent total protein composition.

Although minor differences were observed of the samples tested, protein electropherogram pattern and amino acid data revealed close genetic relatedness. Variation, however, in percent protein composition was noted. Overall, the differences seem attributable to the cultivation parameters of year and geographic location.

Cultivar Differences in Protein Composition of Peanuts (*Arachis hypogaea* L.) as Evidenced by Two-dimensional Polyacrylamide Gel Electrophoresis.
S. M. Mahaboob Basha, U. of Florida, Gainesville.

Peanut proteins are examined by two-dimensional polyacrylamide gel electrophoresis (2-D PAGE) technique which separates proteins based on their isoelectric points (pI) and molecular weights (MW). This technique has resolved peanut proteins into at least 150 components having pI's between 5 to 8 and MW's between 12,000-85,000. Examination of several peanut cultivars by 2-D PAGE has revealed interesting differences in their relative polypeptide compositions. For example, 'Florissant' and 'UF 75102' contained one major polypeptide in the MW class 22,000 and in the pI range 7 to 8, whereas 'Jenkins Jumbo' and 'Altika' both contain three such components. Other significant differences are noted in the 40,000-48,000 molecular weight range (pI's 5.8 to 6.5). Jenkins Jumbo and Altika have at least five major proteins mapping in this region of the gel. Florissant and UF 75102 contain about three polypeptides and clearly lack the most acidic species. Other differences are also seen in the 26,000-30,000 MW range (pI's 5.6 and 5.8) and among low MW components running close to the dye front (pI's 5.5 to 6.5). After analyzing several cultivars, a composite polypeptide map has been constructed for purposes of varietal comparison.

Differential Centrifugation of Peanut and Soybean Protein Isolates as Influenced by Preparation Technique and Heat Treatment. R. H. Schmidt and E. M. Ahmed. University of Florida.

Protein extracts were prepared from defatted 'Florunner' peanuts and 'Cobb' soybeans and dehydrated by spray, freeze and drum drying techniques. Differential centrifugation was performed on 2.0% protein dispersions at 2000 x g, 40,000 x g and 200,000 x g. Differences in supernatant protein of preparations centrifuged at the lower speeds (2000 x g and at 40,000 x g) were only slight with lowest supernatant protein observed in drum dried protein preparations. Ultracentrifugation of unheated spray and freeze-dried protein dispersions generally resulted in lowered supernatant protein. Increased centrifugal force only slightly affected supernatant protein in drum dried protein dispersions. Heat treatment at 70C for 30 min increased supernatant protein (at 2000 and 40,000 x g) for the protein dispersions. The effects of heating on supernatant protein of ultracentrifuged preparations were only slight. Molecular size distribution in the protein dispersions was investigated by gel filtration on Sepharose 6B.

Functional Properties of Peanut and Soybean Protein Isolates as Influenced by Processing Methods. E. M. Ahmed and R. H. Schmidt, University of Florida.

Proteins were extracted from defatted 'Florunner' peanuts and 'Cobb' soybeans and dried with different methods. The dried preparations were stored at room temperatures for periods up to 36 months. Freshly prepared peanut protein isolates contained 73.9 to 81.3% protein and 1.4 to 4.3% fat. The corresponding values for soybeans were 54.7 to 61.6% and 2.7 to 4.5%. Spray dried peanut protein isolate contained 69.1% protein after 36 months storage at room temperature. Spray dried protein isolates stored for 36 months exhibited less solubility than those stored for 24 months or freshly prepared. Freeze dried soybean isolate contained more soluble protein than the freeze dried peanut protein isolate. The reverse was true for the spray dried peanut and soybean isolates. Protein solubility, emulsifying capacity, foaming capacity and foam stability of peanut and soybean protein isolates were higher for the spray dried and freeze dried than the drum dried preparations. Heat treatment of peanuts (107°C for 20 min.) did not influence protein solubility, and emulsifying capacity but decreased its foaming capacity and foam stability. Storage of peanut isolates resulted in a loss of emulsifying capacity, especially for the freeze dried peanut preparation.

Chemical Properties of Bread Fortified With Flour From White-Testa Peanuts.
Robert L. Ory and Edith J. Conkerton, USDA,SEA,SRRC, New Orleans, LA.

Fortifying wheat bread with vegetable proteins is one of the primary methods used to raise the dietary protein levels of some segments of the population for economic and/or health reasons. Three breads were prepared: a control made from milled, bleached wheat flour, and two breads in which defatted flour from different white-testa peanut genotypes replaced 10% of the wheat flour. A comparison of various chemical and physical properties of the breads showed that neither of the fortified loaves decreased in loaf volume or texture. After baking, the fortified loaves had increased protein content, moisture retention, and browning (Maillard reaction) of the crust. There were also increases in certain metal concentrations. Additional data will be presented as a basis for comparing the two peanut flours as potential new sources of plant protein for food applications.

Effects of Low Oxygen Atmospheres in Maintaining Grade and Germination Quality of Shelled Peanuts. Whit O. Slay, Jack L. Pearson, and Charles E. Holaday, National Peanut Research Laboratory, Dawson.

A cooperative study tested application techniques, materials, and the effectiveness of low oxygen atmospheres as an energy efficient method of preserving grade and germination quality of shelled peanuts. Two peanut moistures (7.6% and 6.9%), two packaging materials (nylon-EVA resin and nylon-saran-EVA resin) and two atmospheres (26 in./Hg vacuums and vacuums with nitrogen backflush to 14 in./Hg) were studied. Shelled peanuts in burlap bags stored in ambient and refrigerated (37° F and 65% RH) conditions and ambient stored bulk farmers stock peanuts were used as controls. Grade quality, and germination analyses were made after 3-, 6- and 12-month storage periods. Quality parameters by storage period showed significant differences among treatments and controls. Inshell farmers stock controls had the most moisture loss and the largest increase in split, fall through and externally damaged kernels. Interactions were found between moisture and atmospheres, but materials were not significantly different. Low oxygen atmospheres were generally superior in maintaining grade and germinability. After 12 months, nitrogen stored peanuts were 4 to 10% higher in germination than the controls. The study indicates that low oxygen atmosphere methods improve sanitation, insect control, and handling and require less space and energy for shelled peanut storage.

Effects of Atmospheres, Application Techniques and Time on Peanut Quality. J. L. Pearson, W. O. Slay and C. E. Holaday, National Peanut Research Laboratory, Dawson.

As part of a continuing storage study three atmospheres and two application methods were used to evaluate effectiveness of low oxygen concentrations as energy and space-efficient methods of maintaining peanut quality. Atmospheres studied were nitrogen, carbon dioxide and air. Control was peanuts in burlap bags, stored at 37° F and 65% RH. Quality evaluations were made on samples stored for 3, 6 and 12 months.

Analysis of combined data from the three storage periods showed significant differences among the treatments and control for raw-peanut brightness and red coloration, peanut-butter red coloration, flavor, oil color at 480 nm and corrected 450 nm and oxygen-bomb shelf-life prediction. All of these quality measurements varied significantly among the storage periods, but interaction between treatment and storage period was not significant for any of these quality parameters.

Effects of Some Harvesting and Curing Practices on the Milling Quality of 'Florunner' Peanuts. J. I. Davidson, Jr., E. J. Williams, J. M. Troeger, and J. L. Butler, National Peanut Research Laboratory, Dawson and Georgia Coastal Plain Experiment Station, Tifton.

'Florunner' peanuts were dug weekly during a 42-day period starting 125 days after planting. Each week peanut samples were handpicked from the vines immediately after digging (green) and again just prior to combining (semi-green). Handpicked and combine samples were cured with 95° F, 60% RH air. The samples were subjected to several pre-curing and post-curing treatments. After curing and storage all the peanut samples were shelled by the Model 3 sample sheller to determine the actual milling quality of peanuts subjected to the various treatments. Results showed that digging time (maturity), picking time (green vs semi-green), and picking methods (hand vs mechanical) affected milling quality. Generally, the percentage of split kernels for both handpicked and combine picked peanuts increased as the peanuts become more mature. Over the 42-day digging period, split kernel outturn doubled for each of the methods-handpicked, green, handpicked semi-green, and combined semi-green. Split kernel outturn was higher for the combined peanuts. Split kernel outturn for the combined peanuts was two times higher than for the "handpicked green" peanuts and approximately one and one-half times higher than for "handpicked semi-green" peanuts. Skin slippage (bald kernels) was zero for all samples. Pre-curing and post-curing treatment were not severe and did not greatly affect milling quality.

Observations on the Handling of the Aflatoxin Problem in Japan. Kenneth H. Garren, USDA-SEA, Suffolk, VA.

Japanese scientists in government and in the agricultural and food processing industries are acutely sensitive to the aflatoxin problem. For centuries Aspergillus flavus has been a fermenting organism for processing some favorite Japanese foods. Japanese fondness for peanuts and peanut products results in importation of large quantities of peanuts. This report describes the work of the Japanese Mycotoxin Association, ca. 75% of the time of which is devoted to checking for aflatoxin in imported raw peanuts and peanut butter. Basic figures are given on imports and inspections of peanuts in 1975 and 1976. The report also outlines briefly: 1. Japanese Ministry of Agriculture's research on A. flavus in those Southeastern Asian countries from which Japan imports peanuts. 2. Cooperative research of Asahi Chemical Co. and the Japanese National Institute of Health on using imported peanuts that would otherwise be destroyed because of aflatoxin contamination to produce an aflatoxin-free peanut flour. 3. A program of Zen Noh, the largest Japanese farmers' cooperative, for dealing with the aflatoxin-mycotoxin potential in commodities used as feed by its egg and broiler industry.

BREEDING TOUR AND DISCUSSION

A. J. Norden
University of Florida, Gainesville, Fl.

SUMMARY

Thirty-one persons participated on the tour by bus to visit the peanut crossing greenhouse and the breeding nurseries, field experiments and facilities located at the University of Florida Green Acres Agronomy Farm 13 miles from the campus. Although the 1978 greenhouse crossing program was completed at the time of the tour, the group walked through the greenhouse and viewed the crossing facility and the parental plants from which the hybrid seed will soon be harvested. Rain interrupted the tour of the field plots at the Green Acres Agronomy Farm but not before the group was able to walk by one replication of labeled plots of the different entries in the National Uniform Peanut Performance Test and of the Advanced Florida Lines Test. The tour bus then drove by the space planted nursery, breeder seed increase plots and a number of experiments and stopped briefly at the peanut laboratory and drying, processing and storage building. Due to the rain and the shortage of time the discussion was limited primarily to questions concerning various phases of the breeding program and the maintenance of breeders seed.

ENTOMOLOGY DISCUSSION GROUP

Sidney E. Poe, Discussion Leader
University of Florida, Gainesville, Fl. 32611

SUMMARY

The entomology discussion was attended by about 20 persons with all the peanut producing states accounted for except Texas and Oklahoma. Present were personnel from University, extension service, experiment stations, USDA-SEA, agricultural chemical industry and production.

The discussion centered around changing crop protection philosophy (pest management) practical techniques of monitoring fields, administrative approaches to supply scout training and service demands, and specific comments about current research and individual pest status.

Program of individual states involved in scout training and formation of grower cooperatives or advisory groups was reviewed. In Georgia, 28 counties for a total in excess of 100,000 A are scouted; 206 persons attended the scouting schools. In Alabama, 6 of 9 peanut growing counties utilize scout services, our 100 persons attended the scout training school. Florida trained 120 persons in its school and reported about 16,000A of several field crops in the scouting program. Lesser amounts from other states were reported. The extent of consultant services in the various states is not known.

Topics of interest included the effects of a pegging application of aldicarb, cercospora leaf spot on insect feeding, antifeeding effects of organotin fungicides and the influence of irrigation on individual pest status, such as lesser cornstalk, mites and southern corn rootworms.

Concern was expressed over growing commercial sales of egg parasite Trichogramma to producers and a request made for any available information. Although data for peanuts is lacking, the consensus was that any beneficial effect of releasing a few Trichogramma for control of Lepidoptera would be minimal.

The pressing need for information on compatibility of tank mixed agrichemicals was discussed.

The group was introduced to the Southern Peanut Insect Research Work Group that meets annually in March and all interested persons encouraged to attend and participate. The meeting adjourned after 1 hour 40 minutes.

Report on the Discussion Group
on Peanut Product Development

E. M. Ahmed
University of Florida, Gainesville, Fl. 32611

Twenty-nine persons participated in the discussion. The highlights of their recommendations are:

1. Investigate ways to increase the use of defatted peanut flours prepared from red-skin and white-skin peanuts.
2. Determine functional qualities of peanut meal, flour and paste. Investigate means to improve these functional properties by chemical, physical or enzymatic methods.
3. Determine functional properties of mildly extracted peanut protein.
4. Development of food products enriched with peanut flour as bakery, meat, beverage, convenience and snack foods.
5. Comparison of quality of food products prepared with peanut flour or meal with those prepared by mildly extracted peanut proteins.
6. Evaluation of nutritional values of peanut-enriched food products.
7. Investigate heat treatments required to inactivate any trypsin inhibitors present in peanuts.
8. Development of fermentation studies with peanut and peanut flour to prepare improved food products.
9. New uses for peanut proteins as ingredients for whipped toppings and coffee whiteners.
10. New uses of peanuts and peanut flour in combination with dairy products should be investigated.
11. Definite comparisons of peanut protein characteristics with those of soybean are needed.

DISCUSSION GROUP ON PEST MANAGEMENT

1:10 to 2:45 P.M. on 13 July 1978

In the early portion of this session which was chaired by D. H. Smith, the following topics were introduced and briefly discussed: (A) Management of peanut diseases with resistant cultivars. (B) Disease forecasting and remote sensing as aids in a peanut disease management system. (C) Enhancement and/or suppression of non-target organisms in a peanut disease management system. (D) Management of fungicide-tolerant strains of Cercospora arachidicola and Cercosporidium personatum. (E) Analyses of pesticide application methods which are used in the peanut crop management system and (F) Compatibility and efficacy of pesticidal mixtures which are used in peanut production.

APREA BOARD OF DIRECTORS MEETING

Gainesville Hilton Inn, Gainesville, Florida

11 July 1978

The meeting was called to order by President Astor Perry at 8:05 P.M. The following board members were present: A. H. Allison, J. W. Dickens, Wayne Eaves, John Martin, A. J. Norden, Wilbur Parker, Astor Perry, Dennis Robbins (representing the late J. B. Roberts), D. H. Smith and Leland Tripp. Others present were: E. Broadus Browne, Ray O. Hammons, J. Kirby, Harold Pattee, Morris Porter, Joe Sugg and Clyde T. Young.

Ray Hammons presented the report on the Ad Hoc Committee for studying the feasibility of revising PEANUTS-CULTURE AND USES. Leland Tripp moved that the report be accepted. Seconded by A. H. Allison. Motion passed. The complete report is published in this volume of APREA PROCEEDINGS.

A. J. Norden presented the report of the Program Committee. He thanked the members of the Local Arrangements and Technical Program Committees. A. H. Allison moved that the report be accepted. Seconded by Leland Tripp. Motion passed.

Joe Sugg, Chairman of the Publications and Editorial Committee, asked Ray Hammons to present the report on PEANUT RESEARCH. J. W. Dickens moved that the publication of PEANUT RESEARCH be changed from a bi-monthly to a quarterly schedule. Seconded by Wayne Eaves. Motion passed.

Harold Pattee presented the report on PEANUT SCIENCE. Harold Pattee moved that the report be accepted and that the financial report be turned over to the APREA Finance Committee. Seconded by Wilbur Parker. The complete PEANUT SCIENCE report is published in this volume of APREA PROCEEDINGS.

Leland Tripp moved that the membership list in APREA PROCEEDINGS should include those members whose dues are paid at the end of the annual meeting and that addenda to the membership list should be published in PEANUT RESEARCH. Seconded by Wayne Eaves. Motion passed.

Clyde T. Young presented the report of the Peanut Quality Committee. It was moved by Leland Tripp and seconded by A. H. Allison that the Peanut Quality Committee Report be accepted. Motion passed.

Leland Tripp moved that the time of adjournment for this meeting be set at 10:30 P.M. Seconded by A. H. Allison. Motion passed.

Morris Porter presented the report of the Bailey Award Committee. Wayne Eaves moved that the report be accepted. Seconded by Wilbur Parker. Motion passed. The complete report will be published in this volume of APREA PROCEEDINGS.

Leland Tripp presented the report of the Nominating Committee. A. H. Allison moved that the report be accepted. Seconded by Wilbur Parker. Motion passed. The complete report is published in this volume of APREA PROCEEDINGS.

James Kirby presented a preliminary report on the site for the 1979 meeting. A final report was delayed until the APREA Board Meeting of 13 July 1978.

The report of the Executive Secretary-Treasurer was presented by D. H. Smith. Leland Tripp moved that the report be accepted. Seconded by J. W. Dickens. The complete financial statement is published elsewhere in this volume of APREA PROCEEDINGS.

President Astor Perry adjourned the meeting at 10:30 P.M.

APREA BOARD OF DIRECTORS MEETING

Gainesville Hilton Inn, Gainesville, Florida

13 July 1978

The meeting was called to order by President Astor Perry at 8:15 P.M. The following board members were present: A. H. Allison, J. W. Dickens, Wayne Eaves, A. J. Norden, Wilbur Parker, Astor Perry, Dennis Robbins (representing the late J. B. Roberts), D. H. Smith and Leland Tripp. Others in attendance were: P. A. Backman, E. Broadus Browne, C. A. Dunn, Bill Flanagan, R. O. Hammons, James Kirby, Vince Morton, Delbert O'Meara, Harold Pattee, Russell Schools, Olin Smith, R. V. Sturgeon, Joe Sugg and J. C. Wells.

The first item of business was to discuss the question of "special interest group" meetings in conjunction with APREA meetings. After a lengthy discussion among board members and others in attendance, J. W. Dickens moved that the APREA Program Chairman solicit proposals from special interest groups on meetings which will be held either one day prior to the APREA meetings or one day after the APREA meeting. Seconded by A. H. Allison. Motion passed.

Wayne Eaves presented the Finance Committee Report. The following action was taken on the recommendations of the Finance Committee:

Leland Tripp moved that APREA set up the secretarial help for the Secretary-Treasurer and Editor of PEANUT SCIENCE editor for paying F.I.C.A. and withholding taxes and instruct the Secretary-Treasurer to deduct these items. Seconded by J. W. Dickens. Motion passed.

A. H. Allison moved that air mail charges for foreign members of APREA be increased from \$6.00 to \$10.00 per year on July 1, 1979. Seconded by Wilbur Parker. Motion passed.

Leland Tripp moved that the financial statements submitted by the Secretary-Treasurer and Editor of PEANUT SCIENCE be accepted. Seconded by Astor Perry. Motion passed.

Leland Tripp moved that the proposed budget for July 1, 1978 to June 30, 1979 be adopted. Seconded by J. W. Dickens. Motion passed.

James Kirby reported on the meeting site for 1979. Leland Tripp moved that the 11th annual APREA meeting be held in Tulsa, Oklahoma from 10-13 July 1979 and that the selection of the hotel be at the discretion of James Kirby. Seconded by A. H. Allison. Motion passed.

Wayne Eaves moved that proposed by-laws changes be mailed to board members for approval and then to all APREA members, except Institutional Members. Seconded by A. H. Allison. Motion passed.

Wayne Eaves moved that gratis copies of PEANUT SCIENCE be mailed to the following abstracting services: The Library, Commonwealth Bureaux of Pasture and Field Crops, Hurley Nr. Maidenhead, Berks, ENGLAND, (Herbage Abstracts and Field Crop Abstracts). Biosciences Information Service, 2100 Arch Street, Philadelphia, PA 19103, (Biological Abstracts). Institute of Scientific Information, Baltiyskaya ul, 14, Moscow A219, USSR, (Abstracts 25,000 scientific journals from 130 countries). Chemical Abstracts Service, Ohio State University, Columbus, OH 43210. Seconded by Wilbur Parker. Motion passed.

Wayne Eaves moved that henceforth the Local Arrangements Committee will be responsible for obtaining the funds which are needed to provide the coffee break refreshments at annual meetings. Seconded by Leland Tripp. Motion passed.

Leland Tripp moved that each incoming President of APREA appoint an ad hoc committee on site selection for two years in advance of the annual meeting. Seconded by J. W. Dickens. Motion passed.

A new ad hoc committee on Revision of PEANUTS-CULTURE AND USES will be appointed by President A. J. Norden.

The meeting was adjourned at 10:45 P.M.

Minutes of the Regular Business Meeting of the
AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION
Gainesville Hilton Inn, Gainesville, Florida, July 14, 1978

The meeting was called to order by President Astor Perry at 8:15 A.M.

The invocation was given by Joe Sugg.

A. J. Norden, Chairman of the Program Committee, thanked the members of the Local Arrangements committee and the Technical Program Committee for their help with the tenth annual meeting of APREA.

A summary of the activities of the Publications and Editorial Committee was presented by Chairman Joe Sugg. Ray O. Hammons reported on PEANUT RESEARCH and announced that it will now be published at quarterly intervals. The complete report of the Publications and Editorial Committee is published elsewhere in this volume of APREA PROCEEDINGS. Robert Ory moved that the report of the Publications and Editorial Committee be accepted. Seconded by James Kirby. Motion passed.

Wayne Eaves presented the report of the Finance Committee and moved that the proposed budget be adopted. Seconded by Joe Sugg. Motion passed.

Clyde T. Young presented the report of the Peanut Quality Committee. Terry Coffelt moved that the report be accepted. Seconded by Dan Hallock. Motion passed. The complete report is published elsewhere in this volume.

A. H. Allison presented the report of the Public Relations Committee. Dan Hallock moved that the report be accepted. Seconded by W. T. Mills. Motion passed. The complete report is published in this volume.

Ray O. Hammons reported on the findings of the Ad Hoc Committee on Revision of PEANUTS-CULTURE AND USES. C. T. Young moved that the report be accepted. Seconded by Olin Smith. Motion passed. The report is published in this volume of APREA PROCEEDINGS.

Don Smith presented the report of the Secretary-Treasurer. Leonard Cobb moved that the report be accepted. Seconded by Robert Ory. Motion passed.

President Astor Perry presented the Bailey Award. J. M. Troeger and J. L. Butler received the award for their paper on "Solar Drying of Peanuts in Georgia".

President Perry presented the Past-President award to Leland Tripp.

President Perry presented his report to the members of APREA. The complete report is published in this volume of APREA PROCEEDINGS.

The 11th annual meeting of APREA will be held at the Camelot Inn, Tulsa, Oklahoma from 10 to 13 July 1978.

The meeting was adjourned at 9:25 A.M.

PRESIDENT'S REPORT

Astor Perry

It has been a pleasure to serve as your president for the past twelve months. They have been busy months for me as I have attempted to represent you as best I could at many meetings and planning sessions.

The structure of APREA with its Board of Directors, Committees, and rotating meeting sites on an annual basis was well conceived ten years ago when the organization was founded in Norfolk, Virginia. The real strength of the organization has been its members and their willingness to contribute both scientifically and financially. I well remember the initial discussion we held then on our ability to finance ourselves as well as our ability to generate enough papers to justify an annual meeting. I believe we have done both of these with distinction.

Our membership continues to grow with current membership now in excess of 530 members. We have published and sold almost all the copies of "Peanuts - Culture and Uses." The number of articles in PEANUT SCIENCE continues to increase as authors note its high editorial standards and its acceptance by scientists the world over. I see continued growth for APREA as an organization and of the service it provides its members.

I am happy to report to you that liaison has been established between APREA and the American Society of Agronomy. Dr. R. O. Hammons has been appointed to serve as the collaborator or liaison person between the two societies.

It was a great honor for me to represent APREA at the first Peanut Industry Workshop in Kingaroy, Australia last March. They have formed through the leadership of Mr. Alex Baikaloff an organization similar to our predecessor, PIWG.

Last year I was given the charge to appoint members who had not served on committees before to all of our committees. I would like to thank all of you who volunteered to serve on committees. It was a challenge to find a spot for all of you. The committee work has been excellent this year and I hope an informal policy is adopted that will insure that all members have an equal opportunity to serve on committees. Many of us who have been around since PIWG was organized will shortly become inactive, and we must always make sure that our leadership positions are filled with people who have been active in the affairs of APREA.

It is now my pleasure to pass the gavel to your incoming President, a scientist who has made enormous contributions to the peanut industry through his release of superior varieties, Dr. A. J. Norden.

PROGRAM COMMITTEE REPORT

A. J. Norden, Chairman

The printed program for the tenth annual meeting of the American Peanut Research and Education Association, Inc. as given below is complete except that the sponsors of the various food and refreshment functions were not included. It is important that APREA meetings be not only educational but also pleasurable, and certainly the following organizations must be recognized for contributing substantially towards making the program more gratifying for those in attendance:

Mobil Chemical Company	- Reception	- July 11 7:00-8:00 PM
Diamond Shamrock Corporation	- Hospitality Suite	- July 12 6:30-8:30 PM
Mid-Florida Peanuts, Inc.	- Breakfast	- July 13 6:30-8:00 AM
Uniroyal Chemical Company	- Barbecue	- July 13 6:30 PM
U.S. Gypsum Company	- Wine for BBQ	- July 13 6:30 PM

Proceeds from the following exhibitors provided the coffee and cokes during the breaks:

North American Plant Breeders

Container Corporation of America

Mobil Chemical Company

Nitragin Company

American Pelletizing Corporation

The Peanut Producers Associations of Georgia, Florida and Alabama.

Appreciation is also extended to the Woodroe Fugates for hosting a tour of their farm and shelling plant, and to the Florida Peanut Producers Association for providing roasted and fried peanuts and other favors during the meetings.

PROGRAM
for the
Tenth Annual Meeting
of the
American Peanut Research and Education
Association, Inc.

Tuesday, July 11

1:00-8:00	Registration - Alcove
3:00-5:00	Committee meetings (committee meetings are open to all APREA members)
	Finance - Wayne Eaves, Chairman - Murphy Room 165
	Peanut Quality - Clyde Young, Chairman - Murphy Room 166
	Public Relations - Charles Bruce, Chairman - Murphy Room 167
	Publications and Editorial - Joe S. Sugg, Chairman - Murphy Room 168
8:00-10:00	Board Meeting - Epsilon Room

Wednesday, July 12

8:00-5:00	Registration - Alcove
	Exhibits - Gamma Room
GENERAL SESSION - Astor Perry, presiding - Alpha Room	
8:10	President's Welcome - Astor Perry
8:30	Address by E. T. York, Jr., Chancellor, State University System of Florida
9:00	A Peanut Farmer - Legislator Views the Peanut Industry - The Honorable Wayne Mixson
9:30	BREAK - Gamma Room
9:45	Two concurrent sessions
SESSION 1. PLANT PATHOLOGY AND NEMATOLOGY - Alpha Room	
9:45	Opening Remarks - Pat Phipps, presiding
9:50	Relationship between the method of incorporation and the effectiveness of two nematocides against the peanut root-knot nematode - H. Ivey, R. Rodriguez-Kabana, and H. W. Penick
10:05	Comparison of liquid and granular formulations of Ethoprop for control of root-knot nematodes in 'Florunner' peanuts - J. M. Hammond and R. Rodriguez-Kabana
10:20	Effectiveness of ethylene dibromide (EDB) and chloropicrin-EBD mixtures against root-knot nematodes in 'Florunner' peanuts - Peggy S. King, R. Rodriguez-Kabana, and J. G. Starling
10:35	Efficacy of at-plant and additional at-pegging applications of nematocides for control of <u>Meloidogyne arenaria</u> on peanut - D. W. Dickson and R. E. Waites
10:50	Control of Sclerotinia blight of peanuts with DPX4424 - D. M. Porter
11:05	Sodium azide offers some promise for control of Cylindrocladium Black Rot (CBR) of peanuts - B. A. Womble and K. H. Garren

- 11:20 Factors initiating epidemics of southern stem rot (white mold) disease of peanuts - M. K. Beute and R. Rodriguez-Kabana
- 11:35 A method for determining numbers of sclerotia produced by the southern blight fungus Sclerotium rolfsii - R. Rodriguez-Kabana and M. K. Beute
- SESSION 2. MATURITY AND FLAVOR - Sigma Room
- 9:45 Opening remarks - H. P. Dupuy, presiding
- 9:50 Seed-hull maturity index - optimum sample size and effect of harvest date, location, and peanut cultivar in North Carolina - H. E. Pattee, J. C. Wynne, and C. T. Young
- 10:05 Comparison of four peanut maturity methods in Georgia - T. H. Sanders and E. J. Williams
- 10:20 Comparison of maturity tests on three peanut cultivars in South Texas - A. M. Schubert and C. L. Pohler
- 10:35 The effect of digging time on seed-size distribution of 'Florunner' peanuts - E. J. Williams, James I. Davidson, Jr., and J. L. Butler
- 10:50 Identification of volatiles from enzymic reaction products by direct gas chromatography/mass spectroscopy - A. J. St. Angelo and M. G. Legendre
- 11:05 Instrumental methodology for predicting potential flavor quality of roasted peanut products - G. L. Linthicum, J. D. Tallant, H. P. Dupuy, and R. O. Hammons
- 11:20 Instrumental analysis of volatiles in air- and nitrogen-packed peanut butter - S. P. Fore, G. S. Fisher, M. G. Legendre, and J. I. Wadsworth
- 11:35 Effects of freeze damage on the volatile profiles of raw peanuts - Mona Brown, H. P. Dupuy, and W. Mazingo
- 1:25-5:00 Two concurrent sessions and related discussion groups
- SESSION 1. PEST MANAGEMENT (weeds, insects, diseases) - Alpha Room
- 1:25 Opening remarks - John French, presiding
- 1:30 Evaluation of Ethalfluralin for weed control in peanuts - B. J. Brecke, W. L. Currey, and D. W. Gorbet
- 1:45 A comparison of low and high level management peanut farming operations in Comanche, Texas - D. S. Moore, C. E. Hoelscher, and J. S. Denton
- 2:00 Lesser Cornstalk Borer: an alternative sampling technique - Davy Jones and Max Bass
- 2:15 Interactions of pesticides and two spotted spider mite on peanuts - W. V. Campbell
- 2:30 Interaction of pesticides and peanut varieties in relation to insect pest populations - L. W. Morgan and J. W. Todd
- 2:45 Provisioning with pre-paralyzed hosts to improve parasite effectiveness: a pest management strategy for stored commodities - D. A. Nickle and D. W. Hagstrum
- 3:00 Effect of leafspot and artificial defoliation on photosynthesis of peanut canopies - K. J. Boote, J. W. Jones, G. H. Smerage, C. S. Barfield, and R. D. Berger
- 3:15 BREAK - Gamma Room

- 3:45 Discussion group on Entomology (Sid Poe)
Physiology tour and discussion (Ken Boote and D. E. McCloud)
- SESSION 2. BREEDING AND GENETICS - Sigma Room
- 1:25 Opening remarks - Aubrey Mixon, presiding
- 1:30 A cytological study of three diploid species of the genus Arachis L. - P. M. Ressler and W. C. Gregory
- 1:45 Cytological analysis of Erectoides x Arachis inter-sectional hybrids - H. T. Stalker
- 2:00 The probable sources of Arachis hypogaea genomes and some implications in peanut breeding - J. Smartt, W. C. Gregory, M. P. Gregory, and P. M. Ressler
- 2:15 Differential reaction of peanut genotypes to web blotch - O. D. Smith, D. H. Smith, and C. E. Simpson
- 2:30 Reaction of peanut Arachis hypogaea L. genotypes to two Cercospora leafspot diseases - Teddy Monasterios, L. F. Jackson, and A. J. Norden
- 2:45 Screening methods and further sources of resistance to peanut rust - P. Subrahmanyam, R. W. Gibbons, S. N. Nigam, and V. R. Rao
- 3:00 Utilization of new harvesting and curing techniques in the production of breeder's seed - T. A. Coffelt, F. S. Wright, and J. L. Steele
- 3:15 BREAK - Gamma Room
- 3:45 Food science tour and discussion (Sam Ahmed)

Thursday, July 13

- 8:00-12:00 Registration - Alcove
Exhibits - Gamma Room
- 8:10-9:45 Two concurrent sessions
- SESSION 1. PATHOLOGY - Alpha Room
- 8:10 Opening remarks - H. A. Melouk, presiding
- 8:15 Fungi associated with stem and pod rot diseases of peanut in Egypt - M. M. Satour, M. A. Abdel-Sattar, A. A. El-Wakeel, E. A. El-Akkad, and L. A. El-Chareeb
- 8:30 A correlation between the amount of soluble amino compounds in the testae of peanuts and colony development of inoculated A. Flavus - Vera L. F. de Souza, Jaime Amaya-Farfan, Antonio S. Pompeu, and Clyde T. Young
- 8:45 Laboratory technique for assessing efficacy of fungicides for control of Cercospora and Cercosporidium leafspots of peanut - R. H. Littrell and J. B. Lindsey
- 9:00 Isolation of Benomyl tolerant strains of Cercospora arachidicola and Cercosporidium personatum at one location in Texas - D. H. Smith, R. E. McGee, and L. K. Vesely
- 9:15 Effects of irrigation on peanut disease - P. A. Backman, E. W. Rochester, and J. M. Hammond
- 9:30 Practices in growing new plant introductions at the Southern Regional Plant Introduction Station - G. Sowell, Jr. and R. O. Hammons
- 9:45 BREAK - Gamma Room

SESSION 2. PHYSIOLOGY AND GENETICS - Sigma Room

- 8:10 Opening remarks - J. W. Tanner, presiding
- 8:15 Physiology of peanut seeds that received sub-freezing temperatures while in the windrow - D. L. Ketring
- 8:30 Screening of peanut germplasm for emergence following a chilling stress - G. R. Ablett and J. W. Tanner
- 8:45 Callus growth and root organogenesis in peanut tissue cultures - A. L. Guy, T. C. Bleen, and S. K. Pancholy
- 9:00 Isolation and evaluation of Rhizobium from Arachis nodules collected in South America - T. J. Schneeweis, G. H. Elkan, J. M. Ligon, J. C. Wynne, and T. G. Isleib
- 9:15 Quantitative genetic aspects of nitrogen fixation in peanuts - T. G. Isleib, J. C. Wynne, G. H. Elkan, and T. J. Schneeweis
- 9:30 Increasing nitrogen fixation of the peanut - J. C. Wynne, G. H. Elkan, T. J. Schneeweis, T. G. Isleib, C. M. Preston, and C. A. Meisner
- 9:45 BREAK - Gamma Room
- 10:00-12:00 Two concurrent sessions

SESSION 1. PRODUCTION AND GENERAL - Alpha Room

- 10:00 Opening remarks - A. M. Schubert, presiding
- 10:05 Plant stand and root development in relation to combine-harvested versus hand-harvested seed - R. C. Roy, G. Ablett, and J. W. Tanner
- 10:20 Effect of plant density on growth, yield, and grade of Spanish peanuts - J. N-O. Azu and J. W. Tanner
- 10:35 Response of peanuts in Virginia to several sources of manganese - D. L. Hallock
- 10:50 Water use and yield of peanuts on a well-drained sandy soil - L. C. Hammond, K. J. Boote, R. J. Varnell, and W. K. Robertson
- 11:05 The effect of irrigation, inoculant type, and nitrogen fertilizer on nitrogen fixation and yield of Spanish peanuts - V. M. Reddy and J. W. Tanner
- 11:20 Discussion

SESSION 2. PROTEINS - Sigma Room

- 10:00 Opening remarks - Kay McWatters, presiding
- 10:05 Amino acids, oil and protein content of some selected peanut cultivars - S. K. Pancholy, A. S. Deshpande, and S. Krall
- 10:20 The amino acid content of the U. S. commercial peanut varieties - C. T. Young and R. O. Hammons
- 10:35 Relatedness of Jenkins, Hawthorne and Storers Jumbo Peanuts - C. F. Savoy, D. Stoker, and S. K. Pancholy
- 10:50 Cultivar differences in protein composition of peanuts (*A. hypogaea* L.) as evidenced by two-dimensional polyacrylamide gel electrophoresis - S. M. Mahaboob Basha
- 11:05 Differential centrifugation of peanut and soybean protein isolates as influenced by preparation technique and heat treatment - R. H. Schmidt and E. M. Ahmed
- 11:20 Functional properties of peanut and soybean protein isolates as influenced by processing methods - E. M. Ahmed and R. H. Schmidt

11:35 Chemical properties of bread fortified with flour from white-testa peanuts - R. L. Ory and E. J. Conkerton

1:10-2:45 Two concurrent sessions

SESSION 1. HARVESTING, CURING, SHELLING AND STORAGE - Alpha Room

1:10 Opening remarks - J. L. Steele, presiding

1:15 Air flow interruption during peanut drying - J. M. Troeger and J. L. Butler

1:30 Reducing energy consumption during conventional peanut drying - P. D. Blankenship and V. Chew

1:45 Effects of low oxygen atmospheres in maintaining grade and germination quality of shelled peanuts - W. O. Slay, J. L. Pearson, and C. E. Holaday

2:00 Effects of atmospheres, application techniques and time on peanut quality - J. L. Pearson, W. O. Slay, and C. E. Holaday

2:15 Effects of some harvesting and curing practices on the milling quality of 'Florunner' peanuts - J. I. Davidson, Jr., E. J. Williams, J. M. Troeger, and J. L. Butler

2:30 Observations on the handling of the aflatoxin problem in Japan - K. H. Garren

2:45 BREAK - Gamma Room

SESSION 2. DISCUSSION GROUP ON PEST MANAGEMENT - Sigma Room

1:10-2:45 D. Smith, R. Kabana, W. Currey, and J. French, Co-Chairmen

2:45 BREAK - Gamma Room

2:45-5:00 Three Tours
Fugate Farm and Shelling Plant (Ben Whitty)
Breeding tour and discussion (Al Norden)
Entomology tour (Mike Linker)

8:00 Board meeting - Epsilon Room

Friday, July 14

7:30 Breakfast - Alpha Room

8:15 President's address and business meeting - Alpha Room

10:00 Adjourn

FINANCE COMMITTEE REPORT

Wayne Eaves, Chairman
Kelly Sears
Paul Blankenship
Russell Schools
Don Banks

The finance committee met at 3:00 p.m. on July 11, 1978. Audits of the financial statements submitted by the Secretary-Treasurer and Peanut Science editor were conducted, and both were found to be in good order. The Bailey Award Fund was also reviewed and found to be in order. A copy of the Peanut Science financial statement is attached to this report and reflected in the Secretary-Treasurer's report.

The committee met again at 6:30 p.m., July 13, 1978 to make recommendations and a new budget proposal.

The following recommendations were submitted by the Finance Committee and adopted by the Board of Directors:

1. That the allocation for assistant to the Secretary-Treasurer be increased from \$1,500 to \$1,800 per year.
2. That the Association set up the secretarial help for the Secretary-Treasurer and Peanut Science editor for paying F.I.C.A. and withholding taxes and instruct the Secretary-Treasurer to deduct these items.
3. That air-mail charges for foreign members be increased from \$6.00 to \$10.00 per year effective July 1, 1979.
4. That the financial statements submitted by the Secretary-Treasurer and Peanut Science editor be accepted.
5. That the proposed budget for July 1, 1978 to June 30, 1979 be adopted.

The finance committee commends the Secretary-Treasurer, the Peanut Science editor, and others involved in the business affairs of the Association for an outstanding job.

AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION

Financial Statement

July 1, 1977 to June 30, 1978

ASSETS AND INCOME

I

Item

A. Balance - July 1, 1977	\$19,478.68
B. Membership & Registration (Annual Meeting)	12,351.00
C. Proceedings & Reprint Sales	703.36
D. Special Contributions	750.00
E. The Peanut	2,151.00
F. Peanut Science Page Charges & Reprints	8,975.37
G. Institutional Membership	718.00
H. Differential Postage Assessment - foreign members	437.19
Total	<u>\$45,564.60</u>

LIABILITIES AND EXPENDITURES

II

Item

1. Proceedings - Printing & Reprints	\$ 3,160.00
2. Annual Meeting - Printing, Catering & Misc.	1,225.87
3. Secretarial	1,500.00
4. Postage	662.06
5. Office Supplies	494.06
6. Position Bond for \$5,000 (Exec.Sec.Treas.)	-
7. Travel - President	-
8. Travel - Executive Sec. Treas.	-
9. Registration - State of Georgia	5.00
10. Miscellaneous	224.14
11. Peanut Science	9,507.00
12. The Peanut	119.00
13. Bank Charges	12.00
14. Peanut Research	1,079.87
15. Certificate of Deposit	10,000.00
Total	<u>\$27,989.00</u>

AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION

Financial Statement

July 1, 1977 to June 30, 1978

SAVINGS ACCOUNTS

	<u>Date</u>	<u>Interest</u>	<u>Balance</u>	<u>Disbursed</u>
Yoakum National Bank Wallace K. Bailey Fund	6-30-78	\$10.81	\$849.47	\$35.00
Yoakum Federal Savings & Loan Association Certificate of Deposit	6-24-78	\$167.70	\$10,405.18	-

APREA

BUDGET

July 1, 1978 - June 30, 1979

ASSETS AND INCOME

Balance	\$27,980.78
Membership and registration	12,500.00
Proceeding and reprint charges	750.00
Peanut Science page and reprint charge	10,672.00
<u>The Peanut - 180 copies @ \$11.33</u>	<u>2,039.40</u>
 TOTAL	 \$53,942.18

EXPENDITURES

Peanut research	\$ 1,250.00
Proceedings, Printing, Etc.	4,500.00
Annual meeting	1,750.00
Secretarial Services	1,800.00
Postage	1,500.00
Office Supplies	600.00
Travel - President	400.00
Secretary-Treasurer	400.00
Registration (State of Georgia)	5.00
Peanut Science	10,600.00
Miscellaneous	<u>500.00</u>
 TOTAL	 \$23,305.00
Reserve	\$30,637.18
 TOTAL	 \$53,942.18

REPORT OF THE PUBLICATIONS AND EDITORIAL COMMITTEE
TO THE ANNUAL APREA MEMBERSHIP MEETING
JULY 1978

Joe S. Sugg, Chairman

The activities of the Publications and Editorial Committee were carried out, as shown in the report by Ray Hammons and J. E. Cheek, co-editors of APREA PEANUT RESEARCH, which is attached to this report, and in the report of PEANUT SCIENCE by Harold Pattee, which report is also attached hereto. The financial report and budget for PEANUT SCIENCE was presented to the membership and filed with the Secretary.

Recommendations by the editors of PEANUT RESEARCH, Hammons and Cheek, were as follows:

"First, we recommend that PEANUT RESEARCH be changed immediately to a quarterly issuance. These four issues might be keyed to specific activities of APREA, i.e., call for papers, announcement of annual meeting, report of annual meeting, etc. Consideration should be given to its preparation and transmittal from the office of Don Smith or Harold Pattee (who hold master mailing lists).

"Second, we recommend that the incoming president, A. J. Norden, appoint an Ad hoc committee to review the status of PEANUT RESEARCH and present their recommendation at an appropriate time (perhaps at the 11th Annual meeting)."

The editors of PEANUT SCIENCE and PEANUT RESEARCH are to be commended upon the excellence of the performance of their duties.

The annual question of what to do about up-to-date revision of the book, "Peanuts - Culture and Uses", was referred last year to the Ad hoc Committee and is covered in their report under special committee reports.

The Proceedings of the annual meeting held July 12-15, 1977 were prepared and distributed to all the members but were later getting out than was the desire of the Publications and Editorial Committee; however, due to the late rounding up of memberships, the publication was delayed. It is hoped that this situation will be corrected this year and that the Proceedings will be in the hands of the members a month earlier than that, if not sooner. It would greatly expedite the publication of the Proceedings and would help the Secretary if members would all renew their membership upon the receipt of the first notice.

PEANUT SCIENCE REPORT

The past year has been a very prosperous year for the PEANUT SCIENCE journal. The submission rate of manuscripts has increased significantly and manuscripts from research areas not previously touched are now being received, as are manuscripts from authors not members of APREA. The financial report for PEANUT SCIENCE has been given to the Finance Committee and will be included in their report. The status of the journal is as follows:

Manuscripts submitted July 1, 1977 - June 20, 1978. . 39
Total manuscripts printed 33
Pages printed 142
Cost per page including free reprints \$54.17
Average length of article 4.3 pages
Total cost per page \$73.61
Manuscripts currently in progress 21
Estimated size of the Fall Issue 16 to 18 papers

Editorial Board Members:

<u>Term Expiring 1978</u>	<u>Area</u>	<u>Nominations</u>
Ellis W. Hauser	Weed Science	Ellis W. Hauser
Darold L. Ketring	Plant Physiology	Darold L. Ketring
William T. Mills	Agricultural Engineering	Thomas B. Whitaker
James W. Smith	Entomology	Sidney L. Poe
Ruth Ann Taber	Plant Pathology	Ruth Ann Taber
Johnny C. Wynne	Plant Breeding	Johnny C. Wynne

Proposed changes in journal policy are as follows:

- 1) Free reprints to authors be reduced to 100, effective July 1, 1979.
- 2) Cost per 100 reprints be increased to \$6.00/page, effective immediately.

I express sincere appreciation to each Editorial Board Member for a job well done and to the APREA membership for their active support of PEANUT SCIENCE.

Respectfully submitted,

Harold E. Pattee,
Editor

PEANUT SCIENCE

Financial Statement

July 1, 1977 - June 30, 1978

Balance - July 1, 1977	\$ 2,437.06
Received from APREA	9,507.00

EXPENDITURES:

Printing		7,922.85
Postage	Domestic	353.65
	Foreign	320.95
		78.37
Office Expense		112.50
P. O. Box and Bulk Mailing Permit		1,700.00
Salary, Editorial Assistant		7.00
Travel and Miscellaneous		
	Total	\$ 10,495.32
Balance on Hand		\$ 1,448.74

Estimated Expense \$15,750.00

Income from Peanut Science	\$ 8,975.37	
Outstanding Invoices for page charges	364.00	
APREA Member Subscription (484 x 200)	968.00	
Library subscriptions (56)	672.00	
Foreign Mailing Reimbursement	320.95	
	Total	\$ 11,300.30
	Budget	\$ 16,002.00

Manuscripts submitted July 1, 1977-June 30, 1978 -- 39

Spring issue 1977 - 10 articles - 45 pages printed

Fall issue 1977 - 9 articles - 37 pages printed

Spring issue 1978 - 14 articles - 60 pages printed

Total - 33 articles - 142 pages printed

Printing cost, per page, including free reprints \$54.17

Average length of article: 4.3 pages

Total cost per page \$73.61

PRINTING COST BREAKDOWN:

	Cost
Total pages: 148 Printed pages: 142	\$ 5,023.20
Reprints supplied free	1,499.25
Ordered reprints	231.00
Journal cover	575.60
Taxes	302.66
Shipping charges	70.34
Special color page	220.80
	<u>\$ 7,922.85</u>

PROPOSED BUDGET 1978-1979

Number of issues: 2 (Fall 1978; Spring 1979)

Estimates: Pages - 130; cost per page - \$60.00;

Reprint cost per/100 - \$6.00

EXPENDITURES:

Printing costs	\$ 7,800.00
Reprints (25 pages)	300.00
Editorial Assistant	1,400.00
Office Supplies	300.00
Postage	Domestic 400.00
	Foreign 400.00
	Total \$ 10,600.00

INCOME:

Page charges	\$ 8,400.00
Reprint charges	200.00
Foreign mailing	400.00
APREA Member Subscriptions (500 x 2.00)	1,000.00
Library subscriptions (56)	672.00
	Total \$ 10,672.00

APREA PEANUT RESEARCH

Report of Editors to the American Peanut Research and Education Association, Inc., 10th Annual Meeting, Gainesville, Florida, July 11-15, 1978.

Ray O. Hammons and J. E. Cheek

Five issues of APREA PEANUT RESEARCH (Volume 15, Numbers 1 through 5, Issues 62-66) were compiled, edited, published and mailed to the membership during the year.

Circulation was to about 548 individual members or institutions in the U.S. and abroad.

PEANUT RESEARCH is sent to Libraries at all Land-grant institutions in the Southern United States, to the USDA-SEA National Agricultural Library, to various abstracting services and to several agricultural periodicals.

All informational issuances from APREA officers were published. 182 selected references and 43 theses or dissertations were documented.

REPORT OF THE 1977-1978 PEANUT QUALITY COMMITTEE

During the year, some 20 methods were mailed out to prospective writers for procedures that might be incorporated into the APREA Methods Manual. Listed are the methods that have been received by the close of the 1978 APREA Meeting.

Direct Gas Chromatographic Method for Measuring Flavor Quality of Peanuts. Applicable to raw peanuts. by Harold P. Dupuy.

Peanut Seed Size and Shape. Applicable to representative samples of peanut seed. by James I. Davidson, Jr.

Peanut Size and Shape. Applicable to individual peanut pods or seed. by James I. Davidson, Jr.

Total Oil and Fat Content - Refractive Index Method. Applicable to raw and roasted peanuts and peanut butter. by Wilbur Parker and J. R. Baxley.

Light Filth. Applicable to peanut butter for the detection of light extraneous matter such as insect fragments, rodent and other animal hairs, and feather fragments. by Wilbur Parker and J. R. Baxley.

Color Measurement by Reflectance Method. Applicable to whole kernels, blanched kernels, roasted kernels, paste, butter. by E. M. Ahmed.

Free Fatty Acids of Peanuts. Applicable to oil extracted from peanuts. by L. L. Khatri.

Free Fatty Acid Composition of Peanut Oil by Gas-Liquid Chromatography. This procedure is suitable for the quantitative determination of those fatty acids found in peanut oil after conversion to methyl esters. The eight fatty acids of peanut oil contain from 16 to 24 carbons. Trace quantities (< .5%) of both longer and shorter chain acids are present in peanut oil but these are not usually quantitated.

Aflatoxin - Rapid Thin-Layer Chromatograph Method. Applicable to raw and roasted peanuts, peanut meal and peanut butter. by C. E. Holaday.

Aflatoxin B₁ and G₁ Confirmatory Test. Applicable to all sample extracts where estimated concentrations of Aflatoxin B₁ and G₁ have been determined. by C. E. Holaday.

Aflatoxin - Rapid Minicolumn Screening Method. Applicable to raw and roasted peanuts, peanut meal, peanut butter and peanut candy. by C. E. Holaday.

Laboratory Roasting of Peanuts. Applicable for maximizing uniformity of doneness-of-roast among peanut lots of equal roasting quality, also for determining the potential for variability in doneness-of-roast among lots of unequal roasting quality. by Jack L. Pearson.

Polyacrylamide Gel Electrophoresis of Peanut Protein. Applicable to prepared plant tissues, seed meal and flour. by C. F. Savoy.

Testing the Germination of Peanuts. Applicable to non-dormant shelled peanut seeds, treated with a fungicide. by George E. Spain.

The attendance at the committee meeting was the best ever and was attended by Wilbur A. Parker, Russ Baxley, Larry L. Hodges, David M. Hogg, Bill Birdsong, Jr., E. M. (Sam) Ahmed, James J. Spadaro, Earl Worthington, Timothy H. Sanders, W. A. Carver, Henry C. Harris, M. V. Reddi, Jerry Coffelt, Arthur L. Guy, Terry C. Bleen, S. Pancholy, Abdelrahman K. Osman, A. S. Deshpande, Harold P. Dupuy, Lakho Khatri, Sam Cecil, James H. Young, Tom Whitaker, Doyle Welch, William Flanagan, Jay Williams, G. L. Linthicum, Carol Pulliam, and Walt Wilkens.

The format for use by the methods committee was reviewed and discussed, and the following review procedure was approved at the 1978 Committee meeting. Methods will carry one of the following titles.

- (1) Proposed (The revised method will have been reviewed by two or more reviewers.)
- (2) Tentative (The method has been tested by two or more additional laboratories.)
- (3) Final (Supported by a collaborative study).

The proposed methods will be available in loose leaf form at some future date. They will be mimeographed on 8 1/2 x 11 sheets for distribution. Prospective users will be made aware of the availability of these methods through the Annual Report of APREA, Peanut Research, and peanut newspapers. Those desiring copies of the proposed methods can request them by sending a self-addressed stamped envelope to the Chairman of the Peanut Quality Committee. At some future date, probably

in 3-5 years, the proposed, tentative, and final methods will be made available for sale in printed form using good quality paper.

Other topics of current interest of peanut quality were discussed at the meeting. These were freeze damage, nut grass problems, staling or rancidity after roasting, splitting of nuts probably due to excessive drying or shelling at 40° or below, effect of copper on rancidity, effect of excessive fumigation on flavor of peanuts, and problems of blanching and processing of two separate lots of peanuts which were suspected to be of the Early Bunch variety.

Respectfully submitted,

Clyde T. Young, Chairman

Report of The Nominating Committee
Leland D. Tripp, Chairman

The nominating committee presents for your consideration the following nominees.

President	A. J. Norden
President-Elect	James Kirby
Executive Secretary - Treasurer	Don Smith
U.S.D.A. Representative	Robert Ory

Presentation of Fourth Annual
Bailey Award

Tenth Annual Meeting of The
American Peanut Research and Education Association
Gainesville Hilton, Gainesville, Florida
July 14, 1978

by
Astor Perry - President - APREA
Business Session - July 14, 1978

This award was established in honor of Wallace K. Bailey, an eminent peanut scientist. It is awarded each year to that scientist or scientists who presented the best paper at the previous year's annual meeting of APREA as determined by the Bailey Award Committee.

Each paper presented at the 1977 meeting in Asheville was considered for The Bailey Award. They were judged for merit, originality, clarity, and their contribution to peanut scientific knowledge. Papers based on oral presentations were obtained from the authors for evaluation by the awards committee.

It is now my privilege as president of APREA to present The Bailey Award to J. M. Troeger and J. L. Butler for their excellent paper entitled "Solar Drying of Peanuts in Georgia." Both of these scientists are located at The Coastal Plains Experiment Station in Tifton, Georgia.

REPORT OF THE AD HOC COMMITTEE TO REVIEW
THE STATUS OF PEANUTS - CULTURE AND USES

TO: The APREA Board of Directors, 10th Annual Meeting, Gainesville. Florida
11 July 1978

In November 1977, President Astor Perry appointed a five-member committee charged with the responsibility of making recommendations on revising and/or reprinting the book, Peanuts - Culture and Uses.

The committee included D. J. Banks, Chairman, J. L. Steele, R. O. Hammons, D. H. Smith and P. A. Backman.

Several methods were used by committeemen to sample and evaluate. Emory Cheek and I drafted a survey form which was sent by Banks, Smith and Hammons to a stratified sample of APREA members. We sought to canvas individuals who had (or had access to) a copy of the Book, who might be expected to complete the form, and who then would return it.

We had about a 60% response.

Jim Steele and Paul Backman canvassed APREA members in the V-C area and in Alabama, respectively. Not only did they inquire about revision or reprinting but they also obtained opinions concerning the status of information (current, outdated, etc.) in the respondents field.

Altogether, there were more than 70 responses. These were as variable as APREA's membership. Since the questionnaire was prepared by amateurs rather than professional pollsters, some questions were not mutually exclusive.

To the first question, "Should the book be revised?", 48 said "Yes" and 8 answered "No."

Then 37 favored "repeating and updating" compared with 5 favoring a completely new edition and 2 who thought the book could be reprinted as is.

From the results of our survey, we can conclude that the greater majority of APREA members believe and feel that the book Peanuts - Culture and Uses should be revised and reissued.

On behalf of our committee I present that recommendation to the Board of Directors. I further recommend that the Ad Hoc Committee be discharged.

Respectfully submitted.

Ray O. Hammons
Acting Chairman

RESOLUTION

Be it resolved, that the passing of Dr. Karl F. Mattil is recognized by the American Peanut Research and Education Association with utmost regret. At the time of his passing Dr. Mattil was Director of the Food Protein Research and Development Center and Professor of Food Science and Technology in the Department of Soil and Crop Sciences at Texas A&M University. Prior to his service with Texas A&M University, Dr. Mattil served as Research Chemist and Associate Director of Research for Swift and Company for 24 years with interests in edible fats and vegetable oil products and protein uses. He was well known to industry for his research leadership and publications, his 21 patents in the field of oil and fat technology, and his ability to communicate as a lecturer. Dr. Mattil's contribution to the peanut industry and fellowship with his many friends will be greatly missed.

We, therefore, recommend that this resolution be included in the official minutes of the 1978 Annual Meeting of APREA and that a copy of it be forwarded to his widow.

RESOLUTION

WHEREAS:

Since the last meeting of the American Peanut Research and Education Association, God in his infinite wisdom did take from our midst our true and loyal friend J. B. Roberts, President, Dothan Oil Mill Co., Dothan, Alabama and

WHEREAS:

J. B., as known to all of us, unselfishly served the peanut industry in keeping with the objectives of APREA as a charter member and as one of the key organizers of the Peanut Improvement Working Group, the predecessor of APREA, and

WHEREAS:

J. B. in his love for the peanut industry and his deep seated desire to expedite progress for this industry in the field of research, education and legislation did make himself available to serve as member and officer of the Sheller Association, Oil Mill Association, National Peanut Council, National Peanut Advisory Committee and many other civic and business organizations.

Therefore, be it resolved that the membership of APREA here assembled, recognize the passing of J. B. Roberts as a profound loss to this association and the American Peanut Industry and further that this resolution be made a part of the permanent record of APREA and that a copy be sent to Mrs. J. B. Roberts and family.

Adopted this 14th Day of July 1978.

BY-LAWS
of
AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION, INC.

Article I. Name

Section 1. The name of this organization shall be "AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION, INC."

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 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) 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 able to serve
- c. The president-elect (elected annually)

- d. 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.
 - e. 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.
 - f. 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 peanuts; (3) the production or preparation of consumer food-stuffs or manufactured products containing whole or parts of peanuts.
 - g. A person oriented toward research - to be named by the chairman of the Board of Directors of the National Peanut Council.
 - h. 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.
 - i. The president of the National Peanut Council - a non-voting member.
- 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 seven 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 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 may be presented in writing to the Board of Directors which shall discuss the proposal and, at its choice, present the proposal to the annual meeting for adoption or rejection. Proposed amendments not presented to the Board of Directors 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 Annual Business Meeting
of the American Peanut Research and
Education Association, Inc., July 18,
1972, Albany, Georgia; and amended at
the annual meeting held in Dothan,
Alabama, July 18, 1975.

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