1976

PROCEEDINGS

American Peanut Research

and

Education Association, Inc.

Volume 8 **Number 1**

Volume 8 Number 1

PROCEEDINGS

Of

American Peanut Research and Education Association, Inc.

Meeting

Dallas, Texas

July 14 - 16, 1976

PAPERS

ABSTRACTS

MINUTES

BY-LAWS

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Publication Date
October, 1976

1976-77

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EDUCATION AND RESEARCH NEEDS OF THE PEANUT PRODUCER

Floyd L. King
Eakley, Oklahoma

Good morning! Are you awake? Stand up and shake hands with those near you. Wake them up! Introduce yourself, wish them luck and offer your help and assistance in solving their problems.

Be seated now, and just think, you now are a fully committed individual -- to try to undo those things already known to have been done wrong, both in your backyard and also in theirs. To try to follow those "HUNCHES" which have been deep seated in the back of your mind and bedded even deeper in your heart and conscience.

Some things are difficult to say and much harder to do than we sometimes like to admit; such as, to openly criticize our own selves. It is not pleasant to the mind or, in most cases, odorless to our very being. I believe, however, I must in my own mind and heart live through a reasonable amount of self critique periodically in order to properly evaluate and equate my judgment of the needs of our peanut industry, and especially the producer. However, I still find myself coming up short in my full commitment to follow this criticism. Producers are one group who are most difficult to acclimate to the real needs of Research and Education.

I believe first of all and foremost, we must begin with ourselves. As one man and/or woman, to be able to more fully know that we are not wasting valuable minutes and hours in efforts of futility, or in dreams of building our own castle of accomplishments. What do I mean? I mean dedication to the job of accomplishing those educational and research needs of the producer while the atmosphere is at least luke-warm. We all know it is difficult to sell to the Congress, and in many cases to the Bureaus of Government, even the need for our extension and research efforts on specific projects. Money and more money enters the picture quickly and sometimes the trials we go through in efforts to get funds are cruel and heartless. Why? Because of many different views within our society, but also because of apathy and less than full dedication on the part of the producer, representatives, and also on the part of the researcher and his associates. You know and I know that more producers need to be "In the Ring", doing battle to furnish support adequate to do the job. We both know that in universities there is too much jealousy between segments and departments, and too little cooperation between extension and research elements within even the same university. What are our needs?

(a) This jealousy must stop! Like President Truman said, "THE BUCK STOPS HERE". Who is going to stop the buck passing? Who in each university is going to be the dedicated leader who will say I will do it because it is my job and my responsibility?

(b) We need the researcher to get his butt off the chair behind the desk or in the lab long enough and often enough to get to the problem in the field, and Field Try his theory and challenge his knowledge against the weather, and the elements, and the hundred other side effects which the producer is constantly threatened with. This would, I think, be one way that less turn around time could be reached. From research to adapting the practice at the producer level. It is pathetic in some cases how the lack of adapting the project in the field quickly sometimes finally results in a negative answer, rather than what was thought to be a positive one in the laboratory. Let's do it where the problem is.

(c) More cooperation between research and extension and personnel and less of this thing we could call "Widening the Gap" between these two very important and necessary segments of our university complex.

(d) Let's quit some of the time wasting research that is done "<u>just for the sake of research</u>," when problem solving is not considered. We know this is now existing and has been going on for some time. Extension personnel know that on occasions more human fuel could have and should be used to fully implement already

proven practices. Educational efforts and methods are in some cases lagging years behind the need! The economics of producing, harvesting, and selling to the consumer adequate amounts of good and wholesome food products demand rigid guidelines on our time and efforts. Thoughtful dedication again comes to the front of the list of necessities.

(e) We as producers need different ways to apply chemicals which require less time over the field and over the crop. This is expensive and inefficient. Less cultivation, soil preparation, and irrigation play a very real role in these items and can be more fully used if we together will use our heads and hearts to do the job.

(f) Engineers need to get out the lead and help find ways to make equipment last longer. Better methods of harvesting. Less down time. Let's don't wait until manufacturers of equipment set the standards by which all things are judged in this mechanical field.

(g) Breeding of better and better varieties are far behind in some areas. I must say, I believe this to be one of the areas most neglected and I think part of it is due to almost complete ignorance of the field conditions to be met by this new product. The breeder cannot ignore or lay aside the fact that pathology and agronomic and other aspects known more fully by those people in extension and these other departments have to be brought into this determined effort, finally bringing to the producer the product which will rank high and show crystal clear that "This was a Total Effort" by a group of people who saw the problem, visualized the goal and then did a superb job of developing the answer.

(h) We are ever reminded that our peanut program as we have known it may not be as the producer desires in the future. Most of us know that if George Meany tried to change the peanut program, he could have devastating effects. All know that Butz has had tremendous detrimental influence in regard to our farm program and more recently has tried to wreck it completely. Isn't it time that the people in these great universities as well as industry personnel opened their mouths and hearts and said something about these things instead of being scared of losing their jobs? I know I'll be complimented widely for that statement! But please think-how many universities are there working on agriculture problems. Can Bureaucrats put all of you out of business and expect to gain by it? I think not, and yet I hear voices, "Don't say anything on this legislation effort" or "Keep out of this, it's hot politics". I say to you, it's that time of day. It's 11:59, time to do something which deep down you know should have already been done or undo things which should not have been done. Let's think of the handshake we gave earlier and meditate on its meaning and then do something about it.

(i) Lastly, we must take pride in what we have already done. Please accept my sincere compliments on doing many things not yet ever used, but valuable. For being devoted to the proposition of living a life which will result in you some day leaving behind a better world because of yourself. One example: "Parts per Million" is a phrase heard many times. We have all come face-to-face with it in Aflatoxin aspect of the peanut industry. One part per million is the same as: 1 inch in 16 miles, 1 minute in 2 years, a one-gram needle in a ton of hay, 1 penny in $10,000.00, 1 oz. of salt in 62,500 lbs.

I marvel at the people who work in this field of detecting such and following through to success. May the projects now funded for this detection find success swiftly.

It takes 6 minutes to earn enough money to buy 1 dozen eggs. It takes 8 minutes to earn enough money to buy 1 pound of butter. It takes 24 minutes to earn enough money to buy 1 pound of sirloin steak. Whoever makes two ears of corn grow,or two blades of grass where only one grew before, deserves better of mankind and I appreciate him. Someone said, "Burn down your cities and leave your farms, and your cities will spring up again, as if by magic; but destroy our farms and the grass will grow in the streets and every city in the country."

Ralph Waldo Emerson said, "The glory of the farmer is that in the divisions of labor, it is his part to create. All trade rests at last on his activity." Will you help us? We can't get there by ourselves. Together we can and we both deserve it.

Proc. Amer. Peanut Res. & Ed. Assoc.

COMPARISON OF PROTEIN AND AMINO ACID COMPOSITION OF VARIOUS PREPARATIONS FROM FLORUNNER (*ARACHIS HYPOGAEA* L.) PEANUTS INFECTED WITH SELECTED FUNGI

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INTERPRETIVE SUMMARY

Research to prepare protein derivatives from oilseeds is usually conducted with high quality material, however, future utilization of oilseeds as flours, concentrates, or isolates will probably include seed from both high and low quality sources. Peanuts infected with *Aspergillus parasiticus*, *Aspergillus oryzae*, *Rhizopus oligosporus*, or *Neurosporus sitophila* hydrolyzed protein at different rates during an infection period. Total and free amino acid composition of soluble and insoluble preparations from infected seeds were continually changing. Quantities of certain essential amino acids increased in various preparations of infected seeds to levels above those of noninfected peanuts. These factors should be considered in future research on expanding utilization of protein derivatives from oilseeds as ingredients in foods or feeds.

Research Work Unit: 7102-15650-010 Properties of cottonseed protein isolates that may affect end use in food systems.

Research Activity: 7102-15650 Technologies for food and feed uses of oilseeds and forages

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COMPARISON OF PROTEIN AND AMINO ACID COMPOSITION OF VARIOUS PREPARATIONS FROM FLORUNNER (*ARACHIS HYPOGAEA* L.) PEANUTS INFECTED WITH SELECTED FUNGI

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ABSTRACT

Lyophilized and defatted whole seed, and sodium phosphate buffer (pH 7.9; I = 0.01) - soluble and - insoluble preparations from peanuts infected for intervals up to 7 days with *Aspergillus parasiticus*, *Aspergillus oryzae*, *Rhizopus oligosporus*, or *Neurospora sitophila*, compared with noninfected seed, showed differences in protein and amino acid levels. Gel electrophoretic analysis of soluble fractions suggested that there are different rates and/or mechanisms of protein hydrolysis for these various fungi. The percentage of protein in soluble fractions of infected seeds decreased, whereas increases were noted in corresponding insoluble preparations during the test period; only minor quantitative and qualitative changes were noted in the controls. These changes were further confirmed by observations that total amino acid composition of soluble and insoluble preparations from infected seeds were continually changing, and at the same time, quantities of most free amino acids increased. Protein preparations from infected seeds usually contained higher quantities of certain essential amino acids, including threonine, methionine, isoleucine, leucine, phenylalanine, lysine, and arginine, than their control counterparts. These changes were dependent on the type of fungus infecting the seeds and the length of the test period. Thus, proteins fractionated from raw peanuts infected with different fungi will not necessarily yield preparations with similar food or feed qualities as those from high quality seeds.

Protein Components of Fungi-Infected Peanuts

INTRODUCTION

Fungi have been used directly as food and in the processing of food and feed for many years. However, their potential has been only partially explored, and in this day of widespread world protein shortages they are being reexamined. For example, fungi are used to process a variety of seed materials into various food products including: (1) miso - a peanut-butterlike product prepared by fermenting mixtures of rice and soybeans with Aspergillus oryzae or Aspergillus soyae and Saccharomyces rouxii (Shibasaki and Hesseltine, 1961a,b,1962; Hesseltine and Wang, 1967); (2) shoyu - a liquid food (soya sauce) prepared from fermenting soybeans and rice with Aspergillus oryzae or Aspergillus flavus and Zygosaccharomyces sp. yeast (Dyson, 1928; Lockwood, 1947, Yokotsuka, 1960); (3) tempeh - a material fermented from soybeans with Rhizopus oligosporus (Steinkraus et al., 1960; Djien and Hesseltine, 1961); (4) ang-khak - a product fermented from rice with Monasus purpureus, used as a food coloring agent (Palo et al., 1961); and (5) ontjom - a peanut presscake fermented by Neurospora sitophila (Hesseltine and Wang, 1967; Gray, 1970). Enhanced nutritive quality and digestibility of these fermented products have been partially attributed to proteolytic activities of the various fungi used in these fermentation processes (Hesseltine, 1965; Steinkraus et al., 1965; Nakadai et al., 1972a,b; Wang et al., 1974; Beuchat et al., 1975; Quinn et al., 1975). Recently, Cherry et al. (1974, 1975, 1976) and Cherry and Beuchat (1976) presented data supporting this contention after following the biochemical changes in raw peanut seeds infected for various time intervals with either Aspergillus parasiticus, A. oryzae, N. sitophila, or R. oligosporus.

In general, the following changes distinguishable from "standard" profiles of uninoculated seeds were noted: (1) decomposition of the major storage proteins to low molecular weight components; (2) quantitative depletion of the small protein components; (3) changes in total amino acid composition of various protein extracts; and (4) increases in free amino acid levels. In most cases, fungal infected peanut seeds are considered poor commercial quality or nonusable as food or feed. However, these seeds may be useful sources of food- or feed-grade protein concentrates or isolates, since research to develop methods for detoxification of mycotoxins in oilseed meals is extensive (Goldblatt, 1971; Gardner et al., 1971; Mann et al., 1971; McKinney et al., 1973; Natarajan et al., 1975). Moreover, numerous techniques are available for preparation of concentrates and isolates from high quality-grade peanuts (Harris et al., 1972; Rhee et al., 1972; Mattil, 1973; Ayres et al., 1974; Cater et al., 1974; Basha and Cherry, 1976). These procedures must be modified for use with fungi-infected seeds. This study examines further the potential of proteins and their amino acid components in various meal preparations of fungi-infected peanut seeds as sources of ingredients for foods or feeds.

MATERIALS AND METHODS

Potato dextrose agar slants were used to culture Aspergillus parasiticus NRRL A-16, 462; Aspergillus oryzae NRRL 1988; Neurospora sitophila NRRL 2884; and Rhizopus oligosporus NRRL 2710 at 24°C for 10 days. Fungal spores were collected from the surface of the culture slants with a sterile solution of 0.005% Span 20[1/]. The skins were first removed by hand from peanut seeds of the cultivar Florunner, soaked in an inoculum of one of the fungi for 1 minute and finally placed in petri dishes set in

ventilated containers lined with water-saturated absorbent cotton, in an incubator set at 29°C. Uninoculated seeds were similarly treated, omitting the fungi in the inoculation step. After test periods of 2, 4, and 7 days, duplicate samples of three uninoculated and three samples each of A. parasiticus-, A. oryzae-, N. sitophila-and R. oligosporus-infected seeds were collected. The samples were individually ground in 7 ml of sodium phosphate buffer (pH 7.9; I = 0.01) with a pestle in a mortar and centrifuged at 43,500 x g for 30 minutes to separate soluble (supernatant) and insoluble (pellet + fat pad) fractions.

The proteins in the soluble fractions of noninfected and infected seeds were characterized by gel electrophoresis on 10% polyacrylamide disc gels according to previously published procedures (Anonymous, 1973; Cherry et al., 1970). Prior to evaluation of total protein (%) and free (nM/100 mg meal) and total (g/100 g protein) amino acids, all samples were first lyophilized, then ground into their respective meals or concentrates, and finally defatted with diethyl ether. The percentage protein in these products of noninfected and infected seeds was determined by the macroKjeldahl technique. A nitrogen-to-protein conversion value of 5.46 was used. Free and/or total amino acids of these fat-free preparations were determined by ion-exchange chromatography using a Durrum Model D-500 Amino Acid Analyzer, as previously described (Spackman et al., 1958; Young et al., 1974; Cherry et al., 1975).

RESULTS

The data in this paper represent means from two independent experiments or replicates, each run in duplicate. Variance was analyzed statistically on pooled data of (1) the 7-day test period within each fungus treatment (A, Tables 1 to 6), and (2) the four fungi within each test interval of days 0, 2, 4, and 7 (B, Tables 1 to 6). This method was used to consolidate the vast amount of data collected from these experiments, as well as to give information that would be expected in the typical commercial situation, i.e., where samples would contain seeds infected by one or more fungi for various time intervals.

Protein

Mean percentages of crude protein in whole seed and in soluble and insoluble fractions of noninfected seeds from the 7-day test period were approximately 43.30, 60.50, and 34.18%, respectively (Table 1, A). Whole seed infected with A. oryzae or N. sitophila contained percentages of total protein which were greater statistically than those of noninfected seeds; values for A. parasiticus and R. oligosporus were not different from those of the control. Soluble and insoluble fractions of seeds infected with different fungi contained significantly lower and higher protein percentages, respectively, than those of noninfected preparations. All protein changes of infected seeds, regardless of the fungus used, were significantly different from those of the noninfected control during the test period of 2 to 7 days (Table 1, B); i.e., averaging protein values of the various preparations from fungi-infected seeds and comparing these data to those of the control showed that proteins increased significantly in whole seeds and the insoluble extract, but decreased in soluble preparations during days 2, 4, and 7 after inoculation.

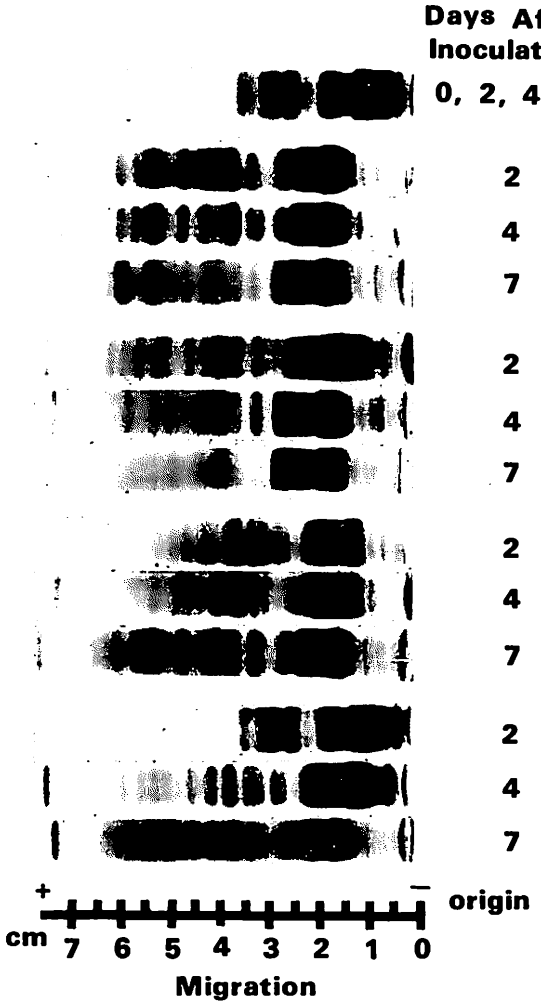
Gel electrophoretic patterns of proteins in soluble fractions showed that each fungus caused specific changes in these storage components during the infection period that were different from those of the control (Fig. 1); no protein changes were noted on gel patterns of noninfected seeds between 0 and 7 days. In general, protein patterns of seeds infected by the various fungi, when compared to those of the noninfected control, showed new protein components in region 0-1.0 cm and increased

Table 1. Percentage protein changes[1] in various fractions of peanut seeds. (A. Averages of protein changes within each seed treatment for the 7-day test period. B. Protein changes averaged for the five treatments within each time interval of the test period.)

	Treatments	% Protein in fractions		
		Whole Seed	Soluble	Insoluble
A	Noninfected	43.30^{c}	60.50^{a}	34.18^{b}
	A. parasiticus	44.07^{c}	45.53^{bc}	47.08^{a}
	A. oryzae	47.23^{a}	49.81^{b}	42.57^{a}
	R. oligosporus	45.05^{bc}	40.98^{c}	47.71^{a}
	N. sitophila	46.31^{ab}	49.04^{b}	41.70^{a}
B	Time intervals (days)			
	0	43.94^{a}	61.14^{a}	33.75^{c}
	2	46.14^{b}	48.86^{b}	41.77^{b}
	4	45.33^{b}	44.13^{b}	47.59^{a}
	7	45.35^{b}	42.54^{b}	47.48^{a}

[1]Values having no common postcript letter in each column (whole seed, soluble and insoluble fractions) within A or B separately are significantly ($P \leq 0.05$) different.

Fig. 1. Polyacrylamide disc gel electrophoretic patterns of soluble proteins.



mobility and poor resolution of the bands in region 1.0-2.0 cm as the infections progressed to day 7. At the same time, bands normally located in region 2.0-3.5 cm disappeared, and a new group of polypeptides appeared in region 3.5-7.0 cm. Moreover, by day 7, after the seeds were inoculated with either A. parasiticus or A. oryzae, many of the proteins in the lower half of the gel patterns became difficult to distinguish.

Total amino acids

Statistically significant changes from those of noninfected seeds were observed for certain total amino acids of whole seeds infected with the different fungi included in this study (Table 2, A, B). Significant changes relative to seed infection with a certain fungus were noted mainly with aspartic acid, threonine, glycine, alanine, valine, and phenylalanine (Table 2, A). Content of aspartic acid and glycine decreased in R. oligosporus- and both aspergilli-infected seeds, respectively, but threonine and valine increased in those inoculated with aspergilli-species. Significant increases in phenylalanine were noted in R. oligosporus- and N. sitophila-infected seeds. At the end of the 7-day infection period, mean values for the combined fungi-infected material showed significant increases in threonine, valine, methionine, and phenylalanine, whereas those of glycine, and lysine decreased (Table 2, B).

Major quantitative changes were noted for most total amino acids in soluble fractions of peanut seeds infected with different fungi (Table 3, A). The total amino acids showing significant increases above those of the control, depending on the fungus infected seed examined, included threonine, glycine, valine, methionine, isoleucine, phenylalanine, histidine, and lysine. At the same time, Table 3, B shows that the combined data for aspartic acid, threonine, valine, methionine, isoleucine, and leucine in soluble fractions from infected seeds increased significantly over those of the control as the infections progressed to day 7; arginine in infected seeds decreased to values significantly lower than those of the control.

While these amino acid changes were observed in soluble extracts, major variations from those of noninfected seeds were also occurring in the insoluble fractions (Table 4, A, B). Proline (A. oryzae, R. oligosporus, N. sitophila), cysteine (R. oligosporus, N. sitophila) and valine (both aspergilli) of fungi-infected seeds increased significantly over those of the control while serine, glycine, alanine (R. oligosporus and N. sitophila), and tyrosine (except A. parasiticus) decreased (Table 4, A). Pooled data of insoluble fractions from these treatments at days 2 to 7 showed significant decreases in serine, glycine, and tyrosine, whereas quantities of proline, isoleucine, and leucine increased significantly by day 4 (Table 4, B).

Free amino acids

The gel electrophoretic data suggested that the seed storage proteins were hydrolyzed by the different fungi to their structural components (Fig. 1). Thus, changes in free amino acids in these seeds were examined to determine the extent of protein breakdown (Tables 5 and 6). These data show that the essential amino acids, threonine, isoleucine, leucine, and arginine increased significantly in certain fungi-infected samples (Table 5, A). Among the nonessential amino acids, serine, proline, glycine, alanine, tyrosine, and the unidentified components increased in certain infected seeds (Table 6, A); aspartic acid decreased in all fungi-infected seeds. Quantitative changes in both essential and nonessential free amino acids at each time interval tested during the 7-day experiment were in most cases significant increases over those of noninfected samples (B, Tables 5 and 6).

Table 2. Total amino acid[1] changes [2] in whole peanut seeds
(For explanation of A and B, see Table 1.)

	Treatments	Asp	Thr	Ser	Gly	Ala	Val	Met	Leu	Phe	Lys
		Total amino acids (g/100 g protein)									
A	Noninfected	12.15^{a}	2.68^{bc}	5.07^{a}	6.42^{a}	4.16^{ab}	3.99^{c}	0.38^{a}	6.56^{a}	5.96^{b}	3.65^{a}
	A. parasiticus	12.16^{a}	2.82^{a}	5.05^{a}	5.41^{b}	4.32^{a}	4.17^{ab}	0.61^{a}	6.75^{a}	6.12^{b}	3.55^{a}
	A. oryzae	12.20^{a}	2.74^{ab}	4.91^{a}	5.42^{b}	4.27^{a}	4.28^{a}	0.67^{a}	6.56^{a}	6.38^{ab}	3.48^{a}
	R. oligosporus	11.72^{b}	2.66^{bc}	4.84^{a}	6.19^{a}	4.02^{b}	4.02^{bc}	0.70^{a}	6.50^{a}	6.70^{a}	3.66^{a}
	N. sitophila	11.96^{ab}	2.64^{c}	4.95^{a}	6.05^{a}	4.02^{b}	4.05^{bc}	0.71^{a}	6.56^{a}	6.72^{a}	3.65^{a}
	Time intervals (days)										
B	0	11.89^{a}	2.67^{b}	5.11^{a}	6.59^{a}	4.13^{a}	3.88^{b}	0.49^{b}	6.54^{b}	6.38^{a}	3.88^{a}
	2	12.02^{a}	2.66^{b}	4.77^{b}	5.88^{b}	4.05^{a}	4.14^{a}	0.73^{a}	6.40^{b}	6.51^{a}	3.49^{b}
	4	12.18^{a}	2.75^{a}	4.97^{a}	5.61^{bc}	4.21^{a}	4.22^{a}	0.44^{b}	6.80^{a}	6.14^{a}	3.52^{b}
	7	12.07^{a}	2.76^{a}	5.01^{a}	5.45^{c}	4.25^{a}	4.16^{a}	0.80^{a}	6.62^{ab}	6.47^{a}	3.51^{b}

[1] Arg, his, ile, cys, gly, pro, tyr, and NH_4 are not listed because they did not show any statistically significant changes within either A or B.

[2] Values having no common postcript letter in each amino acid column within A or B separately are significantly ($P \leq 0.05$) different.

Table 3. Total amino acid[1] changes[2] in soluble fractions of peanut seeds. (For explanation of A and B, see Table 1.)

	Treatments	Total amino acids (g/100 g protein)												
		Asp	Thr	Glu	Gly	Val	Met	Ile	Leu	Tyr	Phe	His	Lys	Arg
A	Noninfected	12.07^{a}	2.68^{b}	21.27^{a}	4.71^{b}	4.23^{b}	0.48^{b}	3.49^{b}	6.73^{a}	4.01^{a}	5.70^{c}	2.84^{b}	3.31^{b}	11.72^{a}
	A. parasiticus	12.38^{a}	3.19^{a}	21.00^{a}	5.13^{ab}	4.74^{a}	1.01^{a}	3.77^{ab}	6.72^{a}	3.87^{ab}	5.85^{bc}	2.92^{a}	3.88^{a}	8.71^{b}
	A. oryzae	12.37^{a}	3.00^{ab}	20.75^{ab}	5.01^{b}	4.49^{ab}	1.01^{a}	3.61^{ab}	6.69^{a}	3.75^{ab}	5.94^{bc}	2.91^{b}	3.28^{b}	11.05^{a}
	R. oligosporus	12.24^{a}	3.14^{a}	19.86^{b}	6.01^{a}	4.35^{b}	0.98^{a}	3.58^{ab}	6.44^{a}	3.16^{c}	7.47^{a}	3.56^{a}	3.56^{ab}	10.66^{a}
	N. sitophila	12.59^{a}	2.98^{ab}	20.42^{ab}	5.62^{ab}	4.51^{ab}	0.88^{a}	3.71^{a}	6.68^{a}	3.49^{bc}	6.91^{ab}	3.26^{ab}	3.29^{b}	10.76^{a}
B	Time intervals (days)													
	0	12.25^{b}	2.76^{b}	21.23^{a}	4.64^{a}	4.19^{b}	0.46^{b}	3.38^{c}	6.58^{b}	3.93^{a}	5.76^{a}	3.17^{a}	3.51^{a}	11.85^{a}
	2	11.99^{b}	2.96^{ab}	20.36^{a}	5.40^{a}	4.46^{a}	1.24^{a}	3.61^{b}	6.55^{b}	3.55^{a}	6.31^{a}	3.07^{a}	3.36^{a}	11.08^{ab}
	4	12.75^{a}	3.17^{a}	20.64^{a}	5.71^{a}	4.64^{a}	0.59^{b}	3.83^{a}	6.89^{a}	3.61^{a}	7.04^{a}	3.21^{a}	3.65^{a}	9.71^{b}
	7	12.32^{b}	3.10^{a}	20.41^{a}	5.44^{a}	4.57^{a}	1.20^{a}	3.71^{ab}	6.60^{b}	3.54^{a}	6.40^{a}	2.95^{a}	3.33^{a}	9.69^{b}

[1] Pro, cys, ser, ala, and NH_4 are not listed because they did not show any statistically significant changes within either A or B.

[2] Values having no common postscript letter in each amino acid column within A or B separately are significantly ($P \leq 0.05$) different.

Table 4. Total amino acid[1] changes [2] in insoluble fractions of peanut seeds. (For explanation of A and B, see Table 1.)

	Treatments	Total amino acids (g/100 g protein)										
		Asp	Ser	Pro	Gly	Ala	Cys	Val	Ile	Leu	Tyr	NH_4
A	Noninfected	11.84^{bc}	5.30^{a}	2.23^{b}	8.70^{a}	4.34^{a}	0.20^{b}	3.76^{c}	3.43^{a}	6.80^{a}	4.52^{a}	1.72^{a}
	A. parasiticus	12.39^{a}	5.08^{b}	3.44^{ab}	5.75^{c}	4.25^{a}	0.37^{ab}	4.21^{a}	3.51^{a}	6.82^{a}	4.34^{ab}	1.83^{a}
	A. oryzae	12.23^{ab}	4.92^{b}	3.67^{a}	6.02^{c}	4.28^{a}	0.34^{ab}	4.17^{ab}	3.55^{a}	6.83^{a}	4.22^{b}	1.81^{a}
	R. oligosporus	11.90^{bc}	4.97^{b}	4.62^{a}	6.89^{b}	4.05^{b}	0.59^{a}	3.96^{abc}	3.43^{a}	6.62^{a}	4.19^{b}	1.63^{a}
	N. sitophila	11.74^{c}	5.00^{b}	4.47^{a}	7.00^{b}	4.08^{b}	0.50^{a}	3.91^{bc}	3.41^{a}	6.59^{a}	4.23^{b}	1.69^{a}
B	Time intervals (days)											
	0	11.81^{a}	5.34^{a}	2.20^{c}	9.24^{a}	4.29^{a}	0.23^{a}	3.88^{a}	3.29^{b}	6.54^{b}	4.72^{a}	1.77^{a}
	2	12.14^{a}	4.99^{b}	3.47^{b}	6.56^{b}	4.10^{b}	0.45^{a}	3.98^{a}	3.45^{ab}	6.63^{b}	4.11^{b}	1.85^{a}
	4	12.09^{a}	4.93^{b}	4.92^{a}	5.92^{b}	4.26^{a}	0.38^{a}	4.12^{a}	3.65^{a}	7.00^{a}	4.26^{b}	1.54^{b}
	7	12.04^{a}	4.97^{b}	4.16^{ab}	5.77^{b}	4.17^{ab}	0.53^{a}	4.05^{a}	3.48^{ab}	6.76^{ab}	4.12^{b}	1.78^{a}

[1] Glu, met, his, lys, arg, thr, and phe are not listed because they did not show any statistically significant changes within either A or B.

[2] Values having no common postcript letter in each amino acid column within A or B separately are significantly ($P \leq 0.05$) different.

Table 5. Essential free amino acid[1] changes[2] in whole peanut seeds. (For explanation of A and B, see Table 1.)

	Treatments	Free amino acids (nM/100 mg meal) Thr	Met	Ile	Leu	Phe	Lys	Arg
A	Noninfected	0.65^{b}	0.51^{a}	0.48^{b}	0.45^{c}	3.47^{a}	0.44^{a}	1.34^{b}
	A. parasiticus	0.74^{b}	0.35^{a}	0.59^{ab}	1.01^{a}	1.89^{b}	0.80^{a}	1.68^{b}
	A. oryzae	0.92^{a}	0.40^{a}	0.69^{a}	1.10^{a}	2.04^{b}	0.79^{a}	1.61^{b}
	R. oligosporus	0.62^{b}	0.29^{a}	0.45^{b}	0.61^{bc}	1.81^{b}	0.59^{a}	1.66^{b}
	N. sitophila	0.66^{b}	0.39^{a}	0.58^{ab}	0.89^{ab}	2.07^{b}	0.80^{a}	2.60^{a}
B	Time intervals (days)							
	0	0.35^{c}	0.12^{b}	0.40^{c}	0.34^{c}	2.52^{a}	0.37^{b}	0.90^{b}
	2	0.74^{b}	0.58^{a}	0.51^{bc}	0.79^{b}	2.25^{a}	0.72^{a}	2.05^{a}
	4	0.83^{ab}	0.37^{ab}	0.56^{b}	0.89^{b}	2.22^{a}	0.78^{a}	2.12^{a}
	7	0.95^{a}	0.47^{a}	0.76^{a}	1.23^{a}	2.03^{a}	0.87^{a}	2.00^{a}

[1]Val, his, and try are not listed because they did not show any statistically significant changes within either A or B.

[2]Values having no common postscript letter in each amino acid column within A or B separately are significantly ($P \leq 0.05$) different.

Table 6. Non-essential free amino acid[1] changes[2] in whole peanut seeds. (For explanation of A and B, see Table 1.)

	Treatments	Free amino acids (nM/100 mg meal)								
		Asp	Ser	Glu	Pro	Gly	Ala	Tyr	NH_4	Unknowns
	Noninfected	4.13^{a}	2.24^{b}	5.08^{a}	1.39^{b}	0.94^{b}	1.34^{b}	0.71^{b}	1.76^{b}	4.15^{b}
	A. parasiticus	1.80^{b}	2.18^{b}	3.92^{a}	1.69^{b}	1.35^{a}	2.86^{a}	1.49^{a}	2.50^{a}	6.89^{a}
A	A. oryzae	2.06^{b}	1.94^{b}	4.95^{a}	1.84^{b}	1.42^{a}	3.08^{a}	1.40^{a}	2.66^{a}	8.44^{a}
	R. oligosporus	1.81^{b}	2.11^{b}	3.99^{a}	1.52^{b}	0.62^{b}	2.07^{b}	0.82^{b}	2.65^{a}	7.36^{a}
	N. sitophila	2.34^{b}	3.09^{a}	5.18^{a}	2.96^{a}	0.78^{b}	2.06^{b}	1.37^{a}	2.74^{a}	9.30^{a}
	Time intervals (days)									
	0	2.59^{a}	1.21^{b}	5.98^{a}	0.97^{b}	0.58^{b}	1.40^{b}	0.44^{b}	2.09^{b}	3.40^{c}
	2	2.22^{a}	2.73^{a}	4.35^{b}	2.59^{a}	1.13^{a}	2.24^{a}	1.18^{a}	2.18^{a}	10.17^{a}
B	4	2.22^{a}	2.47^{a}	3.67^{b}	1.96^{a}	1.26^{a}	2.59^{a}	1.42^{a}	2.61^{ab}	8.09^{ab}
	7	2.69^{a}	2.84^{a}	4.51^{b}	2.00^{a}	1.12^{a}	2.91^{a}	1.59^{a}	2.99^{a}	7.25^{b}

[1] Val and ile are not listed because they did not show any statistically significant changes within either A or B.

[2] Values having no common postscript letter in each amino acid column within A or B separately are significantly ($P \leq 0.05$) different.

DISCUSSION

The observation that protein and amino acid quantities in various preparations of raw peanut seeds infected with A. parasiticus, A. oryzae, R. oligosporus, or N. sitophila are different from those of noninfected seeds expands presently known information on the effects of infecting this type of material with saprophytic organisms (Cherry et al., 1974, 1975, 1976; Cherry and Beuchat, 1976). For example, gel electrophoretic data show that aqueous-soluble proteins from infected peanut seeds are hydrolyzed to their structural components during a test period of only 7 days. These data also imply various rates and/or mechanisms of storage protein hydrolysis for the different fungi included in this study.

Other studies have shown that although certain proteolytic enzymes may be common to different fungi, each species has the capacity to produce proteinases endemic to itself (Hesseltine, 1965; Steinkraus et al., 1965; Nakadai et al., 1972 a,b; Wang et al., 1974; Beuchat et al., 1975; Quinn et al., 1975). Quantitatively, there is a decrease in percentage protein of soluble extracts during the 7-day test period, regardless of the fungus used, while at the same time an increase in these constituents occurs in insoluble fractions. These changes are further confirmed by observations showing that the total protein amino acid composition of the soluble and insoluble fractions are continually changing and that free amino acid quantities are increasing. Evidently, in the presence of these fungi the major storage proteins of infected whole seeds are converted to polypeptides of varying sizes with different solubility characteristics and free amino acids. Changes in solubility of various hydrolyzed products of proteins may also be related to their differential interactions with other degraded constituents stored in peanut seeds (oils, fatty acids, sugars, etc.).

Previous to these studies with raw peanut seeds infected with different fungi, most research on this subject was on the proximate composition of finished fermented products compared to nonfermented substrates (van Veen et al., 1968; Beuchat and Worthington, 1974; Worthington and Beuchat, 1974; Beuchat et al., 1975; Quinn et al., 1975). Other studies showed that quantities and proportions of amino acids in certain fermented products were greatly improved over those of raw substrates (Gray, 1970). These improvements were apparently partly attributed to fungal digestion of proteins to their structural components, which yielded a more nutritious food product. Thus, while hydrolyzed protein components in fermenting substrates serve as primary sources of readily available nutrients for fungal metabolism and growth, they in turn have the possibility of improving the nutritional and functional properties of ferments as foods or feeds.

The present study shows that techniques normally used to prepare protein extracts from high quality raw peanut seeds will not necessarily produce fractions similar to those from seeds infected with A. parasiticus, A. oryzae, R. oligosporus, or N. sitophila. In fact, the resulting extracts will depend on the species of fungus growing on peanut seeds and the length of the infection period. Since these conditions affect the type and quantity of proteins and amino acids in various peanut extracts, they should also alter the nutritional and functional

properties of peanut protein derivatives to different forms from those of quality seeds. For example, this study shows that fungus-infected peanut seeds have greater quantities of certain essential amino acids in soluble and insoluble protein fractions than those of high quality seeds. In future studies, these factors need to be considered in research to expand utilization in foods or feeds of protein isolates or concentrates from various fungi-infected peanut seeds.

ACKNOWLEDGMENT

The excellent technical assistance of Linda P. Garrison is acknowledged.

FOOTNOTE

1/ Use of a company and/or product named by the Department does not imply approval or recommendation of the product to the exclusion of others which may also be suitable.

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A DISCUSSION OF SENSORY EVALUATION PANEL TRAINING TECHNIQUES DESIGNED FOR PEANUT BUTTER

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Introduction

Research in the peanut industry often has flavor application. To provide meaningful flavor data, it is imperative that Sensory testing methods be correctly applied. If test objectives are analytical, sensory methods should be discriminative; subjective "like-dislike" objectives require measurement of consumer opinion.

Preference testing was designed to measure consumer opinion; however, incorrect use of the preference method frequently occurs. Unfamiliarity with available sensory methods may be the reason for misuse. In most instances, consumer opinion is unavailable within the laboratory. If the experiment involves a familiar product and a limited population, false or inconclusive preference data may be generated. Preference responses are often inconsistent; if panelist variability is significant, treatment effect may be masked by large standard deviations. Thus, incorrect application of preference panel methods may result in the ruination of a logical pattern of scientific investigation.

Directional information, essential to product development or product quality maintenance, may be masked when the experimenter substitutes a preference test for a discriminative measurement. The following propositions require application of discriminatory methods:

- What is the effect of roasting time on perceived roast peanut flavor intensity?
- Does salt level variation affect perceived saltiness?
- Is perceived bitterness level affected by the use of underroasted or overroasted peanuts?
- What effects do processing methods and ingredients exert on flavor stability?

Since the propositions require discriminatory testing methods, the use of trained panelists is imperative.

To be considered "trained", panelists must complete a series of tests designed to measure (1) taste sensitivity and (2) judgment reproducibility. The procedure of teaching individuals to taste is divided into two major areas: Panelist Selection and Panelist Training. Selection and training procedures were applied by the Sensory Evaluation Division of Swift & Company in the evaluation of peanut butter.

Training Procedures:

Twenty individuals were selected to participate in the screening and training series. Candidates successfully completing the series were to be added to an established panel of peanut butter judges. Candidate selection prerequisites were:

1. Individual interest.

2. Availability.

3. Average sensitivity to basic sweet, salt, and bitter tastes.

Interest was imperative; candidates had to exhibit willingness to participate if the training program was to be effective. Only candidates with minimal travel demands were considered. Lastly, basic taste sensitivities of potential panelists were determined through dilution testing prior to actual peanut butter flavor training.

Prior to panelist sensitivity screening sessions, fresh and stored peanut butter samples were descriptively characterized by the Flavor Profile Method of Descriptive Analysis. Descriptive data reflecting fresh and stored peanut butter aroma and flavor compositions appear in Table I. Fresh peanut butter was described as a basic flavor blend of roast peanut, salt, sweet, and bitter notes; aged peanut butter contained an additional rancid flavor. Candidates were screened for sensitivity to roast peanut, salt, sweet, bitter, and rancid flavors.

Predetermined knowledge of fresh and aged peanut butter flavor composition facilitated the development of references or standards for panelist screening. References representing intensified levels of each basic flavor were formulated; i.e. a reference for roast, a reference for sweetness, a reference for bitterness, and a reference for rancidity. Fresh peanut butter, sampled from a single production Lot, was the base for reference formulation. Following preparation of flavor standards, the screening series, designed to teach new panelists, began. The screening series was divided into four segments:

A. Flavor Identification

B. Paired Difference Tests

C. Triangle Difference Tests

D. Quantitative Rating Tests

A. Flavor Identification

Potential panelists first participated in an introductory "flavor identification" panel. Candidates blindly tasted three competitive peanut butter brands, one sample at a time, describing in written form the flavors within each. Because this was an analytical evaluation, peanut butter samples were

served without carriers. Individual sample analyses were followed by group discussion. Panel function was strictly informative; candidates familiarized themselves with peanut butter flavor composition and discussed sample flavor differences. References for each characteristic flavor were available for review. Participants generally agreed that the competitive peanut butter brands represented varied in flavor character.

B. Paired Difference Tests

To specifically acquaint panelists with roast peanut, salt, sweet, bitter, and rancid flavors, a paired difference test series was conducted; the chance probability of correct identification within each pair was 50%. Each candidate received five sample pairs at each tasting session; one pair was presented at a time. Sixty-second intervals were observed between pairs. Use of a warm water rinse and unsalted cracker was recommended between sample tastings. Within each pair, samples varied in roast, salt, sweet, bitter, or rancid flavor intensities; one sample within each pair was more intense than the other. Candidates were asked to indicate if a flavor difference was apparent; candidates discerning a flavor difference then made a directional flavor intensity judgment within each pair. For example, the following procedure was designed to test bitterness sensitivity:

> Two peanut butter treatments were prepared for each replication. A "high" level of caffein was added to one treatment; a "low" level of caffein was added to the second treatment. Candidates were given paired samples of these treatments within succeeding panel sessions. In a blind test situation, candidates were asked (1) was a bitterness difference detected? (2) if a bitterness difference was discerned, which sample was more bitter?

The paired differences series acquainted candidates with specific product flavor attributes and generated preliminary flavor sensitivity data. Panelist selection was further based upon (1) more stringent triangle difference tests and (2) quantitative intensity rating tests; both followed paired difference testing.

C. Triangle Difference Tests

Candidates were next subjected to a series of triangle difference tests, the chance probability of correct odd sample selection in a triangle test being 33.3%. In each triangle test, participants received three randomized, coded samples, two identical and one odd or different. Participants were requested to (1) select the odd or different sample on the basis of a specific flavor difference, (2) to indicate the degree of flavor difference perceived, and (3) to describe additional flavor differences discerned.

Within each triangle test, sensitivity to one basic peanut butter flavor was tested; for example, low-level sweet versus high-level sweet. Replications for each of five treatment combinations were obtained; each candidate performed two

triangle tests per panel session. Candidates exhibiting a minimum of 60% correct odd sample selection over the triangle test series were selected for quantitative intensity training.

D. Quantitative Rating Tests

Ten candidates who successfully completed paired and triangle difference tests, lastly participated in multiple sample rating panels. Prior to blind sample evaluation, each participant independently rated a fresh reference sample; group discussion followed individual reference evaluations. Through group agreement, a benchmark for rating blind test samples was established. Following reference discussion, coded, randomized samples, varied in age, were quantitatively rated for roast, sweet, salt, bitter, and rancid flavor intensities. Replicate panels were performed.

Each candidate's data were submitted for individual analysis of variance; the resulting F-ratio values for each criterion reflected an individual candidate's ability to discriminate differences and replicate judgments. Table II illustrates F-ratio data for the ten candidates. Following American Society for Testing and Materials recommended procedure, candidates exhibiting F-ratio values significant at or above .05 were selected.

Analysis of Variance yielded two judges with multiple significant F-ratio values. Obviously, judges able to discriminate differences and replicate judgments within each flavor criterion were most desirable.

Summary:

To collect meaningful analytical Sensory data, panel methods, judge selection, and product evaluation criteria must be carefully planned; Sensory methods should be discriminative. Only those candidates exhibiting discriminatory ability through comprehensive selection and training procedures should be considered trained panelists. Accurate data is generated only by applying recognized Sensory testing procedures and utilizing reliable judges.

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Table I. Flavor Profile Descriptions of Three Peanut Butter Age Variations

Flavor Character Note	Flavor Perception Level[a] "Fresh" Peanut Butter	"Stale" Peanut Butter	"Rancid" Peanut Butter
Roasted Peanut	2	2	1-2
Sweet	1-2	1	)(-1
Salt	1-2	1-2	1-2
Dusty (shells)	1	-	-
Musty/Moldy (shells)	-	)(	1
Bitter (skins)	1†[b]	1†	1†
Reversion (oil)	-	1	-
Rancidity (oil)	-	-	2

a Perception levels based on a standard)(= just detectable; 1 = slight; 2 = moderate; 3 = strong intensity rating scale.

b Increasing intensity level.

Table II. Peanut Butter Flavor Screening - F-Ratio Determinations

Judge	F-ratio Value/ Roast Peanut	p = .05 or Above	F-ratio Value/ Sweet	p = .05 or Above	F-ratio Value/ Salt	p = .05 or Above	F-ratio Value/ Bitter	p = .05 or Above	F-ratio Value/ Off-Flavor	p = .05 or Above
1	1.0000		2.4000		4.7500		3.3636		8.8182	.025
2	0.4375		2.0000		1.0909		1.9546		1.9706	
3	19.5000	.005	0.6000		0.3333		3.5455		21.0000	.005
4	9.5000	.025	10.5000	.025	0.9999		10.7500	.025	10.0909	.025
5	7.8000	.025	28.0000	.005	1.0000		37.5000	.005	46.5000	.005
6	4.3333		0.5000		-0.0000		9.8000	.025	17.7143	.005
7	6.3333	.05	1.7500		1.0000		4.6667		9.3750	.025
8	2.6667		0.2500		1.3333		3.0000		4.7273	
9	3.5000		7.0000	.05	0.6667		1.5000		25.8000	.005
10	3.4444		22.2000	.005	2.3929		0.5000		5.2500	.050

AN OBJECTIVE METHOD FOR EVALUATING SIZE AND SHAPE CHARACTERISTICS OF PEANUT SEED

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ABSTRACT

An objective method for evaluating size and shape characteristics of peanut seed is described. Use of the method is demonstrated by evaluation of the Florunner variety and its four component genotypes. The method consists of hand shelling and sizing representative subsamples of seed over slotted- and round-hole screens and evaluating outturns, seed-size distribution, seed shape, and seed count. A range of values for seed characteristics of runner varieties is presented, along with a rating procedure for use in evaluating seed characteristics of new varieties and genotypes.

INTRODUCTION

Seed size and shape are very important to researchers and industry because these properties are among the factors that determine the market value and acceptability of the variety. A need has existed for the development of efficient and accurate objective methods for evaluating size and shape characteristics of seed of standard or potential varieties. Current methods of evaluating seed size and shape characteristics are not adequate.

This paper describes a method that has good potential for use in evaluating the size and shape characteristics of peanut varieties. The method is described and then demonstrated by an evaluation of the Florunner variety and the four lines that comprise that variety.

OUTLINE OF EVALUATION METHOD

The evaluation method consists of ordered steps as follows:

1. Obtain a representative sample of pods of both the experimental line and a standard variety that were grown in the same location.
2. Divide the samples into subsamples.
3. Weigh the subsamples, hand shell them, and weigh the components.
4. Screen the seed of each subsample for size and shape, and record weight and number of seed that ride each screen.
5. Calculate totals, mean percentages, mean size, and mean count per pound.
6. Determine market value at farm and shelling-plant levels.
7. Plot seed-size distributions, and examine plot for symmetry or distortion of plot.

8. Compare values for the experimental line and the standard variety, and rate each seed characteristic of the experimental line as being poor, fair, average, good, or excellent.

DESCRIPTION OF EVALUATION METHOD

In this section of the report, the eight steps of the method, as shown in the preceding outline, are discussed.

Step 1

This step, obtaining representative samples of pods of both the experimental variety and a standard variety, is probably the most important one in the evaluation method. It is especially important that the experimental line and standard variety to be compared in the evaluation be grown in the same location and that good cultural practices be used. Characterizations on the basis of samples produced under unusual field conditions should be avoided. Consideration should be given to broadening the scope of the evaluation through use of data from multiple growing locations in each one of which both the experimental line and standard variety are grown. Such data could minimize possible confounding of the data by obscure climatic effects and by indeterminancy.

Step 2

Statistically, a large sample from each location and several subsamples are desirable, but the amount of peanuts available is usually limited. In our studies the use of a clean representative sample of at least 5 pounds of seed per variety, subdivided into four subsamples each, has proved to be satisfactory. An approved farmers stock divider such as that used by the Federal State Inspection Service should be used for division of each sample.

Step 3

After subsamples are weighed, they are hand shelled so that seed splitting and possible bias from such splitting will be minimized. After the peanuts are shelled, the components are weighed so a material balance can be obtained and so outturn data will be available for calculation of market value.

Step 4

Both slotted- and round-hole screens are used simultaneously during the screening operations. The slotted-hole screens measure the seed thickness. Data on seed-size distribution and count per pound are based upon the weight and count of seed that ride each slotted-hole screen, since this type of screen is used by the industry in establishing the market grades for whole seed. The round-hole screens measure seed width and are used only for determination of the percentage of seed that is much greater (6/64 inch or greater) in seed width and thickness than the rest of the seed. Such seed are identified here as "flat seed." Varieties with a large percentage of flat seed may be unacceptable for some uses that require uniformity in seed shape. We have also found that varieties with more than 20 percent flat seed are very difficult to shell and process.

Large variation in seed length also results in nonuniformity in seed shape. Seed length cannot be measured accurately by screening but must be measured with a micrometer or a similar instrument. Fortunately, an evaluation of seed length, other than visual, is seldom needed for most varieties.

In the first part of the screening procedure, slotted-hole screens are stacked on the vibrator such that the screen with the narrowest slots is on the bottom of the stack and each successive screen in the upward pattern has slots that are 2/64 inch wider than those of the screen immediately below. In addition a screen with 15/64-inch-wide slots should be inserted between the 14/64 and the 16/64 screens when Virginia- and Spanish-type lines are sized. After the seed from each sub-sample are sized over these screens, they are removed from each successive screen, weighed, counted, and placed on a round-hole screen with holes 6/64 inch larger in diameter than the width of the slots in the respective slotted-hole screens.

The seed that ride the respective round-hole screens should be stood on end and positioned by hand over the holes. Those that do not pass through should be weighed and identified as flat seed.

Step 5

All calculations of percentages should be based upon weight. (See sample calculation in the Appendix.) For all screen sizes, outturns (including sound mature kernels), are based upon net weight of farmers stock peanuts; seed size distributions, upon net weight of seed; flat seed per screen size, upon weight of seed in each seed size; and flat seed, upon net weight of seed.

Calculation of mean size is based upon seed weight distribution. Mean size indicates the width of slots needed in a vibrating screen to divide the net seed weight approximately in half. This value will be about 1/64 inch smaller than the mean seed size.

Seed count per unit of weight is increasing in popularity as an additional buyer specification for shelled runner- and Spanish-type peanuts. Varieties with seed larger than those of the standard variety are generally popular among shellers because they meet current count per pound specifications more easily than do small-seed varieties.

Food processors who buy shelled peanuts are becoming increasingly concerned about the screen size and seed count per unit of weight that should be specified to insure that they purchase only the mature seed. The gradient of seed count versus screen size usually provides an indication of the screen size that will be needed for removal of most of the immature seed.

Step 6

The market value of peanuts at the farm level is based on current prices. Their value at the shelling plant level fluctuates greatly during a particular shelling season. Their value at the time they leave the shelling plant is based on the type and quantity of outturn involved. Of course the market value potential is greatly enhanced by outturns of seed sizes that bring premium prices.

Step 7

The plot of seed-size distribution provides for visualization of variations in seed size. The curve plotted is usually smooth and symmetrical. If it is distorted the field history of the peanuts should be reviewed very carefully for climate or growing conditions, harvesting losses, immaturity, or biased sampling that might have caused its distortion. If the shape of the curve is characteristic of the genetic line or variety, then any irregularities or skewness of the curve should be examined in detail. Irregularities in the curve may be attributed to fruiting habit, nonhomogeneity in mixture of parent lines, dominance of component genetic lines, or similar genetic reasons. Large irregularities in the curve may indicate excessive variation in seed size.

Screening efficiencies in shelling plants are generally poor when the size of a large percentage of the seed is about the same as that of the holes in the market sizing screen. If any irregularities in the plot indicate that such a situation existed, then the nature of that irregularity will also indicate that the seed size distribution was undesirable.

Positive skewness (long right tail) of the distribution curve indicates the tendency of the line or variety to have a large percentage of seed sizes that will bring premium prices, and negative skewness (long left tail) indicates that the variety tends to have a large percentage of seed sizes that will bring a low price. All irregularities in the distribution curve should be noted and flagged for future study and verification.

If size distributions of seed varieties or genetic lines are being compared, then the hypothesis "the lines or varieties are identical with respect to dispersion" can be tested by analysis of variance on the logarithmic transformation of the

variances for each of the subsamples. Analysis of variance is also useful in determining whether the percentage of flat seeds differs in the various lines. Duncan's Multiple Range Test can be used for identification of the lines that differ with respect to seed size dispersions or percentage of flat seed.

Step 8

In this step, the comparison of values for the experimental line with those of the standard variety provides a means for determining the quality level of the seed and shape characteristics of the experimental line. The analysis will have additional meaning if data obtained on the size and shape characteristics can be compared with data established for long-accepted varieties. A suggested rating procedure for final evaluations of size and shape characteristics for runner-type peanut seed is presented in Table 1.

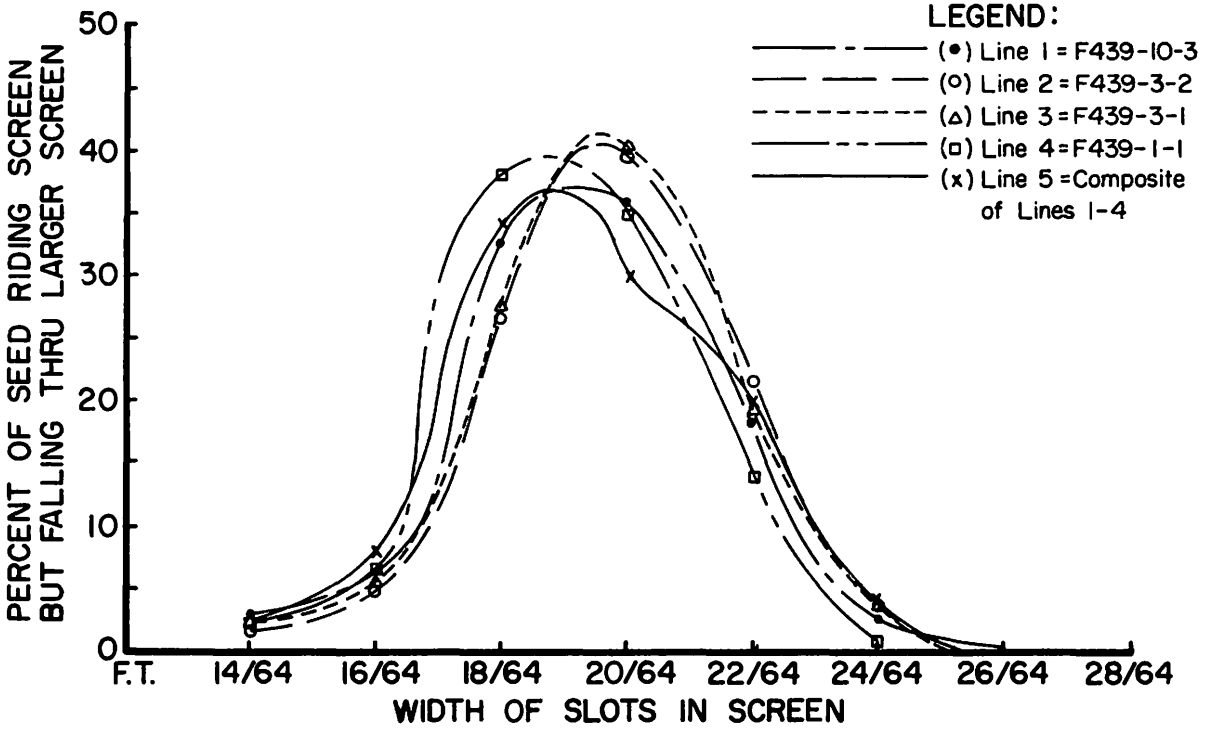
TABLE 1.--A suggested rating procedure for evaluating size and shape characteristics of seed of lines proposed for marketing as the runner type

Property or characteristic	Normal range of values	Suggested range of values for each rating 1/ 1	2	3	4	5	Remarks
Outturn (percentage of seed)	74-80	< 75.1	75.1-76.0	76.1-77.0	77.1-78.0	>78	Varies with maturity and hull properties.
Sound mature kernels (percentage of seed riding 16/64" slotted screen)	62-72	< 64.1	64.1-66.0	66.1-68.0	68.1-70.0	>70	Varies with maturity, seed size, and hull properties.
Value (dollars per ton of net farmers stock)	361-411	< 371	371-380	381-390	391-400	>400	Varies with sound mature kernels and outturn. Based upon CY 1975 prices. Subject to change each year.
Maturity (count/lb differences between 18/64" and 16/64" seed sizes)	200-450	>400	351-400	301-350	251-300	< 251	Varies with seed size and shape. Additional maturity evaluations should be made by use of Arginine Maturity Index or optical density methods.
Percentage of jumbos (premium-price seed)	5-25	<9.1	9.1-13.0	13.1-17.0	17.1-21.0	>21	Varies with maturity and seed size. Currently, jumbos ride 21/64" slotted screen. Current count/lb required by buyers is 576-640.

TABLE 1. (Continued)

Property or characteristic	Normal range of values	Suggested range of values for each rating 1/ 1	2	3	4	5	
Percentage of mediums (slightly lower in price than jumbos)	50–70	<54.1	54.1–58.0	58.1–62.0	62.1–66.0	>66	Varies with seed-size distribution. Currently, mediums fall through 21/64" slotted screen and ride 18/64" size. Current count/lb required by buyers is 688–736.
Mean size (in 64th in.)	17–19.5	<17.6	17.6–18.0	18.1–18.5	18.6–19.0	>19	Varies with maturity and seed size distribution.
Percentage of flat seed	20–40	>40.0	35.1–40.0	30.1–35.0	25.1–30.0	< 25.1	May be related to maturity, herbicide practices and soil type, as well as to genetic factors.

1/ 1 = poor
2 = fair
3 = average
4 = good
5 = excellent.


LEGEND:
(•) Line 1 = F439-10-3
(o) Line 2 = F439-3-2
(Δ) Line 3 = F439-3-1
(□) Line 4 = F439-1-1
(x) Line 5 = Composite of Lines 1-4
PERCENT OF SEED RIDING SCREEN BUT FALLING THRU LARGER SCREEN
50
40
30
20
10
0
F.T.
14/64
16/64
18/64
20/64
22/64
24/64
26/64
28/64
WIDTH OF SLOTS IN SCREEN

USE OF EVALUATION METHOD FOR SEED OF FLORUNNER AND ITS COMPONENT GENOTYPES

To illustrate the use of this method, we present below an evaluation of the Florunner variety and each of the four lines that originally made up this variety. The breeding development, physical features, and shelling properties of the Florunner variety have been described (1, 2, 3), but this portion of this report provides the first information on the size and shape characteristics of seeds of the component genotypes. The peanuts evaluated were grown at Tifton, Georgia, during CY 1974 in adjacent field plots with identical growing periods and treatments.

For convenience in presenting the data, we numbered the lines and composite 1-5. The actual identification numbers for lines 1-4 were as follows: Line 1 = F439-10-3, Line 2 = F439-3-2, Line 3 = F439-3-1, and Line 4 = F439-1-1. Line 5 = Florunner as released in 1969.

The raw data and the percentages, counts per pound, and mean seed size that were calculated from the raw data are shown in Tables 2-6. Sample calculations are presented in the Appendix. Table 7 shows a comparison of the percentages of flat seed in Florunner and its component genotypes. Figure 1 shows the plots of seed-size distribution for each of the five lines.

Figure 1.--Seed size distribution for four component genotypes of Florunner peanuts and for the composite of the genotypes.

TABLE 2.--Data and some calculations [1/] for evaluating seed of experimental line no. 1 (F439-10-3) of Florunner variety

Sub-sample [2/]	Weight of seed (gm)	Seed weight, count, and weight of flat seed [3/] sized over slotted screens																	
		24/64 in.			22/64 in.			20/64 in.			18/64 in.			16/64 in.			14/64 in.		
		total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)
A	446.6	17.2	21	2.7	90.8	126	17.0	149.1	224	90.4	137.7	231	75.8	23.8	64	3.4	15.9	60	0.9
B	498.1	3.4	4	0.0	76.4	105	11.4	182.9	231	66.3	180.9	236	72.5	27.1	71	7.5	18.0	67	0.3
C	446.6	8.0	9	0.0	94.5	129	12.3	171.2	263	64.6	127.0	224	76.6	25.4	65	7.9	10.4	39	0.0
D	449.4	11.4	13	0.9	74.8	104	9.0	154.6	235	51.9	149.4	265	80.3	32.7	82	9.2	14.4	51	0.7
Totals [4/]	1840.7	40.0	47	3.6	336.5	464	49.7	657.8	953	273.2	595.0	956	305.2	109.0	282	28.0	58.7	217	1.9
Mean percentages:																			
Size distribution		2.2			18.3			35.7			32.3			5.9			3.2		
Flat seed per seed size				9.0			14.8			41.5			51.3			25.7			3.2

Flat seed = 36.1

Outturn = Total seed = 82.4 (see footnote 2); sound mature kernels = 77.9; hulls = 17.6

Mean counts per pound:

Each seed size	533	626	658	729	1175	1678

Jumbos (all seed riding 22/64 in. screen) = 616

Mediums (seed falling through 22/64 in. and riding 18/64 in. screen) = 692

Mean size = 19.2/64 in.

1/ See Appendix for sample calculations.

2/ Weight of subsamples: A=546.5, B=595.7, C=544.9, D=546.2, total=2233.3; weight of hulls: A=99.9, B=97.6, C=98.3, D=96.8, total=392.6.

3/ Flat seed were those that rode round-hole screen having a hold diameter 6/64 in. larger than width of slots in the slotted-hole screen.

4/ On 26/64 in. screen 0.1 percent of the seed rode and 2.3 percent of the seed fell through the 14/64 in. screen. These data should be presented in columns like those shown, but were omitted here because of insufficient space.

TABLE 3.--Data and some calculations for evaluating seed of experimental line no. 2 (F439-3-2) of the Florunner variety

Sub-sample 1/	Weight of seed (gm)	Seed weight, count, and weight of flat seed 2/ sized over slotted screens																	
		24/64 in.			22/64 in.			20/64 in.			18/64 in.			16/64 in.			14/64 in.		
		total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)
A	448.6	18.5	22	0	86.8	118	12.2	197.2	299	56.7	107.2	186	54.1	21.5	55	3.3	7.9	31	0
B	453.7	19.5	24	0	104.4	144	1.8	154.8	229	44.1	139.9	245	74.4	20.5	53	3.9	7.6	29	0
C	449.8	10.1	11	1.2	96.4	133	15.6	175.0	269	39.4	128.1	219	72.3	23.7	60	5.0	8.1	30	0
D	450.3	18.0	21	1.3	102.2	140	11.8	183.6	279	53.3	103.6	186	51.8	23.7	65	6.7	11.1	42	0
Totals 3/	1802.4	66.1	78	2.5	389.8	535	41.4	710.6	1076	193.5	478.8	836	252.6	89.4	233	18.9	34.7	132	0

Mean percentages:

Size distribution	3.7	21.6	39.4	26.6	4.9	1.9
Flat seed per seed size	3.8	10.6	27.2	52.8	21.1	0

Flat seed = 28.4

Outturn = Total seed = 82.6 (see footnote 1); sound mature kernels = 79.5; hulls = 17.4

Mean counts per pound:

Each seed size	536	623	687	793	1183	1727

Jumbos (all seed riding 22/64 in. screen) = 610

Mediums (seed falling through 22/64 in. and riding 18/64 in. screen) = 730

Mean size: = 19.5/64 in.

1/ Weight of subsamples: A=544.7, B=548.3, C=544.7, D=544.3; total=2182; weight of hulls: A=96.1, B=94.6, C=94.9, D=94.0, total=379.6.

2/ Flat seed were those that rode round-hole screen having a hole diameter 6/64 in. larger than width of slots in the slotted-hole screen.

3/ On 26/64 in. screen 0.05 percent of the seed rode and 1.8 percent fell through the 14/64 in. screen. These data should be presented in columns like those shown, but were omitted here because of insufficient space.

TABLE 4.—Data and some calculations for evaluating seed of experimental line no. 3 (F439-3-1) of the Florunner variety

Sub-sample [1]	Weight of seed (gm)	Seed weight, count, and weight of flat seed [2] sized over slotted screens																	
		24/64 in.			22/64 in.			20/64 in.			18/64 in.			16/64 in.			14/64 in.		
		total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)
A	447.4	9.9	12	0	89.6	120	24.0	178.7	262	75.5	124.0	209	89.0	24.5	61	7.1	9.4	37	0
B	453.3	13.1	15	2.0	103.4	143	21.3	185.6	274	74.6	114.7	201	71.8	22.5	59	5.8	9.0	34	0.8
C	448.8	21.2	25	5.0	76.8	104	19.1	179.9	269	77.8	122.1	208	85.9	26.1	65	7.5	10.9	38	0.8
D	448.5	18.5	23	2.0	77.8	105	17.8	183.2	278	69.8	120.9	216	70.8	25.3	68	4.9	13.7	50	0
Totals [3]	1798.0	62.7	75	9.0	347.6	472	82.2	727.4	1083	297.7	481.7	834	317.5	98.4	253	25.3	43.0	159	1.6

Mean percentages:

Size distribution	3.5	19.3	40.5	26.8	5.5	2.4
Flat seed per seed size	14.4	23.6	40.9	65.9	25.7	3.7

Flat seed = 40.9

Outturn = Total seed = 82.7 (see footnote 1); sound mature kernels = 79.1; hulls = 17.3

Mean counts per pound:

Each seed size	543	616	675	786	1167	1678

Jumbos (all seed riding 22/64 in. screen) = 604

Mediums (seed falling through 22/64 in. and riding 18/64 in. screen) = 720

Mean size: = 19.5/64 in.

1/ Weight of subsamples: A=453.3, B=545.7, C=543.7, D=541.9, total=2174.6; weight of hulls: A=95.9, B=92.4, C=94.9, D=93.4, total=376.6.

2/ Flat seed were those that rode round-hole screen having a hole diameter 6/64 in. larger than width of slots in the slotted-hole screen.

3/ On 26/64 in. screen 0.2 percent of the seed rode and 1.8 percent fell through the 14/64 in. screen. These data should be presented in columns like those shown, but were omitted here because of insufficient space.

TABLE 5.--Data and some calculations for evaluating seed of experimental line no. 4 (F439-1-1) of the Florunner variety

Sub-sample 1/	Weight of seed (gm)	Seed weight, count, and weight of flat seed 2/ sized over slotted screens																	
		24/64 in.			22/64 in.			20/64 in.			18/64 in.			16/64 in.			14/64 in.		
		total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)
A	445.9	2.3	3	0	71.8	108	7.9	149.2	257	33.6	166.8	334	79.4	31.1	85	9.4	14.2	57	0.3
B	448.0	5.5	7	0	64.8	97	7.8	169.9	295	38.9	160.1	324	83.8	25.7	72	10.3	12.5	49	1.0
C	447.2	4.2	5	0	59.9	88	5.8	161.9	281	33.5	173.9	350	86.7	26.6	75	10.1	10.9	45	0.6
D	446.6	5.8	7	0	60.1	91	4.8	141.1	238	43.5	183.1	364	101.5	31.0	87	7.9	12.3	29	0.9
Totals 3/	1787.7	17.8	22	0	256.6	384	26.3	622.1	1071	149.5	683.9	1372	351.4	114.4	319	37.7	49.9	180	2.8
Mean percentages:																			
Size distribution		1.0			14.4			34.8			38.2			6.4			2.8		
Flat seed per seed size				0			10.2			24.0			51.3			33.0			5.6
Flat seed = 31.9																			
Outturn = Total seed = 82.2 (see footnote 1); sound mature kernels = 77.9; hulls = 17.8																			
Mean counts per pound:																			
Each seed size		485			679			782			911			1266			1638		
Jumbos (all seed riding 22/64 in. screen) = 667																			
Mediums (seed falling through 22/64 in. and riding 18/64 in. screen) = 849																			
Mean size: = 18.9/64 in.																			

1/ Weight of subsamples: A=543.2, B=543.9, C=543.5, D=543.8, total=2174.4; weight of hulls: A=97.3, B=95.9, C=96.3, D=97.2, total=386.7.

2/ Flat seed were those that rode round-hole screen having a hole diameter 6/64 in. larger than width of slots in the slotted-hole screen.

3/ On 26/64 in. screen 0.00 percent of the seed rode and 2.4 percent fell through the 14/64 in. screen. These data should be presented in columns like those shown, but were omitted here because of insufficient space.

TABLE 6.--Data and some calculations for evaluating seed of experimental line no. 5 (Florunner as released) of the Florunner variety

Sub-sample 1/	Weight of seed (gm)	Seed weight, count, and weight of flat seed 2/ sized over slotted screens																	
		24/64 in.			22/64 in.			20/64 in.			18/64 in.			16/64 in.			14/64 in.		
		total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)	total (gm)	no.	flat (gm)
A	440.9	21.7	29	0	89.9	136	3.8	121.5	210	20.2	150.6	292	90.2	34.2	88	16.1	14.7	59	0.5
B	446.5	18.5	25	0	101.2	157	3.6	130.4	227	17.5	143.9	286	87.8	33.6	90	17.7	11.9	47	1.7
C	447.9	12.2	19	0	82.3	129	3.8	125.9	227	12.4	167.2	324	95.7	38.5	101	21.0	8.9	37	0.5
D	441.2	16.9	23	1.2	81.2	128	4.0	152.8	266	31.6	145.6	291	82.7	32.1	89	13.4	11.1	46	0.8
Totals 3/	1776.5	69.3	96	1.2	354.5	550	15.2	530.6	930	81.7	607.3	1193	356.4	138.4	368	68.2	46.6	189	3.5
Mean percentages:																			
Size distribution		3.9			20.0			29.9			34.2			7.8			2.6		
Flat seed per seed size				1.7			4.3			15.4			58.7			49.3		7.5
Flat seed = 29.7																			
Outturn = Total seed = 82.0 (see footnote 1); sound mature kernels = 78.5; hulls = 18.0																			
Mean counts per pound:																			
Each seed size		629			704			796			892			1207			1841		
Jumbos (all seed riding 22/64 in. screen) = 692																			
Mediums (seed falling through 22/64 in. and riding 18/64 in. screen) = 847																			
Mean size: = 19.2/64 in.																			

1/ Weight of subsamples: A=541.8, B=542.9, C=543.9, D=538.3, total=2166.9; weight of hulls: A=100.9, B=96.4, C=96.0, D=97.1, total=390.4.

2/ Flat seed were those that rode round-hole screen having a hole diameter 6/64 in. larger than width of slots in the slotted-hole screen.

3/ On 26/64 in. screen 0.00 percent of the seed rode and 1.7 percent fell through the 14/64 in. screen. These data should be presented in columns like those shown, but were omitted here because of insufficient space.

TABLE 7.—Comparison of percentages of flat seed in Florunner and its component genotypes

Line no. 1/	Mean percent of flat 2/ seed
2	28.4a
5	29.7a
4	31.9a
1	36.2b
3	40.9c

1/ Lines 1-4 are Florunner genotype components. Line 5 is composite of Lines 1-4.
2/ Means not followed by the same letters are significantly different at the 0.05 level.

Finally, the analysis is summarized in Table 8. We made no attempts to calculate an overall rating for each line because such a value would depend upon the relative importance of each seed size and shape characteristic. The excellent rating on so many of the characteristics that affect the monetary value for both farmer and processor minimizes the influence of some of the other characteristics that have undesirable ratings. In many cases (as in Table 8), the analysis will indicate ways in which some of the undesirable characteristics may be upgraded to more acceptable ratings. Note that the plot of line 5 (Fig. 1) was irregular between about 19.5/64 and 22/64. It also had a positive skewness, which indicated a tendency of the composite variety to have a large percentage of jumbos and mediums.

TABLE 8.--Ratings of size and shape characteristics of seed of the Florunner variety and its component genotypes

Property characteristics	Source of data	Property rating of line: 1	2	3	4	5	Remarks
Outturn (percentage of seed)	Tables 2-6	5	5	5	5	5	Thin hull.
Sound mature kernels (percentage of seed riding 16/64" slotted screen)	Tables 2-6	5	5	5	5	5	Thin hull and very few small seed.
Value (dollar per ton of net farmers stock)	Tables 2-6 and CY 1975 prices	5	5	5	5	5	Exceptionally high outturn and sound mature kernel values.
Maturity (as indicated by differences in count/lb for 18/64" and 16/64" seed sizes)	Tables 2-6	1	2	2	2	3	A large difference in count/pound for the 18/64" and 16/64" seed sizes indicates that maturity may be poor for no. 1 size of seed. Maturity should be evaluated further by use of methods with improved reliability.
Percentage of jumbos	Tables 2-6	4	5	5	3	5	Count per pound for lines 4 and 5 does not meet the 576-640 current requirement of buyers. A screen size larger than 22/64" may be required to size jumbos for these two lines.

TABLE 8. (Continued)

Property characteristics	Source of data	Property rating of line: 1	2	3	4	5	Remarks
Percentage of mediums	Tables 2-6	5	4	5	5	4	Count per pound for lines 4 and 5 does not meet the 688-736 current requirement of buyers. A screen size larger than 18/64" may be required to size mediums for these two lines. Dropping line 4 would tend to provide more desirable counts per pound for the composite variety.
Mean size	Tables 2-6	5	5	5	4	5	Although line 4 had a significantly smaller mean size than the others, its mean size was larger than that of other runner varieties. Dropping line 4 would tend to increase mean size of seed in composite.
Percentage of flat seed	Tables 2-7	2	4	1	3	4	Lines1 and 3 had significantly more flat seed than did other lines. Dropping lines 1 and 3 would tend to improve shape of seed in composite.

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APPENDIX

Sample calculations for evaluating Florunner variety and its component genotypes, based on values in Table 2.

Mean percentage of seed falling through 26/64 in. screen and riding 24/64 in. screen $= \frac{(40)\ (100)}{1840.7} = 2.2\%$

Mean percentage of flat seed per seed size $= \frac{(3.6)\ (100)}{40.0} = 9.0\%$

Mean percentage of flat seed $= \frac{(3.6+49.7+273.2+305.2+28.0+1.9+3.1)(100)}{1840.7} = 36.1\%$

Mean hull outturn $= \frac{(392.6)(100)}{2233.3} = 17.6\%$

Mean seed outturn $= \frac{(1840.7)(100)}{2233.3} = 82.4\%$

Sound mature kernels $= \frac{1840.7-(58.7+42.7)}{2233.3} = 77.9\%$

Mean count per pound for 24/64 in. seed size $= \frac{(47)\ (454)}{40} = 533$

Mean count per pound for mediums $= \frac{(953+956)(454)}{657.8+595.0} = 692$

Mean size $= \frac{1/64\,[(26)(0.1)+(24)(2.2)+(22)(18.3)+(20)(35.7)+(18)(32.3)+(16)(5.9)+(14)(3.2)+(10)(2.3)]}{100}$

$= 19.2/64$ in.

USE OF ACCELERATED GENERATION INCREASE PROGRAMS IN PEANUT BREEDING

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ABSTRACT AND PAPER

ABSTRACT

One of the major limiting factors in making progress in peanut breeding is the time required for variety development. Procedures reducing variety development time increase the efficiency of peanut breeding programs.

Accelerated generation increase programs using a modified pedigree breeding procedure (single-seed descent) in conjunction with greenhouse, phytotron, and winter increase nurseries in a tropical environment can be used to increase the efficiency of peanut breeding.

Near-homozygous lines (F_5 generation) were developed from F_1 embryos in 24 months using single-seed descent and greenhouse facilities while the regular pedigree method requires 48 months. An accelerated disease-resistance breeding program using the phytotron is being used to make crosses and grow five generations in a 24-month period. A recurrent selection scheme for peanuts requiring only 24 months per cycle is proposed using an accelerated generation increase program.

These methods illustrate the usefulness of accelerated generation increase programs in peanut breeding.

INTRODUCTION

Development of peanut varieties requires 12-15 years after hybridization (6) when traditional pure line breeding methods are used. With increased demands for peanut varieties with higher yields, pest resistance, and specific quality components, it is mandatory that peanut breeders increase the efficiency of their breeding programs. Burton (3) indicated that one measure of efficiency was the rate of generation increase for establishing near-homozygous lines. He states that time-requirement studies, actual or projected, might give more useful information on efficiency of breeding procedures than estimates of efficiency based on variance component estimates.

Norden (6) states that off-season nurseries in a tropical environment, use of greenhouse facilities and a modification of the pedigree breeding method can be used to reduce the time required for variety development. In addition to these methods, the North Carolina State Phytotron Unit of the Southeastern Plant Environmental Laboratories is being used to increase the efficiency of the peanut breeding program at North Carolina State University by reducing the time required for development of varieties.

Accelerated generation increase programs and their use in peanut breeding are discussed in this paper.

Use of Modified Pedigree and Greenhouse in Cultivar Development. A modified pedigree method of selection (single-seed descent) proposed by Goulden (5) and described by Brim (1) can be used in conjunction with greenhouse facilities to reduce variety development time. The single-seed descent method is effective when additive genetic variance comprises the larger portion of total genetic variance. With complete inbreeding and only additive genetic variance means over generations remain unchanged and the genetic variance is readily translatable from one generation to the next. Where progenies trace to a single plant in the previous generation, the among-progeny variance increases while the within-progeny variance decreases. At complete homozygosity the genetic variance among progenies is twice that of F_2 progenies and within-progeny genetic variance is zero (2).

The method consists of advancing each F_2 plant in the population by a single seed. The principal advantages of the method are that genetic variance can be maintained with relative ease for characters with low heritability, and more than one generation can be obtained annually if greenhouse facilities are used.

This method has been used successfully in the peanut breeding program at North Carolina (Emery, unpublished data). A single-seed descent breeding program for transfer of southern corn rootworm (Diabrotica undecimpunctata howardi) resistance from lines with undesirable agronomic traits to lines with CRW resistance and desirable agronomic qualities was initiated in 1966. Details of this breeding procedure for peanuts is given here to illustrate how the method is applied to peanuts. Crosses were made during the summer of 1966. Fifty-six F_1 embryos were planted November 22, each in a separate 14 x 14-in. box for maximum F_2 embryo production. Seeds from the F_1 plants were harvested May 25, 1967. The number of F_2 embryos per plant ranged from 47-150 with a mean of 82.4 seeds per plant or a total of 4617 F_2 seeds (embryos). The F_2 generation was planted June 16, 1967 and harvested October 25, 1967. Thirty F_2 plants were planted in each of 56 boxes. A single F_3 seed (embryo) was harvested from each F_2 plant. The number of harvested F_2 plants ranged from 11 to 29 with a mean of 23.2 per box. The F_3 generation was planted December 1967 and harvested in May 1968. The number of F_4 embryos ranged from 5 to 22 per box with a mean of 14 F_4 embryos harvested from the 56 boxes. The F_4 embryos were planted in 2 1/2-in. peat moss pots filled with soil and transplanted to the field in mid-June 1968. All seeds (F_5 embryos) were harvested from each plant in October 1968. Seeds were used to grow 782 progeny rows in F_5 generation in 1969. Each row traced to an individual F_2 plant. Selection for insect resistance, pod and kernel size, and yield were practiced in subsequent generations. The F_5 embryos produced from F_1 embryos by single-seed descent required 23 months (November 1966-October 1968) while the regular pedigree method requires 48 months. Dormancy of seeds between generations was broken using ethylene gas. The entire single-seed descent program required less than two greenhouse benches, although 782 F_5 lines tracing to individual F_2 plants were evaluated in the program.

Accelerated Disease-Resistant Breeding Program Using Phytotron, Greenhouse and Winter Nursery. A serious peanut disease (Cylindrocladium black rot) was discovered in North Carolina in 1970. Spread was rapid and, although an extensive research effort was made, no cultural practices or chemicals offered satisfactory control. A screening program to find CBR-resistant peanut lines was initiated in 1973. A small-seeded line, NC 3033, was found to have high resistance to CBR in field studies. The situation demanded that the time for variety development be minimized. After harvesting in October 1974, an accelerated breeding program to decrease the time required for the establishment of near-homozygous lines was devised. The program consists of using the single-seed descent breeding method in conjunction with the North Carolina State Phytotron Unit and a winter increase nursery in Puerto Rico (Table 1).

Table 1. Accelerated breeding program for development of Cylindrocladium black rot resistance.

Time schedule	Action
1. Nov 1974-Jan 1975	Produce F_1 embryos (phytotron)
2. Jan 1975-Apr 1975	Grow F_1 generation (phytotron)
3. May 1975-Sep 1975	Grow F_2 generation (field and greenhouse)
4. Oct 1975-Jan 1976	Grow F_3 generation (phytotron)
5. Feb 1976-May 1976	Grow F_4 generation (phytotron)
6. May 1976-Oct 1976	Evaluate F_5 progeny rows (CBR-field)
7. Nov 1976-Apr 1977	Increase seeds of selected lines (Puerto Rico)
8. May 1977-Oct 1977	Increase seeds and evaluate

This breeding program will allow the breeder to produce some breeders seed for increase during the growing season of 1977 and the winter of 1977-78. Several lines will be increased while yield and market acceptability is simultaneously measured. From initiation of the crossing program until evaluation of F_5 progeny rows for pod shape and size and CBR resistance will require 24 months. This decrease in time required for development of near-homozygous inbred lines would not be possible without the controlled environment of the phytotron and the use of the single-seed descent breeding method.

The controlled environment of the phytotron allows rapid growth of the peanut plant and early maturity of the peanut fruit (7, 8). Plants were grown at high temperatures (30 C day-26 C night) in 10-in. pots filled with a gravel-sand-vermiculite mixture that was watered twice daily with a modified Hoagland's nutrient solution. A single fruit was harvested from 100 F_2 plants and 100 plants in F_3 generation. Dormancy of seeds was broken using ethylene gas. Single fruits were harvested after 90 days and the plants were then allowed to set more mature fruit. The seeds for the F_4 generation were planted February 1976. All seeds will be harvested from each F_4 plant and will be used for progeny testing in the field in the F_5 generation. This breeding program, using the phytotron as a tool, has the possibility of greatly reducing the time required for variety development. The F_5 generation breeding lines will have been evaluated for CBR resistance in the field 24 months after the parents were selected for hybridization.

An Accelerated Recurrent Selection Program. Norden (6) discusses recurrent selection for peanuts but points out that the difficulty in making sufficient crosses to initiate the recombination portion of each cycle and the length of time involved for each cycle were major handicaps. With slight modification of a procedure proposed by Compton (4) and a winter increase nursery, both of these objections to recurrent selection can be negated. Compton (4) proposed a recurrent selection procedure for self-pollinated crops that does not require extensive crossing. The procedure is based on the use of the single-seed descent method but with each derived line being a descendent of a different F_1 rather than from different F_2 plants within an F_1. One line is extracted from each single cross with the initial cycle being formed from a set of n/2 single crosses. The genetic variability among the extracted lines will be twice that of the original group of homozygous lines used as parents, if only additive genetic variance is assumed.

The following recurrent selection procedure, for total productivity, which is a modification of Compton's proposal, is now being used in North Carolina. The first cycle of the recurrent program was initiated by randomly pairing 40 diverse Virginia-type peanut lines producing 100 single crosses. Approximately 200 pollinations were made but fewer would have been sufficient. A single F_1 seed was selected from each cross. The F_1 generation was grown in the greenhouse with a single F_2 seed selected from each F_1 plant. All F_3 seeds were harvested from the F_2 plants. These will be increased in a winter nursery for F_4 seeds to be used in evaluating productivity. Phenotypically superior plants from superior yielding lines will be used as parents to initiate the next recombinational cycle. At any stage in the program lines can be extracted and evaluated further for release as varieties.

The time schedule proposed for each cycle is given in Table 2. Each cycle would require 2 years with a winter increase nursery or 3 years without winter increase. This procedure has the advantage of minimizing the number of pollinations required per cycle but will provide a large number of combinations between many different genotypes. It also reduces the length of time for each cycle to two years. This proposed breeding procedure should allow peanut breeders the opportunity to take advantage of proven breeding theory of population improvement through recurrent selection.

Table 2. Time required for one cycle of accelerated recurrent selection program in peanuts.

Time	Time in months	Action
Nov	0	Initiate crossing program
Mar	4	Grow F_1 plants in greenhouse
Jul	8	Grow F_2 plants in greenhouse
Dec	14	Increase seeds of F_3 plants in winter nursery
May	19	Evaluate productivity of F_4 generation
Nov	25	Initiate second cycle crossing program and repeat first cycle

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PEANUT BREEDING STRATEGY: MODIFIED COMPOSITE CROSS[1/]

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ABSTRACT

Peanut geneticists use several procedures for broadening the genetic base and alleviating the hazards of genetic vulnerability. In addition to the early generation multiline variety development procedure, a modified composite cross technique has been employed. The method exploits the variation released by combining complexly-bred parental lines. Mechanical sizing of pods — an objective method — was used, in F_2 - F_5 progenies of the heterogeneous bulk populations, to select phenotypes meeting the rigid demands of the present peanut marketing system. In later generations, line selection was practiced for agronomic suitability and for growth characters that favor ease of production and harvest. Finally, strains are composited on the basis of shelling grade and market value criteria. This approach has resulted in populations with high agricultural value.

INTRODUCTION

In a plant-breeding situation the breeder is generally interested in maximizing the variation from a cross that involves the recombination of genes dispersed between the parents. For any continuously varying character, such as yield, selective breeding in relatively early stages following hybridization is clearly advantageous not only to enhance the probability of finding superior materials, but also to permit elimination of inferior materials unlikely to be commercially usable.

General principles that proved successful with other self-pollinated crop species have been exploited in breeding a number of the peanut (*Arachis hypogaea* L.) cultivars developed in the U. S. However, Florida breeders, by multiline bulking of early generation sibling progenies, have developed cultivars widely adapted to U. S. production environments and market demands (Norden, 1973). North Carolina breeders have used the single seed descent procedure to maximize generation advance with minimum population size until a high level of homozygosity is achieved (Wynne, 1976). Other innovative techniques will be discussed in subsequent papers of this minisymposium.

Most of these methods depend to a great extent on *subjective* selection of relatively large numbers of individual plants and their evaluation in progeny rows and other comparative trials.

This paper describes a modified bulk system as an alternative procedure for handling the heterogeneous hybrid populations in some peanut crosses. The method applies an *objective* device — the market grading service pod presizer — to stratify the early segregating populations into current market size categories. Although the technique has been employed with different crosses to select agronomically suitable Spanish, Runner, and Virginia type peanuts, application of the method will be discussed using an example from the Runner commercial market class.

1/ Presented at the annual meeting of the American Peanut Research and Education Association, Dallas, TX, July 1976. Contribution of ARS-USDA in cooperation with the University of Georgia, College of Agric. Exp. Stn., Coastal Plain Stn., Tifton, GA 31794.

2/ Supervisory Research Geneticist and Leader, Crops Res. Unit, ARS-USDA, Georgia Coastal Plain Stn., Tifton.

3/ Mention of a specific commercial cultivar does not constitute endorsement by the USDA.

BACKGROUND

Composite cross breeding has been used primarily in small grains, to develop variable populations for alleviating the hazards of genetic vulnerability. A typical composite derives from polyallelic mating of few to many lines, mixing the F_2 seed, maintaining the unselected bulk across several generations in diverse environments, and selecting adapted cultivars from the panmictic bulk. The notion of letting natural selection (i.e., survival in a heterogeneous bulk population) do some of the breeder's work for him has long been fairly familiar to the cereal breeders. The method described below is based on the same assumption that underlies the composite cross and is, indeed, but a narrowly based version of the latter (Simmonds, 1962).

We crossed a promising combination, bulked the F_2 seed, carried the population in bulk for several generations, made selections, compared the populations with the standard cultivar, and composited the agronomically valuable lines as a potential cultivar. Our procedure differs in at least two ways from the cereal composite program. First, the Agricultural Marketing Service sample presizer developed by Dickens (1962) was used to objectively sort pods into the desired market size categories. Second, variability was maintained by compositing promising lines rather than using the pedigree method employed in cereal breeding at this stage. Thus, the multilineal product is somewhat analagous to the final bulking achieved in Florida by the early generation composites, except that a greater heterogeneity is maintained.

The simplest form of the composite cross involves two parents. Since the objective was to improve yield, we chose high yielding lines adapted in the Southeast. Different hybridizations involved various combinations among the three major market types. One cross will be discussed to describe and illustrate the procedure.

EXPERIMENTAL MATERIAL

Georgia C-194: In 1967, we crossed parental accessions T 1645 and T 1861 in the Georgia - USDA cooperative peanut breeding program. T 1645 was a selection in the F_{12} generation from the progeny of a complexly-bred Florida cross (UF 416) involving 6 strains ('Virginia Jumbo Runner', 'Small White Spanish', 'Pearl Spanish', 'Jenkins Jumbo', 'Dixie Giant' and 'Florida Small Spanish') in its pedigree. T 1861, a selection made in Georgia in 1966 from a field of Virginia type peanuts, is of obscure origin. The line is thought to have originated in central Florida as a chance cross between Spanish and Virginia (Jumbo) peanuts grown as a mixture.

Progeny generations were field grown in summer at the Georgia Coastal Plain Station agronomy farm, Tifton, or in the ARS winter generation nursery in cooperation with the Mayaguez Institute of Tropical Agriculture, Mayaguez, Puerto Rico. Traits measured included: 1) distribution of fruit in the pod presize categories, 2) seed density (g/100 seed), 3) fruit yield (kg/ha) in comparison with the commercial cultivar Florunner.

SELECTION PROCEDURES

The breeding scheme (Figure 1) is a variation of the bulk population method of selection commonly used after hybridization, but with modifications at several stages. The progeny was grown in bulk through the F_4 generation and again in F_7 and F_9. However, two of the bulks composited seeds from 6 productive plants advanced a generation in the ARS winter nursery in Puerto Rico. Bulk progeny fruits from the F_2, F_4, F_5 and F_6 were sorted in tandem on the Runner and Virginia spacings of the pod sizing machine (Dickens, 1962). That portion of the fruit sample which passed over the 29/64-in and through the 34/64-in roller spacings formed the Runner Sort for subsequent evaluations. (Pods riding the 34/64-in rollers comprised a Virginia Sort in other trials).

Preliminary yield tests in F_3 and F_7 confirmed the agronomic potential of the population. Plants with apparently superior pod yields, chosen from the F_8 spaced-plant nursery, were bulked and multiplied in F_9. Agrotype trials were

GEORGIA C 194R

F_0		T 1645	X	T 1861	
F_1	1967				single plant
F_2	1968	SI		bulk	sized. 25 seed/WI
F_3	1969	YT		yield trial	
F_3	1968-69	WI		bulk	6 plants/SI
F_4	1969	SI		bulk	sized/SP
F_5	1970	SP		spaced	sized/YT
F_6	1971	YT		yield trial	sized. 25 seed/WI
F_7	1971-72	WI		bulk	6 plants/SP
F_8	1972	SP		spaced	150 bulk/SI
F_9	1973	SI		bulk	
F_{10-12}	1974-76	YT		yield trials	

SI = Summer increase, WI = Winter increase

SP = Spaced plant, YT = Yield trial

Figure 1. A modified bulk breeding scheme using the sample pod presizer and winter generation selection techniques in peanut composite cross population Georgia C 194R.

grown in F_{10} through F_{12}. Various modifications of this procedure may be made. For example, another population was advanced through consecutive yield trials beginning with the F_3. The bulk plots were presizer-sorted and performance was evaluated in regular field tests without using accelerated generations or limiting the material to 6 selected plants.

RESULTS

Presizer Selection. Wide variation in fruit size occurred in the F_2 and F_3 generations in Cross 194. In sorting these fruits for shelling with the Agricultural Marketing Service sample sheller, we noted that nearly all of the pods traversed the Runner rollers, but approximately one-half of these fruits passed through the smallest size opening on the Virginia grading rollers. This observation permitted mechanical sorting of fruits in Cross 194 into populations approximating the rigid demands of the present peanut grading system.

An unsorted population, maintained throughout the experiment by sequential bulking without selection, served as a control. Mechanical sorting gave Virginia and Runner "size" populations for breeding research.

The distribution of fruit sizes for the 3 populations from a common production environment is given in Table 1. One objective of mechanical sorting was to transform a variable population into size categories suitable for the commercial market. The close agreement between C 194 Runner Sized and the Florunner

cultivar in percentages of pods for each size category indicates that objective selection was an effective procedure with this material (Table 1).

Table 1. Distribution of Peanut Fruit (Pods) in Pre-Sizer Categories: C 194 Populations and Florunner (1975).

Presizer / Population	RUNNER <25	RUNNER >25 <29	RUNNER >29	VIRGINIA <34	VIRGINIA >34 <38	VIRGINIA >38
	%	%	%	%	%	%
C 194 Bulk:						
Unsorted	0.7	5.4	93.8	46.2	17.4	36.3
Va. Sized	0.0	0.0	100.0	0.6	8.1	91.3
Run. Sized	1.6	14.9	83.5	89.0	11.0	0.0
Check:						
Florunner	1.9	21.1	77.0	91.7	8.3	0.0

The C194 "unsorted: population was maintained by sequential bulking; the "Virginia Sized" portion traces to three sortings in which those pods riding the 34/64-inch pre-sizer rollers were retained for further planting; the "Runner Sized" portion derives from pods riding the 29/64-inch but passing the 34/64-inch pre-sizer rollers. (See text).

Shelling Grade Characteristics. Seed size and shape of peanuts is important to breeders and to the peanut industry because these properties, along with other factors, determine the market value and acceptability of a cultivar (Davidson, et al., 1976). The average density (g/seed) of peanut seed in the "No. 1," "Medium," and "Extra Large" seed sizes forms part of the objective basis for establishing marketing criteria.

The effectiveness of presizer selection in stratifying the C 194 materials into a Runner Sized population with commercial seed size characteristics is shown in Table 2. The average seed size of a sample of 194 R peanuts is essentially equivalent to that for cv. Florunner in the standard market categories.

Table 2. Seed Size Characteristics (g/seed) in 1975 for Populations of Georgia C 194 Peanuts and the Florunner Cultivar.

Population	Market Category 1/ No. 1 $\bar{x}$	No. 1 ±σ	Mediums $\bar{x}$	Mediums ±σ	Extra Large $\bar{x}$	Extra Large ±σ
C 194 Bulk:						
Unsorted	.407	.051	.503	.037	.826	.042
Va. Sized	.375	.106	.555	.097	1.165	.042
Run. Sized	.386	.044	.536	.036	.681	.027
Check:						
Florunner	.377	.022	.546	.025	.707	.065

1/ No. 1 Runner seed ride the 16/64 x 3/4-in. screen.
No. 1 Virginia seed ride the 15/64 x 1-in. screen;
Mediums ride the above, but pass through the 18/64-in. screen;
Extra-Large ride the 20/64 x 1-in. screen

Initial studies of shape characteristics of Georgia 194 R, using the method of Davidson et al. (1976), suggest that its seed may be somewhat less symmetrical than that of Florunner. However, the higher outturn of premium priced seed may greatly affect the market value of C 194 R at the sheller level.

Fruit Yield. Cross 194 showed agronomic promise in early generations. A portion of the bulk F_3, grown in replicated field trial, significantly out-yielded standard commercial cultivars. But the very wide range in fruit and seed size made this material unsuitable for market, *per se*. The initial Runner-sort bulks, in F_4 and F_6 tests, again exceeded check cultivars in fruit and seed yield.

In 11 agrotype trials in Georgia, 1972-75, the Georgia 194 Runner peanut had average fruit yields of 5263 kg/ha compared with 5147 kg/ha for Florunner (Table 3). The tests sampled 3 major peanut soils and 2 water management practices (irrigation vs. no irrigation during droughts). Performance in Georgia shows that the presizer-selected Runner population has fruit yield and locational adaptability that make this peanut fully competitive at the grower level.

Table 3. Fruit Yield (kg/ha) of the Georgia 194 Runner Compared with Florunner Peanut in 11 Agrotype Trials.

Year	Location	Treatment	GA 194R	Florunner
1975	Tifton	Irrigated	6017	5221
	Tifton	Rainfall	4708	4570
	Plains	Irrigated	5103	6114
	Plains	Rainfall	4465	4188
1974	Tifton	Irrigated	6363	6710
	Plains	Irrigated	4861	3958
1973	Tifton	Irrigated	3847	4091
	Tifton	Rainfall	5335	5177
	Plains	Irrigated	6196	5629
	Bulloch Co.	Rainfall	4955	4559
1972	Tifton	Irrigated	6045	5503
Mean			5263	5147
SEM			±243	±263

Irrigated in periods of drought stress.

DISCUSSION

Peanut breeders are concerned with broadening the genetic base of future cultivars to minimize the hazards of genetic vulnerability (Hammons, 1976). Two procedures for handling early-generation populations have been successfully employed in Florida (Norden, 1973, 1976) and North Carolina (Wynne, 1976) cultivar development. A third method has been tried in Georgia.

Ample variability in yield can be achieved via intersubspecific hybridizations in *Arachis hypogaea* L. In practice, lines which are themselves the products of complex hybridizations are chosen as parents (Norden, 1973). Constraints placed upon breeders by the requirements of certifying agencies and the marketing system have enforced pedigreed selection after hybridization to sort the desirable genotypes from the segregating progenies.

Use of mechanical pod sizing (presizing) in early generations, in conjunction with the bulk population method of breeding, has several advantages, namely:

a) it is easy, objective, and repeatable;

b) it is independent of the skill of the plant breeder;
c) it increases the efficacy of natural selection for stability and adaptation by maintaining a broad germplasm base;
d) it is economical, reducing labor in handling and documenting progenies;
e) it is efficient in use of plot land and in minimizing the chance loss of genotypes;
f) as a laboratory procedure, it is independent of seasonal peak work loads during harvest; and
g) it is adaptable with either the pedigree or bulk methods of selection for objectively reducing population size in peanut breeding.

With highly heterogeneous peanut populations, such as Georgia cross 194, pod sizing has been shown to effectively separate early generation germplasm into sorts that meet the requirements of the current peanut marketing system. Line selection for agronomic suitability and for growth characters (maturity, plant habit) that favor ease of production and harvest can be practiced in the middle or later generations.

The procedure described herein has given several populations with high agricultural value.

ACKNOWLEDGMENT

Technical assistance by M. E. Griner, J. E. Harvey, Ben Mullinax, and Peter Tai is gratefully acknowledged.

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PEANUT BREEDING STRATEGY TO MINIMIZE AFLATOXIN CONTAMINATION[1/]

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ABSTRACT

Screening, selection and breeding procedures for increasing the resistance of peanut varieties to toxin-producing strains of Aspergillus flavus Lk. ex Fr. are reviewed and discussed. This review includes consideration of sources and nature of resistance, variation of peanut genotypes to seed colonization, variation among fungal isolates of A. flavus, and factors associated with the interaction of aflatoxin-producing strains of the fungus and seed of peanut genotypes. The pros and cons of breeding an improved peanut variety with greater resistance to aflatoxin contamination are presented.

INTRODUCTION

Aflatoxin contamination of farmers' stock peanuts by toxin-producing strains of Aspergillus flavus has been a vital concern to the peanut industry for several years. Prevention, removal, and inactivation are three approaches to control of fungi and their toxic metabolites in peanuts. The best approach to prevention of fungal growth by the toxin-producing molds would be the utilization of genetic resistance. The current prevention of A. flavus contamination of peanuts has been largely associated with growing, harvesting, curing and storage methods that help keep the contamination by the fungus to a minimum.

Genotypic Response to Seed Colonization and Aflatoxin Contamination by Toxin-producing Strains of Aspergillus

In 1967, Rao and Tulpule of India (10) reported that U.S. 26, 'Koboka' variety, failed to produce aflatoxin when seed were contaminated with A. flavus. Also in 1967, Kulkarni, et al. of Hyderabad (3) reported that a red-seeded variety, 'Asiriya Mwitunde', supported only moderate aflatoxin production. However, when Doupnik (2) and Mixon and Rogers (8) evaluated two accessions of Asiriya Mwitunde (P.I. 295170 and P.I. 268893) and an accession of the Koboka variety (P.I. 246388) in the laboratory using toxin-producing strains of A. flavus and A. parasiticus Speare, they were unable to confirm the resistance in these genotypes.

Nagarajan and Bhat (9), using three toxin-producing isolates of A. flavus and two isolates of A. parasiticus, tested the toxin-producing potentials of seed of varieties 'TMV-2' and P.I. 246388 in the laboratory. The results of aflatoxin assays revealed varietal differences in the amount of toxin produced; these differences were attributed to the inherent abilities of the fungal isolates to produce toxins.

In 1973, Mixon and Rogers (8) published information from an extensive peanut germplasm screening program indicating that two peanut genotypes (P.I. 337394F and P.I. 337409) (Fig. 1, Table 1) exhibited resistance to seed colonization by two toxin-producing strains of A. flavus. They showed that several hundred genotypes ranged in fungal colonization from less than 10% to 100% in laboratory evaluations (Fig. 2). This indicates the potential for selection of genotypes with resistance to seed infection by A. flavus.

Using similar screening procedures, Bartz, et al. (1) at the University of Florida identified a genotype that had less than 15% seed colonization following inoculation for four consecutive years. They found other genotypes with

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1/ For oral presentation as part of a minisymposium on "Peanut Breeding Strategies" at the 8th annual meeting of the American Peanut Research and Education Association, Dallas, Texas, July 14-16, 1976.

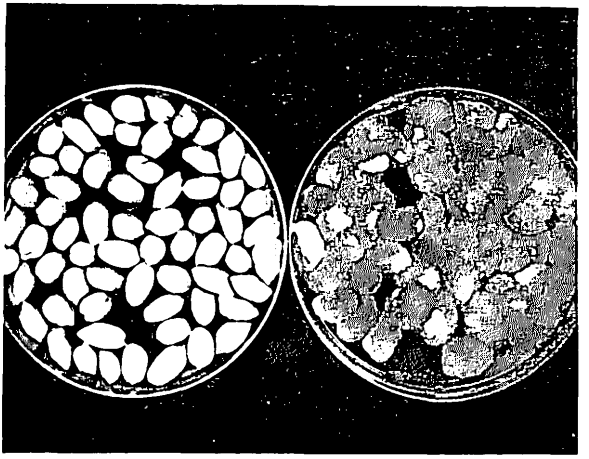

Figure 1. Seed of P.I. 337394F free from A. flavus infection (left) and the highly susceptible P.I. 331326 (right) following inoculation and incubation under conditions conducive to growth of the fungus

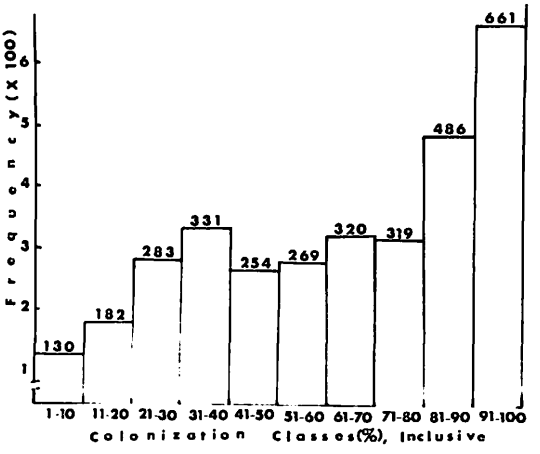

Figure 2. Frequency distribution of 3,235 samples from accessions, selections, and varieties of peanuts in infection rating classes following inoculation and incubation with A. flavus strain NRRL A-13794.

Table 1. Seed Colonization of Resistant and Sesceptible Peanut Accessions and Varieties following Inoculation with A. flavus strain NRRL 2999.

Identity	Seed Colonization (%)
P.I. 337394F	6.4a*
P.I. 337409	7.3a
Florunner	21.5 b
Goldin I	22.7 b
Argentine	37.7 c
P.I. 331326	89.1 d
P.I. 343419	91.3 d

* Means with same letter are not significant at the .05 level.

appreciable resistance. Lindsey (6) noted that when pods of 'Tennessee Red' and 'Virginia 46-2' were inoculated with A. flavus under gnotobiotic conditions, the fungus consistently penetrated the pods, but was limited in its invasion into the testa. Invasion of the embryos also appeared to be limited.

Nature of Resistance to Colonization by Aspergillus sp

In peanut genotypes resistant to A. flavus colonization, LaPrade and Bartz (4) suggested that testa permeability was involved. LaPrade et al. (5) gave evidence that the resistant genotypes had a thicker cuticular wax accumulation on the seed. In other studies, Taber, et al. (11) observed that resistant genotypes had smaller hila, more compact arrangement of the palisade-like layer of the testa than did susceptible genotypes.

In an analysis of soluble amino acids from A. flavus-resistant and susceptible genotypes, Young, et al. (12) found that total amino acids were less in hydrolyzed testa extracts of the resistant lines. The most notable differences in amino acids were methionine, lysine, tyrosine, histidine, glycine, alanine; ammonia content of resistant lines was also lower. In a study by Lindsey and Turner (7), substances inhibitory to A. flavus and Trichoderma viride Pers. ex Fr. growth on agar media were found around peanut embryos of freshly harvested peanut seed, but not around embryos of cured seed, intact peanut seed or testa. These substances were extracted with acetone and four compounds were detected in crude extracts. Three of the compounds had phenolic properties.

Strategy in Breeding for Resistance to Aspergillus flavus

At the Coastal Plain Experiment Station, Tifton, GA one phase of the A. flavus research has been the screening of large numbers of peanut accessions, breeding lines, and commercial varieties using a standardized laboratory procedure. Following curing and drying, seed with intact seedcoats of certain genotypes are more resistant to colonization by A. flavus than that of other genotypes when seed are washed thoroughly, adjusted to 25% seed moisture, incubated with toxin-producing strains of A. flavus, placed in petri dishes, and incubated at 26° C in a humid chamber. Using the pure line breeding approach, resistant genotypes have been increased each successive year from single plants.

The resistant lines have been utilized in numerous crosses with the most productive varieties and advanced breeding lines. The objective is to incorporate the resistance to A. flavus into the breeding development of desirable commercial varieties. Advanced breeding lines have been selected from the segregating progenies of the crosses that have A. flavus resistance. An example of the selection procedure and progress is given in Table 2.

Table 2. Seed Colonization of F_4 and F_5 Generation Peanut Lines in Comparison with Parents of Cross.

Identity	Seed Colonization (%) 1974	1975
FR x 337409 (F_4)	12	25
(FR x 337409) X FR (F_5)	13	15
FR	42	36
337409	14	21

An additional breeding aid is being utilized in the ARS project by growing a Winter Peanut Breeding Nursery in Puerto Rico. This provides two generations of breeding material for evaluation each year.

Table 3. Frequency distribution of percent Aspergillus flavus colonization of seed from F_1 and F_2 plants from crosses between resistant and susceptible parents.

Identity	Plants per seed colonization class(%) 0-20	21-30	41-60	61-80	81-100	N	$\bar{x}$
PI 337409 (Res)	28					28	17
PI 331326 (Sus.)					34	34	93
PI 337409 X 331326 (F_1)			11	27	2	40	64
PI 337409 X 331326 (F_2)	2	28	26	7	11	74	51
Mid parent							59
PI 331326 X 337409 (F_1)			5	27	12	44	73
PI 331326 X 337409 (F_2)	3	15	26	12	12	68	59
Mid parent							59

An evaluation in the laboratory of the frequency distribution of A. flavus colonization of seed from F_1 and F_2 plants from reciprocal crosses between a resistant genotype (P.I. 337409) and a susceptible genotype (P.I. 331326) is given in Table 3. The high degree of heritability for these crosses was evident and verified by using the following broad sense heritability formula:

$$H = \frac{\sigma^2 F_2 - \sigma^2 \text{ pooled parents}}{\sigma^2 F_2} = 78.5\%$$

These data from one season are very encouraging, but resistant selections from crosses of resistant lines with improved commercial varieties evaluated for several seasons under fluctuation of environmental conditions are difficult to identify and maintain. Observations indicated that the heritability of A. flavus resistance is somewhat like that for yield. This is not unexpected because environmental factors contribute to the variation in resistance by peanut genotypes to invasion by the fungus and the production of the toxin metabolites. Among these factors are moisture stress, activity of other microorganisms, the invasion of the pod by soil insects and nematodes, maturity of the fruits at harvest, the time of harvesting, etc.

Breeding A. flavus resistant varieties, particularly as part of a peanut breeding program, appears to be very encouraging. Screening and selecting breeding lines for resistance would insure the development of future peanut varieties with a high degree of tolerance to invasion by A. flavus in peanuts.

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BENOMYL CONTROL OF PEANUT BLACKHULL DISEASE AND ITS CAUSAL FUNGUS THIELAVIOPSIS BASICOLA

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ABSTRACT AND PAPER

ABSTRACT

On the basis of 14-day growth of Thielaviopsis basicola plugs on potato carrot dextrose agar plates bordered by chemically treated paper discs, and on the basis of 14-day T. basicola growth on peanut pods first dipped in chemical solutions and subsequently inoculated, benomyl at concentrations as low as 50 to 150 ppm caused considerable inhibition of T. basicola. In a greenhouse test, pathogen-infested soil was treated with 100 ppm benomyl (soil weight basis) which was applied at zero to seven weekly intervals after planting. No blackhull was detected on large peanut pods (over 1 cm long) in pots receiving surface or subsurface treatment for the first three weeks after planting. There was some blackhull on large pods in pots treated with benomyl four weeks after planting but the amounts were still considerably less than the untreated check. No blackhull was found on small pods from pots receiving surface application of benomyl up to four weeks after planting. Some blackhull was found on small pods from pots receiving subsurface treatment of benomyl at planting time, two, four and six weeks after planting. Using benomyl as an in-furrow band spray treatment at planting time at 1.13 to 2.27 kilograms active ingredient per hectare effectively controlled blackhull in the field since 1971. Even though benomyl-treated plots have less propagules of T. basicola per gram of soil than the check plots, the population levels were still fairly high and the reduction in blackhull in the benomyl-treated plots cannot be explained entirely on the basis of inoculum density alone. The use of benomyl as a soil treatment has not been approved by the Environmental Protection Agency. Appreciable reduction in blackhull occurred in field plots receiving benomyl as post-emergence foliar spray one and two months after planting. Benomyl-treated plots showed quality improvement but no advantage in yield over the nontreated check plots during the test period from 1971 to 1975.

PAPER

Eastern New Mexico produces over 90 percent of the Valencia peanuts in the United States. They are marketed almost exclusively for sale as raw or roasted peanuts in the hull. The supply of high quality Valencia peanuts has consistently fallen short of market demands. This shortage has been made more acute by losses due to the blackhull disease, a unique type of fruit discoloration which lowers the value of the crop for the normal market demand. Several species of fungi have been isolated in the laboratory from blackhull sections but Thielaviopsis basicola was determined to be the causal agent (4).

Benomyl[1] has been reported to be effective for the control of Thielaviopsis root rot of citrus, tobacco, poinsettia and bean (1, 2, 3, 5, 6, 7, 8). Pagavizas et al. (6) evaluated a large number of fungicides against black root rot of bean and tobacco and found only benomyl, thiabendazole, thiabendazole + 5-Ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole (ETMT), 2-methylsulfonyl-6-nitrobenzothiazole (MSNB), captan, maneb, tetrahydro-3,5-dimethyl-2H-thiadiazine-2-thione (DMTT), and sodium N-methyldithiocarbamate (SMDC) to be effective against the disease. They also found that MSNB controlled black root rot by greatly reducing inoculum density of the pathogen (T. basicola) in soil whereas benomyl did not appreciably change the inoculum density in soil.

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[1]Common and trade names are used in this article for convenience. Mention of their names is not intended as an endorsement of products by the New Mexico Agricultural Experiment Station, and does not imply its approval to the exclusion of other products that may also be suitable.

MATERIALS AND METHODS

Protective action of benomyl against attack by T. basicola was tested by means of treated paper discs or by dipped peanut pods in the laboratory. Filter paper discs were first dipped in benomyl solution at desired concentration and subsequently plated singly in groups of four on the surface of potato carrot dextrose agar in sterile petri dishes. Five mm plugs from seven to 10-day old T. basicola cultures were placed between the paper discs in the middle of the plate. Measurements of the rate of growth of T. basicola were made (in mm) in two, seven, ten and 14 days after inoculation. The percentage of growth was determined by dividing the final measurement by the total distance from the plug to the disc with lower percentage indicating the more effective inhibitive action of the chemical. As a second measure of chemical protective action, steam sterilized, whole, clean, undamaged, peanut pods were dipped in benomyl solution for one minute and then inoculated with plugs of T. basicola culture. Readings on the growth of T. basicola were taken two, seven, ten and 14 days after inoculation. Area fungal growth on inoculated peanut pod was expressed in percentage by dividing the final measurement of the plug growth by the total length of the peanut pod.

Greenhouse soil treatment test was conducted in 1970. Surface or subsurface soil was treated with benomyl at planting and every week thereafter up to seven weeks at the rate of 100 ppm (soil weight basis). Plants were dug four and one-half months after planting and blackhull readings of the pods were made at that time.

Soil treatment tests were conducted in fields which were known to produce peanut blackhull in the past and which were infested with T. basicola. Two methods of fungicidal applications were made during the period from 1971 to 1975. They were: (1) in-furrow band spray application at planting time and (2) post-emergence band spray application. For field plots, combinations of nozzle size, pressure and tractor speed delivered the desired rates of benomyl in ten gallons of spray solution per acre. Surfactant GAFAC PE-510 was used in the spray at .1% concentration to enhance the fungicidal activity and to improve coverage. Blackhull readings were often made before harvest on the basis of random pod samples from field plots. Final blackhull percentage and yield were obtained at harvest. Sometimes two blackhull percentages of the harvested peanuts were available; one from the official grading station on the basis of composite sample and the other was based on the average of five small individual samples from each test plot.

Experimental designs for field experiments were those of complete randomized block with two or more replications. Statistical analyses were made and least significant differences (L.S.D.) at five percent level were used to indicate whether or not significant differences in yield or disease incidence existed between treatments.

Soil samples for determination of T. basicola populations were taken from the soil treatment test plots in 1974 and in 1975. There were five monthly samplings from planting to harvest. Soil dilutions were prepared on a modified rose bengal streptomycin medium containing pentachloronitrobenzene (PCNB) at 500 ppm and Nystatin at 30 ppm (9).

RESULTS AND DISCUSSION

Table 1 shows the extent of growth of T. basicola on potato carrot dextrose agar plates bordered by chemically treated paper discs after 14 days. Benomyl showed high degrees of inhibition of T. basicola growth at several dosages from 2500 to 10,000 ppm in 1969. In 1974, benomyl showed varying degrees of inhibition of T. basicola growth at dosages from 75 to 500 ppm.

Table 1. Growth of T. basicola on PCDA plates bordered by chemically treated paper discs after 14 days, Plains Branch Station, Clovis, New Mexico. Each value being the average of six or more replications.

Chemical	Concentration	Growth of T. basicola on culture plates	
		1969	1974
	ppm	---------pct---------	
Benomyl	75		79
	150		50
	300		35
	500		18
	2,500	10	
	5,000	15	
	10,000	0	
Thiophanate-methyl	500		72
	1,000		54
	1,500		57
	3,000		45
Captafol	1,500		48
	3,000		47

Table 2 shows the extent of 14-day T. basicola growth on peanut pods first dipped in chemical solutions and subsequently inoculated. In 1969, benomyl at dosages from 2500 to 10,000 ppm completely inhibited T. basicola. Benomyl at concentrations as low as 50 to 100 ppm still caused considerable inhibition of T. basicola in 1970 and 1974.

Table 2. Extent T. basicola growth on chemically dipped peanut pods after 14 days, Plains Branch Station, Clovis, New Mexico. Each value being the average of six or more replications.

Chemical	Concentration	Area fungal growth on inoculated peanut pods		
		1969	1970	1974
	ppm	----------pct---------		
Benomyl	50		26	
	75			33
	100		0	
	150			8
	250		17	
	300			5
	500		0	0
	1,000		0	
	2,000		0	
	2,500	0		
	5,000	0		
	10,000	0		
Thiophanate-methyl	500			78
	1,000			50
	1,500			39
	3,000			23
Captafol	1,500			24
	3,000			18

Table 3 shows the blackhull percentages of large and small peanut pods produced in pathogen-infested soil treated with 100 ppm benomyl (soil weight basis) applied at zero to seven weekly intervals after planting. At harvest time, little or no blackhull was detected on large (over 1 cm long) or small peanut pods from pots receiving surface treatment up to six weeks after planting. Little or no blackhull was found on large pods from pots receiving subsurface treatment up to

five weeks after planting. There was some blackhull on small pods from pots receiving subsurface treatment at planting time, two, and four weeks after planting and on large and small pods receiving surface or subsurface treatments at six or seven weeks after planting, but the blackhull incidences were still considerably less than the untreated checks.

Table 3. Percent blackhull of Valencia peanut fruits produced in pathogen infested soil treated with 100 ppm benomyl at weekly intervals up to seven weeks after planting, Plains Branch Station, 1970.

Benomyl Treatment	Time of Application[1]	Blackhull	
		Large Pod[2]	Small Pod[2]
		----------pct----------	
Surface Application	0	0	0
	1	0	0
	2	0	0
	3	0	0
	4	11	0
	5	0	11
	6	0	0
	7	31	12
	Check	65	38
Subsurface Application	0	0	16
	1	0	0
	2	0	25
	3	0	0
	4	0	11
	5	3	0
	6	31	21
	7	17	17
	Check	88	40

[1]0 = at time of planting; 1 = 1 week after planting; 2 = 2 weeks after planting, etc. Check = no application at any time

[2]Large Pod = 1 cm or over in length
Small Pod = less than 1 cm in length

Encouraged by the promising control of T. basicola in the laboratory tests and of the disease by benomyl in the 1970 greenhouse test, an experiment was conducted in 1971 in the field using benomyl as an in-furrow band spray treatment at planting time at the rate of 2.27 kilograms active ingredient per hectare. As indicated in Table 4, benomyl-treated plots showed a striking reduction of blackhull at harvest time when compared to the check plots. In order to seek label clearance from the Environmental Protection Agency (EPA) for Benlate as in-furrow soil treatment at planting time, the tests were conducted at ten locations in 1972. The rates used were .57 to 1.13 kilograms of benomyl per hectare rather than the known effective 2.27 kilograms per hectare because of economic considerations. Benomyl-treated plots showed less lackhull than checks in six of the ten locations, especially at the 1.13 kilograms active ingredient per hectare rate. Average yield differences from the ten locations between the benomyl-treated plots and check plots were not statistically different at the five percent probability level. The differences in blackhull percentage between the benomyl-treated plots and check plots, however, exceeded the five percent level of significance. In 1973, benomyl tests were again conducted at two locations using rates of 1.13, 1.70 and 2.27 kilograms active ingredient per hectare. Benomyl-treated plots at all three dosages were effective in reducing blackhull as compared with the non-treated check plots at both locations. In 1974, discoloration percentages of the composite samples as determined by the grading stations were not used because these figures included discoloration caused by aerial contaminants as a result of excessive rain and humidity occurring after digging but before threshing. A critical examination of the peanut pod samples measured only peanut blackhull and not spotted discoloration. Benomyl and thiophanate-methyl treated plots indicated

considerably less blackhull than the check plots. Three chemical compounds were used as in-furrow soil treatment in 1975 at one location. Benomyl and thiophanate-methyl were effective in reducing blackhull whereas captafol was not. At the present time, neither benomyl nor thiophanate-methyl has been approved for use as in-furrow soil treatment by the Environmental Protection Agency.

Table 4. Yield and percent blackhull in field plots treated by in-furrow band spray application of fungicides at planting time, Portales, New Mexico.

Soil Treatment		Yield	Blackhull	
Compound	Rate (a.i.)		Composite	Av.
	kg/ha	kg/ha	--------pct--------	
1971, Peevey's farm				
Check	0	2486	37	31
Benomyl	2.27	2656	6	16
L.S.D. 5%		N.S.		10
1972, Ferguson's farm				
Check	0	1846	48	72
Benomyl	.57	2073	38	64
Benomyl	1.13	1907	32	51
L.S.D. 5%		N.S.		N.S.
1972, Gibson's farm				
Check	0	4313	33	38
Benomyl	.57	4131	23	21
Benomyl	1.13	4495	12	12
L.S.D. 5%		N.S.		12
1972, Chandler's farm				
Check	0	-	40	62
Benomyl	.57	-	40	55
Benomyl	1.13	-	28	48
L.S.D. 5%				N.S.
1972, Baker's farm				
Check	0	1889	28	42
Benomyl	.57	1825	28	13
Benomyl	1.13	1852	10	14
L.S.D. 5%		N.S.		18
1972, McGuyer's farm				
Check	0	-	15	14
Benomyl	.57	-	20	13
Benomyl	1.13	-	23	14
L.S.D. 5%				N.S.
1972, Victor's farm				
Check	0	-	60	60
Benomyl	.57	-	40	38
Benomyl	1.13	-	40	37
L.S.D. 5%				N.S.
1972, ENMU's farm				
Check	0	1846	50	76
Benomyl	.57	1998	40	70
Benomyl	1.13	1982	45	70
L.S.D. 5%		N.S.		N.S.

Table 4. Continued

Soil Treatment		Yield	Blackhull	
Compound	Rate (a.i.)		Composite	Av.
	kg/ha	kg/ha	---------pct---------	
		1972, Marchman's farm		
Check	0	2263	50	58
Benomyl	.57	2154	48	56
Benomyl	1.13	2185	40	53
L.S.D. 5%		N.S.		N.S.
		1972, Rackler's farm		
Check	0	2452	28	12
Benomyl	.28	1981	29	18
Benomyl	.57	2151	28	13
Benomyl	1.13	2315	22	8
Benomyl	2.27	2423	20	7
L.S.D. 5%		N.S.		N.S.
		1972, Rhodes' farm		
Check	0	1759	45	66
Benomyl	.57	1646	50	44
Benomyl	1.13	1816	40	65
L.S.D. 5%		N.S.		N.S.
		1972, Average of ten farms		
Check	0	2338	39.7	50.0
Benomyl	.57	2282	35.5	38.8
Benomyl	1.13	2364	29.2	37.2
L.S.D. 5%		N.S.	5.4	6.7
		1973, Baker's farm		
Check	0	1589	32	45
Benomyl	1.13	1612	15	22
Benomyl	1.70	1634	16	22
Benomyl	2.27	1612	15	24
L.S.D. 5%		N.S.		11
		1973, Gibson's farm		
Check	0	2792	32	47
Benomyl	1.13	3189	10	10
Benomyl	1.70	2917	10	9
Benomyl	2.27	3042	7	9
L.S.D. 5%		N.S.		9
		1974, Baker's farm		
Check	0	1725		58
Benomyl	1.13	1782		24
Benomyl	1.70	1805		16
Thiophanate-methyl	3.18	1759		31
L.S.D. 5%		N.S.		4
		1974, Gibson's farm		
Check	0	3677		51
Benomyl	1.13	3564		22
Benomyl	1.70	3609		18
Thiophanate-methyl	3.18	3677		21
L.S.D. 5%		N.S.		6

Table 4. Continued

Soil Treatment			Blackhull	
Compound	Rate (a.i.)	Yield	Composite	Av.
	kg/ha	kg/ha	--------pct--------	
		1975, Gibson's farm		
Check	0	2628	30	28
Benomyl	1.70	2717	12	19
Captafol	4.54	2670	23	27
Thiophanate-methyl	3.18	2641	19	25
L.S.D. 5%		N.S.		6

Table 5 shows the number of propagules of T. basicola per gram of soil (1:1000 dilution) on five sampling dates of the soil treatment tests conducted in 1974 and 1975. Check plots consistently had more propagules of T. basicola per gram of soil than the chemically treated plots. Benomyl at 1.70 kilograms active ingredient per hectare and thiophanate-methyl at 3.18 kilograms active ingredient per hectare had the least propagules per gram of soil in both years. However, even the benomyl and thiophanate-methyl treated plots had fairly high population of T. basicola and the reduction in blackhull in the treated plots by these two chemicals cannot be explained entirely on the basis of inoculum density alone.

Table 5. Number of propagules of Thielaviopsis basicola per gram of soil (1:1000 dilution) on five sampling dates of the soil treatment tests, Portales, 1974 and 1975.

Treatment		No. Propagules per Gram of Soil in the Sampling Mo.					
Compound	Rate (a.i.)	June	July	Aug.	Sept.	Oct.	Av.
	kg/ha						
		1974, Average of Two Farms (Baker's and Gibson's)					
Check	0	475	539	514	578	708	563
Benomyl	1.13	392	422	342	311	512	396
Benomyl	1.70	356	366	352	275	462	362
Thiophanate-methyl	3.18	316	362	289	303	425	339
		1975, Gibson's farm					
Check	0	611	700	589	622	722	649
Benomyl	1.70	433	600	433	467	533	493
Captafol	4.54	478	644	411	533	556	524
Thiophanate-methyl	3.18	467	611	356	467	600	500

Table 6 shows average yield and percent blackhull of field plots receiving benomyl and thiophanate-methyl post-emergence foliar spray treatment at flowering and/or later in field experiments conducted from 1971 to 1975. Benomyl has shown good control of blackhull in nearly every test conducted except the 1974 test on Brown's farm. Thiophanate-methyl also showed almost as good control of blackhull as benomyl in the 1974 and 1975 tests. The averages of three farms for two or three years or of six farms for four years from 1971 to 1974 showed benomyl-treated plots had considerably less blackhulled peanuts than the nontreated check plots. The averages of three farms for 1974 and 1975 showed benomyl and thiophanate-methyl effectively reduced blackhull as compared to the check.

Table 6. Yield and percent blackhull of field plots receiving post-emergence foliar spray treatment at flowering and/or later, Portales, New Mexico.

Compound	Rate (a.i.)	Yield	Blackhull
	kg/ha	kg/ha	pct
	1971, Jewett's farm		
Check	0	1873	59
Benomyl	1.13	2107	26
Benomyl	2.27	2021	33
L.S.D. 5%		N.S.	16
	1972, Baker's farm		
Check	0	2276	45
Benomyl	.57	2461	23
Benomyl	1.13	2654	24
L.S.D. 5%		N.S.	15
	1973, Marchman's farm		
Check	0	1793	59
Benomyl	.57	1861	32
Benomyl	1.13	1839	19
L.S.D. 5%		N.S.	21
	1973, Rea's farm		
Check	0	2803	18
Benomyl	.57	3030	10
Benomyl	1.13	2593	8
L.S.D. 5%		N.S.	N.S.
	1974, Brown's farm		
Check	0	2807	65
Benomyl	.28	2826	69
Benomyl	.57	2824	69
Benomyl	.85	2838	64
Benomyl	1.13	2726	61
L.S.D. 5%		N.S.	N.S.
	1974, Marchman's farm		
Check	0	-	61
Benomyl	1.13	-	33
Benomyl	2.27	-	24
Captafol	4.54	-	45
Captafol	9.08	-	49
Thiaphanate-methyl	1.59	-	37
Thiaphanate-methyl	3.18	-	34
L.S.D. 5%			10
	1974, Pittillo's farm		
Check	0	2111	58
Benomyl	1.13	2179	30
Thiaphanate-methyl	1.59	2384	32
L.S.D. 5%		N.S.	22
	1975, Brown's farm		
Check I	0	2499	32
Check II	0	2826	22
Benomyl	2.27	2673	11
Thiaphanate-methyl	3.18	2789	9
L.S.D. 5%		N.S.	14

Table 6. Continued

Compound	Rate (a.i.)	Yield	Blackhull
	kg/ha	kg/ha	pct
Average of three farms (1972 and 1973)			
Check	0	2290	41
Benomyl	.57	2450	22
Benomyl	1.13	2362	17
L.S.D. 5%		N.S.	18
Average of six farms (1971 to 1974, excluding 1974, Brown's farm)			
Check	0	2171	50
Benomyl	1.13	2275	23
L.S.D. 5%		N.S.	19
Average of three farms (1971, 1974 and 1975)			
Check	0	2186	51
Benomyl	2.27	2347	23
L.S.D. 5%		159	21
Average of three farms (1974 and 1975)			
Check	0	2305	50
Benomyl	1.13 to 2.27	2427	23
Thiaphanate-methyl	1.59 to 3.18	2586	26
L.S.D. 5%		167	9

The best times for post-emergence application appear to be early July or peanut flowering time and another application one month later. Thiophanate-methyl is still an experimental compound. Benomyl has received EPA label clearance for post-emergence foliar spray for leaf spot control at biweekly rates of .20 to .28 kilograms active ingredient per hectare from 35 days after planting to two weeks before harvest. The use of benomyl at the rates per application reported in this research is not approved for peanut production. Additional experiments are needed to develop the data required for a petition for label clearance at higher rates per application.

In general, benomyl, when used either as in-furrow soil treatment at planting time or post-emergence foliar spray application, did not influence yield one way or another as compared with the nontreated check under field conditions from 1971 to 1975 in New Mexico. The fluctuations in yield were due to environmental variations and not the effect of the chemical.

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Peanut Seed Germination as Related to Soil Water Regime During Pod Development[1/]

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The problem of poor peanut (Arachis hypogaea L.) seed germination has appeared to follow exceptionally dry years in Georgia; consequently, the interaction of soil water availability during the growing season and subsequent seed germination were studied. These results are a composite of four years of study under controlled rainfall shelters on Tifton loamy sand at six soil water levels. Soil water levels involved irrigation at specified matric potentials in surface 60 cm. Matric potentials ranged from -0.2 to -15 bar. It was found that allowing matric potential to reach -15 bar can lower the percentage of sound mature kernels by 50%. Of the sound mature kernels, germination was further lowered by 40% by allowing the plants to reach a condition of nonrecovery from wilt overnight. Virginia, Runner, and Spanish type peanuts were susceptible to drought in decreasing order. Soil water maintained above -0.2 bar mean matric potential in 0 to 60 cm depth gave the most consistent and highest yields with a four year average of 5874, 5858, and 4787 kg/ha for Virginia, Runner, and Spanish types, respectively. Irrigation appears to be good insurance against poor peanut seed germination in the following year. Water use efficiency values indicate the peanut is a rather efficient user of water.

1/ Contribution from Southern Piedmont Conservation Research Center, Watkinsville, Ga., 30677, Athens, Georgia Area, Southern Region, Agricultural Research Service, USDA, in cooperation with the Coastal Plain Experiment Station, University of Georgia College of Agriculture, Tifton, Georgia 31794. This research was supported in part by the Georgia Agricultural Commodity Commission for Peanuts.

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A MEANS TO BREAK DORMANCY OF PEANUT SEEDS IN THE FIELD

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ABSTRACT

Ethylene released from liquid 2-chloroethylphosphonic acid (ethrel) and now released from a powdered formulation of ethrel, breaks dormancy of Virginia-type 'NC-13' peanut seeds.

The powdered formulation of ethrel (15%/W) was diluted with fungicide (Orthocide/Botran, 60-20 S.P. dust PN 5213) and applied to the seeds by shaking in a plastic bag. Fifty seeds weighing about 42g were shaken with 0.3g of each ethrel-fungicide dilution. Concentrations of 0.5, 1, 3 and 5% ethrel were tested for their effects on rate and total emergence of dormant seeds from vermiculite/sand potting mixture and 2 different soils. Both soils were light sandy soils but one had a pH of 6.7 and the other 8.5. Also, seeds were stored after treatment and then planted at monthly intervals in the pH 6.7 soil to test the stability of the ethrel-fungicide mixture, as indicated by the emergence of the initially dormant seeds.

All concentrations of ethrel released the seeds from dormancy and at least 90% emergence was achieved. However, 1% ethrel provided the most rapid rate of emergence. Growth of the hypocotyl-radicle of afterripened seed samples treated with the 1% concentration was initially slower than controls, but recovery had occurred by the 5th day from planting. At this writing the ethrel-fungicide mixture has remained stable in storage for 2 months. The data suggest that the powdered ethrel could be combined with the usual fungicide treatment of peanut seeds to stimulate germination of dormant seeds in the field.

Fruiting Patterns of Virginia-Type Peanuts

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Knowledge of the fruiting patterns of peanut (Arachis hypogaea L.) cultivars would be useful in determining band widths for pesticides, designing new peanut equipment and adapting new production practices for specific cultivars. In this study, fruiting patterns of five large-seeded Virginia-type peanut cultivars were determined by dividing a 91 cm width row into seven equal sections and calculating the percentage of fruit in each section on a dry weight basis. 'Florigiant', 'Va. 72R' and 'NC 5' were classified as having a runner growth-habit while 'NC 17' and 'NC-Fla. 14' had a bunch growth-habit.

The runner type cultivars produced less fruit immediately around the taproot than did the bunch type cultivars. The bunch type cultivars, NC 17 and NC-Fla. 14, produced ca. 98% of their fruit within a 39 cm section centered over the taproot; whereas, the runner type cultivars, Florigiant, Va. 72R and NC 5, produced ca. 98% of their fruit in a 65 cm section. Runner cultivars produced a significantly higher percentage of their fruit on the side of the row having no soil compaction and/or vine damage from field equipment. There were no significant differences for the bunch-type cultivars.

PEANUT FRUIT GROWTH AS AFFECTED BY DATE OF PEGGING AND FRUIT LOAD

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ABSTRACT

Recently-penetrated pegs of Florunner peanut were tagged weekly for 7 weeks beginning June 10 and harvested at biweekly intervals to determine the influence of pegging date and fruit load on fruit growth rate. Information on the growth rate of early or late-set fruits will benefit modeling efforts and crop management.

Fruits set during the first 4 weeks of pegging had similar linear growth rates (33.5 mg/day) between 1 and 7 weeks after peg penetration into the soil and accounted for 78% of the 5450 kg/ha yield at 133 days. Fruits set during the 5th to 7th week of pegging grew at slower rates.

Early-set fruits were larger in size and heavier than later-set fruits such that 88, 74, 74, 56, 47, 51, and 45% of the fully-expanded, mature, 8-to-11-week-old fruits were larger than 11.1 mm pod diameter for fruits set during the 1, 2, 3, 4, 5, 6, and 7th week of pegging, respectively. Progressively smaller pod sizes for later-set fruits may result because older fruits are using photosynthate and less photosynthate is available for later-set fruits while they are in the pod expansion phase (first 2 to 3 weeks in the soil).

Fruits set during the 1, 2, 3, and 4th week appeared to grow for 10, 9, 8, and 7 weeks, respectively, at which age the pods were well-filled. Since growth rates were similar, the decreasing filling period appeared to be determined by pod size which was progressively smaller for later-set fruits.

EFFECTS OF GENOTYPE, LOCATION AND YEAR ON SIZE DISTRIBUTION OF RUNNER PEANUTS

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ABSTRACT

Early Runner, Florunner and F439-16-6 peanuts grown in Headland, Alabama; Yoakum, Texas; Tifton, Georgia; Stephenville, Texas; Marianna, Forida; and Holland, Virginia - as a part of the 1970 and '71 National-Regional Peanut Variety trials - were screened into three size categories. For each category, plus the average-kernel-weight of the largest category, statistical determinations were made as to the significance of mean-value differences attributed to the primary influences (genotype, location and year) and the secondary or interaction influences (genotype X location, genotype X year, location X year and genotype X location X year). Varying degrees of statistical significance were found among these tested influences, with several as significant as the 0.01% level of probability.

Peanut Responses to Inoculation and Nitrogen

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In 1975, an experiment was conducted as the Wiregrass Substation near Headland, Alabama to determine nodulation and yield responses of peanuts to seed-applied and soil-implant inoculants in soils. The influence of light applications of fertilizer N on these parameters was also determined.

Peanut rhizobia were present in adequate number for effective inoculation, even where peanuts had not been grown during the past 30 years. Nodulation was increased with granular soil-implant inoculants over that with conventional application to the seed in this situation. Application of NH_4NO_3 to provide 33 lb N/A at planting reduced nodulation by more than 50% and size of plants by 24%. Nitrogen content was increased at the early bloom stage. These differences did not influence peanut yield.

In soil where peanuts have been grown frequently in recent years, nodulation was abundant in all treatments. There were no differences in yield due to fertilizer N or inoculation High yields were abtained in all treatments.

These results suggest that nodulation may be enhanced by use of soil-implant inoculant in "new" peanut soils but that this may not result in yield increase. "Old" peanut soils apparently contain abundant rhizobia and are not likely to respond to any inoculation. No advantage was gained from fertilizer N in either situation.

MICROBIOLOGICAL AND CHEMICAL DETERMINATION OF TRYPTOPHAN, METHIONINE, AND NIACIN IN PEANUTS

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Twenty varieties of peanuts from the University of Florida were hydrolyzed with Ba)OH)$_2$·8 H_2O for 7 hrs in an autoclave, Assays with Lactobacillus plantarum resulted in an average of 7.13 mg/g tryptophan, while chemical analysis with dimethylaminobenzaldehyde yielded 6.19 mg/g. Methionine was released by acid hydrolysis for 1 hr in an autoclave and for 18 hrs in an oven at 110°C. Using Leuconostoc mesenterioides as test organism, average results were 6.76 mg/g for the 1 hr hydrolysis and 5.02 for the 18 hr hydrolysis. With the amino acid analyzer we obtained 4.8 mg/g. The variety Apollo was richest in methionine but lowest in % protein. For niacin assays cyanogen bromide was used as main reagent, and 17.3 mg/00 g whole peanut was the average.

SPINNING OF PEANUT PROTEIN FIBERS

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ABSTRACT

Raw Altika peanuts were blanched, partially defatted, ground and the protein was removed using an aqueous alkaline extraction, precipitated at pH 4.0, dialyzed and freeze dried to yield a protein concentrate with 85% protein, 3% fat and 1.9% ash on a dry weight basis. Peanut protein concentrate was used to produce dope solutions for the spinning of fibers. Viscosity of dope solutions increased rapidly with increases in protein concentrations from 11 to 14%; the highest protein concentration gelled within a short time after mixing. Dope solutions viscosity increased with increasing NaOH concentration from 0.85% to 0.90%. Higher NaOH concentrations, up to 1.05%, however, resulted in a continued decrease in dope viscosity. Dope viscosity increased as a function of maturation time, especially at NaOH concentrations that yielded the highest viscosities. The best conditions for spinning peanut protein fibers were: 1) dope pH 11.4, 2) maturation time of 10 hours for a 13.0% protein dope or 2 hours for 13.5% protein dope, 3) coagulating bath conditions of 2N acetic acid and 20% NaCl, and 4) dope extrusion pressure of 15 psi. Suitability of dope solutions for spinning depended on the interaction between protein concentration, pH and dope maturity.

Comparison of Protein and Amino Acid Composition of Various Preparations from Florunner (*Arachis hypogaea* L.) Peanuts Infected with Selected Fungi

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ABSTRACT

Lyophilized and defatted whole seed, and sodium phosphate buffer (pH 7.9, I = 0.01)-soluble and insoluble preparations from peanuts infected for intervals up to 7 days with *Aspergillus parasiticus*, *Aspergillus oryzae*, *Rhizopus oligosporus*, or *Neurospora sitophilia*, compared with noninfected seed, showed differences in protein and amino acid levels. Gel electrophoretic analysis of soluble fractions suggested different rates and/or mechanisms of protein hydrolysis for the various fungi included in this study. Percentage protein in soluble fractions of infected seeds decreased, while increases were noted in corresponding insoluble preparations during the test period; only minor quantitative and qualitative changes were noted in the controls. These changes were further confirmed by observations that total amino acid composition of soluble and insoluble preparations from infected seeds were continually changing while quantities of most free amino acids increased. Protein preparations from infected seeds usually contained higher quantities of certain essential amino acids, including threonine, methionine, isoleucine, leucine, phenylalanine, lysine, and arginine, than their control counterparts. These changes were dependent on the type of fungus infecting the seeds and the length of the test period.

RESPONSE OF PEANUT PROTEIN SPUN FIBERS TO APPLIED STRESSES

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ABSTRACT

Dope solutions prepared from peanuts protein concentrate were used for the spinning of fibers. The effects of protein concentration in the dope, as well as NaCl and acetic acid concentrations in the coagulating bath, storage duration at 1°C and orientation configuration on the responses of the spun fibers to applied stresses were studied. The Instron Universal Testing Machine model TM was used for all measurements. Spun fibers prepared from dope solutions containing 13.0% protein were more resistant to applied tensile and shear stresses than those prepared from 13.5% protein dope solutions. Fiber strength was maximal when acetic acid and NaCl concentrations were 2N and 20%, respectively. Minimum concentrations of 2N acetic acid and 15% NaCl in the coagulating bath were required for fiber formation. Stored fibers showed increased tensile strength, stretchability and resistance to shear than the non-stored fibers. Orientation test results showed that two fiber tows placed in a 45° orientation were more resistant to punch shear stresses than tows placed in 90°, random or parallel orientation. Two tows required higher punch shear forces than a single tow.

MEASUREMENT OF FLAVOR QUALITY OF RAW PEANUTS BY DIRECT GAS CHROMATOGRAPHY

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ABSTRACT

The direct gas chromatographic procedure for analysis of the volatiles of peanut butter and other food products was applied to raw peanuts. A 20-40 g sample of raw peanuts is ground for 1 min in a blendor, and 500-740 mg of the ground material is packed into a glass liner fitted at both ends with glass wool plugs. About 40 mg water is added to help distill the volatiles out of the sample and onto the head of the Porapak P column. The liner is placed into the heated inlet of a gas chromatograph and allowed to remain in place for 20-30 min, after which it is removed and temperature programming is begun. Several programming schemes were employed. A series of raw, Virginia type peanuts (1974 harvest) with Cler scores from 6.7 to 53, was analyzed and several GC relationships were correlated with the flavor scores. The GC peaks are tentatively identified, based on retention times of known compounds. Correlations, significant at the 1% level, existed between flavor scores and the logarithms of the ethanol-to-methanol and ethanol-to-total volatiles ratios. The ethanol content was higher in the poorer peanuts. A second series of peanuts (1975 harvest) with Cler scores from 56 to 64 showed correspondingly lower amounts of ethanol. For the two series combined, the correlation coefficients between the flavor scores and the ratios of ethanol-to-methanol and ethanol-to-total volatiles were - 0.87 and - 0.88, respectively.

A DISCUSSION OF SENSORY EVALUATION PANEL TRAINING TECHNIQUES DESIGNED FOR PEANUT BUTTER

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Abstract

Well-planned scientific experiments can yield inconclusive data if Sensory methods are not correctly applied. To be effective, Sensory methods must be planned as thoroughly as the chemical experimentation. Since many research laboratories have limited personnel, preference screening tests are impractical. Sensory methodology is flexible; existing methods can be adapted to effectively utilize the available population. One such method is the trained panel approach. Trained panelists can qualitatively and quantitatively analyze products according to predetermined criteria; criteria which they have been trained to evaluate.

FUNCTIONAL AND COOKIE-BAKING PROPERTIES OF HYDROLYZED PEANUT FLOUR

by

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ABSTRACT

Defatted peanut flour slurries were hydrolyzed with pepsin, bromelain, and trypsin at pH 2.0, 4.5, 7.6, respectively. Each test was conducted at 4°, 22°, and 50°C. Appropriate controls were also prepared. Suspensions were readjusted to pH 6.9, freeze-dried, pulverized, and evaluated for functional characteristics. Control flours which had been adjusted to pH 2.0 and, to a lesser extent, pH 4.5 and 7.6 had reduced nitrogen solubility when suspended in water at pH 2.0 - 9.0. Enzyme hydrolysis generally restored solubility; increases were especially notable at the isoelectric pH range (4.0 - 5.0) of most peanut proteins. The equilibrium moisture content at 97% equilibrium relative humidity was increased substantially in flours which had been adjusted to pH 2.0, with or without pepsin treatment. Adjustment of peanut flours to pH 2.0 markedly decreased emulsion capacity; however, pepsin hydrolysis (22° and 50°) resulted in emulsion capacities exceeding those of the untreated control. Color of dry test flours and flour pastes was darker than untreated control preparations, and pepsin hydrolysate pastes were undesirably bitter.

Flours which had been prepared at 50°C were incorporated in a cookie formula at wheat flour substitution levels of 5, 15, and 25%. Marked improvement in dough-handling characteristics was achieved through pH and enzyme treatments. Cookies containing untreated or treated peanut flour had generally increased volume and weight. With the exception of the bromelain hydrolysate, the use of peanut flour in cookies resulted in increased specific volume when compared to the 100% wheat flour control. Untreated peanut flour reduced the diameter and increased the height of cookies. This trend was reversed by hydrolyzing peanut flour protein. Top-grain was better in fortified cookies containing treated peanut flours as compared to those containing untreated material. Treatment of peanut flour resulted in improved appearance. The trypsin hydrolysate, substituted for 25% of wheat flour, produced an undesirable sulfur aroma and eggy flavor in cookies. The bitterness associated with pepsin hydrolysate pastes was not detectable in cookie formulations having up to 25% hydrolysate substitution.

PEANUT RESPONSES TO LANDPLASTER IN VIRGINIA ATTRIBUTABLE TO POD BREAKDOWN SUPPRESSION

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ABSTRACT

Pod breakdown disease incidence was measured in peanuts grown in experiments, during 1968 to 1975, which included landplaster applications of 0 or 672 to 896 kg/ha. Such rates were the normal basic rates of landplaster recommended in Virginia. Calculations of the portion of the responses in gross crop values per hectare that could be related to changes in pod breakdown disease are based on the assumption that pods which exhibited the disease in pre-harvest observations probably were lost before or during harvest. Contents of pods which had this disease in landplaster-treated plots averaged one-half that found in check plots. Pod breakdown disease incidence decreased in 22 and gross crop value increased in 21 out of 27 cases where landplaster was applied. The average increase in gross crop value was $98/ha, but responses ranged from 0 to $266/ha. Landplaster application increased average gross crop values on Hapludult soils $111/ha and on Paleudult soils $69/ha. Approximately 41% and 33% of the responses in gross crop value obtained on the Hapludult and Paleudult soils, respectively, were attributable to pod breakdown disease suppression. Residual double-acid extractable soil Ca levels were closely related neither to the total gross crop value responses to landplaster application nor to that portion of the response attributable to changes in rot.

Response of Five Peanut (Arachis hypogaea L.) Cultivars to Gypsum

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ABSTRACT

Research data has shown that peanut (Arachis hypogaea L.) cultivars differ in their response to application of gypsum. More recent data, however, have indicated that peanut cultivars respond similarly to Ca application. The similar response may be due to new peanut cultivars differing in their Ca requirements. Three commonly grown and two new peanut cultivars were grown on a low and high Ca soil to measure response to applied Ca. Gypsum was applied to a Fuquay loamy sand and Greenville sandy clay loam at 0 and 1121 kg per hectare in a split-plot design using Florunner, Ga 194R, Florigiant, NC-Fla 14, and UF70115 peanut cultivars. Other nutrients were applied uniformly. Yield, sound mature kernels (SMK), extra large kernels (ELK), and percent N and oil in the seed were measured. Experimental results showed that gypsum applications had no effect on yield or quality of the various cultivars on the high Ca Greenville soil. The gypsum application to the Fuquay soil which contained a low level of soil Ca increased yields, sound mature kernels and extra large kernels of Ga 194R, Florigiant, NC-Fla 14, and UF70115. Florunner produced higher yield and grades regardless of treatments. In general, gypsum applications increased the percent oil and decreased the percent N. On low or high Ca soil Florunner can produce higher yields and grades with or without gypsum, while Ga 194R, Florigiant, NC-Fla 14, and UF70115 on low Ca soil must have adequate Ca for good yields and quality.

The Peanut Seed-Hull Ratio As a Simple Maturity Index

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Abstract

A new, simple, and quantitative method has been established to determine peanut maturity. This new method is based upon the changing weight relationship of peanut seeds and hulls during maturation of the pods. The maturity index value is obtained by dividing the weight of peanuts seeds by the weight of their hulls. Maturity index values may be established for green peanut pods as well as for air-dried pods. Two years of data indicate that there is no significant difference between the fresh weight seed/hull maturity index (FMI) and the air-dried seed/hull maturity index (DMI). Comparison of the Physiological Maturity Index and the DMI show excellent correlation in three separate studies. The correlation coefficients were 0.92, and 0.95 and 0.90. The relationship between Arginine Maturity Index and DMI was also determined and the two maturity indexes were found to be correlated. Comparison of DMI and yield over eight harvest dates and nine planting dates showed correlation coefficients ranging from 0.88 to 0.98. Two peanut varieties, Florigiant and Florunner were tested and found to have different DMI values. How the seed/hull ratio to yield relationship maybe used as a criteria for selecting peanut plants with superior yield potential is also discussed.

AN EVALUATION OF TWO OBJECTIVE METHODS FOR ESTIMATING MATURITY IN PEANUTS

by

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ABSTRACT

Over the years, peanut maturity estimations have been based largely on subjective measurements. This paper reports on two objective methods which are both rapid and simple in operation and should be adaptable for field use. One method is based on the measurement of the light transmittance of a methanolic extract of freshly-dug peanut pods and the other method involves the electrical impedance measurement of peanut kernels. Results this past year show that they correlate with the age of the peanuts and dollar return per acre. Instrumentation for both methods is available commercially.

A Peanut Growth and Development Model

By

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A first generation FORTRAN computer program has been developed to simulate the growth and development of peanuts from the date of planting until harvest. Top growth, flowering, pegging, and fruiting are simulated by the program. Required inputs are daily values for maximum and minimum temperatures, radiation, and soil moisture level. Preliminary evaluations of the model have been made using growth data collected during 1974 and 1975 for the Florigiant and Florunner cultivars. A number of areas have been identified for further research to improve our understanding of peanut growth and development and to evaluate hypotheses included in the current model.

PEANUT YIELD POTENTIAL IN RHODESIA, ISRAEL, AND FLORIDA

by

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and

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Abstract

Solar radiation and temperatures have large effects on peanut yields that are not readily apparent in the United States where climatic differences in peanut growing regions are neither large nor clear cut. Under good management yields in Israel are larger than those in Florida because of higher solar radiation. The Rhodesian record yield of 8600 pounds per acre was made at an elevation of 5000 feet where temperatures were lower than either Israel or Florida and solar radiation was intermediate.

Simulation studies using the model SIMAIZ indicate that yields at the three locations with optimal levels of water and good management can be explained in terms of solar radiation and favorably low temperatures that slow fruit development and lengthen the filling period. A theorectically optimal environment for peanut yields should combine high solar radiation with lower average temperatures than are found in Florida or Israel and with a long growing season.

DRYING AND CURING SPANISH PEANUT PODS WITH SOLAR ENERGY

by

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ABSTRACT

Studies were conducted in developing and evaluating practical systems for drying and curing Spanish peanut pods using energy from low-cost air solar collectors. Four 3 square meter matrix solar collectors and individual drying bins (225 Kg capacity), operating at different flow rates, were used to test effects of collector flow rate and size, maximum drying temperature above 35 °C and length of drying cycle with temperatures greater than 35 °C on milling quality.

Studies under controlled environment conditions were also performed in an effort to determine effects of cyclic drying on peanut quality and temperature controls necessary for future solar drying research. Three temperature-time combinations were designed to simulate a solar drying day. Temperatures up to 57 °C were used for 2-hour durations.

AN OBJECTIVE METHOD FOR EVALUATING PEANUT SEED SIZE AND SHAPE CHARACTERISTICS

by

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ABSTRACT

An objective method for evaluating peanut seed size and shape characteristics is described. Use of the method is demonstrated by evaluating the Florunner variety and its four component genotypes. The method consists of handshelling and sizing representative subsamples of seed over slotted and round hole screens and evaluating outturns, seed size distribution, seed shape and seed count. A range of values for seed characteristics of runner varieties is presented and a rating procedure developed for use in evaluating seed characteristics of new varieties and genotypes.

DEVELOPMENT OF A SAMPLER FOR USE IN AUTOMATIC DUMP SCALES

by
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ABSTRACT

A sampling device for use in automatic dump scales was developed by redesign and modification of an apparatus originally conceived by Melvin and Wilbur Shell of Gorman, Texas. The sampler is operated by action of the dump scale gate counterweight and requires no other source of power. The sampler is easily adjusted so that the same amount of sample can be obtained from lot sizes of peanuts that range from 30,000 to 100,000 pounds. Construction cost of the sampler was less than $50 in quantity lots. Some aspects of design, construction, mounting and operation will be discussed.

REDUCTION OF SHELLING-PLANT NOISE CAUSED BY IMPINGEMENT OF PEANUTS

by
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ABSTRACT

Detailed measurements in several plants revealed that peanut pods and kernels striking metal surfaces cause a major portion of the overall noise level. In controlled tests, the amount of noise caused by peanuts impinging on flat metal plates was found to be greater for thinner metal, higher peanut flow rates, and higher drop heights. Other variables, such as plate size, mounting method, and component composition of peanuts also affected the values. Numerous damping treatments were evaluated for effectiveness of noise reduction, economy, and applicability to peanut shelling plants. Treatments were applied to selected surfaces in a pilot shelling plant, resulting in significant reduction in overall noise levels. Alternate techniques for handling peanuts during processing were also evaluated and found effective for reducing noise.

A PORTABLE AFLATOXIN ANALYSIS UNIT

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ABSTRACT

A self contained, portable instrument package for the analysis of aflatoxin contamination has been designed and constructed. The unit provides all essential equipment and supplies to utilize the minicolumn method recently published by C. E. Holaday and J. Lansden in the Journal of Agricultural and Food Chemistry. The analysis unit can function as a demonstration and educational aid and as a legitimate laboratory tool.

EVALUATION OF THE PEANUT ADMINISTRATIVE COMMITTEE AFLATOXIN TESTING PROGRAM

By

T. B. Whitaker and J. W. Dickens

Abstract

A computer model was used to estimate the probability of accepting or rejecting aflatoxin-contaminated lots of shelled peanuts for the 1975 Peanut Administrative Committee (PAC) aflatoxin testing program. The distribution of lots according to aflatoxin concentration that would have been accepted and of lots that would have been rejected by the testing program were estimated for the 1973 and 1974 U. S. peanut crops. The testing program was evaluated on the basis of cost to the peanut industry and accuracy of detecting lots with unacceptable concentrations of aflatoxin.

POTENTIAL HAZARDS OF LOW-OXYGEN STORAGE OF SHELLED PEANUTS

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ABSTRACT

Tests of both experimental and commercial samples have shown that moisture contents may vary considerably among individual kernels of shelled new-crop peanuts as received for storage. Decreases in processing quality ranging up to complete losses have also been observed when peanuts of moderately high moisture content were subjected to low-oxygen atmospheres through inadequate storage ventilation or use of inert or reducing atmospheres in storage or handling. To similate such conditions, shelled Virginia Bunch 67 peanuts with variable moisture averaging 8% were stored in unsealed and sealed containers at 100°, 70° and 33°F, with 0°F as control. Peanuts sealed under vacuum, CO_2, and N_2 were included for comparisons. Fruity aroma, sweet or off flavor, and excessive browning in heat processing began to develop in sealed peanuts after a few weeks at 100°F or a few months at 70°F, with noticeable changes in less than a year at 33°F. These changes were accompanied by increases in free fatty acids, volatile reducing substances and reducing sugars, with some decrease in sucrose. Decreases in tocopherols and increases in total carbonyls were not as great, however, as in the unsealed peanuts, which remained suitable for processing until quality was reduced by darkening of skins and development of rancidity at the higher temperatures.

PEANUT BREEDING STRATEGY: EARLY GENERATION MULTILINE VARIETY DEVELOPMENT

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ABSTRACT

This paper presents in detail the methodology for implementing the use of intra-varietal heterogeneity for improving peanut yield stability. The benefits of multiline varieties have been demonstrated with peanuts and other self-pollinated species, especially small grains. The procedure of utilizing early generation multilines in the composite of a new peanut variety has been practiced in Florida since the late 1930's. Nearly all of the varieties released by the Florida Agricultural Experiment Station could be classified as multiline strains or as early generation composites of from 4 to 10 sister lines selected in the F_3 to F_8 generations.

USE OF ACCELERATED GENERATION INCREASE PROGRAMS IN PEANUT BREEDING

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ABSTRACT

One of the major limiting factors in making progress in peanut breeding is the time required for variety development. Procedures reducing variety development time increase the efficiency of peanut breeding programs.

Accelerated generation increase programs using a modified pedigree breeding procedure (single-seed descent) in conjunction with greenhouse, phytotron, and winter increase nurseries in a tropical environment can be used to increase the efficiency of peanut breeding.

Near-homozygous lines (F_5 generation) were developed from F_1 embryos in 24 months using single-seed descent and greenhouse facilities while the regular pedigree method requires 48 months. An accelerated disease-resistance breeding program using the phytotron is being used to make crosses and grow five generations in a 24-month period. A recurrent selection scheme for peanuts requiring only 24 months per cycle is proposed using an accelerated generation increase program.

These methods illustrate the usefulness of accelerated generation increase programs in peanut breeding.

PEANUT BREEDING STRATEGY: MODIFIED COMPOSITE CROSS

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ABSTRACT

Peanut geneticists use several procedures for broadening the genetic base and alleviating the hazards of genetic vulnerability. In addition to the early generation multiline variety development procedure, a modified composite cross technique has been employed. The method exploits the variation released by combining complexly-bred parental lines. Mechanical pre-sizing of pods -- an objective method -- was used, in F_2 - F_5 progenies of the heterogeneous bulk populations, to select phenotypes meeting the rigid demands of the present peanut marketing system. In later generations, line selection was practiced for agronomic suitability and for growth characters that favor ease of production and harvest. Finally, strains are composited on shelling grade and market value criteria. The procedure has given populations with high agricultural value.

PEANUT BREEDING STRATEGY TO MINIMIZE AFLATOXIN CONTAMINATION[1/]

Aubrey C. Mixon[2/]

A B S T R A C T

Screening, selection and breeding procedures for increasing the resistance of peanut varieties to toxin-producing strains of Aspergillus flavus is reviewed and discussed. This includes sources and nature of resistance, variation of peanut genotypes to seed colonization, variation between fungal isolates of A. flavus, and factors associated with the interaction of aflatoxin-producing strains of the fungus and seed of peanut genotypes. The pros and cons of breeding an improved peanut variety with greater resistance to aflatoxin contamination are presented.

[1/] Part of a minisymposium on "Peanut Breeding Strategies" at the 8th annual meeting of the American Peanut Research and Education Association, Dallas, Texas, July 14-16, 1976.

[2/] Research Agronomist, Crops Research Unit, SR, ARS, USDA, Georgia Coastal Plain Station, Tifton, GA 31794.

STATUS OF INCORPORATING RESISTANCE TO CYLINDROCLADIUM BLACK ROT IN VIRGINIA TYPE PEANUT CULTIVARS

by
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ABSTRACT

Cylindrocladium Black Rot (CBR), caused by Calonectria crotalariae (Cylindrocladium crotalariae), is a devastating disease of peanuts (Arachis hypogaea L.) in the Virginia-North Carolina peanut area. CBR can reduce yield and value per acre by more than 75% as well as cause death of the plant. The peanut breeding strategy for incorporating resistance to CBR into acceptable commercial cultivars has been to identify those breeding lines having resistance by growing them in fields known to be infested with C. crotalariae. Once resistant lines are identified, inter- and intra-subspecific crosses are made to transfer the resistance into acceptable commercial cultivars. Over 150 cultivars and breeding lines have been screened for resistance to CBR, of which about 10% show some resistance to CBR. In general, Valencia types are the most susceptible, Spanish types the least susceptible, and Virginia types intermediate. Breeding methods being used include pedigree, backcross, composite cross and recurrent selection. The fungicide sodium azide and plant nutrition practices, such as increased levels of major and minor elements, may enhance resistance of cultivars and lines to CBR. Also, the genetic mechanism of resistance to CBR is being studied.

Selection Pressures Exerted by Seed Sizing

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ABSTRACT

Peanut (Arachis hypogaea, L.) cultivars and germplasm composed of genetically different seed sizes can respond to seed sizing selection pressures imposed by various techniques. The 'NC2' cultivar is an example of such an occurrence.

The 'Florunner' cultivar is composed of three to four sister lines, depending on the seed source, and could potentially be affected by seed sizing. Florunner seed sizing studies were initiated in 1972 and continued through 1976. A nested set of slotted grading screens were used in the studies for sizing seed. Differences in various performance traits were noted with field plantings of sized Florunner seed. Vegetative traits consistently responded to seed sizing, but reproductive traits, such as yield, were not as consistent. Larger seed sizes generally gave more desirable agronomic performance. However, differences in yield between seed sizes riding a 6.75 mm screen or larger were not obtained. Size distribution of harvested seed indicated that the planting seed size could have a significant effect on the distribution of harvested seed size. Additional cycles of seed size selection have been conducted. These latter data (3-4 years) have not been analyzed at this time, but no dramatic response to sizing has been evident with Florunner.

BREEDING FOR POD ROT RESISTANCE

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ABSTRACT

Forty-four genotypes have been compared for pod discoloration due to soil-borne fungi in seven South Texas tests since 1974. Entries were comprised of adapted cultivars, breeding lines and introductions reported previously as Pythium spp. resistant. Test sites were located in production fields with histories of high pod rot incidence. Differences among entries in amount of pod damage was significant statistically in six of the seven tests. Entries with the least pod damage were Spanish and Valencia in type.

Pod rot ratings on Goldin 1 x P.I. 341885 F_3 plant rows ranged from 0.5 to 9.5 on a scale of 0 (no discoloration) to 10 (complete discoloration) in 1974. Parental checks averaged 5.0 and 2.8 for Goldin 1 and P.I. 341885, respectively. Independent ratings by cooperating investigators were highly correlated.

Progenies of F_3 families selected as high, intermediate and low in pod discoloration were tested as F_4 bulk populations derived from single F_2 plants in 1975. No correlation was found between F_3 and F_4 ratings. Selection among F_3 families was thus concluded as ineffective.

F_4 pod rot ratings and percentage of damaged kernels were significantly correlated with a coefficient of 0.53. Duration of infection and ability of fungi to penetrate the hulls have important effects on this correlation.

PEANUT BREEDING STRATEGY: TO TRANSFER INTERSPECIFIC GENETIC INFORMATION TO THE CULTIVATED PEANUT

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ABSTRACT

Yield potential of commercial varieties of peanuts could be improved if proper utilization could be made of some of the wild species of peanuts that possess disease, insect, and nematode resistance. Isolating mechanisms such as embryo abortion, seedling lethals, pollen and egg sterility, and flowering inhibition have created barriers that prevent direct utilization of these wild resources in current peanut variety development programs. Progress by geneticists in overcoming these barriers has been slow but continuous. Though poorly understood, the specific mechanisms creating these barriers are under study. Several pathways for eliminating or bypassing the barriers are being pursued. Suspected reasons for hybridization failures and alternative courses of action to permit success were discussed.

PEANUT BREEDING STRATEGY TO EXPLOIT SOURCES OF VARIABILITY FROM WILD *ARACHIS* SPECIES
I. The Sources.

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ABSTRACT

Approximately 200 accessions of wild *Arachis* are available in various collections. These materials probably represent something less than 50 species.

The *Arachis* genus has been divided into seven taxonomical sections. Traits useful for improvement of the cultivated peanut have been identified in all sections. Characters identified include: resistance to leaf spot, nematodes, lesser cornstalk borer, spider mites, rosette virus, stunt virus, peanut rust and tobacco thrips. Also, drouth tolerance, pod rot resistance, green peg strength, southern blight tolerance and web blotch resistance have been observed. Several of the characters have been well documented with research data, others have been identified by observation only.

Intersectional hybrids have been made involving six of the sections. However, three sections remain totally isolated from the *Arachis* section at this writing. Projects in North Carolina, Oklahoma and Texas are attempting to circumvent isolation barriers between sections and/or species.

Interspecific Hybridisation in Arachis

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The U.K. Ministry of Overseas Development has sponsored research at Reading University to transfer resistance to Cercospora leaf spot disease into A. hypogaea. Triploid hybrids have been produced with A. chacoense and with A. cardenasii, and an A. chacoense x A. cardenasii hybrid has been crossed successfully with A. hypogaea.

Sterile triploid hybrids have been treated with Colchicine, and over 200 fertile hexaploids produced, which have been backcrossed with A. hypogaea, but the pentaploids have reduced fertility.

Progeny from an A. hypogaea x A. cardenasii hexaploid, produced by J. Smartt, has been found to consist of plants with 40, 42 or 44 chromosomes.

Seed has been sent to Nigeria, Malawi and India for screening for Cercospora resistance.

Hybrids have also been produced between A. hypogaea and four other species.

Chromosome numbers of A. hypogaea seedlings grown from small seeds of five cultivars were counted to initiate a programme of isolation of aneuploids. Of 26 seedlings counted, 11 had 42 chromosomes, 2 had 44 chromosomes, and 13 had 40 chromosomes.

Benomyl Control of Thielaviopsis basicola, The Causal Fungus of Peanut Blackhull Disease

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On the basis of 14-day growth of T. basicola plugs on potato carrot dextrose agar plates bordered by chemically treated paper discs, and on the basis of 14-day T. basicola growth on peanut pods first dipped in chemical solutions and subsequently inoculated, benomyl at concentrations as low as 50 to 150 ppm caused considerable inhibition of T. basicola. In a greenhouse test, pathogen-infested soil was treated with 100 ppm benomyl (soil weight basis) which was applied at zero to seven weekly intervals after planting. No blackhull was detected on large peanut pods (over 1 cm long) in pots receiving surface or subsurface treatment up to the first three weeks after planting. There was some blackhull on large pods in pots treated with benomyl four weeks after planting but the amounts were still considerably less than the untreated check. Using benomyl as an in-furrow band spray treatment at planting time at 1.13 to 2.27 kilograms active ingredient per hectare effectively controlled blackhull in the field since 1971. The use of benomyl as a soil treatment, however, has not been approved by the Environmental Protection Agency. Even though benomyl-treated plots have less propagules of T. basicola per gram of soil than the check plots, the population levels were still high and the reduction in blackhull in the benomyl-treated plots cannot be explained entirely on the basis of inoculum density alone. Appreciable reduction in blackhull occurred in field plots receiving benomyl as post-emergence foliar spray one and two months after planting. Benomyl-treated plots showed quality improvement but no advantage in yield over the nontreated check plots during the testing period from 1971 to 1975.

PYTHIUM POD ROT CONTROL IN SOUTH TEXAS

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ABSTRACT

Pythium pod rot, caused by Pythium myriotylum Dreschler, is a major soil borne disease of peanuts in South Texas. The disease is increasing in severity under irrigation and especially following periods of excessive rainfall. P. myriotylum is often associated with other pathogenic microorganisms in a disease complex in peanut fields in South Texas. The control of this disease is often difficult because of the other associated microorganisms and environmental and soil conditions which are involved in the disease development under field conditions.

Selected soil amendments, fungicides and nematicides were applied alone and in various combinations in randomized complete block or split-plot design experiments in 1971-75 for control of the disease. Data were recorded on yield, quality and value for the various treatments in each experiment. The pathogenic microorganisms were isolated and identified in each test. Root and pod rot disease indices were recorded.

The results obtained with the various treatments were dependent upon the particular disease problem in each location. In La Salle County tests with P. myriotylum as the dominant pathogen and with poor quality high sodium irrigation water, fungicides were generally less effective than gypsum for control of the disease. Post applications of 500, 1000 and 2000 lbs (560, 1120 2240 kg/ha) per acre of gypsum in a 12 to 15 inch band (30.5 to 38.1 cm) were more effective in reducing the disease than preplant incorporated or planting time treatments. Fungicides, gypsum or combination treatments were effective in reducing Pythium pod rot in Frio and Atascosa County tests where water quality was not a problem. In experiments with P. myriotylum, Rhizoctonia solani Kuehn and Fusarium sp., fungicide combinations were needed for effective disease control. In locations with a disease complex including parasitic nematodes, treatment combinations including a nematicide and fungicide were necessary for most effective control of the disease.

LAND PREPARATION METHODS AND THEIR EFFECTS ON CONTROL OF SCLEROTIUM ROLFSII

Lawton E. Samples1/

ABSTRACT

The principal of deeply burying organic residues with a moldboard plow as a control for Sclerotium rolfsii has been documented. Development in land preparation methods have been introduced recently without knowledge of their effect on peanut yield and disease development. Studies were made at two locations in Georgia during 1974 to determine the effects of various land preparation methods on peanut yield and S. rolfsii development. These studies were repeated in 1975 to further study effects of land preparation on peanut yields and quality. Deep-turn treatments at both locations gave highest yield (3841 lbs/A) and lowest disease incidence (14 disease loci/100 ft. row). In these treatments, the soil was deep-turned with a mold-board plow to bury the organic residue below three inches deep. Rip-hip treatments at both locations gave lowest yields (2987 lbs/A) and showed a higher disease incidence (23 disease loci/100 ft row). Comparasions were also made where the soil was deep-turned followed by ripping under the row and hipping to form a bed.

From these data it appears that burying plant residue deep with a moldboard plow should continue to be a stressed as a means of reducing loss from white mold, especially in fields with previous disease history. The data also suggests that rip-hip type culture which leaves the organic residue near the soil surface will result in increased disease pressure and reduction in peanut yield.

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MULTIPLE FOLIAR APPLICATIONS OF BRAVO 6F-KYLAR 85W TANK MIXES: EFFECTS ON YIELD, FOLIAR DISEASE CONTROL, AND GRADE FACTORS OF PEANUTS

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ABSTRACT

To determine the feasibility of a combined fungicide-growth regulator spray program for peanuts in Texas, tank mixes of Bravo 6F and Kylar 85W were evaluated during three growing seasons. Bravo 6F + Kylar 85W treatments were applied as multiple foliar sprays on Arachis hypogaea 'Starr' in 1973 and 1974 and on A. hypogaea 'Florunner' in 1975. Four treatments were evaluated: (1) Multiple applications (four to five per season) of Bravo 6F at 1.5 pt/acre in 15 gal H_2O. (2) Multiple applications of Bravo 6F at 1.5 pt/acre + 0.25 lb Kylar 85W in each application. (3) Multiple applications of Bravo 6F at 1.5 pt/acre in 15 gal H_2O + 1.0 lb Kylar 85W at 58 to 62 days after planting and + 0.50 lb Kylar 85W at 77 to 93 days after planting. (4) Unsprayed control. Starr yield data from Treatments 1, 2 and 3 were not significantly different from each other within each of two years. However, in the 1975 test with Florunner the yield of Treatment 3 was significantly less than the yield of Treatment 1. Within each of three growing seasons the final foliar disease index for Treatments 1, 2 and 3 was not significantly different. Although statistical evidence was not obtained, we observed that reduced plant height was associated with Treatments 2 and 3 during all three years, and that it was most visually evident in Treatment 2. In the 1973 test the SMK values for Treatments 1, 2 and 3 were not significantly different, but in 1974 the SMK value for Treatment 2 was significantly less than that for Treatments 1 and 3. In the 1975 test with Florunner the SMK values for Treatment 3 were significantly less than those for Treatments 1 and 2. Differences in the DK and OK values were non-significant during all three years. Although the Bravo 6F + Kylar 85W tank mix treatments usually were not deleterious, we conclude that there is insufficient evidence to justify the use of a Bravo 6F + Kylar 85W tank mix foliar spray on peanuts in Texas.

RADIOMETRIC MONITORING OF PEANUT FOLIAR DISEASES

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ABSTRACT

A remote sensing experiment was undertaken in 1975 to examine the epidemiology of peanut foliar diseases and to improve the existing foliar disease control program. Field plots were established with different levels of disease control maintained by different rates and varieties of fungicidal sprays. The seasonal development of the foliar diseases was monitored by quantitative defoliation counts and qualitative defoliation observations three times during the growing season. Clearly distinguishable levels of defoliation and yield were recorded during the monitoring period. In conjunction with the epidemic progress estimates, radiometric data were acquired with a radiometer that simulates the four Landsat bandwidths. The reflectance values of the bandwidths were combined in such a manner to define a parameter which has good correlation with defoliation. In addition, pattern recognition techniques were applied to the radiometric data. The results indicate the probability of correctly distinguishing between treatment levels by the radiometric data is greater than 88% if the best observation date is used alone.

MEASUREMENTS OF CYLINDROCLADIUM BLACK ROT DEVELOPMENT IN PEANUT FIELDS BY USE OF REMOTE SENSING

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ABSTRACT

Cylindrocladium black rot (CBR) development in peanuts, caused by Cylindrocladium crotalariae, was measured in a 300 square mile section of Southampton County, Virginia during 1974 and 1975 using false color infrared imagery. Measurements of diseased areas were made with a compensating polar planimeter. The number of peanut fields with CBR in 1975 was almost three times the number of fields found diseased in 1974. Thirty-one fields were confirmed as having CBR in 1974. In these fields, containing ca. 204 ha, severe CBR occurred in ca. 16 ha. Eighty-eight fields, containing ca. 483 ha, were confirmed as having CBR in 1975. Severe CBR occurred in ca. 12 ha. Eight fields were found with CBR in 1975 in which peanuts were planted in both 1974 and 1975. In six of these the 1974 imagery revealed no CBR in 1974. In the two fields in which CBR had been found in 1974 the disease was more severe in 1975. Results of this research indicate that aerial photography could provide a means of mapping the extent and severity of CBR over large areas rapidly, accurately and economically.

SUSCEPTIBILITY OF PEANUT VARIETIES TO OZONE

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ABSTRACT

Ten peanut varieties and one numbered line were exposed to 0.50 ppm. ozone for 8 hours at 21°C, 75% RH, and 25 Klux light intensity in a controlled environment exposure chamber. Prior to and following exposure to ozone, all plants were maintained in a greenhouse. Twelve plants of each variety were utilized in each of two replications. Five days after exposure a previously determined severity index was used to evaluate the ozone injury on each plant. Results were as follows: Valencia A (83.5 - most susceptible), Argentine (71.8), Chico (56.1), PDRS-76 (50.1), NC-FLA 14 (35.2), Starr (29.9), Tamnut 74 (26.1), Florunner (0.5), Early Runner (0.0), Spancross (0.0), and NC-2 (0.0 - resistant). Data are currently being analyzed for comparison with field observations of apparent ozone injury to peanut foliage.

VARIABLE CHROMOSOME NUMBERS IN TWO "AMPHIDIPLOID" POPULATIONS OF *ARACHIS*

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ABSTRACT

Chromosome counts were made on two populations obtained after doubling the chromosome complement of a triploid hybrid between *Arachis hypogaea* and *A. cardenasii*[1/]. Chromosome numbers of the F_7C_7 plants ranged from 32 to 43 and from 32 to 48 in the two populations, but 40 counts were in the highest frequency with almost half of the plants in this category.

Chromosome numbers of selected F_8C_8 plant rows were stable for some lines and apparently unstable for others. Most of the unstable plant rows could be identified by phenotype in the field nursery. It appeared that chromosome loss and/or fragmentation were common occurrences in most plants. Considerable difficulty was encountered in establishing exact counts because of the fragmentation. Variable counts were made on each plant evaluated.

The plants were not true amphidiploids; however, the populations were hybrid, and characters of both species were evident in each population.

[1/]The two populations were obtained from Dr. W.C. Gregory, North Carolina State University, Raleigh, North Carolina.

Tolerance to colonization by *Aspergillus flavus* found in certain peanut (*Arachis hypogaea* L.) breeding lines and cultivars.[1]

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ABSTRACT

A modification of a prodecure developed by A. C. Mixon was used for screening over 1000 peanut breeding lines and cultivars for tolerance to *Aspergillus flavus* at the University of Florida for the five years, 1971-1975. The average percentage of peanut seeds with sporulating colonies of *A. flavus* ranged from less than 10% to 100% in each year, 1971-1974. Several breeding lines were consistently more tolerant to *A. flavus* than commonly grown cultivars. One breeding line, UF71513, averaged 4, 13, 18 and 4% colonization while Florunner averaged 34, 22, 39, and 25%, respectively, for the years 1971-1974. For the three years, 1972-1974, two introductions released by A. C. Mixon (PI337394F and PI337409) averaged 27, 21 and 10% and 24, 21 and 13%, respectively. Some breeding lines selected for agronomic reasons have been as tolerant as UF71513. Since significant differences in tolerance have occurred even among different plantings of the same line in one year, the tolerance of the lines mentioned above or of any other given line, may not be adequately expressed until it has been evaluated after several different types of growing seasons.

1). This investigation was supported in part by the Agricultural Research Service, U.S. Dept. of Agriculture under Co-operative Agreement No. 12-14-7001-141.

USE OF THE MAJOR PROTEIN COMPONENTS PRESENT IN THE PEANUT SEED (*ARACHIS HYPOGAEA* L.) TO POSSIBLY MONITOR PLANT BREEDING INVESTIGATIONS

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Methodology has been developed to successfully isolate and purify the major protein components present in the peanut (*A. hypogaea*) seed. Because of space, the overall procedure will not be described here in detail. In essence, it involves combinations of sodium lauryl sulfate (SLS) polyacrylamide gel electrophoretic (PAGE) resolution of components, column chromatographic refinement and mini-beeker desalting via dialysis followed by concentration steps. Amino acid analyses of the resulting purified components reveal that they do not possess the same amino acid or nutritional composition. Preliminary evidence indicates that some are glycoprotein in nature in that covalently attached carbohydrate maybe present. This chemical information in addition to the previously reported finding that a universal standard electropherogram protein pattern exists for all or most peanut genotypes allow possible innovation in plant breeding experiments. That is, crossess might be made between selected varieties by SLS PAGE monitoring of the components considered by the investigator as desirable. The finding that all varieties do not contain the same amounts of each detected protein component enhances this idea. Thus, varieties need to be characterized and classified according to amounts of the individual components each possess. Some classification has been performed in this laboratory.

MORE ON AMINO ACID SURVEY

Julius L. Heinis

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Assays of over 200 peanut selections, each in triplicate, has created a mass of data. The decision was made to express the results in mg/gr defatted peanuts. This created less error in our case than the use of % by weight or residues per thousand. Values for methionine, cystine and proline, which were low and had high variability, could be included without affecting other amino acids.

When Pearson correlation coefficients from 560 observations were calculated by the computer, methionine was found to be negatively correlated to % protein. Therefore it appears to breed or find a peanut variety high in both methionine and protein.

MANAGEMENT OF LEAF-FEEDING INSECTS ON TEXAS PEANUTS

Clifford E. Hoelscher[1/] and Joel E. Curtis[2/]

A computer crop model has been developed to aid peanut producers in making production decisions regarding the need for chemical treatments for four species of leaf-feeding insects. Program operations have been initially developed to work with the Star variety produced under irrigation. Recently completed research has demonstrated that some plant foliage can be consumed by insects without reducing peanut yield. Variable factors considered in the model include the following: 1) age of plant, 2) number of insects present per-foot-of-row, 3) size distribution of larval population, 4) species present in sample making up infestation, 5) desired plant age for initiation of % foliage and % yield loss, and 6) time interval desired for predicted data. Estimated dollar loss in yield can be predicted by estimating the production level and correlating estimated % yield reduction. Field evaluations of the estimated loss and actual field loss were conducted in Comanche County, Texas during the 1975 production season. The model and data is written in FORTRAN with data computed on the AUTO BATCH system, which provides output data very rapidly.

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SCREENING FOR GENETIC TOLERANCE TO COLD TEMPERATURE DURING GERMINATION IN PEANUTS (ARACHIS HYPOGAEA L.)

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ABSTRACT

Many spring-planted crops in Oklahoma, including peanuts, suffer chilling injury soon after planting. Tolerance to cold soils should enhance early growth and thus extend the growing season by permitting earlier planting. The earlier planting date would allow a later-maturing variety to be planted to maximize yields or would allow earlier varieties to be harvested earlier, thus escaping the dangers of freezing temperatures in the fall. The first objective of this study was to develop a procedure for identifying sources of resistance or tolerance in peanuts to cold temperatures during germination. Once a suitable technique was developed, peanut germ plasm was screened to identify the best levels of cold tolerance available. Two chest-type growth chambers were used for this study. One chamber was set for the optimum temperature for peanut seed germination. This served as a check for the viability or seed quality of the specific seed lots being evaluated in a particular trial. The other chamber was set at specified temperatures for specified periods of times to give the duplicate seed samples a severe cold stress treatment during germination. Emergence counts were made at the end of three weeks. The seedlings were then classified into four categories: normal, intermediate, abnormal, and non-germinated. The data obtained from the emergence counts and classification were plotted on a uniform scattered diagram, to help in determining susceptible and tolerant accessions, by using the S.A.S. program in the University Computer Center. Plant selections were made during classification of the seedlings which had been exposed to the cold temperatures during germination. Exceptionally vigorous seedlings were selected from the seed lots and were transplanted and grown to maturity. These selections could possibly differ genetically for genes and alleles determining chill tolerances. Seed produced by these selections are being evaluated for cold tolerance to see if heritable differences do exist. Since wide differences appear to exist among the germ plasm accessions for susceptibility and tolerance to chill temperatures, genetic crosses are being made to determine the inheritance. Procedures and results to date will be discussed.

PROGRESS REPORT: INTERACTIONS AMONG SIX PEANUT CULTIVARS, HERBICIDE SEQUENCES, AND A SYSTEMIC INSECTICIDE

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ABSTRACT

Interactions among six peanut cultivars, herbicide sequences and a systemic insecticide were studied at Ashburn, GA in 1975 on a Tifton loamy sand. The systemic insecticide (split-split-plot) was disulfoton (O,O-diethyl-S[2-ethylthio)=ethyl] phosphorodithioate. The five split-plot herbicide treatments, applied at the customary times, were (a) vernolate (S-propyl dipropylthiocarbamate); (b) benefin (N-butyl-N-ethyl-α,α,α-trifluoro-2,6-dinitro-p-toluidine); (c) a "ground-crack" mixture of alachlor (2-chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide plus naptalam-dinoseb (N-1-napthylphthalamic acid) plus (2-sec-butyl-4,6-dinitro-phenol); (d) dinoseb as a postemergence treatment repeated four times; and finally (e) 2,4-DB. The other split-plot treatments were (a) all the aforementioned herbicides applied in sequence and (b) no herbicides. All uncontrolled weeds were removed by cultivation or by hand to minimize the confounding effects of weed competition. The six peanut cultivars (whole plots) were 'GK 3' and 'UF 70115' (Virginia type); 'Florunner' and 'GK 148' (Runner type); 'Tamnut 74' and 'GK 19' (Spanish type). Analyses of variance were made on yield, germination, weight/100 seed, and market quality. Yields, averaged across varieties, were reduced significantly by herbicides in sequence but not by any herbicide applied singly. The cultivar x herbicide interaction effects on yield were not significant in 1975. Germination percent and weight/100 seed were higher for 2,4-DB than for the untreated check. The intensive herbicide sequence significantly reduced weight/100 seed, percent of SMK's, and percent meats. The cultivar x herbicide interaction was significant for weight/100 seed and percent SMK's. The insecticide disulfoton increased average peanut yields by over 200 lb/A. The cultivar x disulfoton interaction was not significant for yields. However, disulfoton interacted significantly with herbicides to increase the percent SMK's where disulfoton was used within the intensive sequence.

COMBINATIONS OF NEMATICIDES AND PCNB FOR CONTROL OF THE SOUTHERN BLIGHT X ROOT-KNOT NEMATODE COMPLEX

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ABSTRACT

Contact and systemic nematicides were evaluated alone and in combination with PCNB for control of Sclerotium rolfsii and the root-knot nematode Meloidogyne arenaria on Florunner peanuts. The experiment was located in a field with severe infestations of both pathogens. Fensulfothion, ethoprop, and phenamiphos were sprayed and disk-incorporated at planting time at the rate of 4 lbs a.i./acre in an 18" band; these nematicides were also tank-mixed with PCNB (10 lbs a.i./acre) and applied in the same manner. A no treatment control and a treatment with PCNB alone were also included. Each treatment was replicated 8 times. PCNB and the contact nematicides ethoprop and fensulfothion failed to significantly reduce severity of disease caused by S. rolfsii when applied alone; however, combinations of these nematicides and PCNB resulted in significant reductions in the disease. The systemic nematicide phenamiphos significantly reduced disease severity and no additional control was obtained by mixing it with PCNB. The number of larvae of M. arenaria in soil was not significantly reduced by any of the nematicides or PCNB alone; however, combinations of PCNB with either ethoprop or phenamiphos resulted in significant decreases in larval numbers. All nematicides when used alone gave significant yield increases but PCNB did not. Ethoprop was the only nematicide that resulted in a significant increment in yield when mixed with PCNB over the yield obtained by its use alone. These data indicate that the performance of planting time applications of mixtures of nematicides with PCNB depend on the nature of the nematicide and that some combinations are not beneficial.

EFFECTIVENESS OF DBCP AND PCNB TANK-MIXTURES FOR CONTROL OF ROOT-KNOT NEMATODE AND SOUTHERN BLIGHT IN PEANUTS

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ABSTRACT

Tank-mixed combinations of the fumigant nematicide DBCP and the soil fungicide PCNB were evaluated for effectiveness against Southern blight (Sclerotium rolfsii) and root-knot nematode (Meloidogyne arenaria) in Florunner peanuts. The field chosen for the study was severely infested with the two pathogens, and the soil was a sandy loam. DBCP was sprayed and disk-incorporated in an 18" band at planting time at rates of: 0, 2, 3, and 4 gal/acre, using the Fumazone 86 E formulation; tank-mixed combinations of each of these rates with PCNB (10 lbs a.i./acre) were also included. Each treatment was represented by 8 replications each 2-row (36") x 30 feet. Severity of Southern blight, determined at harvest time, was not significantly different in plots with DBCP or PCNB alone. The only DBCP + PCNB combination treatment that showed significant reduction in severity of the disease was that with 2 gal/acre of the fumigant; all other combination treatments were not significantly different from the control. Significant reductions in the numbers of larvae of root-knot nematode in soil were observed for rates of DBCP higher than 2 gal/acre and for all DBCP + PCNB treatments. All plots receiving DBCP alone or in combination with PCNB produced significant yield increases; however, at equivalent DBCP rates, no significant increase in yield was obtained by mixing DBCP with PCNB over what was obtained with DBCP alone. Our results indicate that planting time spray applications of DBCP are effective for control of root-knot nematodes in peanuts but that similar applications of tank-mixtures of the fumigant with PCNB are of doubtful economic benefit.

GUAZATINE TRIACETATE, A NEW LOCALLY SYSTEMIC FUNGICIDE EXHIBITING REPELLENCY TO LEPIDOPTEROUS LARVAE

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ABSTRACT

The experimental fungicide guazatine triacetate (9-aza-1,17-diguanidinoheptadecane triacetate) was evaluated in field trials for control of Cercospora leafspot of Florunner peanuts at rates of 3 and 6 pints (2 lbs a.i./gal) per acre during the 1975 season. Results indicated that the fungicide was very effective as a control for Cercospora at the rates tested, and in addition, significantly reduced levels of feeding damage from lepidopterous larvae. Evaluations in greenhouse and laboratory indicated no toxicity when larvae of the soybean looper, Pseudoplusia includens were sprayed directly, but the larvae would not feed on treated foliage for more than a short period of time. Oviposition on treated plants was not affected at the rates tested. This product demonstrates promise for incorporation into an integrated pest management system.

NUTSEDGE CONTROL IN PEANUTS

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ABSTRACT

Field experiments were conducted in South Texas for the control of yellow (Cyperus esculentus) and purple (C. rotundus) nutsedge. Preland preparation treatments of glyphosate (N-(phosphonomethyl) glycine), preplant incorporated treatments of vernolate (S-propyl dipropylthiocarbamate), postemergence treatments of bentazon (3-isopropyl-1H-2, 1, 3-benzothiadiazin-(4)-3H-one-2,2-dioxide) and combinations of these treatments were investigated.

Nutsedge was effectively controlled (65 to 95 percent) with the preland preparation treatments of glyphosate at 2 and 4 lb per acre (2.24 and 4.48 kg per ha). The 4 lb (4.48 kg) rate gave better control based on ratings taken prior to land preparation. The amount of control was dependent on the percentage of nutsedge tubers which had sprouted and emerged before the treatments were applied. Vernolate at 2½ lb per acre (2.80 kg per ha), applied preplant incorporated, gave excellent control of nutsedge for 30 to 60 days after application and approximately 75 percent throughout the season. Bentazon applied postemergence at 2 and 4 lb per acre (2.24 and 4.48 kg per ha) was effective in controlling nutsedge. Combination treatments of two or more of these herbicides which included bentazon postemergence treatments gave excellent nutsedge control throughout the growing season. Highly significant differences in yield and value per acre resulted from these treatments. Increases of 329 to 1767 pounds (368.8 to 1980.8 kg) and $56 to $346 in gross value per acre were recorded for the various treatments. This increase represents a 14 to 89% increase over the untreated check.

STUDY OF THE SOLUBLE AMINO COMPOUNDS AND TOTAL CARBOHYDRATES IN THE TESTA OF SIX EXPERIMENTAL PEANUT LINES WITH VARYING A. FLAVUS TOLERANCE

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ABSTRACT

The testae (pooled samples of about 40 seeds) of three A. flavus-tolerant (I : PI 337394; II : UF 734022; III : PI 337409) and three susceptible (IV : UF 73515; V : PI 331326; VI : PI 343419) varieties of peanuts (Arachis hypogaea L.) were analyzed for soluble amino compounds and carbohydrates. Water-soluble nitrogenous compounds were found in significantly lower concentrations in all three tolerant varieties. Levels of total amino acids (including ammonia) in the hydrolyzed testa extracts for varieties I through VI were: 17.09, 22.36, 28.09, 33.94, 65.28 and 43.91 μmole/g, respectively (mean coefficient of variation = 3.87%). Although the level of most amino acids increased with susceptibility, the most notable changes were in methionine, lysine, tyrosine, histidine, glycine, alanine and ammonia. Such seed-coat extracts contained mostly diffusable (low molecular weight) amino compounds whose precise location in the testa was not ascertained. No qualitative or quantitative relationship was apparent between the carbohydrate (either soluble or hydrolyzable) composition and the resistant character of the seed. The typical carbohydrate composition of the sulfuric acid hydrolysate was (% of dry weight): arabinose (5.18 + 0.34), galactose (0.44 + 0.07), xylose (0.34 + 0.04), glucose (0.14 + 0.08), and three minor unknowns ($\leq$ 0.10 each). Although the susceptible variety IV had a significantly lower concentration of arabinose (2.92 + 0.10%), commensurate decreases in galactose and xylose were also observed thus maintaining the arabinose-to-galactose and arabinose-to-xylose ratios within normal values. These observations suggest that the unavailability (concentration below a critical level) of readily soluble, small molecular weight amino compounds on, or within the testa matrix may play a role in the mechanism of A. flavus tolerance exhibited by some peanut varieties.

STRUCTURAL AND BIOCHEMICAL FEATURES OF PEANUT PODS AS RELATED TO RESISTANCE TO POD ROTTING FUNGI

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ABSTRACT

Studies concerning the structural and biochemical features of peanut pods have provided new tools for screening for pod rot resistance and mycotoxin accumulation. Scanning electron micrographs and histochemical staining procedures were employed to reveal differences among cultivars. The micrographs revealed that pods of Texas breeding line TP1025 contained extensive sclereids in distinct bands. Pods of PI 365553 contained epicarpic cells with thickened cell walls near the pod surface. Histochemical staining of cross-sections of pods revealed areas in which lignin, tannin, pectin, callose, cellulose, and starch were deposited. Pod rot tolerant lines PI 341885, PI 365553, PI 295233, and TP1025 contained greater lignin deposition in the mesocarpic parenchyma. All pods stained for lignin with differences in rapidity of uptake and intensity of stain. Pods of PI 337409 and Florunner stained heavily for tannin deposition. All pod parts stained for pectin. Florunner pods stained exceptionally dark, however, pods of TP1025 absorbed the stain more rapidly in the sclerenchyma. Callose staining occurred in the parenchyma cells of PI 337409 and PI 341885. All pods examined stained for cellulose, particularly in the endocarpic parenchyma. Pods of some cultivars absorbed the stain more rapidly than others. Starch was localized in surface cell layers and sclerenchyma in most pods. Maturity levels also influenced peanut pod composition.

PRODUCTION OF AFLATOXIN IN PEANUT SEED AS RELATED TO SHELL DAMAGE

by
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ABSTRACT

The production of aflatoxin in peanut seed from fruit with damaged and nondamaged shells was studied by placing fruit in an environment condusive to the growth of Aspergillus flavus. Freshly harvested "Virginia 61R" peanuts, artificially dried to ca. 30% moisture content, were divided into two groups. One group was inoculated with a spore suspension of an aflatoxin producing strain of A. flavus and the other group was not inoculated. Both groups were placed under controlled conditions of 31C and 96% relative humidity for a maximum incubation period of 192 hrs. Samples were removed at 24-hour intervals, dried to ca. 10% moisture content, placed in a holding chamber (conditions in equilibrium with peanut moisture content of ca. 10%) until assayed for A. flavus and analyzed for aflatoxin. Shell damage, designated as visible, invisible and sound, was determined by a staining technique. Percentage of seed colonized by A. flavus increased with shell damage and incubation time. The isolation frequency of A. flavus averaged 47, 59 and 72% for the seed from the sound, invisibly damaged, and visibly damaged fruit, respectively. The frequency of A. flavus reached a higher level in a shorter period of time with an increase in shell damage. The isolation frequency of A. flavus in seed from the non-inoculated fruit was about one-half as much as in seed from the inoculated fruit. Quantitative levels of aflatoxin were detected earlier and at higher concentrations in seed from fruit with damaged shells than in seed from sound fruit. Aflatoxin was found in greater concentrations in seed from visibly damaged fruit than in seed from invisibly damaged fruit. The time required for the level of aflatoxin to exceed 25 ppb in seed from sound fruit and invisibly damaged fruit was 96 and 24 hours more, respectively, than in seed from visibly damaged fruit. The aflatoxin level exceeded 25 ppb in about one-half the time in the seed from inoculated fruit as compared to the non-inoculated fruit. In seed from the non-inoculated, visibly damaged fruit, 96 to 120 hours were required for the aflatoxin level to exceed 25 ppb even though 35% of the seed were infected with A. flavus at the beginning of the incubation period.

EFFECT OF FIELD CURING METHOD, RETENTION IN THE SHELL, AND GENOTYPE ON PERSISTENCE OF CYLINDROCLADIUM CROTALARIAE IN PEANUT SEED IN VIRGINIA

by

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ABSTRACT

An earlier study of Florigiant peanut fruit from fields severely infested with Cylindrocladium crotalariae, the causal agent of Cylindrocladium black rot (CBR) of peanuts, used one isolation medium. The CBR pathogen could be found only in shells after 6 months. A 1975-1976 study used four peanut genotypes--Florigiant, NC Acc. 3033, Spancross, and Starr--and tested them for the CBR pathogen on three media. Two of the media were selective media. Florigiant was cured in windrows and stacks, the other genotypes were cured only in stacks. Seed representative of commercial seed stocks were plated on the three media. Seed of all genotypes were infested with C. crotalariae when harvested. The stacks were picked at six weeks and, at picking, C. crotalariae was found in seed of all genotypes except Florigiant. Seed and shells of stacked Florigiant seed were heavily infested with Rhizopus sp. whereas other genotypes were not so infested. The CBR pathogen was never found in stack-cured Florigiant that had been kept in the shell until tested. This relation did not hold for the three other genotypes. This suggests Rhizopus sp. was antagonistic to C. crotalariae. Throughout the study the medium especially formulated for microsclerotia was not superior to the other media as regards isolation of C. crotalariae from seed. The proportion of seed from which C. crotalariae could be isolated decreased markedly in the third month of storage. C. crotalariae was viable in some seeds of all genotypes except Spancross at the time of shelling of fruits for planting seed (4-6 months after digging). It was found in Spancross, however, after this period. NC 3033 (a line of promising resistance to CBR in the field) had as much or more seed with C. crotalariae at the time of shelling of fruit for planting seed as did Florigiant for comparable treatments.

SEVERITY OF CYLINDROCLADIUM BLACK ROT OF PEANUTS INFLUENCED BY TILLAGE PRACTICES

by
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ABSTRACT

The influence of tillage practices on severity of Cylindrocladium black rot (CBR) of peanuts, caused by Cylindrocladium crotalariae, was investigated in a field with a history of this disease. Primary land preparations in the main plots included plowing in the fall or spring to depths of 12.7 or 25.4 cm or chiseling directly under the row in the spring. Significantly fewer plants were infected with C. crotalariae at harvest and yield and value were significantly greater in the deep-plowed fall treatment than in the other plowing treatments. Yields from 12.7 cm fall, 12.7 cm spring, chiseled spring, 25.4 cm spring and 25.4 cm fall plowing treatments were 1475, 1502, 1611, 1828 and 2214 kg/ha, respectively. Secondary land preparations in sub-plots included bedding treatments of flat, medium (formed ca. 7 cm high with a rotary tiller and bed shaper), and high (formed ca. 15 cm high with a disc bedder). Infection by C. crotalariae was significantly less at harvest in peanuts planted on high beds than on the medium or flat beds. Yield and value were significantly greater from plants growing on medium beds than from plants growing on flat beds. Yields from high beds were slightly less than from medium beds. Superimposed on the land preparation treatments, the sub-sub plots of peanuts were cultivated either 0, 2, or 4 times during the growing season. At mid season, significantly fewer plants were infected in plots not cultivated or cultivated two times than in plots cultivated four times. Shortly before harvest, significantly fewer plants were infected with C. crotalariae in plots not cultivated than when cultivated. Yield and value were significantly greater in plots not cultivated or cultivated two times than in plots cultivated four times. Although yield and value were greater in plots not cultivated than in plots cultivated two times, these differences were not significant. Based on one years results, the severity of C. crotalariae as measured by plant infection, yield, price and value of peanuts can be reduced by deep plowing of soil in the fall, planting of seed on a firm bed ca. 7 cm high and without subsequent cultivation. More complete control of CBR may require an integrated control program utilizing these tillage practices along with resistant cultivars and fungicides.

INFLUENCE OF VARIOUS ROTATION SEQUENCES ON PEANUT YIELDS AND INCIDENCE OF WHITE MOLD CAUSED BY SCLEROTIUM ROLFSII IN GEORGIA

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ABSTRACT

Peanut yields increased and white mold counts decreased through various long term rotation sequences. Average peanut yields for continuous, 2-year and 3-year rotation plots were 2372, 2873 and 3080 lbs/acre, respectively. White mold counts (disease loci/100 ft of row) were taken as described by Rodriquez-Kabana and Backman (Jou. APREA, Vol. 5:199-200, 1973). White mold counts for continuous, 2-year and 3-year rotation plots were 33, 25, and 18 loci/100 ft row, respectively. A 3-year corn-peanut rotation resulted in the lowest disease incidence (14 loci/100 ft), but the 3-year soybean-peanut rotation had the highest yield (3295 lbs/A). Rye, used as winter cover crop, did not influence peanut yields or white mold counts significantly.

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PRODUCTION TECHNOLOGY DISCUSSION GROUP

C. A. Dunn, Chairman
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Stillwater, Oklahoma

SUMMARY

Discussion:

Question (to Boote from Jack Tanner): What would happen if late flowers were picked off?

Answer: Fruits were filled but pod size was limiting growth. Picked flowers off and increased yields.

Question: Was N_2 limiting fruit development late in season?

Answer: Could be N_2 or CH_2O.

Question: Was water a factor? Drought?

Answer: Sufficient rain was apparently available.

Question (to Pallas): More immature fruits?

Question (to Pallas): Were non-germ seeds dormant?

Answer: No, seeds were C_2H_4 treated.

Question: Snow on peanuts? Peanuts survived.

Question (to Mozingo):

Answer: Damage was apparently due to spraying equipment.

Question: Does plant compensate by changing location of fruiting? Did you check a row that didn't have the wheel track?

Answer: No.

PEANUT UTILIZATION DISCUSSION GROUP

Robert L. Ory, Chairman
Southern Regional Res. Center
New Orleans, Louisiana

SUMMARY

The discussion centered around the research presented in the 7 papers delivered in Session 2. A major portion of the period was devoted to new high quality peanut protein foods and on flavor quality evaluation of these foods and established foods such as peanut butter. New bakery items (e.g., cookies, cakes, bread) in which part of the wheat flour is replaced by peanut protein flour can be formulated that are nutritious, tasty, and consumer-acceptable. Developing qualified taste panels to evaluate bakery items and peanut butter, however, can require up to a year or more of training for each individual product; the same person(s) may not necessarily be qualified to evaluate both types of foods. Peanut proteins can be spun into fibers to prepare meat analogues or comminuted meat-like products that are similar to soy products but competition will depend upon cost of the starting material and ultimate cost of the final product. Views of researchers from university and U.S.D.A. laboratories and from a producer were presented on this subject. Chemical, microbiological, and enzymatic modification of peanut proteins to obtain certain functional properties for specific types of food products appears to be a promising means for more utilization of peanut protein flour in food products. It will be necessary to consider utilization of all products from the peanut (oil, meal, hulls, etc.), not just for protein or food uses but also non-food uses, to get the best maximum return for the crop.

PRODUCTION TECHNOLOGY DISCUSSION GROUP

R. H. Brown, Chairman
University of Georgia
Athens, Georgia

SUMMARY

Questions were called for on papers presented previously in the session.

There were several questions relative to the paper presented by Dr. M. E. Walker on response of peanut cultivars to gypsum. Observations were made by Dr. Walker and members of the audience that (1) although there was differential response to gypsum among varieties, the response of all varieties depended on calcium level in the soil, (2) even when soil pH and Ca level are sufficiently high for most crops, some peanut varieties will respond to addition of soluble sources of calcium applied during fruiting, and (3) reduced calcium requirement is not a suitable goal in peanut breeding because it is more expensive to breed for reduced calcium requirement than to supply calcium as gypsum.

A question was asked about the reason for a lighter green color in plots with added gypsum as described by Dr. Walker. A possible explanation was offered by a member of the audience that high calcium levels in leaves of some species had been associated with a reduction in chlorophyll content.

There was considerable discussion of peanut growth and yield related to papers presented by Dr. J. H. Young and Dr. W. G. Duncan. Discussion of these two papers produced observations that peanut yields in the southern United States are probably limited by (1) the length of the pod filling period which may increase with lower temperature and (2) light intensity as a result of cloudy weather. A question about the possibility of developing varieties with multi-seeded (more than two) pods as a way of increasing yields by increasing photosynthetic sink size brought two main responses: (1) yield in peanut is not limited by sink size and (2) selection for more than two seeds per pod is difficult and contrary to the natural evolutionary selection process.

A discussion of maturity index procedures involved questions and answers concerning the seed/hull ratio and arginine maturity index. The seed/hull ratio is a newly developed simple method of estimating maturity which shows promise. The arginine maturity index was said to be used at the producer level at present to predict optimum harvest dates. It is mainly used in the Georgia-Florida belt and has not shown as much promise in the Virginia-North Carolina area. The estimation of harvest date with the AMI method was said to afford a savings of up to 500 lbs. of peanuts per acre compared to estimations based on field observation.

ENGINEERING PROBLEMS DISCUSSION GROUP

J. L. Butler, Chairman
Coastal Plain Experiment Station
Tifton, Georgia

SUMMARY

R. Morgan indicated that two problems of using solar energy for drying peanuts are large surface area required for solar collectors and lack of a mobile collector surface. However, current research indicates that permanent collectors on roofs of existing structures may be the best solution.

W. Slay stated that about 250 samplers for use in automatic dump scales are currently in use.

J. Davidson noted that if the technique of peanuts impinging on peanuts collected on deflection panels is used to reduce shelling plant noise, the peanuts that accumulate in corners must be frequently removed to prevent the build-up of insects, etc.

In response to a question concerning the relationship of S. Cecil's low-oxygen storage research results on Slay's current research on vacuum packaging and other packaging techniques, Slay noted that their data after three months storage haven't shown any problems.

T. Whitaker noted that his research makes no attempt to establish nor evaluate dangerous levels of aflatoxin. They only evaluated the aflatoxin testing program for its validity and accuracy. The data from over 21,000 sampled peanut lots were used in their research. He estimated the analytical variability of the test to be $\pm$ 20%, with higher errors at lower aflatoxin levels and decreasing errors with increasing aflatoxin concentrations.

In response to questions on the portable aflatoxin analysis unit, J. Lansden reported that he expects the unit to be used primarily for solving unusual or special problems rather than as a routine testing unit. The sensitivity of the unit depends upon sample size and amount of extract used; a typical sensitivity is 4 ppb for a 100 g. sample. Although about 9 minutes are required to analyze a sample on a single sample basis, less time per sample would be required if used on a production line basis.

Several people noted that several techniques are available for reducing aflatoxin levels in peanut products. For example, the process of roasting peanuts can reduce aflatoxin levels by 25 percent.

BREEDING STRATEGIES DISCUSSION GROUP

Astor Perry, Chairman
Extension Agronomy Specialist
North Carolina State University
Raleigh, North Carolina

SUMMARY

After the presentation of ten excellent papers, a lively discussion period ensued. Advantages and disadvantages of three methods used in peanut breeding -- single seed decent, modified composite cross, and multiline variety development -- were discussed, with the general feeling that all three are valuable and at times may be utilized in a single program. It was pointed out that three lines make up the present Florunner variety and that seven lines make up the Florigiant variety. While it is easier to handle a small number of lines, a larger number probably offers other advantages.

In the single seed decent method of breeding in which mature seed may be produced in 90 days, it is necessary to break dormancy with ethylene. This method as presently utilized in North Carolina consists of the use of a phytron, greenhouses, and an overseas winter nursery. Accelerated generation increases can be useful in meeting an emergency situation such as exists now in the Virginia-Carolina area where CBR is spreading rapidly.

Efforts have been made to obtain peanut plants from tissue culture and the results show promise. Work in Florida indicates that the viable protoplast yield is low in the Florunner variety. In isolating protoplasts it appears that it will be necessary to leave some cell wall as it is impossible to regenerate new ones from protoplasts alone.

Progress has been made in transferring interspecific genetic information to the cultivated peanut. Some sections of the family remain isolated and new paths or bridges must be found in order to utilize the valuable traits found there. This work will be slow but should be continued in order to expand the genetic base of cultivated peanuts.

PLANT PESTS DISCUSSION GROUP

R. A. Flowers, Chairman
University of Georgia
Coastal Plain Experiment Station
Tifton, Georgia

SUMMARY

A question and answer session concerning papers presented in the previous session was held. Stimulating and useful discussions and demonstrations quickly consumed the allotted time. Topics for discussion were as follows:

1. Pythium pod rot control in South Texas
2. Benomyl control of Thielaviopsis basicola, the causal fungus of peanut blackhull disease
3. Land preparation methods and their effect on control of Sclevotium rolfsii
4. Multiple foliar applications of Bravo 6F-Kylar 85W tank mixes: effects on yield, foliar disease control, and grade factors of peanuts
5. Radiometric monitoring of peanut foliar diseases
6. Measurements of Cylindrocladium black rot development in peanut fields by use of remote sensing
7. Susceptibility of peanut varieties to ozone and
8. Demonstration of selective media for fungi

BREEDING AND GENETICS DISCUSSION GROUP

J. S. Kirby, Chairman
Oklahoma State University
Stillwater, Oklahoma

SUMMARY

A lively discussion was held which was still going strong when called to a halt at 5:00 P.M. The first item of discussion involved differences in peanut market types in tolerance to A. flavus. The question was raised as to whether laboratory results corresponded to observations under field conditions. It was pointed out that inoculation in the lab normally gives a more severe test than field conditions for about any pest resistance screening.

The next subject of discussion involved possible reasons for resistance to A. flavus. Tannins in the seed coat was suggested. A Ph.D. thesis from Reading had indicated that the darker the testa, the more resistant to A. flavus. However, it was pointed out that one peanut line with a white testa appeared to be quite tolerant, while several with dark seed coats were quite susceptible. Lignin content of the pod was also mentioned. It was suggested that this total area of the nature of resistance definitely needs additional research. It was then suggested that 2 or 3 papers would be presented the next morning that dealt with this question.

A lengthy debate followed on methodology and terminology of peanut protein studies especially concerning arachin and conarachin fractionation. Discussion then shifted to the need for better methods of testing seed germination and vigor to give a better prediction of field emergence.

The last item discussed was the problem of germ plasm maintenance, including systematic renewal or rejuvenation of seed and then storage under proper conditions. The question was raised as to the feasibility of each peanut breeder growing a small portion of the world collection each year and supplying a small quantity of fresh seed to the Plant Introduction Center and the National Seed Storage Laboratory for storage. The suggestion was made that an additional technician and appropriate funding for the P.I. Center and the NSSL would be a better alternative.

ENTOMOLOGY DISCUSSION GROUP

Clifford E. Hoelscher, Chairman
Texas A&M University System
Stephenville, Texas 76401

SUMMARY

Pest complexes reviewed included insects, nematodes and weeds. Papers presented in the preceding session were opened for questions by the discussion leader.

Chemical control measures for leaf feeders were discussed once larvae numbers have exceeded the damage level. It was pointed out that many peanut producers apply chemical treatments routinely and often before damaging numbers of larvae occur for leaf feeding insects. Control measures for lesser cornstalk borer and burrowing bug were discussed. Plant growth model data from the North Carolina State peanut model may aid in expanding the Texas leaf-feeder model.

The papers on combinations of nematicides and P C N B were discussed. Questions on sampling time and methods for nematodes were raised. It was pointed out that target nematode species govern the method and time of sample. Peggy King reported no apparent increase in other soil pathogens following P C N B applications.

The paper on the action of guazatine triacetate has potential for use in pest management programs. The benefit of getting insect repellent with a disease control material could be very beneficial.

A detail discussion of nutsedge control occupied a major part of the session. Roundup (Glyphosate), Basagron (Basalin) and Vernan (Vernolate) treatments and combination treatments were reviewed. It was pointed out that these new herbicides will not be a "cure-all" for all nutsedge problems. Action of these on herbicides on the yellow and purple varieties of nutsedge were discussed. Rates of application and timing of herbicide applications were reviewed. Experience with the use of the herbicides in Oklahoma, Texas, Georgia, and Alabama was presented.

APREA BOARD OF DIRECTORS MEETING

Hilton Inn, Dallas, Texas

13 July 1976

The meeting was called to order by President J. Frank McGill at 9:05 P.M. on 13 July 1976. The following board members were present: J. Frank McGill, Leland Tripp, D. H. Smith, N. K. Person Jr., J. W. Dickens, James E. Mobley, and Stan Tierney. In addition, J. R. Bone, James R. Butler, Thomas Whitaker, A. H. Allison, Astor Perry and C. T. Young were present.

James E. Mobley moved that the minutes of the 1975 APREA Board of Directors Meeting be approved. Seconded by Stan Tierney. Motion passed.

The following report on the evaluation of PEANUT SCIENCE was submitted by Astor Perry, Chairman of the ad hoc committee:

The ad hoc committee on Peanut Science consisting of J. W. Dickens, Clyde Young, J. W. Smith, and Astor Perry, Chairman, would like to express our thanks and appreciation to the editor and editorial board of Peanut Science for the excellent job they have performed in getting the publication off to an excellent start. The quality of the publication has been of superior quality for a new scientific journal. We are well aware of the tremendous amount of effort and at times personal sacrifice that has gone into publication of this scholarly journal during the past three years.

The editor has asked that he be provided with a brief critique of Peanut Science as to whether it is meeting the needs of APREA members and of means and ways in which the publication might be improved.

The committee therefore offers the following report. We believe that Peanut Science has indeed fulfilled the objectives as outlined by the Publication Committee of APREA and that it has improved the image of APREA as a scientific body which serves its members and the members of the peanut industry with distinction. No publication can, however, completely fulfill the needs of all its members when the membership comes from as many disciplines as is the case with APREA. The minor problems that have arisen with Peanut Science are mainly because of the multi-disciplined membership of APREA and the desire of individual members to have Peanut Science use a style format similar to ones that represent their discipline. Fortunately, these problems have been very minor. The committee would like to make the following recommendations to help overcome these problems:

A. Completely revise format section so that Peanut Science in effect has its own style manual. Publish at least once every two years in Peanut Science. Suggested changes in style include the following:

    1. Generic. Specific names to be followed by authority the first time mentioned. Generic abbreviation alone may be used after the first time. Another alternative would be to use the system where an accepted common name is used followed by genus - species - authority the first time mentioned in abstract and text. Afterwards use either the common name or generic abbreviation plus specific name. For pesticides, preference should be given to using the "accepted common name" followed in parentheses by proper chemical name according to Chemical Abstracts Nomenclature.

2. Literature Citations. All citations to be listed as cited. Text citation should include author(s) and year.

3. Tables. Each table and figure should be submitted on a separate page and placed at the end of the manuscript. Type (insert Table No. ___) or (insert Figure No. ___) immediately after the paragraph containing the first reference. Figures may be glossy print photographs or line drawings on plain white paper, blue lined cross section paper, or tracing cloth no larger than 8½ x 11 inches. Figures for two copies of the manuscript may be suitable photocopies.

B. Several other comments were made by members of the committee which would improve the image and effectiveness of Peanut Science. These were as follows:

1. Promptness in publication. The date on the publication seldom matches the season in which the publication arrives. Every effort should be made to publish on a definite schedule.

2. There continues to be far too many errors in the spelling of scientific names as well as names of the authors.

3. It would be helpful if the page number in Peanut Science was on the reprints.

4. The printed quality of the tables tends to be low.

5. Reprints often arrive in poor condition due to poor packaging.

6. Associate editors should be from the membership who play an active role in APREA.

C. Subscriptions. It is suggested that membership in APREA include a subscription to Peanut Science. Membership dues to overseas members should be $2.00 more per year than for domestic members to cover the cost of air mailing Peanut Science.

Leland Tripp moved that the minutes of the APREA Board of Directors meetings be published in APREA PROCEEDINGS. Seconded by Stan Tierney. Motion passed.

A. H. Allison, Chairman of the ad hoc Committee on PEANUT RESEARCH submitted the following report:

The committee was composed of Don Banks of Oklahoma, Harold Pattee of North Carolina, Gale Buchanan of Alabama and A. H. Allison of Virginia. Each area representative was requested to poll recipients of "Peanut Research" for opinions, ideas, and comment. Three (3) points of emphasis were stressed in the poll, as follows:

1. Is "Peanut Research" meeting the needs of those persons doing research on Peanuts in the U.S.?

2. Do we really need this publication or is this function being served elsewhere; and if so, can the required time and effort be afforded?

3. The Peanut Grower Associations are supposed to defray all costs involved in publishing "Peanut Research". However, for the past several years, the Georgia Agricultural Commodity Commission has paid all costs. Obviously, this was not the way it was intended, so what is the best approach to financing, provided its publication is continued?

The polls indicated very strongly that Peanut Research served a vital need of researchers and that it should be continued in its present form. There was much opposition to including information contained in Peanut Research in the Peanut Journal. Most negative reports concerning Peanut Research came from non-research commercial personnel, with a few from the scientific community in one state.

The recommendation of this committee to the Board of Directors is to continue Peanut Research in its present form and to commend the authors for their efforts and to re-arrange the financing so that the Georgia Peanut Commission will not have to bear the burden for all the costs.

James R. Butler, Chairman of the Ad Hoc By-Laws Study Committee, submitted a report on proposed revisions of Article IV, Section 3; Article VII, Section 2; Article VIII, Sections 2, 3, 4, 5 and 6; Article IX, Section 1; Article IX, Section 1(c.); and Article XI, Sections 1, 2 and 3. These revisions were discussed, but no action was taken. President McGill asked the Ad Hoc APREA By-Laws Committee to continue its study of the by-laws during the next fiscal year.

J. R. Bone, Chairman of the Ad Hoc Committee on Membership Recruitment submitted the following report:

The Ad-hoc membership committee will recommend to the Finance Committee that the Organizational Membership category ($25.00 per year) be eliminated and that the Sustaining Membership category ($100.00 per year) be retained.

The meeting was adjourned by President McGill at 10:25 P.M.

APREA BOARD OF DIRECTORS MEETING

Hilton Inn, Dallas, Texas

15 July 1976

The meeting was called to order by President J. Frank McGill at 8:00 P.M. on 15 July 1976. The following board members were present: J. Frank McGill, K. H. Garren, Leland Tripp, D. H. Smith, N. K. Person Jr., J. W. Dickens, James E. Mobley, Dean M. Carter, Stan E. Tierney and John Currier. Others in attendance were: J. R. Bone, Joe Sugg, P. H. Reid, Glen Redlinger, Wilbur Parker, C. A. Dunn, R. V. Sturgeon, Reid Faulkner, M. C. McDaniel, Thomas W. Whitaker, Ray O. Hammons and Morris Porter.

As a representative of the Extension-Industry Disease Workers Group, Roy V. Sturgeon, Jr. suggested that the following resolution be endorsed by APREA:

Be it resolved that the responsibilities of the Environmental Protection Agency as set forth by the Federal Insecticide, Fungicide, and Rodenticide Act, as amended 1972, be redefined whereas once a pesticide receives a crop tolerance the states can approve and recommend additional uses on the same crop as long as these uses do not exceed label tolerance.

Hence, we request that you send a copy of this resolution and supporting letter to the respective chairman of the U. S. House and Senate Agriculture Committee and contact your State and National representatives concerning the seriousness of this request.

After considerable discussion of this resolution, the consensus was that the objective of this resolution could be most effectively implemented by peanut commodity organizations in the peanut production areas of the United States. Therefore, no action was taken by the Board of Directors.

Nat Person Jr. moved that J. R. Butler continue to serve as Chairman of the Ad Hoc Committee on APREA By-laws. Seconded by Dean Carter. Motion passed.

J. R. Bone presented the report on the activities of the Public Relations Committee. The complete report will be published in Volume 8 of APREA PROCEEDINGS.

K. H. Garren moved that the two resolutions be accepted. Seconded by Stan Tierney. Motion passed.

J. R. Bone will confer with Astor Perry on the feasibility of a theme for the 1977 annual meeting.

There was some discussion relevant to the elimination of the Organizational Membership category ($25.00 per year), with the goal of converting Organizational Members to Sustaining Members ($100.00 per year). However, no action was taken by the APREA Board of Directors.

Nat Person Jr. moved that the President of APREA ask Jim Butler, Chairman of the Ad Hoc APREA By-laws Committee, to investigate the feasibility of establishing a permanent APREA Membership Committee, separate from the Public Relations Committee. Seconded by Leland Tripp. Motion passed.

The Finance Committee report was presented by Morris Porter, The complete report will be published as an appendix in Volume 8 of APREA PROCEEDINGS.

J. W. Dickens moved that the proposed Finance Committee budget be adopted. Seconded by Leland Tripp.

J. W. Dickens moved that the Executive Secretary-Treasurer assess foreign members an amount of money sufficient to air mail all APREA publications. Seconded by Dean Carter. Motion passed.

Preston Reid presented the report on PEANUT SCIENCE. This report will be published in Volume 8 of APREA PROCEEDINGS.

Ray Hammons reported on PEANUT RESEARCH. A complete report will be published in Volume 8 of APREA PROCEEDINGS.

Joe Sugg announced that the Publications and Editorial Committee has recommended that Harold Pattee be appointed as the new Editor of PEANUT SCIENCE.

Stan Tierney moved that the report of the Publications and Editorial Committee be accepted. Seconded by K. H. Garren. Motion passed.

Wilbur Parker presented the Peanut Quality Committee report. The complete report will be published as an appendix in Volume 8 of APREA PROCEEDINGS. Dean Carter moved that the Peanut Quality Committee report be accepted. Seconded by K. H. Garren.

C. A. Dunn reported on the Bailey Award.

K. H. Garren presented the report for the APREA Nominating Committee. A complete report will be published as an appendix in Volume 8 of APREA PROCEEDINGS. Leland Tripp moved that the report be accepted. Seconded by Stan Tierney. Motion passed.

The report of the Executive Secretary-Treasurer was presented by D. H. Smith. A complete report will be published in Volume 8 of APREA PROCEEDINGS. Leland Tripp moved that the report be accepted. Seconded by J. W. Dickens. Motion passed.

Leland Tripp moved that the 1977 APREA Meeting be held in Hershey, Pennsylvania on 13, 14 and 15 July, pending approval by Astor Perry after a site inspection during August of 1976. Seconded by J. W. Dickens. Motion passed.

The meeting was adjourned by President McGill at 10:40 P.M.

Minutes of the Regular Business Meeting of the
AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION
Hilton Inn, Dallas, Texas, July 16, 1976

The meeting was called to order by President J. Frank McGill at 8:05 A.M.

The invocation was given by Dan Hallock.

President McGill introduced Leland Tripp. Leland Tripp thanked Nat Person for serving as Chairman of the Technical Program Committee. Nat Person thanked the members of the Technical Program Committee for their dedicated service. As Chairman of the Local Arrangements Committee, Leland Tripp expressed his appreciation to the committee members.

President McGill announced that the minutes of the 1976 Board of Directors meetings will be published in Volume 8 of APREA PROCEEDINGS. Additionally, President McGill announced that an Ad Hoc by-laws committee chaired by J. L. Butler will be continuing its work during the current fiscal year.

President McGill presented the Bailey Award to J. W. Dickens and T. B. Whitaker. Their award-winning paper was entitled "Efficacy of Electronic Color Sorting to Remove Aflatoxin Contaminated Kernels from Commercial Lots of Shelled Peanuts".

President McGill presented plaques to past Presidents of APREA as a symbol of recognition for their service to APREA. Past Presidents in attendance at the annual business meeting were: J. W. Dickens (1970-1971), E. L. Sexton (1973-1974), and K. H. Garren (1974-1975). Other past Presidents of APREA who did not attend the business meeting were: N. D. Davis (1968-1969), David Moake (1969-1970), W. T. Mills (1971-1972), and Olin Smith (1972-1973).

President McGill asked for the following committee reports:

Finance: Morris Porter presented the report. See Appendix "I" for the complete report.

Publications and Editorial: Joe Sugg presented the report on APREA PROCEEDINGS. Preston Reid presented the report on PEANUT SCIENCE. Ray Hammons presented the report on PEANUT RESEARCH. The complete report of the Publications and Editorial Committee is published in Appendix "II".

Public Relations: J. R. Bone presented the report. For complete details see Appendix "V" .

E. L. Sexton moved that the aforementioned committee reports be accepted. Seconded by Ray Hammons. Motion passed.

The APREA Nominating Committee report was presented by K. H. Garren. Dan Hallock moved that the report be accepted. See Appendix "VI" for the complete report.

President McGill presented his report to the membership. See Appendix "A" for the complete text.

President McGill introduced Leland Tripp as the new President of APREA.

The site for the ninth annual meeting of APREA has been tentatively set for Hershey, Pennsylvania on 13, 14 and 15 July 1977. Astor Perry will inspect the site in August of 1976.

The meeting was adjourned at 9:00 A.M.

APPENDIX A

PRESIDENT'S REPORT

J. Frank McGill

The purpose of your Board of Directors is to screen committee reports, take any official action deemed appropriate and then they are brought to you for final adoption or rejection in this business session. It is of significance to report that your Board of Directors recently approved, by unanimous vote, the publishing of Board Meeting minutes in the annual proceedings.

Much has been accomplished this past year through our committee system of actively reporting and adoption. However, "what has been done," if we are to be realistic, must be evaluated in terms of "what yet needs to be done" to make this organization more responsive to the needs of its membership.

There is a need for more continuity in our committee work. All committees in APREA will now be requested to name a vice chairman so that this person will know a full year in advance that he will next assume chairmanship. This should make a substantial contribution to adding more continuity in all our committee work.

During this past year, your Board of Directors requested your chairman appoint an ad-hoc committee to evaluate "Peanut Research." This was chaired by Allen Allison and while their report was highly complimentary of its activities and its editor, you can help us make it better. Frankly, I'd like to see at least one person in an Extension role be appointed from each producing area to be responsible for contacting and soliciting items from all segments of the industry in his area to secure more items for use in "Peanut Research."

An ad-hoc committee was also appointed to evaluate "Peanut Science." While Chairman Astor Perry was highly complimentary of the Editors, recommendations were formulated for changes in format. I am sure you will give Harold Pattee your full cooperation and suggestions for improvement that will make "Peanut Science" the highest quality and most prestigious publication in American Agricultural Scientific circles.

At the request of your Board, an ad-hoc committee was appointed to review and up-date by-laws. Chairman Jim Butler has brought a number of major changes in our by-laws which have been very favorably received by your Board. However, as you have noted from the various committee reports, there are still other changes to be made. Therefore, your Board in official action has asked Jim Butler to continue serving as chairman for another year so that the task can be finished. This report will first be approved by your Board and then, according to our by-laws, these changes will be circulated among the entire membership for final approval or rejection.

As the work of APREA expands, so will the need for new committees expand. I would hope that our by-laws can be amended to permit the appointment of any new committees deemed appropriate by the Board of Directors (instead of ad-hoc committees) when it is determined that a need exists which, if implemented, will more effectively carry out the objectives of APREA -- "to provide a continuing means of exchange of information between all segments of the peanut industry."

Our membership is on the move. Don Smith, our highly efficient Secretary-Treasurer reports that our total membership of 483 last July 1 has increased to 559 this July 1st. J. R. Bone, Bob Pender, and George

Hartnett are to be commended for this effort. Membership we must have, but even more important, is how well our organization is serving the needs of its members.

Yes, we have a long way to go on to maturity as an organization and we must continue to evaluate APREA on the basis of what has been done only against what needs to be done. I want to thank each of you for the high honor and privilege that has been mine in trying to serve as your President during the past year. It's been a gratifying personal experience to be on the team. And now it is a signal honor for me to "turn the reins" over to our new President of APREA for next year, whom I am confident will lead this organization to new levels of professional achievement -- Dr. Leland Tripp.

REPORT OF THE FINANCE COMMITTEE

APPENDIX I

D. M. Porter, Chairman
J. E. Mobley
W. G. Conway
C. E. Simpson
Ron Henning

The Finance Committee met at 7:00 p.m. July 14, 1976 and made the following recommendations which were adopted by the Board and at the general business meeting on Friday morning:

1. To assume the financial liabilities of PEANUT RESEARCH. This responsibility will include both publication and mailing.

2. To assess all foreign memberships for an amount sufficient to air mail all APREA publications.

3. That the financial statement submitted by the Executive Secretary be accepted. A limited audit was conducted by the Finance Committee.

4. That the proposed budget for July 1, 1976 to June 30, 1977 be adopted.

Other items of business were discussed. These included:

1. The Bailey Fund was examined and found to be in order.

2. The budget for the secretary of the Secretary-Treasurer was increased to $1,200.00.

3. The Finance Committee commends the Secretary-Treasurer for outstanding performance in conducting the business affairs of APREA.

AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION

Financial Statement

July 1, 1975 - June 30, 1976

ASSETS AND INCOME

I

Item	
A. Balance - July 1, 1975	$14,119.92
B. Membership & Registration (Annual Meeting)	7,563.71
C. Proceedings & Reprint Sales	838.50
D. Special Contributions	565.00
E. The Peanut	2,128.87
F. Peanut Science Page Charges & Reprints	4,605.00
G. Institutional Membership	469.25
Total	$30,290.25

LIABILITIES AND EXPENDITURES

II

Item	
1. Proceedings - Printing & Reprints	$ 3,293.28
2. Annual Meeting - Printing, Catering & Misc.	2,332.81
3. Secretarial	1,000.00
4. Postage	400.00
5. Office Supplies	282.90
6. Position Bond for $5,000 (Exec.Sec.Treas.)	33.00
7. Travel - President	-
8. Travel - Executive Sec-Treas.	-
9. Registration - State of Georgia	10.00
10. Miscellaneous	97.52
11. Peanut Science	6,000.00
12. The Peanut	100.00
13. Bank Charges	23.11
Total	$13,572.62
Balance June 30, 1976	$16,717.63

AMERICAN PEANUT RESEARCH AND EDUCATION ASSOCIATION

Budget
July 1, 1976 - June 30, 1977

Assets and Income

Balance	$16,717.63
Membership and Registration	7,500.00
Proceedings and Reprint Sales	500.00
Peanut Science page charge	5,000.00
"The Peanut" - 384 copies on hand @ $11.33 ea.	4,350.72
Total	$34,068.35

Expenditures

Peanut Research	$ 1,000.00
Proceedings Printing, etc.	3,500.00
Annual Meeting	1,500.00
Secretarial Services	1,200.00
Postage	700.00
Office Supplies	500.00
Travel - President	400.00
Travel - Sec.-Treas.	400.00
Registration (State of GA)	5.00
Peanut Science	7,500.00
Miscellaneous	100.00
Total	$16,805.00
Reserve	17,263.35
Total	$34,068.35

APPENDIX II

REPORT OF THE PUBLICATIONS AND EDITORIAL COMMITTEE
TO THE ANNUAL APREA MEMBERSHIP MEETING
FRIDAY, JULY 16, 1976

Joe S. Sugg, Chairman
Ray O. Hammons
J. E. Cheek
Preston Reid
William T. Mills
Astor Perry
Coyt T. Wilson

It is a distinct pleasure and privilege to report to you on the activities of the Publications and Editorial Committee covering the past year. It is, indeed, unfortunate that President Reid is leaving peanut work and will be working as soybean specialist in the State of Virginia and, because of this fact, has tendered his resignation as Editor of PEANUT SCIENCE. Your Publications and Editorial Committee has nominated Harold Pattee, North Carolina State University, as Editor to succeed Preston Reid and this nomination has been approved by your Board. I would like to ask Mr. Pattee to stand for recognition and allow me to express my appreciation for his accepting this important assignment.

To Preston Reid, on behalf of all the members of APREA, I want to express our sincere appreciation for the excellent manner in which he took over this task, started PEANUT SCIENCE from scratch, and developed it into a Journal recognized throughout the industry for its excellent qualities in the publication of scientific papers reporting the work of the peanut scientists. I now ask Preston Reid to give his report on PEANUT SCIENCE for the past year.

"Gentlemen, I have enjoyed working with PEANUT SCIENCE and the Associate Editors and regret very much that the Committee didn't see fit to let a soybean specialist continue as Editor. It has been a rewarding experience to me and hope that Harold will receive the cooperation which you, the members, extended to me. As you know, our Associate Editors are elected on a rotating basis and terms which have expired at this meeting are being filled by succession or new appointments, as follows:

L. E. Sample	1978
Charles Dunn	1978
Charles E. Holaday	1978
William V. Campbell	1978
Robert L. Ory	1978
Paul Santleman	1978
R. Harold Brown	1977 (filling unexpired term)

"There were two issues, 111 pages printed (2 in full color), total cost per page $63.43, manuscripts received 18, articles printed 26, printing cost per page $36.46, average length of articles 4.27 pages. The financial statement is as follows:

Balance, July 1, 1975		$ 502.42
Received from APREA		6,000.00
EXPENDITURES		
Printing		4,647.82
Postage		374.72
Office Expense		110.93
Salary, Secretary		946.40
Travel and Misc.		298.89
	Total	$ 6,378.72
Balance		$ 123.62

OUTSTANDING BILLS		
Pierce Printing Company		$ 497.88
Salary, Secretary		53.60
Misc. Expense, Editor		112.73
	Total Expense	$ 7,040.93
	(Budget	$ 7,190.00)
RECEIVED AND DUE FROM AUTHORS		$ 6,236.26
	(Budget	$ 5,840.00)

"If there are any questions concerning the report on PEANUT SCIENCE, I will be happy to answer them. I will now turn the discussion back over to Mr. Sugg."

Gentlemen, are there any questions for Mr. Reid?

At this time I will call on Ray Hammons, Co-Editor of PEANUT RESEARCH, to present his report:

"Six issues of PEANUT RESEARCH (volume 13, numbers 1 through 6, issues 50-55) were compiled, edited, published and mailed to the membership during the fiscal year, July 1, 1975-June 30, 1976. The combined newsletter totaled 42 pages. Circulation was to about 610 individual members or institutions in the United States and abroad.

"PEANUT RESEARCH is sent to libraries at all land-grant institutions in the southern United States, to the USDA National Agricultural Library, and to several abstracting services.

"Extensive revisions, made necessary by the change in membership year, kept the mailing list current. Nine separate change lists were processed, involving 117 address card changes. The new fiscal year basis should make future revisions easier.

"300 Selected References and 19 theses and dissertations were documented. All informational issuances from APREA officers were published.

"Printing charges for the 6 issues of Volume 13 averaged $141.20 each for a total of $847.20, including page charges and the mailing cover. The latter is $6 per issue. Postage was $140.58. Charges were paid largely by the Georgia Agricultural Commodity Commission for Peanuts, with some assistance from other grower groups.

"There are no cost estimates for a number of other activities associated with the preparation and publication of PEANUT RESEARCH. These are provided by the Georgia Coastal Plain Station and co-editors as a public service."

Thank you, Ray, for your report.

Gentlemen, the other document published which completes our communication efforts among members and with the outside world on scientific accomplishments by our members is the Journal of Proceedings covering this meeting.

I want to thank Nat K. Person for the excellent manner in which he has gathered in the papers and has them in hand. To publish the PROCEEDINGS all I need now is the official minutes of this meeting which Secretary-Treasurer Don Smith will send to me as soon as he gets home. Hopefully, I will be able to set a new record and have the PROCEEDINGS to you in less than a month. All authors will be notified of the cost of reprints and any person desiring reprints may have them by returning the appropriate order to me as soon as I notify them of the cost.

Thank you all for your excellent cooperation in "helping to get the word out."

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

Tuesday, July 13

2:00-10:00 Registration - Mezzanine

Wednesday, July 14

7:30-5:00 Registration - Mezzanine

GENERAL SESSION - J. Frank McGill, presiding - South Ballroom and Mockingbird

8:00 President's Welcome - J. Frank McGill

8:30 Future Education and Research Needs of the Producer - Floyd King

9:00 The Role of Agriculture Experiment Stations Relative to the Future Needs of the Peanut Industry - Jarvis E. Miller

Break

10:00 Two concurrent sessions and related discussion groups

SESSION 1. PRODUCTION TECHNOLOGY - C. A. Dunn, presiding - North Ballroom

10:00 Peanut seed germination as related to soil water regime during pod development, J. E. Pallas, Jr., J. R. Stansell and R. R. Bruce

10:15 A means to break dormancy of peanut seeds in the field, D. L. Ketring

10:30 Peanut fruit growth as affected by date of pegging and fruit load, K. J. Boote

10:45 Fruiting patterns of Virginia-type peanuts, Walton Mozingo

11:00 Effects of genotype, location and year on size distribution of runner peanuts, J. L. Pearson

11:15 Peanut responses to inoculation and nitrogen, A. E. Hiltbold and J. G. Starling

11:30-12:00 Discussion Group on Production Technology - C. A. Dunn, presiding

SESSION 2. PEANUT UTILIZATION - R. L. Ory, presiding - Center Ballroom

10:00 Microbial determination of tryptophan, methionine, and niacin, George A. Hudson and Julius L. Heinis

10:15 Comparison of protein and amino acid composition of various preparations from Florunner (Arachis hypogaea L.) peanuts infected with selected fungi, John P. Cherry, C. T. Young, and L. R. Beuchat

10:30 Measurement of flavor quality of raw peanuts by direct gas chromatography, Mona L. Brown, J. I. Wadsworth, H. P. Dupuy, and R. W. Mozingo

10:45 Spinning of peanut protein fibers, D. L. Fletcher and E. M. Ahmed

11:00 Response of peanut protein spun fibers to applied stresses, E. M. Ahmed and D. L. Fletcher

11:15 Functional and cookie-baking properties of hydrolyzed peanut flour, Larry R. Beuchat and Sam R. Cecil

11:30 A discussion of sensory evaluation panel training techniques designed for peanut butter, Nancy C. Rodriguez

11:45-12:00 Discussion Group on Peanut Utilization - R. L. Ory, presiding

SESSION 1. PRODUCTION TECHNOLOGY - A. E. Cloburn, presiding - North Ballroom

1:30 Peanut responses to landplaster in Virginia attributable to pod breakdown disease suppression, D. L. Hallock

1:45 Response of five peanut (Arachis hypogaea L.) cultivars to gypsum, M. E. Walker and T. C. Keisling

2:00 The peanut kernel/hull ratio as a simple maturity index, H. E. Pattee, J. C. Wynne, and F. R. Cox

2:15 An evaluation of two objective methods for estimating maturity in peanuts, C. E. Holaday, E. J. Williams, and V. Chew

2:30 A peanut growth and development model, J. H. Young, F. R. Cox, and C. K. Martin

2:45 Peanut yield potential in Rhodesia, Israel, and Florida, W. G. Duncan and D. E. McCloud

3:00 Break

3:30-5:00 Discussion Group on Production Technology - R. H. Brown, presiding

SESSION 2. ENGINEERING AND INSTRUMENTATION - R. S. Hutchison, presiding - Center Ballroom

1:15 Drying and curing Spanish peanut pods with solar energy, R. G. Morgan, R. A. Rogers, B. L. Clary, and G. H. Brusewitz

1:30 An objective method for evaluating peanut seed size and shape characteristics, J. I. Davidson, Jr., Victor Chew, and R. O. Hammons

1:45 Development of a sampler for use in automatic dump scales, W. O. Slay

2:00 Reduction of shelling-plant noise caused by impingement of peanuts, J. D. Woodward

2:15 Potential hazards of low-oxygen storage of shelled peanuts, S. R. Cecil

2:30 Evaluation of the peanut administrative committee aflatoxin testing program, T. B. Whitaker and J. W. Dickens

2:45 A portable aflatoxin analysis unit, J. A. Lansden and C. E. Holaday

3:00 Break

3:30-5:00 Discussion Group on Engineering Problems - J. L. Butler, presiding

7:30-9:00 Committee Meetings

(Committee Meetings are open to all APREA members)

Finance---Morris Porter, Chairman - Parlor A
Public Relations---Jim Bone, Chairman - Parlor B
Publication & Editorial---Joe Sugg, Chairman - Parlor C
Peanut Quality---James Spadero, Chairman - Parlor D

Thursday, July 15

SESSION 1. BREEDING STRATEGIES - Astor Perry, presiding - North Ballroom

8:00 Peanut breeding strategy: early generation multiline variety development, A. J. Norden

8:15 Use of accelerated generation increase programs in peanut breeding, J. C. Wynne

8:30 Peanut breeding strategy: modified composite cross, R. O. Hammons

8:45 Peanut breeding strategy to minimize aflatoxin contamination, A. C. Mixon

9:00 Status of incorporating resistance to Cylindrocadium black rot in Virginia type peanut cultivars, T. A. Coffelt

9:15 Breeding for pod rot resistance, O. D. Smith, T. E. Boswell, C. E. Simpson, R. E. Pettit, and B. L. Jones

9:30 Selection pressures exerted by seed sizing, D. W. Gorbet

9:45 Break

10:15 Peanut breeding strategy: to transfer interspecific genetic information to the cultivated peanut, D. J. Banks

10:30 Peanut breeding strategy to exploit sources of variability from wild Arachis species, C. E. Simpson

10:45 Interspecific hybridization of peanuts at Reading, J. P. Moss

11:00-12:00 Discussion Group on Breeding Strategies - Astor Perry, presiding

SESSION 2. PLANT PESTS - D. C. H. Hsi, presiding - Center Ballroom

8:00 Pythium pod rot control in South Texas, T. E. Boswell and W. H. Thames, Jr.

8:15 Benomyl control of Thielaviopsis basicola, the causual fungus of peanut blackhull disease, David C. H. Hsi

8:30 Land preparation methods and their effects on control of Sclerotium rolfsii, Lawton E. Samples

8:45 Multiple foliar applications of Bravo 6F-Kylar 85W tank mixes: effects on yield, foliar disease control, and grade factors of peanuts, D. H. Smith and Laurie K. Vesely

9:00 Radiometric monitoring of peanut foliar diseases, R. C. Hines, D. H. Smith, and J. C. Harlan

9:15 Measurements of Cylindrocladium black rot development in peanut fields by use of remote sensing, N. L. Powell, K. H. Garren, G. J. Griffin, and D. M. Porter

9:30 Susceptibility of peanut varieties to ozone, D. D. Davis and D. H. Smith

9:45 Break

10:15-12:00 Discussion Group on Plant Pests and Demonstration of Selective Media for Fungi - R. A. Flowers, presiding

SESSION 1. BREEDING AND GENETICS - Gene Sullivan, presiding - North Ballroom

1:30 Variable chromosome numbers in two "Amphidiploid" populations of Arachis, K. S. Davis and C. E. Simpson

1:45 Tolerance to colonization by Aspergillus flavus found in certain peanut (Arachis hypogaea L.) breeding lines and cultivars, J. A. Bartz, A. J. Norden, J. C. LaPrade, and T. J. Demuynk

2:00 Use of the major protein components present in the peanut seed (Arachis hypogaea L.) to possibly monitor plant breeding investigations, C. F. Savoy

2:15 More on Amino Acid Survey, J. L. Heinis

2:30 Screening for genetic tolerance to cold temperature during germination in peanuts (A. Hypogaea), W. D. Branch and J. S. Kirby

2:45 Break

3:15-5:00 Discussion on Breeding and Genetics - J. S. Kirby, presiding

SESSION 2. PLANT PESTS (Insects, Nematodes and Weeds) - L. W. Morgan, presiding - Center Ballroom

1:15 Management of leaf-feeding insects on Texas peanuts, Clifford E. Hoelscher and Joel E. Curtis

1:30 Progress report: Interactions among six peanut cultivars, herbicide sequences, and a systemic insecticide, Ellis W. Hauser, J. E. Harvey, Charles W. Swann, J. W. Slaughter, and R. O. Hammons

1:45 Combinations of nematicides and PCNB for control of the southern blight X root-knot nematode complex, Peggy S. King, R. Rodriguez-Kabana, and P. A. Backman

2:00 Effectiveness of DBCP and PCNB tank mixtures for control of root-knot nematodes and southern blight in peanuts, R. Rodriguez-Kabana, Peggy S. King, and P. A. Backman

2:15 Guazatine triacetate, a new locally systemic fungicide exhibiting repellency to lepidopterous larvae, P. A. Backman, J. D. Harper, J. M. Hammond, and E. M. Clark

2:30 Nutsedge control in peanuts, T. E. Boswell, W. J. Grichar, and M. G. Merkle

2:45 Break

3:15-5:00 Discussion on Plant Pests - J. W. Smith, presiding

8:00 Board Meeting - Frank McGill, presiding - Southwest Conference Room

Friday, July 16

7:15-7:45 Breakfast served (registered APREA members only)

8:00 President's Address and Business Meeting - J. Frank McGill, President - South Ballroom and Mockingbird - Committee reports, election of officers

9:30 Break

10:00 Two concurrent sessions and related discussion groups

SESSION 1. MYCOTOXINS AND PLANT PATHOLOGY - R. A. Taber, presiding - North Ballroom

10:00 Study of the soluble amino compounds and total carbohydrates in the testa of six experimental peanut lines with varying A. flavus tolerance, Clyde T. Young, Jaime Amaya-F, Aubrey C. Mixon, and A. J. Norden

10:15 Structural and biochemical features of peanut pods as related to resistance to pod rotting fungi, Robert E. Pettit, Billy L. Jones, Olin D. Smith, and Ruth Ann Taber

10:30 Production of aflatoxin in peanut seed as related to shell damage, F. S. Wright, D. M. Porter, and J. L. Steele

10:45 Effect of field curing method, retention in the shell, and genotype on persistence of Cylindrocladium crotalariae in peanut seed in Virginia, K. H. Garren, D. M. Porter, and F. S. Wright

11:00	Severity of Cylindrocladium black rot of peanuts influenced by tillage practices, D. M. Porter and F. S. Wright
11:15	Influence of various rotation sequences on peanut yields and incidence of white mold caused by Sclerotium rolfsii in Georgia, Randel A. Flowers
11:30-12:00	Discussion Group on Mycotoxins and Plant Pathology - R. A. Taber, presiding

SESSION 2. EXTENSION TECHNIQUES AND TECHNOLOGY - Sam Thompson, presiding - Center Ballroom

10:00-12:00	Current disease control program

REPORT OF THE 1975-76 PEANUT QUALITY COMMITTEE

Members Present: Olin Smith
W. Birdsong

Co-Chairmen serving in place of regular Chairman who could not attend:

C. Young
W. Birdsong

Total Attendance - 14

Recommendations:

1. Due to problems of lack of continuity in the operation of the Quality Committee and the change of members under the present structure, it was recommended by a unanimous vote that a standing committee, consisting of a Chairman, Vice Chairman, and others as required in the present By-Laws be appointed after the appropriate changes have been made in the present By-Laws.

2. It is recommended that the Sampling Sub-Committee should be discontinued and function as needed through appointments by the Peanut Quality Committee.

3. So as to provide direction and continuity, it is recommended that the following Sub-Committee accumulate the testing methods and procedures that are used for peanuts and peanut products. Such methods should include tests that are made on peanuts during all phases of production (viz. growth, shelling, grading, storage, etc.) and be reviewed at the next annual meeting by the Quality Committee.

Sub-Committee members for the Methodology Committee are:

Name	Subject Area
Jim Davidson	Shelling
Charles Holaday	Quality
Clyde Young	Maturity
John Cherry	Chemical
Jim Young	Seed Quality & Germination
Tom Whitaker	Sampling
Sam Cecil	Sensory and Storage
Carl Cater	Processing and Proteins
Leonard Redlinger	Insect Prevention & Control

with E. Sexton and W. Parker
Coordinators

APPENDIX V

Report of the Public Relations Committee

During 1976 the Public Relations Committee promoted American Peanut Research and Education Association (APREA) activities through mail and direct contact with prospective members and interest groups; special emphasis was placed on obtaining additional Organizational and Sustaining members. News media contacts were maintained.

As a means of increasing revenue to help to defray increasing operational costs, it is suggested that Organizational memberships be dropped in favor of a single supporting membership (Sustaining). After discussions with several Organizational members, it is felt most will be in a position to continue support of our activities at the higher Sustaining membership level.

Currently memberships are as follow:

Type of Membership	1975	1976
Individual	412	446
Organizational	51	53
Sustaining	20	25

To help promote future meetings it is suggested consideration be given to establishment of a meeting theme. A theme becomes a key factor relative developing news media and public interest.

Respectfully submitted,

J. R. Bone (Chairman)
Ross Wilson
Charles Holaday
Robert Pender
T. E. Boswell
A. H. Allison

JRB/am/3-4

RESOLUTION

WHEREAS, Dr. Preston Reid has served with distinction and dedication as editor of Peanut Science, the American Peanut Research and Education Association (APREA) does hereby recognize his contribution to the peanut industry. Practicing the highest principles of professionalism, Dr. Reed has established Peanut Science as a credit to APREA and a valuable tool to the industry.

THEREFORE, BE IT RESOLVED that we, the members of APREA, do hereby recognize and thank Dr. Reed for services rendered.

RESOLUTION

BE IT RESOLVED, that the American Peanut Research and Education Association (APREA) does hereby recognize the tragic death of Dr. John Chapin as a loss to our association and the farming industry of Texas. Serving as an Area Agronomist for the Texas Agricultural Extension Service from 1968, Dr. Chapin was influential in many phases of crop and pasture production, but will long be remembered for his activities on behalf of the peanut industry.

WE, THEREFORE, recommend that this resolution be included in the official minutes of the 1976 annual meeting of APREA and then a copy be forwarded to his widow and sons.

APPENDIX VI

REPORT OF THE NOMINATING COMMITTEE

Ken Garren, Chairman

The Nominating Committee presents for your consideration the following nominees:

President ---------- Leland Tripp

President-Elect ---------- Astor Perry

Executive Secretary-Treasurer -------- Donald H. Smith

State Employee's Representative ----- Allen H. Allison

Industry Representative (Production) ------ J. R. Odom

APPENDIX VII

PRESENTATION OF SECOND ANNUAL

BAILEY AWARD

8th Annual Meeting of the
American Peanut Research & Education Assn.

Hilton Inn - Dallas, Texas
July 14-16, 1976

by

J. Frank McGill, President - APREA
Business Session - July 16, 1976

This award was established in honor of Wallace K. Bailey, an eminent peanut scientist. It is awarded each year to that scientist or scientists that has presented the best paper at the previous year's annual meeting of APREA as determined by an appropriately appointed committee. Last year's recipient, the first recipient of the Bailey Award, was Robert Pettit and co-authors: Frederick Shokes and Ruth Ann Tabor.

Manuscripts are judged for merit, originality and clarity and for their contributions to peanut scientific knowledge. Each paper presented last year at Dothan, Alabama was considered. Manuscripts of selected papers were obtained from the authors for further evaluation by an Award Committee.

It is now my privilege as President of APREA to announce the second recipient of the Bailey Award - J. W. Dickens and co-author T. B. Whitaker - for their excellent paper entitled "Efficacy of Electronic Color Sorting and Hand Picking to Remove Aflatoxin Contaminated Kernels From Commercial Lots of Shelled Peanuts".

J. W. Dickens is Research Leader in Peanut Quality Investigations, USDA, ARS, North Carolina State University, Raleigh, North Carolina and T. B. Whitaker is Research Agricultural Engineer, USDA-ARS, North Carolina State University, Raleigh, North Carolina.

BAILEY AWARD COMMITTEE

Ralph S. Mattock	(1976)	Clyde Young	(1978)
Coyt Wilson	(1977)	Pete Bloome	(1979)

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 proceedes 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 therof 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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Institute for Documentation
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This paper printed by membership demand:

GENETIC EVOLUTION OF HOMOSAPIENS - DARWIN'S MISTAKE

by Monk, Monk and Monk

Paper presented by Big Monk, Coconut University,
Little Island, Pacific

Three monkeys sat in a coconut tree
Discussing things as they're said to be.
Said one to the others, "Now listen, you two.
There's a certain rumor that can't be true,
That man descended from our noble race.
That very idea is a disgrace.
No monkey ever deserted his wife,
Starved her babies or ruined her life,
And another thing you will never see,
A monk build a fence around a coconut tree,
And let the coconuts go to waste,
Forbidding all other monks to taste.
If I put a fence around this tree,
Starvation would force you to steal from me.
Here's another thing a monk won't do,
Go out at night and get on a stew,
And use a gun or club or knife
To take some other monkey's life.
Yes, man descended, the ornery cuss,
But, brother, he didn't descend from us."