highlights

of agricultural research

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Agricultural Experiment Station
R. Dennis Rouse, Director

Auburn University
Auburn, Alabama

Director's Comments

R. Dennis Rouse

THE RECORD over the past 25 years shows an annual rate of return of about 26% from investments in all agricultural research in the state agricultural experiment stations but much higher on some commodities. It should be of interest to the reader of HIGHLIGHTS what kind of investment is being made in Alabama on the several major agricultural commodities and what our analysis indicates are needed for a reasonably adequate research effort into these more important commodities. This effort for 1976 given in scientist years (one scientist devoting full-time effort for 1 year) is listed below:

RESEARCH PROGRAM BY COMMODITIES AND AREAS
AUBURN UNIVERSITY AGRICULTURAL EXPERIMENT STATION
1976

	SY Effort		
		Additional	
	Present	Needs	Total
Soybeans	6.9	3.4	10.3
Cotton	10.0	5.3	15.3
Corn	3.0	2.3	5.3
Forages and small grains	11.9	6.9	18.8
Peanuts	4.9	3.0	7.9
Vegetables, fruits, and nuts	12.3	8.3	20.6
Ornamentals	3.8	2.5	6.3
Forestry	11.4	8.2	19.6
Poultry	8.3	5.2	13.5
Beef	14.5	6.9	21.4
Swine	5.7	3.4	9.1
Dairy	6.2	2.3	8.5
Fish and wildlife	8.9	5.7	14.6
Others	5.8	4.0	9.8
TOTAL	113.6	67.4	181.0

* The total present effort does not include scientist years devoted to basic research and other programs not directly associated with the above-listed commodities and areas.

A scientist year reflects all support and cost to maintain one scientist one year. For example, 6.9 scientist years in soybeans include the total time of all scientists conducting research on control of insects, diseases, nematodes, and weeds; cultural practices, including variety testing, management, growth regulators, nitrogen fixation, liming, fertilization, seedbed preparation, and cultivation; and marketing and economics. It also includes administrative effort at Auburn and the substations. Thus, the total investment being made on soybean research in Alabama, everything that is necessary to provide the knowledge base for this crop that is expected to have a cash sale value in Alabama well in excess of $200 million in 1977, is the cost of 6.9 scientists working on this crop. Our evaluation of research needs for this crop support the need for an additional 3.4 scientist years, or an increase of 50%. If this research alone results in just an increase of one-half bushel per acre on Alabama's estimated 1.6 million acres of soybeans in 1977, the additional farm sales, at present prices, would exceed the total annual state appropriations for the entire Alabama Agricultural Experiment Station.

A detailed analysis of our current effort and projected needs has recently been given to the Auburn University Agricultural Advisory Council. We have asked the members to review these and counsel with us on this program. We always welcome opportunities to discuss needs and priorities with any persons or groups. This is why Agriculture is so much more successful in the United States than elsewhere. We endeavor to work as partners with all producers and users of the information resulting from the work of the Agricultural Experiment Station.

We believe we are using the resources available to this Station in the best interest of the people of this state and region. We intend to keep it that way but, to do so, we have to work as partners with all of you.

may we introduce . . .

The Auburn University Agricultural Advisory Council members pictured on the cover are, left to right seated: Milton (Buzz) Wendland, Autaugaville; H. M. (Fuzzy) Perritt, Fuzzy's Feed Inc., Florence; John Livingston, General Manager, Wayne Poultry Company, Albertville; W. M. (Bill) Brown, Atmore; Ed Allen, President, Ellis Implement Company Inc., Centre; A. W. (Buck) Compton, Nanafalia; James Earl Mobley, Shorterville; Jim Brady, Marion; and Emory Cunningham, President, The Progressive Farmer, Birmingham.

Ex-officio members standing, from left: David Ozment, Executive Vice-President, Alabama Poultry and Egg Association, Cullman; J. D. Hays, President, Alabama Farm Bureau Federation, Montgomery; Dr. R. Dennis Rouse, Dean and Director, School of Agriculture and Agricultural Experiment Station, Auburn University; Dr. J. Michael Sprott, Director, Alabama Cooperative Extension Service, Auburn University; Dr. E. V. Smith, Dean and Director Emeritus, School of Agriculture and Agricultural Experiment Station, Auburn University; Hilton Watson, Executive Vice-President, Alabama Forestry Association, Montgomery; and E. H. (Ham) Wilson, Executive Vice-President and Chief Executive Officer, Alabama Cattlemen's Association, Montgomery. Not pictured is ex-officio member Brice Moore, Manager, American Dairy Association of Alabama, Montgomery.

HIGHLIGHTS of Agricultural Research

SUMMER 1977 VOL. 24, NO. 2

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Steer vs. Heifer PERFORMANCE During Growing-Finishing

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J. K. BOSECK and W. B. WEBSTER, Tennessee Valley Sub.

CATTLE FEEDERS generally agree that heifers and steers perform differently in growing-finishing programs. There also is agreement that feeder heifers should be cheaper to compensate for feedlot performance differences. However, there is little agreement on what the relative price spread should be between feeder steers and heifers.

Results of a recent Auburn University Agricultural Experiment Station test provide data that can serve as guidelines in determining relative value of heifers and steers. According to these findings, heifers selling for $3 to $5 per cwt. less than steers might be more profitable than steers for feedlot operators.

Steers, Heifers Compared

The 1973-75 study at the Tennessee Valley Substation, Belle Mina, compared feedlot efficiency of steer and heifer calves of similar weights and breeding. Both sex groups were of predominately Hereford breeding, with a few Angus-Hereford crossbreds. Steer calves were either purchased locally or produced on the Substation. All heifers were from the Substation herd and all were open.

Twelve steers and 12 heifers were fed annually for about 200 days. The groups were fed separately. Rations were designed to support gains of about 2 lb. daily. Cattle were slaughtered at an average age of 15-16 months. The test began about November 15 and ended around June 1.

Good quality corn silage was full-fed, along with 1.5 lb. of cottonseed meal per head daily and a limited amount of whole, high-moisture (HM) shelled corn. Corn feeding was started at a rate of 0.5% of body weight and progressively increased within a feeding season to a maximum of 2.0% of body weight. The increases in amount of corn fed were done in steps, by adding 0.5% of body weight at approximately 56-day intervals. The corn was harvested at about 28% moisture and was fed at about 26% moisture. The freshly-harvested corn was treated with an organic acid preservative and stored in an oxygen-controlled metal silo.

Steers Gained Faster, More Efficiently

Steers gained about 5% faster than heifers fed similarly (1.98 vs. 1.89 average daily gain). Although the steers ate more total feed, they were slightly more efficient in feed conversion, as indicated by data in the table.

Heifers were somewhat fatter at slaughter, having slightly more backfat than steers (0.53 vs. 0.44 in.), less desirable yield grade (3.3 vs. 3.1), and higher marbling scores (6.1 vs. 5.2). Marbling was probably responsible for a larger proportion of heifer carcasses grading Choice (94% vs. 75% for steers).

The heifers had a higher dressing percentage than steers (61.3% vs. 59.6%). This difference, as well as other carcass differences, showed up in comparative values of the steers and heifers since carcasses were sold on weight and grade basis with no price differential because of sex.

Findings of the Tennessee Valley Substation comparison establish that non-pregnant beef heifers perform similarly to steers on high-silage, growing-finishing rations. When fed for the same length of time, higher proportions of heifer carcasses graded Choice. Heifers were found to generally finish at lighter weights than steers.

Feeder heifers often sell for $3 to $5 less per cwt. than steers of comparable weight and quality. The Auburn results indicate that when this price differential exists, feeding of heifers would be more profitable than feeding of steers. Success of heifer feeding requires feeding young non-pregnant heifers to gain at least 1.75 lb. daily and selling finished animals on the basis of carcass weight and grade.

COMPARATIVE GAIN AND FEED CONSUMPTION OF STEERS AND HEIFERS, TENNESSEE VALLEY SUBSTATION, 1973-75

Performance measure	Result, by sex	
	Steers	Heifers
Number of feeders	36	36
Initial weight, lb.	550	508
Final weight, lb.	947	886
Average daily gain, lb.	1.98	1.89
Feed per head		
Corn silage, lb.	5,416	5,150
HM corn, lb..	1,076	1,071
Cottonseed meal (41%), lb..	260	260
Feed per cwt. gain		
Silage, lb.	1,517	1,522
Corn, lb.	296	312
Cottonseed meal, lb.	73	77

Arginine Maturity Index (AMI) Method For Determining Peanut Harvest Dates

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Department of Botany and Microbiology

PEANUTS represent one of the major sources of agricultural income in Alabama, ranking second among crops and fifth among all commodities in 1975.

In spite of improvement in cultural practices, a problem that persists from year to year is selecting a harvest date that will result in the greatest yield. Harvest date selection is a problem for peanuts because it is an indeterminant plant, which means that varying proportions of immature peanuts are obtained at any particular digging date. Farmers seek to harvest when most of the peanuts are mature.

Until recently, only subjective methods for determining peanut maturity and harvest dates were practiced and included such factors as size and color of testa, degree of darkening of the inside of the pod, certain seed characteristics, and number of days from planting.

Dr. Clyde T. Young, at the University of Georgia Agricultural Experiment Station, discovered a relation between the arginine maturity index (AMI) and peanut maturity, and subsequently developed an automated method for determining peanut harvest dates based on this relationship. AMI is the ratio of arginine and dry matter contents of 30 g. of seed. Arginine is an amino acid and one of the building blocks of protein. If AMI values of peanuts from representative plants in a field are taken at weekly intervals beginning 5-6 weeks prior to a probable harvest date and plotted, a graph such as that in the figure is obtained. AMI values decrease to a minimum, which represents a stage when a majority of peanuts are mature and the field is ready to harvest. Once an AMI curve is established, peanut harvest dates can be accurately estimated by determining the AMI values of two samples taken approximately 2 and 3 weeks prior to the probable harvest date. The AMI values of these samples are located on the curve and the harvest date for the field from which these samples were taken is estimated by determining the time required for the values of the samples to reach a minimum.

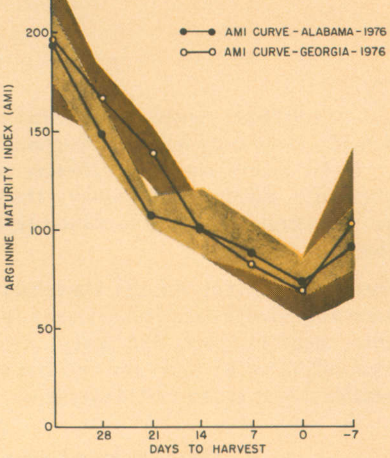
In 1976, a study was initiated at the Auburn University Agricultural Experiment Station to test the applicability of the AMI method in Alabama and begin establishing data (AMI curve) on which peanut harvest date estimations can be based. There were two primary objectives of the study: (1) develop an AMI curve for Alabama based on data from experimental plots at the Wiregrass Substation and (2) to increase the amount of data on which to base the AMI curve from samples taken by growers ("participating growers") contacted prior to harvest. In addition, some farmers brought samples to the laboratory for analysis and harvested at least some of their crop according to AMI analysis. This report presents results of the first objective and briefly summarizes results of objective two and preliminary results of peanuts harvested according to the AMI.

An AMI laboratory was established at the Wiregrass Substation in Headland. Beginning April 7, 1976, peanuts of the florunner variety were planted at 1 week intervals on different plots for 5 weeks at the Wiregrass Substation. Beginning August 3, 1976, 2-3 samples were taken for analysis from each plot at 2-7 day intervals. Sampling continued through September 29, 1976. The yield and quality of peanuts from these plots were considered very good; the best yields from each plot averaged 3,651 lb. per acre and the best grades averaged 75.

AMI values were determined for all samples and the values plotted according to weeks from harvest using the lowest AMI values to represent plants with the greatest number of mature peanuts (the figure). The AMI curve for Alabama is very similar to that developed for peanuts grown in Georgia. AMI values declined very rapidly, each reaching a low point in the same general range. AMI values for peanuts from Alabama seem to decline more rapidly than those from Georgia, but the AMI curve for Alabama must be considered tentative until more baseline data are accumulated over the next 2-3 years.

Prior to harvest, peanut farmers were contacted through county chairmen of the Alabama Cooperative Extension Service and requested to collect samples from some of their fields. They began taking samples 4-5 weeks prior to probable harvest dates and stored them in a freezer for analysis at a later date. Of approximately 100 growers contacted, only 23 provided samples. Although the data were variable, an AMI curve from these samples approximated the curve (the figure) developed from samples taken at the Wiregrass Substation.

In addition, approximately 190 farmers brought peanut samples to the AMI laboratory for analysis in late August and September. It was made clear that only tentative estimates of harvest dates could be made, since no previous data for Alabama were available. For this reason, it was recommended that the farmer harvest his crop according to the AMI analysis only at his own discretion. However, based on responses to questionnaires, 33 of the growers harvested approximately 1,700 acres of peanuts according to the AMI analysis. Fields that were harvested accordingly yielded approximately 200 lb. per acre more than fields (about 1,900 acres) of these same growers not harvested according to the AMI determination. Although many areas were severely affected by drought and the data presented above are based on relatively few acres, it appears that the AMI method of determining peanut harvest dates has a great potential for increasing yields for Alabama peanut farmers.



AMI curves for Alabama (1976) and Georgia (provided by Dr. Clyde T. Young).

Soil Acidity Reduces Effectiveness of Atrazine

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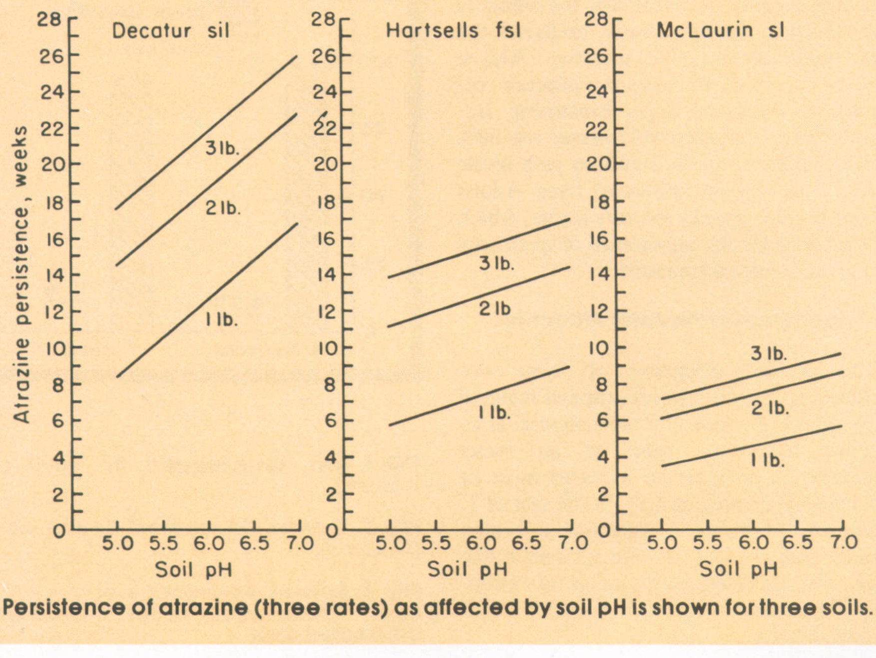
SOIL ACIDITY reduces the persistence of atrazine applied for weed control in corn. Therefore, liming acid soils improves both herbicidal weed control and nutritional conditions for crops.

Activity of atrazine depends on its absorption through roots and shoots of seedling weeds. In acid soil, atrazine reacts with clay and soil organic matter in a way that reduces its herbicidal activity.

Effect of soil acidity on atrazine persistence was determined in corn plots at three Auburn University Agricultural Experiment Station locations during 1972 and 1973. Atrazine was applied at 1, 2, and 3 lb. active ingredient per acre to plots ranging in acidity from pH 5 to pH 7. Soil types were Decatur silt loam at the Tennessee Valley Substation, Hartsells fine sandy loam at the Sand Mountain Substation, and McLaurin sandy loam at the Lower Coastal Plain Substation.

At intervals during each season, atrazine remaining in the soil was determined. Persistence was measured as the time from application to the date when atrazine activity was barely sufficient to reduce the growth of oats (a sensitive species) to 50% of that where no atrazine had been applied. Persistence was then related to soil pH in each plot.

Persistence of atrazine was found to increase with each increase in pH in all three soils. Effects were essentially the same in both years. The graphs present the 1972-73 average for each soil.



Persistence of atrazine (three rates) as affected by soil pH is shown for three soils.

Increasing the pH of Decatur silt loam from 5.5 to 6.5 increased the period of atrazine activity by 4 weeks. In the Hartsells soil, this pH increase extended atrazine's persistence by nearly 2 weeks, while in the McLaurin soil there was only about a 1-week increase in length of persistence of the herbicide.

The effects of pH on persistence are a factor in determining how much atrazine is required for effective weed control. In Decatur silt loam, for example, 3 lb. per acre was required to provide the same period of atrazine activity at pH 5.5 that could be obtained with only 2 lb. at pH 6.2. Thus, herbicide economy is an obvious advantage of liming acid soils for corn production.

Also revealed in the Auburn studies was that soil conditions other than pH affect atrazine persistence. For example, atrazine activity lasted three times longer in Decatur silt loam than in McLaurin sandy loam at the same soil pH. Persistence of atrazine observed in these soils is consistent with that found in other Alabama soils.

As a general rule, the activity of atrazine is reduced by one-half with each 20 days after application. Some soils, such as the McLaurin, take only 10 days to inactivate atrazine by half, while 30 days may be required in soils like the Decatur. Alkaline clay soils of the Black Belt show the greatest persistence of atrazine among Alabama soils. Research is continuing to explain why some soils retain atrazine and others quickly lose it.

While atrazine may persist too long in some regions of the United States, this is seldom a problem in the Southeast. To the contrary, increasing persistence would be an advantage in some soils by maintaining herbicidal activity until crops grow enough to suppress weeds. Liming acid soils should improve corn production through both improved fertility conditions and better weed control from atrazine.

Pine Bark Beetles May Attract Their Own Enemies

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INSPECTION of almost any dying, freshly killed, or newly felled pine tree reveals the activity of many species of insects—bark beetles, wood borers, predators, parasites, and scavengers. For many of these, particularly the bark beetles, such pines provide highly desirable food and development sites. Tree condition mainly attracts these species, but according to results of research at the Auburn University Agricultural Experiment Station tree condition has little attraction for certain bark beetle predators. The presence of these insects is directly related to the presence and activity of the bark beetles themselves.

Research Conducted

Investigations were conducted on the occurrence of two pine bark beetle predators on bark beetle-infested material and similar material that was free of beetle attack. The predators were *Medetera bistriata* (Figure 1), one of the long-legged flies, and *Thanasimus dubius* (Figure 2), a checkered beetle. Each species is commonly found in association with southern pine beetle and *Ips* engraver beetle infestations.

Procedures

In studies with the fly *M. bistriata,* the *Ips* engraver *I. grandicollis* was the host insect. *Ips*-infested and uninfested, beetle-susceptible pine bolts were caged in a pine stand so that flies had equal access to all cages. Each cage was equipped with a sticky-type trap to collect a sample of the fly population alighting there. Traps were collected and replaced daily for the duration of one *Ips* generation, and the number of flies captured was recorded.

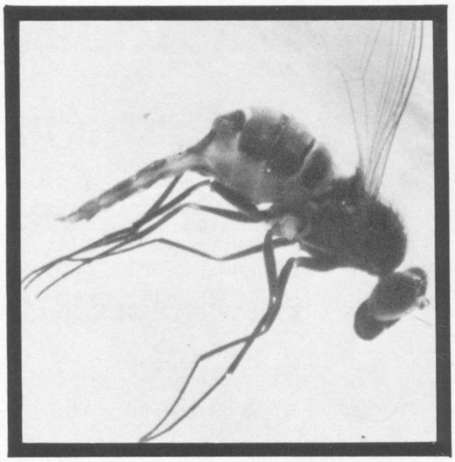
The *T. dubius* studies were conducted in an active southern pine beetle infestation. In this case, sticky traps were placed around the boles of newly attacked trees and adjacent uninfested trees. Traps were collected and replaced at weekly intervals for one complete southern pine beetle generation.

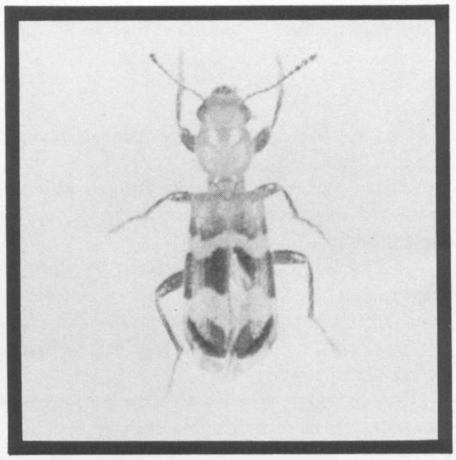
Research Results

Results (Figure 3) reveal that the adults of each predator species clearly preferred the bark beetle-infested pine material. Almost 94% of the total *M. bistriata* collection occurred in traps on cages containing *Ips*-infested pine. Collection of *T. dubius* was 88% at trees under attack by southern pine beetle and 12% at adjacent uninfested trees. Adults of both of these species are very active, which may account for the appearance of specimens in traps at uninfested material.

Importance of Predator Attraction

The decided attraction of these two predators to the bark beetle-infested material is significant. To have any real potential as an effective regulating agent in an insect population, a predator (or parasite) must be able to locate its prey or host. In the case of *T. dubius* and *M. bistriata,* attraction to beetle-infested pine ensures location of their hosts. Thus, the attacking bark beetles are essentially responsible for attracting some of their natural enemies.





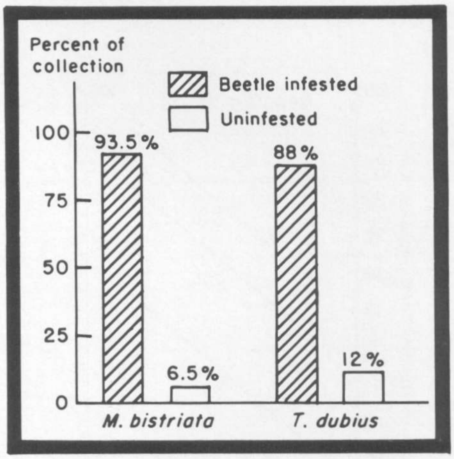


FIG. 1. Top, Long-legged fly adult (M. bistriata**).**

FIG. 2. Center, Checkered beetle adult (T. dubius**).**

FIG. 3. Bottom, Abundance of M. bistriata **and** T. dubius **adults at Ips-infested and uninfested pine.**

Molds and Mycotoxins in Foods

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MAN HAS long been aware of the unpleasant flavors, odors, and other undesirable changes in foods caused by molds. Specific molds or fungi can also produce poisonous chemical substances in food. These chemicals are mycotoxins, and the toxicity syndromes that they cause in animals are mycotoxicoses.

Contamination of a food supply by toxin-producing fungi can result in a direct hazard to human health when foods containing mycotoxins are eaten by man. When the identity of the fungi involved is known, it is easier to assess the extent of the mycotoxin hazard to man. Results reported here are part of a screening program in which fungi were isolated from a variety of human foods, then identified and tested for toxicity to brine shrimp and chicken embryos by standard procedures for evaluating toxin formation by molds.

Forty-five fungi were isolated from visibly molded foods purchased or obtained with the cooperation of personnel in a local supermarket and from home refrigerators during 1973-74. Isolation was by direct plating on YE agar (2% dextrose, 0.7% yeast extract (Difco), 0.5% KH_2PO_4, and 2% agar), from which the fungi were monocultured at room temperature (25 to 30 C) on either Czapek-Dox or potato-dextrose agar for identification. The fungi were then grown in 1-liter Erlenmeyer flasks on nutrient-amended shredded wheat which had been autoclaved 15 minutes at 121 C twice in 24 hours. The cultures were incubated 14 to 21 days at 25 C. Moldy substrates were extracted with chloroform-ethanol (80:20), filtered, and evaporated under an airstream at room temperature. Extracts for the brine shrimp bioassay were taken up in 95% ethanol, while extracts from chicken embryos were suspended in corn oil. Controls of uninoculated nutrient-amended shredded wheat extracts were included in all bioassays.

Initial screening was with brine shrimp, a sensitive test organism for mycotoxins. Since some fungi elaborate naturally-occurring fatty acids that are toxic to brine shrimp, toxicity must be confirmed with at least one additional test organism, which in this research was chicken embryos. Certain isolates not toxic to brine shrimp were also tested.

Results of the brine shrimp primary bioassays revealed that nearly 44% of all isolates were toxic to brine shrimp. Nineteen of the toxic isolates plus three that were nontoxic to brine shrimp were subsequently bioassayed with chicken embryos. Fourteen of these 22 isolates (64%) were highly toxic to chicken embryos, causing 60 to 100% mortality, see table. These were: *Aspergillus niger* (#769), *Cladosporium sphaerospermum* (#533), *Fusarium oxysporum* (#597), *F. solani* (#625), *Penicillium corylophilum* (#765), *P. cyclopium* (#535), *P. herquei* (#603), *P. lanosum* (#560), *P. nigricans* (#748), *P. steckii* (#511), *Penicillium* sp. (#707), *Rhizopus nigricans* (#620), *R. nigricans* (#675), and *R. nigricans* (#618). These 14 highly toxigenic isolates represented 31% of all fungi obtained from foods.

Five other isolates, *A. niger* (#647), *F. lateritium* (#553), *Fusarium* sp. (#665), *Mucor fragilis* (#664), and *R. nigricans* (#644) exhibited low to moderate toxicity. Thus, approximately 42% of the fungi initially isolated from foods were at least moderately toxic to brine shrimp and chicken embryos.

Extracts from approximately one-third of the fungi were moderately to highly toxic to brine shrimp and chicken embryos. In Japan, 30% of 247 fungal isolates from foods were toxic to mice; in southern Africa, 36% of 531 fungal isolates from foods in the diets of rural Bantu were toxic to ducklings. In situations of extreme hunger and concern for quantity rather than quality, the hazard of mycotoxins is compounded by the fact that the undernourished generally are more susceptible to these toxicants than individuals with more adequate diets.

Penicillium was the most frequently isolated group of fungi in the study, with 41% of 17 isolates being toxigenic to brine shrimp and chicken embryos. The apparent predominance of *Penicillium* species may reflect the influence of refrigeration; *Penicillium* appears to be very competitive at low temperature storage of high moisture foods.

This investigation did not determine whether the foodstuffs actually contained known mycotoxins or were toxic per se. It only determined that 42% of the moldy foodstuffs investigated were invaded by strains of fungi capable of elaborating toxic substances. Additional work is required to determine the identity of the toxic compounds and the extent to which the toxigenic fungi elaborate their mycotoxins on the foods from which they were originally isolated.

TOXICITY OF FUNGAL EXTRACTS TO BRINE SHRIMP AND CHICKEN EMBRYOS

AUA culture number	Fungus	Food source	Brine shrimp mortality [1]	Chicken embryos deaths/ total eggs
Check	Uninoculated medium		0	1/20
647	*Aspergillus niger*	onion	2	10/20
769	*A. niger*	bread	2	8/10
533	*Cladosporium sphaerospermum*	honey bun	0	14/20
553	*Fusarium lateritium*	orange	2	5/10
597	*F. oxysporum*	carrot	1	10/10
625	*F. solani*	cabbage	0	10/10
665	*Fusarium* sp.	squash	2	5/10
664	*Mucor fragilis*	squash	1	10/20
765	*Penicillium corylophilum*	bread	2	10/10
535	*P. cyclopium*	corn meal	2	10/10
630	*P. herquei*	corn meal	1	10/10
650	*P. lanosum*	onion	2	6/10
748	*P. nigricans*	peach	2	10/10
551	*P. steckii*	chocolate syrup	2	13/20
707	*Penicillium* sp.	diet jelly	2	8/10
644	*Rhizopus nigricans*	tomato	1	5/10
648	*R. nigricans*	onion	2	4/10
598	*R. nigricans*	peach	2	3/10
620	*R. nigricans*	sweet potato	0	10/10
675	*R. nigricans*	applesauce	2	7/10
606	*R. nigricans*	corn meal	2	4/10
618	*R. nigricans*	strawberry	2	10/10

[1] 2=60 to 100% mortality; 1=20 to 59%; 0=0 to 19%.

Many Factors Affect Incidence of Body-checked and Misshapen Eggs

DAVID A. ROLAND, SR., Department of Poultry Science

MANY QUESTIONS about causes of body-checked and misshapen eggs are answered by findings of Auburn University Agricultural Experiment Station research. Such factors as too little cage space per hen, aging hens, and time of oviposition were found to cause eggs to have a ridge around the middle (banded eggs) or otherwise be misshaped.

In the Auburn tests, eggs were collected from various aged hens and scored for degree of misshapenness, using these classifications:

- Slightly ridged—small ridges or bands around the middle of the egg.
- Medium ridged—pronounced bands or ridges around the middle of the egg.
- Body checked—pronounced ridges around the middle of the egg and a visible body check.
- Flat sided—eggs with a flat side.

Approximately 20% of the eggs were misshaped or had body checks, Table 1. Questions about causes were answered as follows:

How did hen age and time of oviposition affect incidence? The incidence of body-checked eggs increased with age. Conversely, the incidence of eggs with ridges around the middle appeared to decrease as the hen aged. The greatest percentage of misshapen eggs were laid between 6 a.m. and 10 a.m. Few were laid after 10 a.m., Table 2.

How did cage density affect misshapen and body-checked eggs? Eggs were collected and scored from cages that had 4 birds, 3 birds, or 2 birds per cage. Body-checked and misshapen eggs were found to be directly related to number of birds per cage. Reducing cage density decreased the percentage of misshapen and body-checked eggs, Table 3.

In another experiment, birds were first housed 1 and 2 birds per cage, then moved to 3 birds per cage, and finally moved back to 1 and 2 per cage. Eggs were collected and scored each time. Again the incidence of body-checked or misshapen eggs was related directly to the number of birds per cage. The incidence was increased or decreased by changing bird density.

How did time of day affect incidence of misshapen and body-checked eggs? The vast majority of body-checked and misshapen eggs were laid between 6 and 8 a.m. This was thought to be related to time of oviposition. Eggs laid at 8 a.m. were ovulated about 8 a.m. the previous day. It takes about 4 hours for eggs to reach the uterus, which would be about 12 noon, and during the next 4 hours little shell calcification could occur. Then from 4 p.m. to 8 p.m. just enough shell is put on to make the egg fragile. When the lights go off at 8 p.m., the hens settle down in space inadequate for their size, thus body pressure causes the thin egg shell to break.

Why was the ridge or body check always around the middle of the egg? This is the widest part of the egg and it is believed that the greatest amount of pressure placed on the eggs in the uterus is exerted at this shell location. This would cause the crack to occur around the middle of the egg.

Why do body checks increase as hens age even though normal mortality decreases number of hens per cage? The egg of a young hen is small and she has enough calcium to completely seal the broken area, leaving only a slight ridge. The older hen has a larger egg and does not have enough calcium to seal the egg, thus leaving a body check. Approximately 5% of the eggs in experiments 1-3 were lost because of body checks.

What can be done to avoid the problem? Most body checks and misshapen eggs could be prevented by housing 1 bird per cage, but this is not economically feasible. However, results of the Auburn research suggest steps that will minimize the incidence of body checks:

- Do not increase cage density above recommended level. As layers die due to normal mortality, redistribute the birds to minimize cage density.

- Eliminate all conditions that will increase body movement, such as excess noise, sudden movements by personnel, or strangers, wild birds, or animals in the cage house. Undue excitement of the bird increases body or cage pressure on the oviduct causing body-checked eggs.

- The diets should be properly formulated. Inadequate dietary levels of calcium, phosphorus, vitamin D, or other nutrients that can affect shell calcification could reduce the hens' ability to satisfactorily repair body-checked eggs.

TABLE 1. EXTENT AND TYPE OF MISSHAPEN EGGS AS AFFECTED BY AGE OF HEN

Exp. number	Hen age, months	Type of misshapen egg, pct. Slight ridged	Medium ridged	Body checked	Flat sided	Total mis-shapen
1	8	16.9	1.3	0.9	0.4	19.4
2	11	15.6	.5	5.4	.2	21.7
3	14	9.5	.3	8.5	.4	18.6

TABLE 2. MISSHAPEN EGG INCIDENCE AS AFFECTED BY AGE OF HEN AND TIME OF OVIPOSITION

Oviposition time	Misshapen eggs, by age of hens: 8 months (Exp. 1)	11 months (Exp. 2)	14 months (Exp. 3)
	Pct.	*Pct.*	*Pct.*
6 p.m.- 6 a.m.	12.2 (3.8)[1]	29.1 (4.7)	28.1 (6.0)
6 a.m.- 8 a.m.	57.7 (12.6)	28.7 (17.4)	49.7 (15.6)
8 a.m.-10 a.m.	26.1 (25.8)	30.2 (29.1)	19.9 (26.0)
10 a.m.-12 noon	9.5 (27.8)	12.0 (26.5)	8.2 (24.1)
12 noon- 2 p.m.	7.1 (16.3)	17.1 (12.0)	5.8 (13.0)
2 p.m.- 4 p.m.	7.9 (8.8)	15.5 (9.5)	9.2 (10.3)
4 p.m.- 6 p.m.	9.5 (4.9)	8.0 (0.8)	5.7 (5.0)

[1] Values in parenthesis represent percentage of total eggs laid during specified period.

TABLE 3. EFFECT OF CAGE DENSITY ON INCIDENCE OF MISSHAPEN EGGS (EXPERIMENT 4)

Oviposition time	Percentage misshapen[1], by cage density: 4 hens/cage C	4 hens/cage R	4 hens/cage Total	3 hens/cage C	3 hens/cage R	3 hens/cage Total	2 hens/cage C	2 hens/cage R	2 hens/cage Total
6:00 a.m. 7:30 a.m.	33.8	21.8	55.6	14.9	10.6	25.5	8.3	16.7	25.0
7:30 a.m.- 10:00 a.m.	18.0	8.5	26.5	7.0	9.3	16.3	0	2.0	2.0
6:00 a.m.- 10:00 a.m.	21.7	11.5	33.2	9.4	9.9	19.3	2.7	6.9	9.6

[1] Misshapen eggs identified as C (checked) and R (ridged). Ridged includes slightly ridged, medium ridged, and flat sided.

HANDLE LARGE ROUND BALES . . . . WITH CARE

ELMO RENOLL, Department of Agricultural Engineering

ALABAMA farmers are excited about the new large round hay bale that shows great prospects for helping reduce farm labor and feeding cost. This well placed enthusiasm should be coupled with good farm safety practices when handling these 1,000 to 1,500 lb. monsters. These large bales and the machines that produce them have already caused numerous serious injuries and several deaths.

Any farm machine that gathers up forage and compresses it is dangerous and should be treated with caution. Farmers have operated the conventional rectangular baler for years and are generally familiar with it and the potential hazards. But the large round bale machines are of less familiar design and present different hazards. For example, the rear parts of these balers are hydraulically opened and closed by the operator and can strike a bystander. Rectangular bales usually stay in position on the ground where they drop. This is not always true of large round bales. They are ejected to the ground some distance to the rear of the machine and sometimes also roll. When baling on sloping ground remember to discharge the bales so they will not roll down the hill. Farmers have reported bales rolling down hills, destroying fences, and going onto highways, causing automobile accidents.

Handling and transporting these bales can also be hazardous. Machines and systems to handle one bale or several per trip are available and all should be operated with care. One reasonably safe way to lift and transport single bales is with a tractor equipped with a rear mounted fork or loader. Extra ballast on the tractor front end will usually be needed to counteract the bale weight.

Many farmers use a front-mounted loader on a tractor to handle these large bales even though it can be very dangerous. If the front-mounted loader is used, add plenty of weight to the rear of the tractor. This will improve stability and traction. If possible, use a tractor with wide front wheel spacing. Front loaded bales interfere with operator vision. This presents two problems. If the bale is raised high enough to see under it, the tractor tends to become unstable and is easily turned over on sloping or rough land or during a quick tractor turn. If the operator stands to see over the bale, it is difficult to reach the tractor controls.

For front bale hauling use a tractor equipped with an operator protective frame or safety cab to protect the operator from bales that might accidentally fall from the loader arms. Pay extra attention to front tire condition and inflation. These big bales place additional weight on the front tires which can cause tire failure and may result in an accident.

If you do use a front-end loader, remember to keep the bale low and the tractor speed slow.

Many large farm operators handle bales with a self-loading wagon or hauler pulled behind the tractor. Slow transport speeds are also important here. Remember to use a tractor with enough weight and braking power to safely handle the heavy load.

FIG. 1. If bales are transported with a tractor front-end loader keep the load low and speed slow. FIG. 2. Front-end bale is too high making the tractor unstable. Note the protective frame for the tractor operator. Transporting with a rear tractor loader is one suggested way to handle round bales. FIG. 3. Hauling several bales on a trailing transporter behind a suitable size tractor is one reasonably safe way to transport round bales.

2

1

3

Spray Method of Application of Fungicides to Control Peanut White Mold

P. A. BACKMAN, R. RODRIGUEZ-KABANA and J. M. HAMMOND
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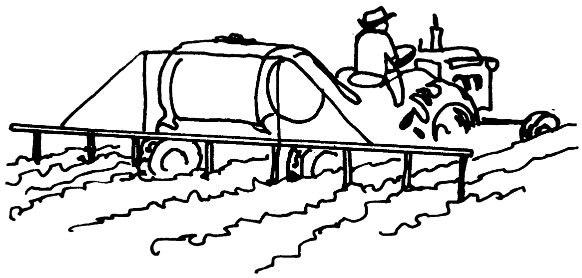


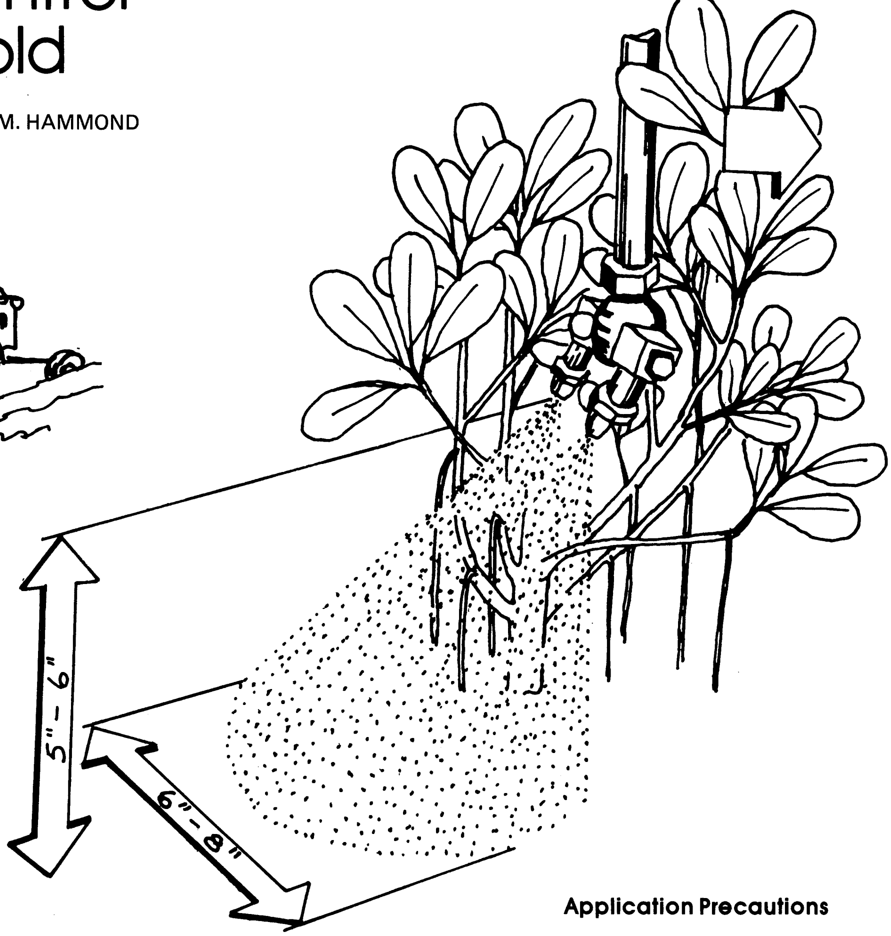


FIG. 1. Ground application of Vitavax using boom sprayer equipped with drop nozzles.

FIG. 2. Two hollow-cone spray nozzles directed to cover a 6-8" band along the ground and crown of the plant.

A MAJOR PROBLEM in controlling peanut white mold *(Sclerotium rolfsii)* is the inability to get the fungicide to the soil surface after the plant is established. Previously, the only method available to peanut farmers was to apply granules over the top of the peanut plant. The dense granule would then fall through the leaves to the soil surface, where the white mold was active. Fungicide sprays could not be used because when applied over the top of the plant, fungicide adhered mostly to the leaves, which acted as an umbrella over the soil.

Research Procedures

In 1975, researchers from Auburn University's Agricultural Experiment Station attached flexible drops to a standard ground sprayer boom, with one drop per row (figures 1 and 2). The nozzles on the drop were in the foliage and beneath the majority of the leaves, and were therefore able to apply the fungicide to the soil surface. The spray nozzles used were hollow cone types with two per drop. The sprayer operated at 60 lb. of pressure per square inch and 20 or more gal. per acre. Only the pegging zone (4-6 in. on each side of the stem) was treated.

Research Results

Results, see table, reflect the standard Terraclor 10G granule in comparison with Terraclor 2EC liquid and Vitavax 3F liquid applications. The dollar value per acre figure indicates that all fungicides were economical. These data further indicate that the drop nozzle system effectively delivers fungicides for white mold control in peanuts.

Satisfactory Compounds

Based on these and other data developed by Auburn University, Vitavax 3F is presently recommended at a rate of 3 pt. per acre (slightly higher than the rate reported in the table). This recommendation is for use in Alabama only. The Terraclor 10G formulation can also be used at a rate of 100 lb. per acre on a 12-18 in. band.

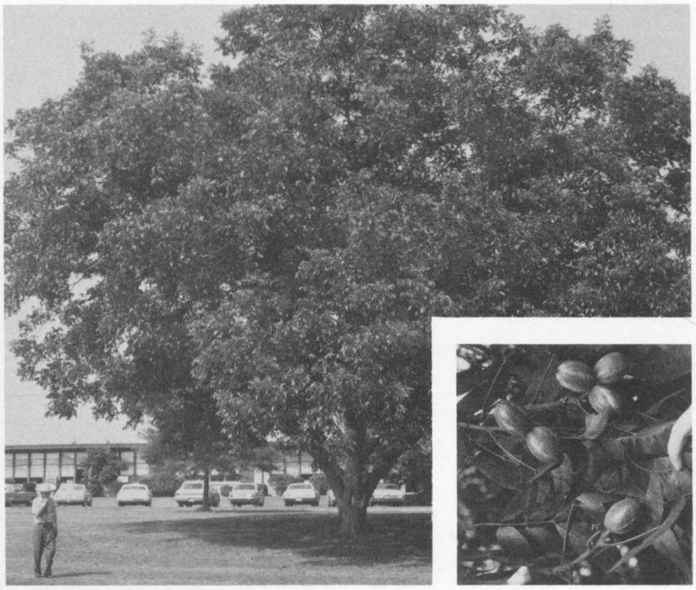
Application Precautions

These products should be applied only to fields with a history of white mold, before white mold breaks out, and preferably between 45 and 70 days after planting. As a rule of thumb, 3-4 dead sites per 100 ft. of peanut row last year indicate that a treatment should be applied this season. Product cost varies greatly between recommended treatments; from a high of $43 per acre for the terraclor-nematicide combination treatment to a low of $13.50 per acre for the Vitavax 3F treatment. Terraclor used alone costs about $20 per acre. The addition of Vitavax 3F to the recommended list allows the peanut farmer to choose between two fungicides recommended for peanut white mold control, based on cost and available equipment.

CONTROL OF WHITE MOLD IN PEANUTS WITH COMMERCIAL FUNGICIDES

Treatment	Rate	Dead plants			Yields (lb/acre)			$ value/ton			$ value/acre		
		1975	1976	mean	1975	1976	mean	1975	1976	mean	1975	1976	mean
Control.......	—	5.1	5.5	5.3	3,920	3,412	3,666	411	342	376	808	583	695
Terraclor 10G..	100 lb.	3.0	4.0	3.5	4,429	3,606	4,017	412	347	380	912	625	769
Terraclor 2EC[1]	5 gal.	1.4	4.3	2.8	4,598	3,557	4,077	425	347	386	991	617	804
Vitavax 3F[1] ...	2.5 pt.	2.5	4.7	3.6	4,138	3,799	3,968	420	373	396	869	708	788

[1] Delivered with the drop nozzle technique.



1925 Pecan Test Planting Still Yielding Information

C. L. ISBELL, Department of Horticulture (Retired)

PECAN TREES planted 52 years ago in an experiment at Albertville are still yielding useful information. The experiment was discontinued 2 years after the planting of 123 trees was made on the campus of the Secondary Agricultural School, now Albertville High School, due to lack of funds for supervision. But observations and inquiries by the author since that time indicate that pecan trees are suited to the area. The trees have yielded well, produced excellent shade, and have not been seriously damaged by diseases.

[1] R. W. Taylor, now of Guntersville, planted the trees.

Sandstone near the surface prevented roots from going deep. As a result, the pecan tree blew down in 1976.

Most of the trees planted in the Albertville test orchard were donated by some 16 nurseries. They were shipped to Auburn, heeled in, and later taken up, repacked, and shipped by rail to Albertville for planting during the week ending March 7, 1925.[1] Soil of the planting site is a sandy loam underlain with sandstone, usually 2½-3½ ft. below the surface. Replanting in 1926 was necessary to replace 55 trees that died because of poor condition at planting and dry weather.

Much of the campus had been taken for playgrounds, walks, roads, and building sites when 1976 observations were made. However, 20 of the original trees, or replants made in 1926, remained.

Observations in 1976

A block of four Stuart and four Success trees of the original plantings, located in the southeast corner of the campus (left photo above), was observed in May and September, 1976. Although these trees are spaced 60 ft. apart, limbs are meeting. Trunk diameter is about 3 ft. A good crop of nuts was made in 1976, and fruit scars on twigs indicate that yields were good in past years.

One of these Stuart trees was uprooted by wind after the May 15 observation. Its roots had not gone deep because of the sandstone, as shown in the photograph at left.

Size and productiveness of the other remaining trees vary according to space, soil fertility, and moisture. One of the Success trees (right photo above) has a 4-ft. trunk diameter and a limb spread of 78 ft. It was carrying an estimated crop of 100 lb. or more of nuts on September 24, 1976. A large Schley also had a good crop of nuts, and trees of Alley, Pabst, and Deman were carrying good crops of almost disease-free nuts when observed. Citizens living near the campus report that the trees have fruited well through the years.

Lessons from the Planting

Trees with relatively large diameters at planting survived best. Results further show the importance of setting trees in soil with enough depth, fertility, and moisture for good growth.

Those planted in moist fertile soil became crowded by the time they were 50 years old. Therefore, wider spacing is suggested for maximum nut production or for producing specimen shade trees. Close spaced trees will require pruning to open up foliage for light.

Most varieties remaining show little problem from scab. But trees of the scab susceptible Delmas variety were observed to be seriously damaged by the disease and should not be planted in the area unless control measures are to be taken.

Presence of pecan trees on the campus has provided valuable shade and allowed thousands of students to observe producing pecan trees. Such observations may have helped many decide whether to plant pecan trees around their homes.

ALABAMA WORMS ARE TOUGHER THAN CALIFORNIA WORMS

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THE BEET ARMYWORM has become a pest of cotton, soybeans, peanuts, and several other crops in the southeastern United States in the last few years. Reports on chemical control research from the southeastern and southwestern regions of the United States indicate differences in susceptibility to insecticides between insect populations found in these two areas.

A research worker in California obtained good control of this insect on cabbage and cauliflower with low rates of several organophosphorous and carbamate insecticides. Another entomologist in Texas reported, at about the same time, that he obtained good control of the beet armyworm on alfalfa with methyl parathion (an organophosphorous compound).

In tests conducted during the same time period at the Auburn University Agricultural Experiment Station, scientists were unable to control this insect with organophosphorous compounds and only obtained control with the carbamate compound methomyl at 1 lb. per acre (a relatively high rate for this material).

A laboratory study was begun to try to determine if real toxicological differences existed between these eastern and western strains. This study involved the determination of LD-50's for selected organochlorine, organophosphorous, and carbamate insecticides.

The LD-50 Concept

The term LD-50 literally means ''lethal dose for 50% of the test animals.'' Stated another way, the LD-50 is the quantity of insecticide required to kill 50% of the insects, on a weight for weight basis (micrograms of insecticide per gram of insect). The term LD-50 can be used when referring to any toxicant and any population (penicillin vs. strep throat bacteria, atomic radiation vs. human beings, pesticides vs. laboratory rats, etc.) and it is a very useful way to discuss the relative toxicities of toxicants against a target population. In this case the toxicants were several insecticides and the target population was the beet armyworm. To understand the LD-50 concept, it is necessary to remember that the higher the LD-50 number, the less toxic the compound (a higher number indicates that more of the toxicant is required to reach the LD-50 level).

The Laboratory Test

Two beet armyworm cultures were established, an eastern strain from insects collected in local fields and a California strain from specimens provided by the University of California, Riverside. Both cultures were maintained in the laboratory on an artificial diet developed at Auburn.

Both strains were tested with methomyl, carbaryl, methyl parathion, EPN, aldrin, endrin, and acephate. Stock solutions of technical materials and dilutions were prepared in acetone. Each larva was dosed with 1 microliter of insecticide-solvent solution which was applied to the dorsal surface of the body with a microapplicator.

The following procedure was used to test larvae from both strains. Twelve (15-day-old) larvae were selected randomly for each treatment level from each strain. The 12 larvae were weighed as a group, mean weight per larva was calculated, and insecticide dosages were applied on the basis of this mean weight. Four to six treatment rates plus a solvent-treated check were used for each insecticide tested. Mortality counts were made 48 hr. after treatment. LD-50 values were statistically calculated, based on the micrograms of toxicants used per gram of insect.

Resistance Determined

Based on the LD-50 values, beet armyworm larvae from California were more susceptible to poisoning by each material tested than were local larvae. The exact differences in susceptibility are presented in the table. Although some degree of resistance by southeastern larvae was shown for all compounds, it was particularly pronounced for methyl parathion. Fifty-eight times as much methyl parathion was required to reach the LD-50 level of toxicity among southeastern larvae as was required for California larvae.

LD-50 VALUES AT 48 HOURS AFTER TREATMENT FOR 15-DAY-OLD BEET ARMYWORM LARVAE FROM SOUTHEASTERN AND CALIFORNIA STRAINS

Insecticide	LD-50 in ug/g	
	S. E. Strain	Cal. Strain
Methomyl	62	52
Carbaryl	1300	193
Methyl parathion	700	12
EPN	133	8
Aldrin	240	200
Endrin	70	24
Acephate	300	60

FIG. 1. A beet armyworm beginning to feed on a peanut leaf. FIG. 2. Individual beet armyworms were laboratory reared in these small plastic cups. FIG. 3. Fully grown beet armyworm larvae. Note color variation.

FUTURE STATE CONTROL OF MILK PRICES?

LOWELL WILSON, Department of Agricultural Economics and Rural Sociology

STATE CONTROL of fluid milk prices, particularly retail control, is one of the most controversial issues in the milk industry. In Alabama a state regulatory agency established milk prices at all levels for the past 40 years until January 1977, when resale pricing was discontinued. Periodically, regulation by the Alabama Dairy Commission (formerly Milk Control Board) has become a public and political issue. Currently, the future of state regulation of milk prices in Alabama is uncertain.

A central issue of control by a state agency is the correctness of established prices. An argument against state control of retail prices is that such agencies tend to set prices higher than would be established by competitive forces in the market. Many people simply claim opposition to price control. On the other hand, supporters claim that regulation helps ensure an adequate supply of milk, provides market stability, and maintains reasonable milk prices that are neither excessive nor discounted.

How do retail milk prices in Alabama compare to those found in other markets? To measure price levels, comparisons were made of retail prices in Alabama and several other southern markets. Also, milk price changes were related to movements in certain economic indicators.

Several problems are faced in studying retail milk prices. Milk is sold through various distribution systems[1] and outlets, as well as in several products and container sizes. Each of these market alternatives may affect retail price per unit of milk. The practical choice in price analysis is to select the major product, container size, and place of sale. According to Dairy Commission records, approximately 53% of all fluid milk product sales in Alabama were gallons (32.4%) and half-gallons (20.8%) of homogenized wholesale milk in October 1976. Supermarkets are the leading retail outlets. The gallon container, which is now the most popular unit, was introduced in Alabama in 1970.

[1] In May 1976, 92% of milk sales in Alabama were by wholesale distribution and 8% on retail delivery routes.

TABLE 1. A SUMMARY OF HALF-GALLON MINIMUM RETAIL MILK PRICES, ALABAMA, 1959-1977

Effective dates	Retail minimum price
	Cents
Nov. 1, 1959-Mar. 15, 1967	52-54[1]
Mar. 16, 1967-Aug. 31, 1970	57
Sept. 1, 1970-Jan. 31, 1973	62
Feb. 1, 1973-June 30, 1973	66
July 1, 1973-Sept. 13, 1973	68
Sept. 14, 1973-Feb. 20, 1974	74
Feb. 21, 1974-Dec. 31, 1974	80
Jan. 1, 1975-Apr. 13, 1975	87
Apr. 14, 1975-Jan. 21, 1976	85
Feb. 1, 1976-Jan. 10, 1977[2]	87

Source: Pricing orders of the Alabama Dairy Commission.

[1] Retail prices varied by markets within the State.

[2] Minimum retail prices were decontrolled.

TABLE 2. COMPARISONS OF CHANGES IN ALABAMA MILK PRICES, NONAGRICULTURAL INCOME AND CONSUMER PRICE INDEX, 1960 AND 1976

Item	1960	December 1976	Percentage change
Retail milk price, half-gal., Alabama, dollars	0.52-0.54	0.87	67.3
U. S. Consumer Price Index (1967=100)	87.8	174.3	98.5
Average weekly earnings, Alabama, dollars[1]	75.73	191.82	153.3

[1] Average weekly earnings of workers in nonagricultural industries.

In the 17-year period since 1960, the minimum retail price for a half-gallon of milk was increased eight times and reduced once, Table 1. Prices rose from 52¢ to 87¢ per half-gallon, an increase of 35¢ or 67%. Most of the increases were made since 1973, which has been a period of rapid inflation. From November 1959 to March 1967, which was more than 7 years, milk prices in Alabama were unchanged. Then in 1973 the Commission raised retail prices three times from 62¢ to 74¢ per half-gallon. By January 1975 prices had been increased to 87¢. In April 1975, the Commission granted a 2¢ reduction. In February 1976, it was increased again to 87¢ where the minimum remained until the Commission discontinued retail price control in January 1977.

TABLE 3. RETAIL PRICES FOR MILK SOLD IN HALF-GALLON AND GALLON CONTAINERS IN STORES OPERATED BY A NATIONAL CHAIN, SELECTED MARKETS, APRIL 1977

Market	Half-gallon	Gallon
	Dol.	*Dol.*
Birmingham, Ala.		
Store brand	.87	1.39
Other brand	.87	1.39
Atlanta, Ga.		
Store brand	.99	1.89
Other brand	1.03	1.93
Columbus Ga.		
Store brand	.93	1.69
Other brand	1.09	
Jackson, Miss.		
Store brand	.97	1.95
Other brand	1.05	2.11
Pensacola, Fla.		
Store brand	.75	1.39
Other brand	.87	1.67
Memphis, Tenn.		
Store brand	.92	1.81
Other brand	.94	1.85

Source: Data obtained by the Alabama Dairy Commission on approximately the 5th of each month.

In the absence of controls, retail prices have tended downward. Prices in many stores initially dropped sharply and milk was used as a price special. Gallon prices have experienced the greatest reduction, declining from $1.74 to prices commonly ranging from $1.39 to $1.59. The overall impact on half-gallon prices is less certain. In some instances, half-gallon prices are higher, particularly prices on proprietary brands.

Changes in milk prices were compared to changes in the U.S. Consumer Price Index (CPI) and average weekly earnings of workers in Alabama, Table 2. In the past 17 years, (through December 1976), the cost of living as measured by the CPI almost doubled while earnings of Alabama nonagricultural workers rose over 150%. In January 1977, when the Commission decontrolled retail prices, the minimum retail price had been increased since 1960 about 44% as much as the rise in wages in Alabama and 68% of the rise in the cost of living.

For several years the Dairy Commission has obtained milk prices from stores operated by a national chain in selected southern markets. Retail milk prices are not established by state agencies in any of these markets. The April 1977 information showed that retail prices prevailing in Alabama were among the lowest surveyed. The half-gallon at 87¢, which was unchanged from the minimum in effect in January 1977, was below all other half-gallon prices with the exception of the store brand in Pensacola. Gallon prices at $1.39 were down 35¢ from the January minimum and were substantially below reported prices in the other markets.

Following de-control, milk prices frequently fluctuate widely before market stability is again achieved. In Alabama, the immediate effect was sharply reduced retail prices. However, comparisons with prices in other markets in the region suggest that the longer run effect will be rising prices in Alabama more in line with prices in the region.

FOLIAR FUNGICIDES FOR SOYBEANS

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SOYBEANS through the years have been regarded as a stepchild crop, returning only a marginal profit to the owner. The economics of crop production prevented farmers from utilizing costly pesticides to increase yields. During the past 4 years, however, the average price of soybeans has risen steadily, to a present level of more than $10 per bu. This improved economic position has prompted increased research at Auburn University's Agricultural Experiment Station to determine soybean disease losses and evaluate control measures.

Since 1974, tests have been conducted at various locations in Alabama to evaluate the response of soybeans to foliar fungicides. The fungicide benomyl (Benlate ® 50WP) was of particular interest because it had already shown promise in a Texas research project, and was being actively promoted by its manufacturer. The tests reported here were carried out with two applications of fungicide applied at mid-late bloom and 14 days later. These times of application were chosen on the basis of results from other scientists throughout the southeast.

Table 1 is a summary of yield results from 1974-1976. This table reflects potential benefits if the farmer routinely applies fungicide to his soybeans. Table 2 reports only those locations that were wet (rainfall, heavy dews, etc.) during the bloom to pod-fill periods. In Alabama, the following diseases were found to occur (in order of importance):

Foliage Disease: brown spot (Septoria); frog eye (Cercospora); bacterial blights (Pseudomonas, Xanthomonas); downy mildew (Peronospora).

Stem and Pod Diseases: anthracnose (Colletotrichum); pod and stem blight (Diaporthe); purple stain (Cercospora); and stem canker (Diaporthe).

Of these diseases, anthracnose and brown spot cause the greatest losses; however, on some occasions, severe losses have occurred from pod and stem blight, and stem canker organisms. Brown spot causes premature defoliation; successful control is evidenced by a longer period of leaf retention. Anthracnose and pod and stem blight both cause severe pod damage, and subsequent blanking (empty pods) and seed damage. Symptoms of these diseases are seldom visible at the time when fungicides should be applied.

Data developed during the past three seasons and the fact that symptoms of the most damaging diseases are not visible when fungicides need to be applied, indicate:

(1) When weather conditions are conducive to disease development (rain, fog, or heavy dew) during bloom, a fungicide should be applied at mid-late bloom.

(2) A subsequent application should be made 14-18 days later if weather conditions persist or develop.

(3) Either or both of the applications may be omitted if the weather is dry and unfavorable to disease development.

(4) Benlate 50 WP 8 oz. per acre at each application is the only fungicide presently recommended by Auburn University.

(5) Beans should be harvested as soon as possible after maturity, especially if they are destined to be seed beans.

Application of Benlate by air costs between $12-14 per acre for both treatments. Assuming 5 bu. of extra beans will result (Table 2), with a value of $7 per bu., the farmer will realize $35 more per acre by following these recommendations. In addition, early beans usually have less fungi on the seed and slightly better germination.

TABLE 1. MEAN YIELD OF SOYBEANS FOLLOWING FUNGICIDE TREATMENT (ALL LOCATIONS)

Fungicide	Rate/acre oz.	Yield lb.	Percent increase
Benlate......	8	43.4	10.4
Du-Ter......	8	42.4	7.9
None.......	—	39.3	—

TABLE 2. SOYBEAN YIELDS BU./ACRE FOLLOWING FUNGICIDE TREATMENT (WET LOCATIONS)

Test	Fungicide		
	Control (untreated)	Benlate 8 oz.	Du-Ter 8 oz.
1	39.6	44.3	42.7
2	17.6	21.9	18.5
3	56.8	62.0	61.9
4	38.4	42.1	38.3
5	34.7	41.0	40.3
Mean	37.4	42.3	40.4
Bu. increase	0	4.9	3.0
Percent increase ..	0	13.1	8.3

Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product, nor does it imply its approval to the exclusion of other products that may also be suitable.

THE EUONYMUS SCALE IN ALABAMA

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THE EUONYMUS SCALE, *Unaspis euonymi* (Comstock), is a major scale insect pest in all temperate regions of the world, except Australia. It attacks a number of hosts including bittersweet, boxwood, camellia, euonymus, hibiscus, holly, ligustrum, and pachysandra. This armored scale insect develops in great numbers and is very difficult to control.

Euonymus scale is very common in Alabama, often causing complete defoliation or death to numerous varieties of evergreen euonymus. Climbing euonymus is more often infested than some of the upright forms and plants growing closest to buildings seem to be damaged more than those growing where there is free air circulation.

The euonymus scale is difficult to detect until after it has caused serious damage. The first indication of attack is the occurrence of yellowish or whitish spots on leaves. Heavy infestations will cause leaves to turn yellow and drop (Figure 1). Under such conditions a normally green plant may become bare by midsummer.

Like most scale insects, the euonymus scale forms a tough cover of waxes and proteins which is enlarged as they grow. The female scale covers are about 1/16 in. long and look like dark brown oyster shells (Figure 2A). They are found mainly on the stems and occasionally on the leaves. The male covers are elongate and white with three longitudinal ridges (Figure 2B). They occur in the greatest numbers on the underside of leaves and lower branches of the plant. Their conspicuous white color on green leaves is the best signal that this pest is present.

In Alabama the euonymus scale overwinters as fertilized adult females. Orange-yellow eggs are laid under the female scale cover in early spring and typically hatch during the latter part of March. The nymphs, commonly called crawlers, crawl to other parts of the host plant or are blown to other susceptible hosts. Most crawlers settle on new growth. There are three generations of euonymus scale per year in Alabama, with crawlers emerging in March, June, and August.

FIG. 1. Severely damaged variegated euonymus shrub (foreground) as a result of heavy infestation of euonymus scale.

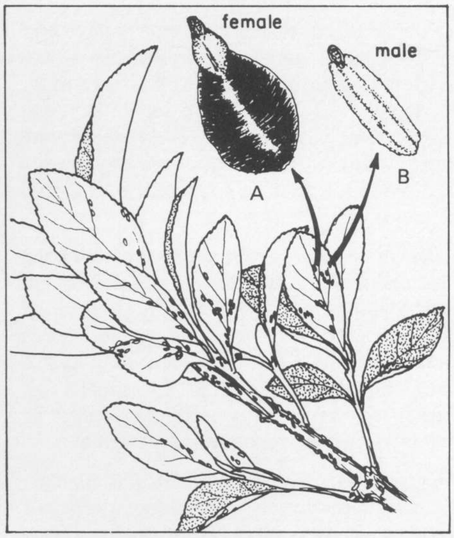

FIG. 2. Illustration of male and female euonymus scale on common evergreen euonymus.

Frequent treatments with pesticides are usually required for control. Best results were obtained by spraying during crawler emergence periods and repeating at 10-day intervals for three treatments. Summer sprays for crawler control include carbaryl (Sevin, Sevimol), dimethoate (Cygon) and malathion (Cythion), used according to label directions. A dormant spray, such as Volck Oil Spray, used in early spring before new plant growth starts will also help control euonymus scale. Cutting back heavily infested euonymus shrubs and hedges and spraying new shoots to protect them from reinfestation can also help.

An alternate control method utilizing natural host plant resistance of euonymus plants to attack by the euonymus scale is currently being investigated by entomologists in Auburn University's Agricultural Experiment Station. This research indicates there is a varietal difference in susceptibility of euonymus plants to attack by the euonymus scale. In 1975, eight varieties of euonymus plants were planted in an 8 x 8 latin square design. These plants were inoculated with scale by tying a 2-in. length of euonymus stem, heavily encrusted with egg-laden female euonymus scale, to each test plant. Test plants were monitored through 1976 to determine the rate and degree of infestation in the eight included varieties. Results are presented in the table.

Because of apparent resistance to euonymus scale, *Euonymus kiautschovica* (spreading euonymus) can be used as a substitute for *E. japonica* (common evergreen euonymus) where low maintenance plants are desired.

RATE AND DEGREE OF INFESTATION OF VARIOUS VARIETIES OF EUONYMUS PLANTS BY EUONYMUS SCALE—1976

Variety	Number of plants infested at end of 1976	Degree of infestation
Euonymus alatus compacta	1 out of 8	1 light
Euonymus fortunei acutus	1 out of 8	1 light
Euonymus fortunei carrieri	6 out of 8	1 heavy, 2 medium, 3 light
Euonymus fortunei kewensis	2 out of 7	2 light
Euonymus fortunei sarcoxie	6 out of 8	1 medium, 5 light
Euonymus japonicus	7 out of 8	3 heavy, 3 medium, 1 light
Euonymus kiautschovicus	0 out of 8	———
Euonymus sieboldianus	5 out of 8	1 heavy, 4 light

[1] Light infestation = only a few scale insects on plant.
Medium infestation = infestation limited to original infestation area.
Heavy infestation = general infestation of entire plant.

Economics of Solar Energy for Broiler Production

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THE POULTRY INDUSTRY has grown rapidly during the past two decades, especially in the South. Although poultry production already ranks as one of the most efficient food supplying industries in the Nation, efforts continue to improve efficiency of all stages of production and marketing.

Past efforts toward improvement have emphasized areas where improvement would yield the greatest benefit. For example, development of labor saving techniques was given priority over methods of conserving energy during the time when energy requirements could be supplied from several sources at relatively low cost.

Recent year energy shortages and high costs have changed the thinking of the poultry industry and made energy use a problem of major concern. New developments in energy sources and supplies are now receiving special consideration in the quest for greater efficiency. However, new technology must be both physically and economically feasible.

Completed research results show that a substantial proportion of the energy needs for brooding young poultry can be obtained from solar radiation. The economic feasibility of using a solar heating system was examined in Auburn University Agricultural Experiment Station research. The economic data were developed on the basis of research results from a potential solar conversion system and using currently relevant cost data.

Adding a solar heating system requires some adaptations. Costs for both fuel and nonfuel inputs change, so estimates were computed for five situations. The results are reflected in annual costs per 1,000 birds grown, given in the table.

Cost estimates were made for five broiler production systems comparing conventional and solar heating methods, as explained in the table. Data used in making estimates were obtained from poultry industry representatives, including producers and contractors.

For systems 1, 2, and 3, estimates were based on a unit that consisted of a house with 12,096 sq. ft. (36 x 336 ft.), insulated roof and ends, and side curtains. Placement rate was 1 chick per 0.8 sq. ft., five batches per year, with single-stage brooding.

In systems 4 and 5, multi-stage brooding was evaluated. Multi-stage brooding assumes adequate disease control when birds of different ages are housed in different sections of the same building. Floor space was increased to 21,002.4 sq. ft. (36 x 583.4 ft.). In addition to roof and end insulation, 83 ft. of the side walls were insulated. Placement rate was the same as in other systems, but the number of batches increased to 10.

Years of useful life were 20 for buildings, 7½ for equipment, and 15 for solar units. Amortization was at the rate of 8%. Cost of L.P. gas was estimated at 36¢ per gal.

Changing poultry brooding management apparently can substantially reduce amount of fuel used. Partial-house brooding with lowered ceiling and well insulated brooding area can contribute to a 40-45% saving in fuel. Production cost per thousand could be reduced approximately 10%.

As indicated by estimates in the table, solar energy brooding is not economically feasible under present management techniques. Installation of a solar unit in single-stage brooding could reduce the volume of fossil fuel used by 75%, according to the estimates, but production costs per thousand birds were increased almost 9%. These estimates were based on current prices for buying and installing solar equipment in relation to alternative energy sources, and on the basis of current technology.

Using solar radiation as a source of energy has the disadvantage that the amount available can be limited by cloudy or inclement weather. On the other hand, it has the distinctive feature of being available in some quantity almost every day. Making continuous use of this available supply of energy greatly improves the chances for economic justification of a solar unit.

Using solar energy in a multi-stage broiler brooding system resulted in a savings of almost 80% of the fossil fuel required. Production cost per thousand broilers was reduced about 16% from that for single-stage brooding using a solar unit.

With current cost and price relationships, savings from multi-stage brooding would pay for the solar unit in approximately 14 years. Whether multi-stage brooding proves feasible will also depend on its effect on such factors as transportation and handling and other costs.

COMPARATIVE COSTS OF DIFFERENT BROILER BROODING SYSTEMS WITH CONVENTIONAL AND SOLAR ENERGY SOURCES

Brooding method and energy system[1]	Initial building-equipment investment	Annual cost	Fuel saved	Value of fuel saved	Brooding cost per 1,000 birds
	Dol.	*Dol.*	*Gal.*	*Dol.*	*Dol.*
1	26,600	5,981	—	—	79.75
2	26,380	5,343	1,691	609	71.24
3	35,153	5,806	2,314	833	77.55
4	43,700	8,379	3,382	1,218	55.86
5	56,375	9,805	4,906	1,766	65.37

[1] Brooding systems are: 1 = whole house brooding, conventional heating; 2 = single-stage partial house brooding, conventional heating; 3 = single-stage partial house brooding, solar heating; 4 = multi-stage partial house brooding, conventional heating; and 5 = multi-stage partial house brooding, solar heating.

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