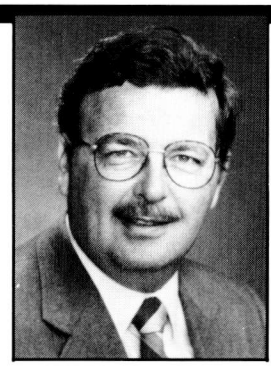
HIGHLIGHTS
OF AGRICULTURAL RESEARCH

Volume 37, No. 1 Spring 1990
Alabama Agricultural Experiment Station Lowell T. Frobish, Director
Auburn University Auburn University, Alabama

DIRECTOR'S COMMENTS



LOWELL T. FROBISH

CONTROL of insects, weeds, mites, nematodes, and pathogens has been a major problem confronting agricultural and forestry production for decades. Early control of crop pests was limited to cultural practices such as crop rotations. With the development of the science of plant breeding, many new cultivars were developed that were resistant to pests. These new varieties, coupled with crop rotation practices, sustained agricultural production for a short time.

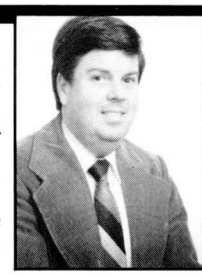
In the 1940's, the discovery of organic compounds such as DDT, 2,4-D, and BHC (benzene hexachloride) heralded a new era in the management of pests. Yields of many crops increased significantly through the 1960's as pesticide use grew rapidly. Concerns mounted as the potential for detrimental environmental effects and human health risks was recognized, and safer and less persistent pesticides were developed.

Because of agriculturists' concern about the heavy use of synthetic chemicals, research was initiated to control pests through a variety of methods — called a systems approach. Integrated pest management (IMP) is one such approach. It is an ecologically based pest control strategy that relies on natural mortality factors (natural enemies, weather, crop management, etc.). IPM involves all aspects of crop production, such as cultivation, fertilization, postharvest management, tillage practices, selection of pesticides, and timing of applications. Use of more specific, less biologically active pesticides is a major principle guiding IPM development.

Genetic resistance is still the most important defense mechanism against pests. The use of recombinant DNA techniques, gene transfer, and cell culture, coupled with traditional plant breeding, will result in the development of cultivars that are both resistant to pests and tolerant of synthetic agricultural chemicals.

The application of biological agents to control pests is a new technology of much promise. Biocontrol may mean utilizing natural microorganisms to control weeds, weeds to control insects, or insects to control weeds and microorganisms. Microorganisms may be used to control other microorganisms, a plant's own defense system may be enhanced by inoculation with an avirulent pathogen, and naturally occurring chemicals or weed diseases may be used to control diseases. All of these offer an alternative to the use of synthetic chemicals, but they will not eliminate the total need for pesticide use.

MAY WE INTRODUCE



Dr. Glenn Wehtje, Associate Professor of Agronomy and Soils. A native of Washington State, Wehtje earned a B.S. degree in agriculture from Washington State University, an M.S. in plant pathology from North Dakota State University, and a Ph.D. in agronomy and weed science from the University of Nebraska.

Wehtje came to Auburn in 1981 as an Assistant Professor and was promoted to Associate Professor in 1986. Since coming to Auburn, Wehtje has worked extensively with peanut weed control. His research team was instrumental in developing timing and rates of paraquat for use on peanuts. Paraquat has subsequently become the leading replacement for dinoseb-containing herbicides that were banned in 1987.

In addition to his herbicide screening work, Wehtje also works extensively in the area of herbicide movement in the soil and herbicide interaction with other cropping practices. His report on work with different peanut seed sizes is featured on page 4.

ON THE COVER. Live oak trees in large containers grew faster when water was kept at a constant level in saucers. See story on page 11.

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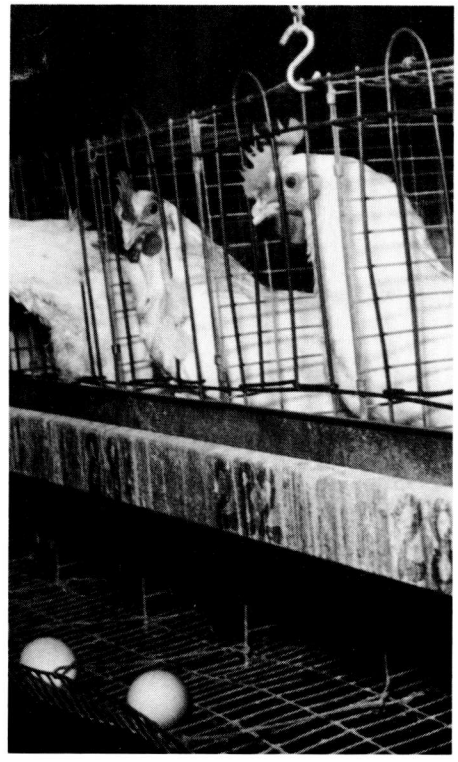
EDITOR'S NOTE. Mention of trade names does not indicate endorsement by the Alabama Agricultural Experiment Station or Auburn University of one brand over another. Any use of pesticide rates in excess of labeled amounts in research reported does not constitute recommendation of such rate. Such use is simply part of the scientific investigation necessary to evaluate various materials. No chemical should be used at rates above those permitted by the label. Information contained herein is available to all persons without regard to race, color, sex, or national origin.

K.S. RAO and D.A. ROLAND, SR.

UNDERSTANDING CALCIUM SOLUBILIZATION IN HENS MAY BENEFIT EGG PRODUCERS



CALCIUM is vital for egg shell formation, but it must be dissolved in the digestive system (calcium solubilization) of hens before it is available for absorption. By understanding how calcium solubilization occurs and how it is affected by external factors, egg producers can make more effective decisions regarding the proper form and quantity of calcium supplement needed.

After ingestion, calcium supplements (limestone or oyster shell) react with the digestive acids secreted in the proventriculus (glandular stomach) of hens and present in the gizzard (muscular stomach), to release calcium in a form available for absorption (bioavailable calcium). Initial experiments at the Alabama Agricultural Experiment Station (AAES) showed that 70% of the 3.75 g (grams) of the daily calcium consumed was solubilized in the digestive system of hens.

Additional AAES experiments indicated that, on a percentage basis, calcium solubilization and utilization (calcium consumed minus calcium excreted) decreased as calcium consumption by hens increased, see table. However, the absolute quantity of calcium solubilized and utilized by hens increased with the amount of calcium consumed.

The particle size of the calcium supplement also influenced calcium solubilization. As shown by data in the table, hens solubilized a greater percentage of calcium from large- versus small-particle limestone at each of the dietary levels tested. Large particles of the calcium supplement were held in the gizzard for a longer period of time, causing a gradual solubilization that allowed continuous intestinal absorption. Therefore, during the night when calcium needs for egg shell calcification are greatest, large particles held in the gizzard could still supply calcium to the digestive system. A prolonged supply of solubilized calcium to the intestine of hens fed large-particle limestone allowed these birds to utilize more calcium than hens fed small-particle limestone, see table.

Small particles of calcium supplement, on the other hand, are an immediate source of calcium to actively feeding laying hens. Although small-particle calcium supplement is highly soluble, its residence time in the gizzard is shorter and thus its overall solubility is decreased.

Hens require approximately 2 g of calcium daily to form an egg shell; based on the AAES study, calcium in the diet needed to meet this requirement could be lowered by feeding only large- instead of small-particle limestone. However, in the commercial layer industry, using an exclusively large-particle calcium supplement may increase calcium separation in the feed, wastage of calcium supplement by hens, and expense.

The experiment also supports the popular practice of adding a portion of the calcium supplement in layer feeds in the form of pullet- or hen-sized particles (limestone or oyster shell), and the rest in the form of pulverized limestone. Partial incorporation of one-third to one-half of a large-particle calcium source in the diet should increase calcium bioavailability during adverse situations, such as elevated environmental temperatures and inadequate feeder space.

It should be noted that large-particle calcium supplements cannot be used in some situations. Some feeding systems do not operate efficiently if large particles are used. Pellet feeding is practiced in some breeder operations to prevent feed propagation of bacteria, and large particles in the feed tend to reduce pellet-binding capabilities. To ensure sufficient calcium solubilization in these situations, higher levels of dietary calcium in the form of small-particle limestone can be used.

CALCIUM SOLUBILIZATION AND UTILIZATION BY LAYING HENS FED VARYING LEVELS OF DIETARY CALCIUM (Ca) FROM TWO PARTICLE SIZES OF LIMESTONE

Treatment	Solubilization and utilization, by dietary calcium level				
	1.5 pct.	3.0 pct.	4.5 pct.	6.0 pct.	Av.
Large-particle limestone[1]					
Ca consumed, g	1.49	2.91	4.00	4.81	3.30
Ca solubilized, g	1.43	2.36	3.21	3.51	2.63
Ca solubilized, pct.	96	85	88	80	87
Ca utilized, g	1.16	1.93	2.40	2.54	2.01
Ca utilized, pct.	78	72	64	56	68
Small-particle limestone[2]					
Ca consumed, g	1.45	2.90	4.32	5.41	3.52
Ca solubilized, g	1.32	2.32	2.76	2.92	2.33
Ca solubilized, pct.	91	81	63	54	72
Ca utilized, g	1.12	1.60	2.07	2.22	1.75
Ca utilized, pct.	77	55	48	41	55

[1]Large-particle limestone = 2 to 4 mm (particles passed through U.S.A. standard testing sieve #5, but were retained by sieve #10).
[2]Small-particle limestone = 0.5 to 0.8 mm (passed through sieve #20, but were retained by sieve #30).

Rao is Graduate Research Assistant and Roland is Professor of Poultry Science.

G.R. WEHTJE, T.V. HICKS, and J.P. BOSTICK

PEANUT YIELDS COMPARABLE FROM LARGE VERSUS SMALL SEED

PEANUT GROWERS can save up to $30 per acre by using smaller, "high count" seed. Whether these smaller seed tolerate herbicide damage and other production rigors, and ultimately produce comparable peanut yields to larger, more expensive seed, is not clear.

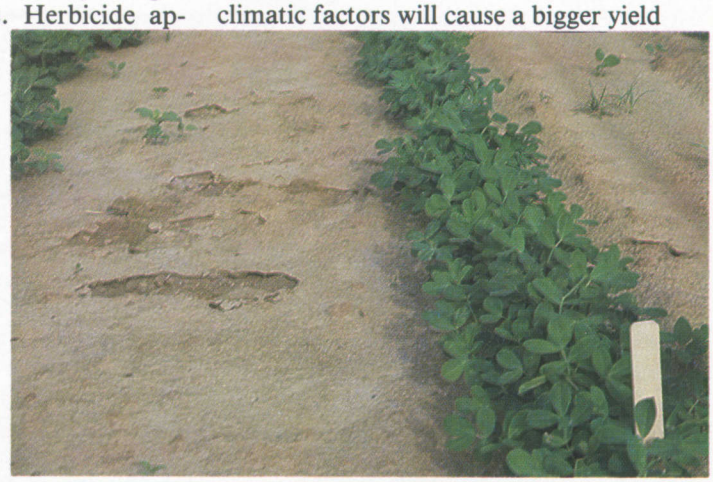
To determine effect of seed size, three sizes of seed were planted in Alabama Agricultural Experiment Station tests at the Wiregrass Substation, Headland. Seed sizes included: small (1,515 seed per pound); medium (1,185 seed per pound); and large (825 seed per pound). The number of seed planted per acre was constant for the three sizes. Three weeks after emergence, plots within each of the seed sizes were treated with Gramoxone at 0.125 or 0.250 lb. active ingredient per acre. Some plots received two applications of the lower rate of Gramoxone.

Upon germination, the smaller seed produced smaller plants, and the medium and large seed produced progressively larger plants. Herbicide application always temporarily stopped growth, regardless of seed size. Measurement of canopy width revealed that these initial differences remained throughout much of the growing season. The rate of growth appeared to be similar, with the larger seed maintaining larger plants throughout most of the growing season.

Though Gramoxone had the expected effect of temporarily stopping growth, it was expected that the larger plants would recover more quickly. This did not appear to be the case. The smaller plants, from small seed, appeared to recover just as rapidly from any of the herbicide treatments.

The direct relationship between increasing seed size and yield was evident, but not great. Small seed, averaged across the various herbicide treatments, yielded 3,180 lb. per acre. Medium seed yielded 3,280 lb. per acre and large seed yielded 3,250 lb. per acre.

It must be pointed out that these data are from 1 year (1989), and this was a nearly perfect climatic growing season. Total rainfall at Headland for May, June, and July was 24 in. Timely rains nearer harvest time provided ideal full season growing conditions. It is expected that stresses from drought and other climatic factors will cause a bigger yield differential among the seed sizes, but this is not known.



Top left shows early season peanuts from small seed, bottom left shows peanuts from large seed, and above shows medium seed; none of these peanuts had been treated with postemergence herbicides.

Based on the 1-year test, it appears that the extra cost of the large seed simply represents a means to enter the growing season with relatively larger plants. The value of these larger plants, under different growing conditions, remains to be determined in future phases of the research.

Wehtje is Associate Professor and Hicks is Research Associate of Agronomy and Soils; Bostick is Executive Secretary, Alabama Crop Improvement Association.

J.D. NORTON, G.E. BOYHAN, J.E. BROWN, and M.H. HOLLINGSWORTH

NEWLY LABELED HERBICIDE PROMISING FOR WATERMELON AND CANTALOUPE WEED CONTROL

UNCONTROLLED weeds can seriously limit melon production. Weeds are a problem during two critical periods of the growing season: (1) during seed germination when weeds grow rapidly and provide damaging competition to the crop, and (2) during the last 2-3 weeks of the production cycle, the time when the majority of sugars are produced in melons and when weeds shade the melon plants to disrupt sugar formation. The vining nature of the crop makes weed control difficult during most of the growing season.

Effective and safe herbicides for use in watermelon and cantaloupe production have been sought for several years in research by the Alabama Agricultural Experiment Station. Unfortunately, only a few herbicides are cleared for use on watermelons and cantaloupes. Curbit® has recently been labeled for this use, joining already labeled herbicides Prefar,® Alanap,® and Poast.®

In previous years' tests at the North Alabama Horticulture Substation, Cullman, Amiben® at 2 lb. a.i. (active ingredient) per acre and a combination of 1 lb. Sonolan® and 2 lb. Amiben® gave best results. However, neither is labeled for use on watermelons and cantaloupes. Furthermore, Amiben severely damaged plants under certain weather conditions. Poast, the only post-emergence herbicide labeled for melons, gave fair control of grasses but did not control broadleaf weeds.

CONTROL OF GRASS AND BROADLEAF WEEDS IN WATERMELONS AND CANTALOUPES, NORTH ALABAMA HORTICULTURE SUBSTATION, 1989

Treatment, lb. a.i./acre	Grass and broadleaf control[1]		
	In watermelon, at 33 days[2]	In cantaloupe	
		At 33 days	At 82 days
	Pct.	*Pct.*	*Pct.*
Prefar & Alanap, 3.0 and 1.0	63	75	53
Curbit, 0.5	63	90	73
Curbit, 1.0	73	90	83
Curbit, 1.5	88	90	73
Command, 0.5	40	58	25
Command, 1.0	60	73	28
Command, 1.5	75	78	33

[1]Weeds present in the experimental area included: grasses—crabgrass, goosegrass, carpetgrass, and panicum; broadleaf weeds—pigweed, lambsquarter, ragweed, purslane, and morningglory.
[2]Watermelon trial terminated before second rating could be completed.

In continuing tests in 1989 at the same location, several different herbicide treatments were evaluated on both watermelons and cantaloupes. The standard treatment of Prefar + Alanap was compared with Curbit, and with another promising, but nonlabeled product, Command.® Treatments were as follows:

1. Prefar + Alanap, 3 lb. and 1 lb., respectively, per acre.
2. Curbit, 0.5, 1.0, and 1.5 lb. per acre.
3. Command, 0.5, 1.0, and 1.5 lb. per acre.

The herbicide treatments were spray-applied immediately after AU-Producer watermelons and Chilton cantaloupes were planted. Watermelon test plots were single rows, 7.3 ft. wide and 60 ft. long, with hills spaced 6 ft. in the row. Cantaloupe plots were two rows, 3.7 ft. apart and 30 ft. long, with hills spaced 4 ft. apart.

Plots that received no herbicidal treatment had a heavy infestation of both grasses and broadleaf weeds. Control from the herbicidal treatments was compared with the untreated plots and rated according to the number of weeds in relation to the untreated plots.

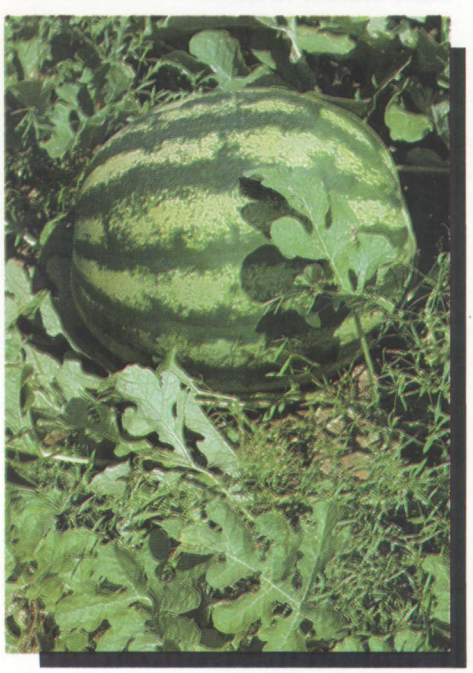
Curbit provided excellent control of both annual grasses and broadleaf weeds. As noted in the table, control in cantaloupes was 90% at 33 days after planting for all three Curbit rates tried. At 82 days, the 0.5- and 1.5-lb. rates provided 73% control and the 1.0-lb. rate gave 83% control. Control in watermelon plots was 63 and 73%, respectively, for the 0.5- and 1.0-lb. Curbit rates and 88% for the 1.5-lb. rate, when rated at 33 days. The other materials generally gave poorer results, as shown by results in the table.

Curbit offers several advantages over the other materials tested. It does not have the volatility problems of Alanap, nor the need for mechanical incorporation and the residue problem of Prefar. Alanap must be watered in after application or the product evaporates. Prefar used alone must be incorporated into the soil, thus adding to the cost of application. Another problem is that certain crops cannot be planted the next crop year where Prefar has been used.

Command gave good control of both annual grasses and broadleaf weeds. However, it caused phytotoxicity to the melon plants, especially at the higher rates. This damage was characterized by an interveinal chlorosis, which did not kill but weakened the plants. In contrast, Curbit caused no obvious plant damage.

Ratings of treatments in this test indicated that Curbit at rates of 1.0 and 1.5 lb. a.i. gave best weed control with no phytotoxicity problems.

Norton is Professor, Boyhan is Research Associate, and Brown is Assistant Professor of Horticulture; Hollingsworth is Superintendent of the North Alabama Horticulture Substation.



T.P. MACK and R.H. SMITH

CAREFUL MANAGEMENT METHODS NECESSARY TO CONTROL RESISTANT SOYBEAN LOOPERS

THE SOYBEAN looper is the number one insect pest of soybeans in Alabama. Its larvae reduce yield by eating leaves that are necessary to produce seed.

Control of this pest is complicated by its habits. The soybean looper usually does not overwinter in Alabama, so adult moths must migrate into soybean fields during the growing season. Populations develop so rapidly (30-fold or greater increase in less than a week) that growers cannot use management practices that build up an abundance of natural enemies to provide control. The explosive population increase of the pest simply overwhelms the ability of natural enemies to provide adequate control.

A further complication is resistance to insecticides that was reported in 1988 in Georgia, Louisiana, Mississippi, and Alabama. No currently registered insecticide consistently controls these resistant pests. However, use of Dipel® (a microbial control agent that causes a bacterial disease of loopers) in combination with an insecticide showed promise in 1989 Alabama Agricultural Experiment Station research.

Several registered and unregistered insecticides were evaluated for soybean looper control during 1989 at Tallassee. Braxton soybeans that were planted July 1, using conventional tillage on 36-in. rows, were used for the comparisons. Plants had full-sized pods with small seeds in them when treated September 13. Treatments are listed in the table.

Treatments were applied in water using a boom sprayer equipped with three nozzles per row operating at 40 p.s.i. and delivering 8 gal. per acre. Insect populations were sampled from each plot 2 hours before treatment and at 2, 5, and 7 days after treatment.

Most treatments reduced the number of soybean loopers 2 days after treatment, but Larvin® and Dimilin® were ineffective. The most effective treatments were Danitol® plus Orthene,® Danitol,® Kryocide,® Dipel plus Larvin, and Dipel plus Ambush® (rates listed in table). Populations of soybean looper in all plots appeared to decline greatly during the experiment, probably because of pupation of larger individuals.

EFFECT OF INSECTICIDE APPLICATIONS ON SOYBEAN LOOPER LARVAE POPULATIONS

Treatment, active/acre	Soybean loopers/3 row-ft.			
	Before treatment	2 DAT[1]	5 DAT	7 DAT
	No.	*No.*	*No.*	*No.*
Untreated	61.4	33.8	10.2	4.3
Ambush 2E, 0.10 lb.	65.8	17.8	7.7	3.2
Ambush 2E, 0.25 lb.	72.4	25.2	10.3	4.8
Ambush 2E + Dimilin, 0.10 lb. + 2.0 oz.	66.6	20.6	10.8	6.3
Kryocide[2], 14.4 lb.	67.1	10.4	4.5	1.7
Dipel ES, 1.5 pt.[3]	67.4	19.4	4.8	1.8
Dimilin 2F, 2.0 oz.	48.4	25.4	10.0	5.5
Dipel ES + Dimilin, 1.5 pt. + 2.0 oz.	67.8	22.3	5.6	2.0
Dipel ES + Ambush, 1.5 pt. + 0.10 lb.	57.6	11.9	4.4	1.4
Dipel ES + Larvin, 1.5 pt. + 0.225 lb.	68.5	11.6	4.2	1.2
Larvin 3.2E, 0.225 lb.	63.2	28.8	8.6	3.3
Danitol 2.4E[2], 0.15 lb.	67.5	10.2	7.3	3.8
Danitol 2.4E[2], 0.20 lb.	75.8	8.6	6.1	3.4
Danitol 2.4E[2] + Orthene 75SP, 0.20 + 0.50 lb.	73.4	6.9	4.4	1.4

[1]Days after treatment.
[2]Not labeled for use on soybeans.
[3]A microbial insecticide (rate is formulated product).

Five treatments reduced the number of larvae at 5 days after application: Dipel, Kryocide, Danitol plus Orthene, Dipel plus Larvin, and Dipel plus Ambush. None of the treatments gave results different from the untreated control plots at 7 days after application.

A large-plot demonstration trial included eight treatments of 5-acre field strips. The following treatments were applied September 12, using two nozzles per row operating at 40 p.s.i. and delivering 5 gal. per acre: Ambush + the synergist Ovasyn® (0.15 + 0.25 lb. active), Ambush + Dipel (0.15 lb. + 1.5 pt. formulated), Larvin (0.8 lb.), Lannate® + Dipel (0.45 lb. + 1.5 pt. formulated), Scout® + Dipel + the synergist PBO® (0.019 lb. + 1.5 pt. formulated + 1.0 lb.), and Orthene + Dibrom® + Dimilin (0.75 lb. + 1.0 lb. + 8.0 oz.).

The Ambush + Ovasyn treatment resulted in 26 larvae per 3 row-ft. 3 days after treatment, the same as the untreated plot. This compared with 8 larvae per 3 row-ft. for the Orthene + Dibrom + Dimilin treatment and 2 or fewer for the other treatments.

Rapid control of the soybean looper may or may not be important, depending on the age of the larvae when they are sprayed. About half of all leaf consumption by this insect occurs in the last 2 days before the larvae pupate, so it is important to prevent larvae from reaching this age. If most loopers in a field are 3/4 in. or larger, then most damage may have already occurred and a spray may not be profitable.

Combinations of an insecticide such as Ambush, Lannate, or Larvin with Dipel were quite effective in both the small-plot and large-plot tests. Dipel appears to be an excellent additive for improving control of looper larvae. The addition of a synergist such as Ovasyn or PBO did not improve control.

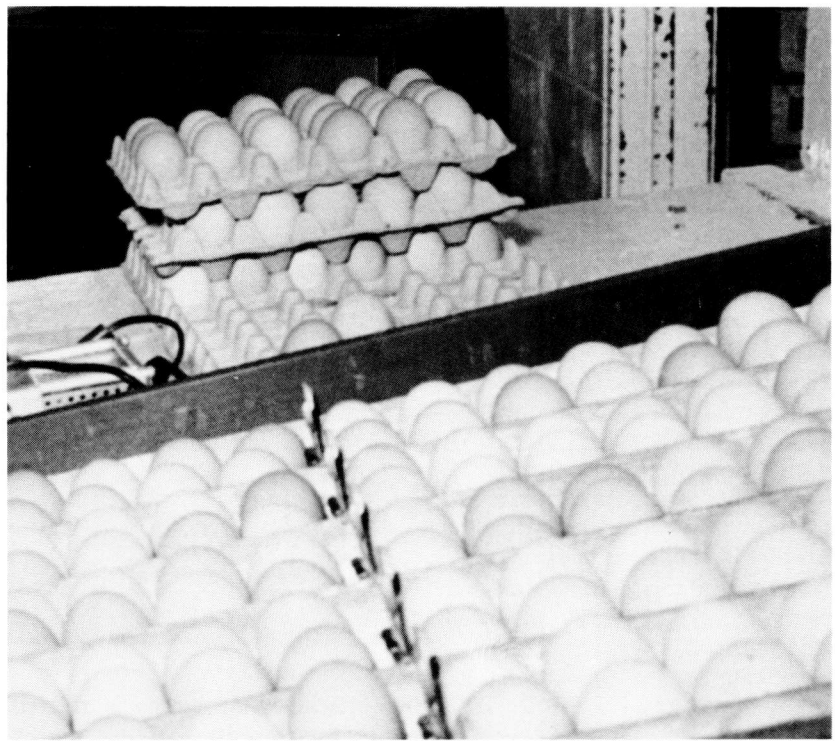
The choice of an insecticide is especially critical because insecticidal resistance will likely continue. Use of an ineffective insecticide could make matters worse, by killing beneficial insects and accelerating development of insecticidal resistance.

Mack is Associate Professor and Smith is Professor of Entomology.

M.L. ESLICK and G.R. McDANIEL

SPERMATOZOA COUNTS AFFECT BROILER/BREEDER EGG FERTILITY AND HATCHABILITY

BY ADAPTING a system of feeding male and female broilers separately, poultrymen have increased hatchability by 5-6%. Despite this improvement, 15% of all eggs set do not hatch. Recent Alabama Agricultural Experiment Station research indicates this is due to reduced spermatozoa counts, which cause decreased fertility, total hatch, and fertile hatch and increased total mortality and early embryonic mortality.



As broiler breeders age, fertility declines due to both the decline in sperm cell output by the male and the decline in the ability of the female to retain viable sperm cells. With this decline in fertility, embryonic mortality increases. However, the cause and effect relationship in the decline in fertility and increase in embryonic mortality has always been confounded with other variables, such as age, health, and physiological state of breeders. Therefore, a study was conducted to determine if levels of fertility are related to embryonic mortality.

Ninety-six broiler breeder hens, 33 weeks of age and of approximately equal weight and production rate (71%), were assigned to wire cages at the density of one hen per cage. A 16% protein, 2,867 kcal/kg breeder diet was hand-fed, and water was available at all times.

Hens in the four treatments were artificially inseminated (AI) with 25, 50, 100, and 200 million spermatozoa cells every 5 days throughout a 4-week period. Semen was collected and pooled immediately prior to AI and spermatozoa numbers per AI were measured.

Eggs were collected once daily and set twice weekly. On the 11th day of incubation the eggs were candled and the clears were removed and broken out to determine true fertility and embryonic mortality. At the end of 21 days of incubation, eggs that failed to hatch were examined to determine whether the failure to hatch was due to infertility or mortality.

Spermatozoa count had a significant effect on fertility and total hatch. Hens inseminated with the lowest concentration had the lowest fertility. A point of spermatozoa saturation was reached between 100 and 200 million, after which fertility decreased. And, of all eggs collected, the lowest spermatozoa counts resulted in the lowest hatch. At spermatozoa counts of 100 million and 200 million, this comparison also reached a point of saturation at which the increment of increase in total hatch decreased to insignificance.

Early embryonic death was affected by varying spermatozoa counts, with lower spermatozoa concentrations resulting in higher early embryonic death. Of the fertile eggs hatched, those with the lowest spermatozoa counts had the lowest hatch of fertility.

Spermatozoa counts had a significant linear response to the total mortality of embryos. Total mortality included early, mid, and late embryonic death. As indicated by data in the table, lower spermatozoa concentrations resulted in higher total mortality.

EFFECT OF SPERMATOZOA CONCENTRATIONS ON FERTILITY AND HATCHABILITY

Variable	Result, by million spermatozoa cells			
	25	50	100	200
	Pct.	*Pct.*	*Pct.*	*Pct.*
Fertile	46	60	66	87
Total hatch	36	50	56	79
Fertile hatch	72	84	86	90
Total mortality	27	15	14	9.6
Early dead[1]	27	12	8.6	7.5
Mid dead[1]	0.2	2.1	4.8	1.5
Late dead[1]	.2	1.3	.9	.5

[1]Early dead = 1-7 days; mid dead = 8-14 days; late dead = 15-21 days.

Eslick is former Graduate Student and McDaniel is Professor of Poultry Science.

D.I. BRANSBY and J.T. EASON

SHEEP OUTPERFORM CATTLE ON RYEGRASS PASTURE

WEANED lambs were more productive than steers when grazing annual ryegrass pastures in spring. This was shown in an 84-day grazing experiment at the Sand Mountain Substation near Crossville.

The objective of this Alabama Agricultural Experiment Station test was to determine relative productivity and stocking equivalents of lambs and steers under grazing conditions.

Marshall ryegrass was seeded at 25 lb. of seed per acre into a prepared seedbed in fall 1988. Potassium and phosphorus were corrected according to soil test. Nitrogen was applied as ammonium nitrate at a rate of 24 lb. per acre at planting and 64 lb. per acre in spring.

Forage was allowed to accumulate until the beginning of April 1989 when grazing commenced. Pastures were grazed at stocking rates of 15, 20, 25, and 30 lambs per acre and 1.5, 2.0, 2.5, and 3.0 steers per acre. Lambs averaged 41 lb. at the start of the experiment and steers averaged 501 lb. Pastures were continuously grazed. Animals were weighed every 28 days and pasture height was measured periodically.

Average daily gain (ADG) is usually higher at low stocking rates than at high stocking rates. However, in this study ADG showed little change with increased stocking rates, see table. This was probably due to substantial amounts of forage that were allowed to accumulate prior to commencement of grazing.

Since the quantity of forage consumed by ruminants is related to their weight, meaningful comparison of ADG for lambs and steers requires an appropriate adjustment. At the beginning of this experiment, steers were 12.2 times heavier than lambs. Steer-equivalent ADG for lambs can therefore be calculated by multiplying mean lamb ADG (0.24 lb.) by 12.2. The value obtained (2.93 lb.) is 54% higher than the mean ADG for steers (1.90 lb.). This higher efficiency of lambs is related partly to their ability to select higher quality leaves and reject stems because of their small mouths and nibbling-grazing action, compared to steers that depend more on tongue action to gather forage into their mouths.

Gain per acre generally increased with stocking rate. Highest gain per acre for the 84-day grazing period was obtained at the highest stocking rate for both lambs and steers, see table. At these stocking rates, lambs provided 49% higher gain per acre than steers, suggesting that they are more efficient at harvesting both a high quantity and quality of forage when grazing. The greater efficiency of lambs in maximizing the quantity of forage consumed may be related to less contamination of forage by excreta, and a tendency for sheep not to reject forage located near excreta as much as cattle do.

Pasture height was generally greater and decreased more as stocking rate increased for steers as compared to lambs. However, at the highest stocking rates (30 lambs per acre and 3 steers per acre), pasture height was similar. This suggests that approximately 10 lambs can be carried in the place of one steer at this high level of pasture utilization.

Results from the first year of this experiment showed that lambs were more productive than steers on both a per animal weight basis and a per acre basis. However, the grazing behavior of sheep and cattle tends to be complementary rather than competitive.

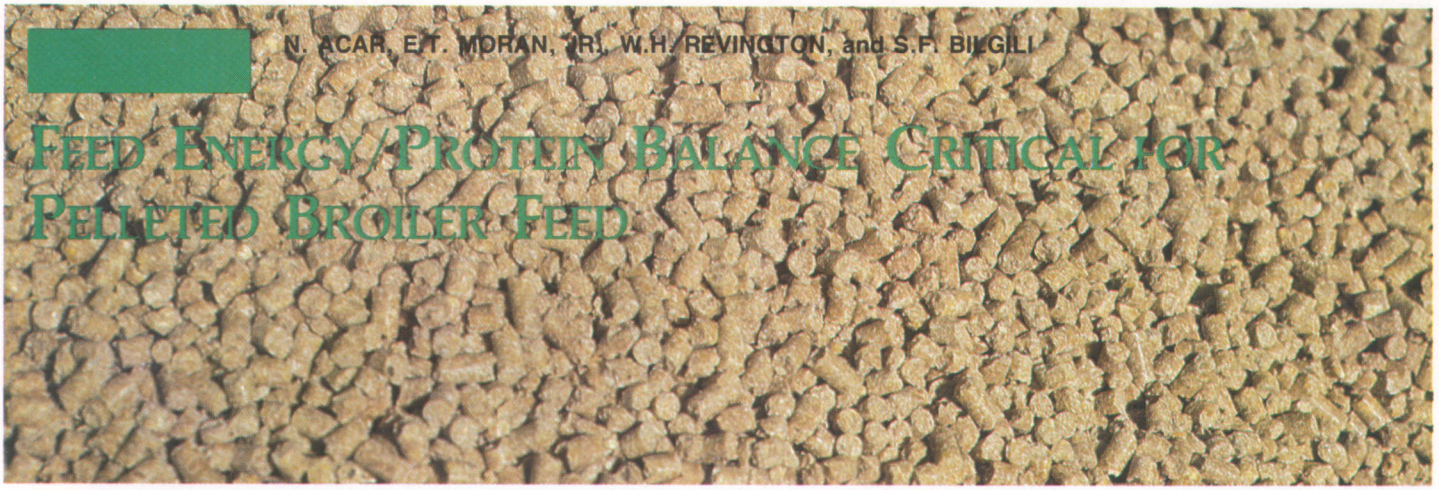
Bransby is Associate Professor of Agronomy and Soils; Eason is Superintendent of the Sand Mountain Substation.

GAIN OF LAMBS AND STEERS GRAZING RYEGRASS

Performance measure	Lambs				Steers			
Per acre stocking rate, no.	15	20	25	30	1.5	2.0	2.5	3.0
Average daily gain, lb.	0.24	0.24	0.21	0.27	1.84	1.81	2.15	1.81
Gain per acre, lb.	302	403	441	680	232	304	451	456
Pasture height, in.	7.6	5.7	5.8	6.2	10.3	8.2	7.3	6.04

N. ACAR, E.T. MORAN, JR., W.H. REVINGTON, and S.F. BILGILI

Feed Energy/Protein Balance Critical for Pelleted Broiler Feed



Binding agents help maintain high pellet quality of poultry feed but may not improve broiler performance.

COMMERCIAL broiler feed is commonly pelleted, a process which can reduce wastage, sometimes increase nutrient availability, and usually improves live performance. Maintaining pellet integrity is essential to realizing most of these benefits. Many feed additives are available to improve pellet stability, each varying in price, composition, and effectiveness.

Lignosulfonates, by-products of the paper industry, have been widely used for over 25 years as binder agents. These compounds are available in sodium, calcium, or ammonium salt forms and contain a high percentage of various wood sugars and hemicelluloses.

Previous studies done elsewhere have generally shown improvements in live performance from the use of lignosulfonates. However, measurements to corroborate effectiveness as a binder, possible alterations to nutrient content, and effects on carcass quality were absent. An experiment to address these inadequacies was conducted at the Alabama Agricultural Experiment Station using calciumlignosulfonate (CaLS) as a binder in feed for broilers.

Broilers used for the study were reared with the sexes separated and mixed, then slaughtered at ages which would equalize their average live weights (males at 41 days, females at 47 days, and combined sexes at 44 days). Feeding was performed during the summer when the advantage of intact pellets and the reduced "work" of eating would be greatest.

All feeds were based on corn, soybean meal, corn gluten meal, and poultry fat, which are ingredients of high nutritional value but often lead to poor pellet integrity. A crumbed starting feed was offered to all birds during the first 3 weeks. The subsequent finisher feed was pelleted, half with 25 lb. CaLS per ton added and half without the CaLS. Feed was sampled from the pen trough so that all aspects of handling would be encountered.

Adding CaLS to the feed led to a 55% improvement of intact pellets, but did not alter nutrient content based on analyses. Amino acids associated with the crude protein (20.6%) were similar with and without CaLS.

Live performance of broilers receiving the CaLS-treated finishing feed did not parallel previous reports. Final body weights were not meaningfully improved by the better pellets for any of the birds in the test, see table. Furthermore, an increase in feed conversion occurred, which was also contrary to expectation.

Yields of the carcass after processing and chilling were typically greater with females than with males, largely because of their age difference at slaughter. The presence of CaLS and improved pellet quality with the final feed had no effect. Abdominal fat usually remains in the body cavity after evisceration. Females have more fat remaining than males and the proportion increases with age. In all cases, fat increased when CaLS had been used.

Enhanced pellet quality has been credited with improved live performance because birds do not have to work as hard or spend as much time at the feed trough to get sufficient amounts of feed. This energy savings can be used for growth.

In this study, the increased productive energy arising from pellet stability led to additional body fat and adversely affected feed conversion. Feed protein must be sufficient if meat rather than fat is to be synthesized. Unfortunately, the finisher was balanced for a moderate environment, and the high temperatures led to protein being low relative to energy. This poor balance is believed to have been further exaggerated by improved pellet quality.

Pellet stability is ordinarily valuable to broiler performance, particularly in hot weather. CaLS substantially improves pellet quality; however, this advantage did not result in better performance, most probably because feed protein had not been adjusted to effectively use the associated increase in productive energy.

Live Performance and Abdominal Fat from the Chilled Carcass of Broilers Given a Finishing Diet from 3 Weeks Until Marketing With and Without Calcium Lingnosulfonate to Improve Pellet Quality

Sex	Market age, days	Final weight		Feed/lb. gain		Carcass yield		Abdominal fat	
		Control	+CaLS	Control	+CaLS	Control	+CaLS	Control	+CaLS
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Males	41	4.15	4.15	1.75	1.80	64.5	63.9	2.45	2.60
Females	47	4.21	4.22	1.94	1.98	66.9	66.8	3.19	3.40
Mixed	44	4.19	4.24	1.85	1.86	65.1	65.6	2.54	2.57

Acar and Revington are Graduate Research Assistants and Moran and Bilgili are Professors of Poultry Science.

J.E. DUNKELBERGER, G.W. GRIFFIN, R.S. MYRICK, and G.J. LYLES

VANDALISM AND PROPERTY CRIME PLAGUE URBAN AND RURAL RESIDENTS

REPORTED crime is again increasing in the United States after a brief period of decline. Some 93 million homes, or one-fourth of all U.S. households, were touched by crime in 1988. Information published by the Alabama Criminal Justice Information Center revealed that this turn-around in crime rates occurred at mid-decade for Alabama. By 1986, all property crimes, including robbery, burglary, larceny, and motor vehicle theft, reflected higher rates than in the early 1980's.

In 1984 and 1985, the Alabama Agricultural Experiment Station and Tuskegee University jointly conducted a statewide survey of Alabama households to determine their experiences with crime. Approximately 1,600 households provided information. For this report, each of Alabama's 67 counties was classified either rural (48 counties with populations less than the State average of 76.7 people per sq. mi. and containing no cities larger than 50,000), urban (14 counties with populations above the State average but containing no cities larger than 50,000), or metropolitan (5 counties in the State containing cities with populations larger than 50,000).

Five distinct kinds of nonviolent household victimization were reported by respondents: (1) vandalism around the home, (2) theft of property from around but not in the home, (3) burglary or attempted burglary of home or building, (4) theft of property from household members while they were away from home, and (5) theft of a motor vehicle. As noted in the table, almost 30% of the sample Alabama households experienced some form of victimization at the hands of nonhousehold members in 1985.

Vandalism of the house itself or any property around the house includes all attempted incidents whether or not property was actually damaged or destroyed. Acts of vandalism are more common in metropolitan counties than in rural counties, even though more police and more frequent police patrolling exist in cities. Rural residents are more likely to experience vandalism the closer they live to a city.

Households that reported incidents of vandalism rarely had their property losses covered by insurance. Much of the cost associated with vandalism is in the frustration and psychological trauma experienced by individuals who have had their household property damaged or destroyed.

About 12% of the sample households were victims of theft from around the home. Households in rural counties were less likely to experience such a crime than residents of either urban or metropolitan counties. Stolen items were not covered by insurance in 75% of the victimized households.

Burglary or attempted burglary of the home or other buildings on the immediate property site was experienced by about 6% of the sample households. Rural residents were more likely to be burglarized than metropolitan residents, while urban households were most likely to be victimized.

The most common theft experience involved the theft of personal property while a household member was traveling or living away from home. Metropolitan county residents were most likely to be victims of such crimes, but rural county residents also experienced a high incidence. Property stolen from a person while away from home was covered by insurance only 10% of the time.

Theft involving a motor vehicle or self-propelled farm machine receives much media attention but is a low-incident type of crime. The property involved in the majority of such incidents was either a car or truck. Urban residents were less likely to be victimized than either rural or metropolitan residents. In half of the incidents, the vehicle was covered by insurance.

Data from the survey suggest that many crimes, especially those involving the theft or damage of personal property, are not reported to law enforcement agencies that collect and report official crime statistics. On the other hand, much of this unreported crime involves relatively minor incidents and modest dollar losses. Nevertheless, frustration and trauma may be serious.

In any one year, a sizeable proportion of Alabama households feel the "sting" of vandalism and crime; 17% of Alabama households experienced an attempted theft of some type in 1988. Although there is less likelihood of being victimized in rural areas, crime does exist and is increasing in the countryside.

PERCENTAGE OF VICTIMIZED HOUSEHOLDS FOR EACH TYPE OF CRIME IN RURAL, URBAN, AND METRO ALABAMA COUNTIES, 1985

Types of crimes	Reporting, by county type		
	Rural (N = 757)	Urban (N = 448)	Metro (N = 434)
	Pct.	*Pct.*	*Pct.*
Vandalism around home	29.0	34.8	39.5
Theft from around but not in home	33.8	43.9	40.1
Burglary or attempted burglary of home or other building	23.2	27.2	20.4
Theft from household members while away from home	42.0	31.8	42.1
Theft of a motor vehicle	8.7	3.8	14.3
Violent crime attempted or committed to household members[1]	5.8	9.8	19.0
Proportion of sample households victimized[2]	27.3 (207)	29.5 (132)	33.9 (147)

[1]Violent crimes were included in determining the proportion of victimized households.
[2]Numbers in parenthesis are numbers of victimized households.

Dunkelberger is Professor and Griffin and Myrick are Graduate Research Assistants of Agricultural Economics and Rural Sociology; Lyles is Professor of Sociology, Tuskegee University.

K.M. TILT, R.L. SHUMACK, and W.J. FOSTER

SAVING NURSERY IRRIGATION RUNOFF OFFERS CONSERVATION AND PRODUCTION ADVANTAGES

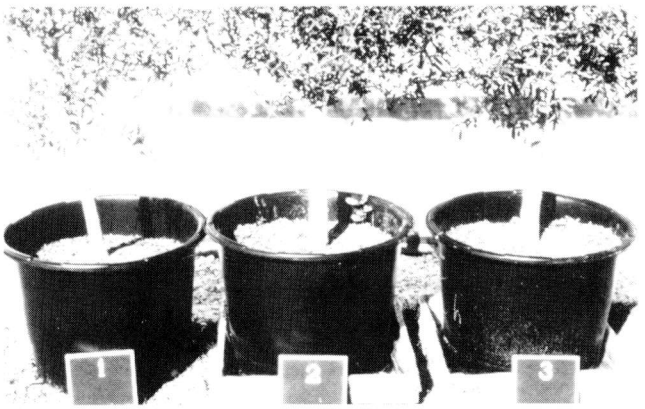


FIG. 1. Drip irrigation treatments: (1) irrigated as deemed necessary, no saucer; (2) saucer allowed to dry out between irrigations; (3) saucer maintained at constant water level.

OVERHEAD IRRIGATION of a container nursery requires about 20,000 to 50,000 gal. of water per acre per day of irrigation. Unfortunately, 70-80% of this water falls between or passes through the containers and cannot be used by the plants. Further, this lost water moves into underground reserves or runs off. Not only is that water lost, but it provides a vehicle for carrying chemical pollutants into surface or ground water. Thus, there are two compelling reasons to look for better irrigation methods.

Some nurseries have already implemented conservation measures to address the concerns about overhead irrigation. One method adopted has been to channel runoff into holding ponds where the water is filtered and recycled. Another technique is to use drip irrigation where each container has its own water source. Drip irrigation prevents water loss between pots, but excess water still passes through the containers into the ground water system to provide the potential for pollution.

Research of the Alabama Agricultural Experiment Station is evaluating an additional conservation measure for use with drip irrigation. In this project at the Ornamental Horticulture Substation, Mobile, water from drip irrigation passing through containers is being caught in saucers rather than being allowed to run off.

The potential benefits of catching the leachate or water passing through the container are being evaluated in the project, along with some other aspects of such a system.

One goal was to determine whether a constant water level maintained in a saucer beneath a container would be detrimental to growth. This treatment simulates the situation in which containers are in a water-filled depression area of a nursery. This type situation often occurs with detrimental effects in nurseries. Three treatments were used with live oak and Shumard oak growing in containers: (1) constant water level in saucer, (2) saucer allowed to dry out between irrigations, and (3) standard drip irrigation in each container as needed, figure 1. The trees were planted January 18, 1988, and growth measurements were made October 10, 1989.

Live oak showed growth advantages to catching and holding water in the saucers over standard drip irrigation and run-off, figure 2. Height and caliper averaged 7.2 ft. and 1.9 in. when water was maintained at a constant level in the saucer. This compares with 6.1 ft. and 1.9 in. when saucers were allowed to dry and 5.1 ft. and 1.4 in. from standard drip irrigation and run-off. The growth increase from use of saucers to catch water would boost wholesale value about $8 per tree.

Another phase of the study compared 15-gal. and 30-gal. containers for growing the trees. Ten trees in each size container were produced under each of the three irrigation treatments already described.

There was a clear advantage to growing the trees in 30-gal. containers compared to 15-gal. containers. Height growth differences favored the larger container by 0.8 ft. for live oak and 1.6 ft. for Shumard oak, figure 3. Caliper size of live oak increased from 1.5 in. in the 15-gal. container to 1.9 in. in the 30-gal. container. Shumard oak showed no difference in caliper between the two container sizes. The size differences resulting from the larger containers translate into $5 to $10 per plant value differences.

Tilt is Associate Professor and Shumack is Head of Horticulture; Foster is former Superintendent of the Ornamental Horticulture Substation.

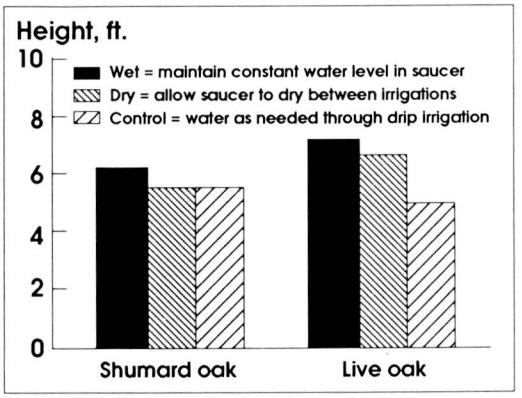


FIG. 2. Effects of irrigation treatments on height growth of live oak and Shumard oak.

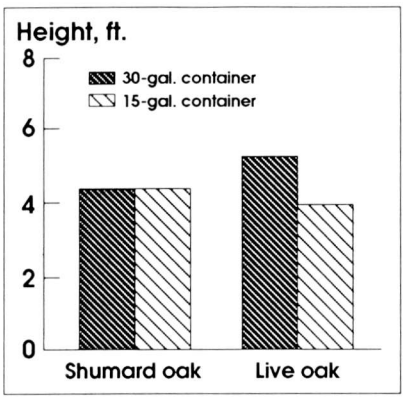
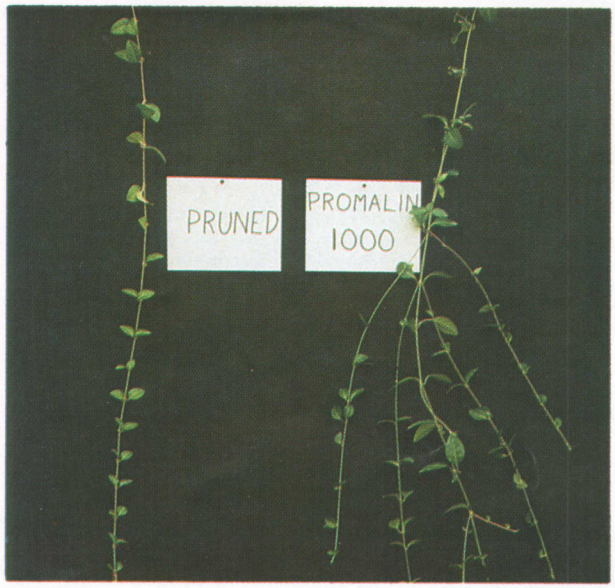


FIG. 3. Effects of container size on growth of live oak and Shumard Oak.

J.T. FOLEY and G.J. KEEVER

BRANCHING OF LESSER PERIWINKLE INCREASED BY GROWTH REGULATORS



Comparison of branching of untreated (left) and Promalin-treated periwinkle.

LESSER periwinkle is one of the most common vining groundcovers in this region because it adapts well to many different settings, including shaded areas, and is fast-growing. Its growth is characterized by long runners and little lateral shoot development.

Lesser periwinkle plants are typically sold by the number of runners on the plant. Many such crops are potted several plants per pot or pruned repeatedly during production to produce well-branched, high quality plants. The first approach requires more plant material than using one plant per pot, while the latter is labor intensive. An Alabama Agricultural Experiment Station study was instituted to determine the effectiveness of several plant growth regulators in inducing lateral budbreak and elongation of lesser periwinkle.

Cuttings of lesser periwinkle were inserted in 36-cell flats with a Pro-Mix BX® medium and placed in a double-layer polyethylene greenhouse under intermittent mist for 11 weeks. Rooted cuttings were pruned to three nodes each; all side and basal shoots were removed. The following foliar spray treatments were then applied to the plants:

Promalin® [a mixture of the synthetic cytokinin BA (6-benzyladenine) and gibberellins A_4A_7] at 125, 250, and 500 parts per million (p.p.m.).

Atrinal® (dikegulac sodium) at 1,000, 2,000, and 3,000 p.p.m.

BA at 62.5, 125, and 250 p.p.m.

Accel® (another synthetic cytokinin) at 62.5, 125, and 250 p.p.m.

Sprays were applied just prior to runoff in a volume of about 2.0 ml (milliliters) per plant. Buffer X® was added as a surfactant at 0.2% to BA, Promalin, and Accel. Plants were fertilized weekly with 200 p.p.m. nitrogen from 20-10-20. A control group of plants was treated identically to these except no growth regulators were applied.

Promalin treatments increased runner number and increased runner length up to 250 p.p.m. Atrinal delayed runner production through week 4, but numbers increased thereafter and runner length decreased as Atrinal rate increased. BA did not increase runner number and increased rates of BA tended to increase runner length. Accel did not increase runner number, and increased rates of Accel decreased runner length.

Based on results of the first experiment, a second test was initiated to determine appropriate rates of the most effective branching compounds from the initial test. Since Atrinal and Promalin both increased runner number, they were selected for comparison in the second test. Foliar spray treatments consisted of Promalin and Atrinal at 250, 500, and 1,000 p.p.m.

PRIMARY RUNNER NUMBER AND LENGTHS OF LESSER PERIWINKLE

Treatment	Final runners[1]	Final runner[1] length
	No.	*In.*
Promalin		
250 p.p.m.	4.2	14
500 p.p.m.	5.1	12
1,000 p.p.m.	7.1	12
Atrinal		
250 p.p.m.	3.3	14
500 p.p.m.	2.3	14
1,000 p.p.m.	3.0	14
Untreated	2.5	15

[1]Runners produced from initial 3-node cutting.

Treatments, excluding pruning, were applied a second time without pruning 6 weeks after the initial application. Data were taken at 2-week intervals and included primary runner number and length, secondary runner number (from primary runners), and basal runner number (from the growth medium). Final data also consisted of a node count of primary runners as well as a measure of the three longest secondary runners.

The results of each chemical treatment in the second study showed that Promalin increased primary runner number from the three-node cutting, increased secondary and total runner number, and decreased primary runner length while secondary runner length increased as rate of Promalin increased. Atrinal did not promote runner production or runner elongation, as shown in the table.

Treatment with Promalin resulted in light to severe chlorosis, especially at higher rates. Plants eventually developed normal foliar color and the majority of secondary runners survived.

These results indicate that Promalin at 500 to 1,000 p.p.m., using two applications about 6 weeks apart, is effective in inducing lateral branching of runners of lesser periwinkle.

Foley is Graduate Student and Keever is Associate Professor of Horticulture.

J.W. ODOM

Boron Fertilizer Applications May Not Be Necessary for Irrigated Corn

COASTAL Plain soils of Alabama are low in extractable boron and it is often assumed that irrigated corn needs boron applications for maximum yield. To evaluate this assumption, an Alabama Agricultural Experiment Station field test was conducted on a Goldsboro soil at the E.V. Smith Research Center near Shorter.

Three boron treatments (0, 2, and 4 lb. boron per acre) were applied as four split applications each year to avoid leaching the boron out of the corn's rooting zone. Nitrogen and sulfur fertilizers were applied at the same times as the boron fertilizer. All phosphorus, potassium, and zinc fertilizers and lime were incorporated before the test was planted each year.

The treatments included: no irrigation (rainfall only); drip irrigation with control tensiometers at a depth of 6 in. (topsoil or AP horizon); and drip irrigation with control tensiometers at a depth of 13 in. (subsoil or BA horizon), as shown in the figure. The least water was applied during 1985 when the amount and distribution of rainfall during the growing season were both favorable. Because irrigation water was applied under the crop canopy, the actual amounts of water required were low.

There was little difference in corn yield between irrigation controlled by 6-in. and 13-in. placement of tensiometers. However, drip irrigation increased shelled corn yield in all years, see table. Shelled corn yields from the irrigated plots decreased the second and third years of the test. These decreases with time may be due to a build-up of disease organisms and parasites in the test area. Crop yields are often increased by crop rotation in Alabama.

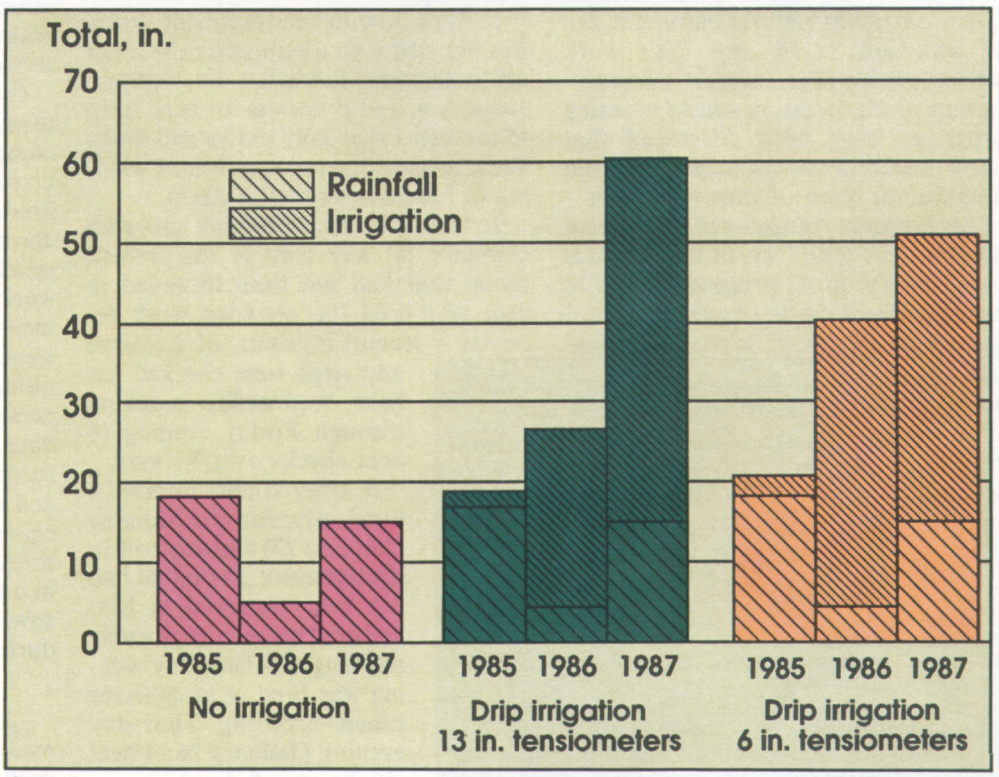
Boron application did not increase shelled corn yield either with or without drip irrigation. However, boron fertilizer did increase the ear-leaf boron concentration at silking from 14 to 26 p.p.m. This increased boron concentration in the plants shows that the boron fertilizer was available to the corn. The extractable boron in the topsoil of the Goldsboro soil (0.22 p.p.m.) is in the range where some soil testing laboratories recommend boron application. Since excessive amounts of boron can be toxic to crops and since boron accumulates in this soil, large annual applications of boron could be a problem.

The grain yield of corn growing on this Goldsboro soil in central Alabama was increased by drip irrigation, but boron application did not increase yield. Application of excessive amounts of fertilizers such as boron can be avoided to both reduce cost of crop production and avoid possible contamination of human and livestock drinking water.

Effects of Irrigation and Boron Fertilizer on Shelled Corn Yield in Central Alabama

Boron per acre, lb.	Yield per acre			
	1985	1986	1987	Av.
	Bu.	*Bu.*	*Bu.*	*Bu.*
No irrigation				
0	165	20	114	100
2	180	16	125	107
4	184	26	107	106
Drip irrigation, 6 in. tensiometers				
0	156	229	156	214
2	261	202	158	207
4	245	223	168	212
Drip irrigation, 13 in. tensiometers				
0	227	231	157	205
2	236	210	173	206
4	170	212	179	187

Odom is Associate Professor of Agronomy and Soils.



Irrigation treatments during three consecutive crop years varied depending on amount and distribution of rainfall received during those years.

D.A. COLEMAN, F.F. BARTOL, J.G. FLOYD, R.W. PEACOCK, and J.B. MAYFIELD

ESTROUS SYNCHRONIZATION AND AI OFFER EFFECTIVE BREEDING PROGRAM

COMBINING estrous synchronization with artificial insemination (AI) offers a progressive breeding program that is suited to both full-time and part-time beef producers. AI provides producers easy and affordable access to the best bulls in the country, while estrous synchronization increases efficiency of heat detection (with no reduction in first-service conception rate) and allows cows to conceive earlier in the breeding season.

Some producers need to concentrate labor associated with estrous synchronization and heat detection from Monday through Friday when hired help is available. Other producers who work off-farm during the week might wish to confine most of these activities to the weekend when they are at home. Beef producers often fail to utilize estrous synchronization with AI because it can be awkward to fit into their work schedules; however, several "package" estrous synchronization and AI breeding programs have been developed that allow maximum pregnancy rates from a minimum input of time and labor.

An Alabama Agricultural Experiment Station study tested one of these estrous synchronization-AI programs using 76 crossbred beef cattle (Angus-Hereford base) at the Piedmont Substation, Camp Hill. This brood cow herd had been utilized previously in a controlled breeding program and, as a result, the herd had a well defined 45- to 60-day October-November fall calving season in 1988. All cows were therefore at least 45 days postpartum by the beginning of the January 1989 breeding season. As part of a routine herd health program, cows had been examined by a veterinarian and were reported to be reproductively normal and cyclic. Half of the herd was assigned to an estrous synchronization program and the other half to a control treatment.

The synchronization program was called a "Monday morning" program because it permitted treatments and observations to take place during the normal Monday-Friday work week. This breeding program included three steps:

1. Each cow in the treatment group was injected with a standard dose of 25 mg (milligrams) Lutalyse® on Monday, January 9, and observed for heat 30 to 45 minutes twice daily (dawn and dusk) Tuesday morning through Friday evening (8 heat checks over 4 days).

2. The following Monday morning (January 16) any cow in the treated group that had not been observed in heat and bred the previous week received a second injection of Lutalyse and cows were checked for heat Wednesday morning through Friday evening (6 heat checks over 3 days).

3. Unbred cows received a third injection on Monday (January 23) and any cow in the treatment group that had not been observed in heat and bred between Wednesday morning and Thursday evening was bred at an 80-hour timed breeding Thursday evening (January 26; 4 heat checks over 2 days).

Cattle in the synchronized group were observed for estrus a total of 18 times over 9 days and had three opportunities to be inseminated during the 15-day treatment period from January 9 through 26.

Control cows were observed for heat twice daily (dawn and dusk) for 3 weeks from the evening of January 9 through January 30 (43 observation periods over 22 days). All cows in the study were artificially inseminated once by one of two AI technicians 12 hours after onset of estrus. Cows in both groups were later turned in with a bull. Cows were palpated for pregnancy 35-60 days after their single AI service.

Analysis of these results showed that the synchronized cows required fewer than half the number of days and observation periods required for detecting estrus in the control group, see table. No heat detection or breeding was required during weekends for the synchronized group. Although a slightly greater percentage of control cows was observed in heat during the trial period compared to synchronized cows, cows in both treatment groups had efficient first-service conception rates of approximately 78%. This compares to an estimated average of only 60 to 70% conception rate to a single natural service by a bull.

Control cows were detected in estrus throughout the 22-day trial period. By comparison, the majority of synchronized cows were observed in estrus, bred, and conceived after the first synchronization treatment. On the average, synchronized cows conceived nearly 1 week earlier than control cows. This means synchronized cows will calve a week earlier than control cows and, ultimately, their calves might be expected to weigh more at a set marketing date. Synchronized cows also will be further along in their postpartum period and should be in better condition to conceive during the next established breeding period. This could also result in a tighter calving schedule since these cows would be ready to breed earlier during the next year's breeding season.

EFFECTS OF ESTROUS SYNCHRONIZATION/AI BREEDING PROGRAM ON TIME SPENT ON HEAT DETECTION AND ON FIRST-SERVICE CONCEPTION RATE IN BEEF COWS

Item	Treatment group	
	Control	Synchronized
Cows assigned to group, no.	38	38
Days of heat detection, no.	22	9
Heat detection periods (approx. 30 min./period), no.	43	18
Cows observed in heat and bred, no.	32	27
Response rate, pct.[1]	84	71
Cows diagnosed pregnant, no.	25	21
Conception rate, pct.[2]	78	78

[1]Number of cows observed in heat and bred divided by the number of cows assigned to the group.
[2]Number of cows diagnosed pregnant by rectal palpation on day 35 to 60 divided by number of cows observed in heat and bred.

Coleman is Assistant Professor, Bartol is Associate Professor, and Floyd is Associate Professor of Animal and Dairy Sciences; Peacock is Herd Supervisor and Mayfield is Research Technician of the Piedmont Substation.

M.G. PATTERSON, W.B. WEBSTER, D.P. MOORE, and L.W. WELLS

PREPLANT 2,4-D CONTROLS HORSEWEED IN MINIMUM TILLAGE

HORSEWEED (mares tail) is a common annual weed in fields that have not been tilled and causes problems when these fields are planted to cotton using minimum tillage. Seed are widely distributed by the wind from late fall to early spring. After germination, they form a small rosette of basal leaves at the soil surface, then a leafy stem up to 6 ft. tall grows from the rosette and terminates in a flowering panicle.

Currently used preplant foliar-applied herbicides can be effective, but the cost is relatively high, and these materials must be applied before weeds reach 12 in. tall to achieve maximum efficacy. Therefore, research was initiated by the Alabama Agricultural Experiment Station in 1987 to evaluate preplant applications of 2,4-D amine as an alternative, reduced-cost herbicide in minimum tillage cotton.

Four field tests were conducted to evaluate 2,4-D preplant at 0.5 and 1.0 lb. active ingredient per acre, applied February 1, March 1, or April 1, prior to planting cotton during the last 2 weeks of April. One trial was conducted at the Tennessee Valley Substation, Belle Mina, in 1987, and one trial each was conducted in 1988 at the Tennessee Valley Substation; Prattville Experiment Field, Prattville; and Wiregrass Substation, Headland. After minimum tillage cotton planting, each trial was sprayed with a mixture of Cotoran,® Prowl,® and Gramoxone® for general weed control. Plots were not cultivated. Horseweed control and potential crop injury caused by 2,4-D carryover were evaluated at Belle Mina in both years. Crop injury was evaluated only at Prattville and Headland since no horseweed was present in these tests.

Application of either 0.5 or 1.0 lb. per acre 2,4-D at Belle Mina provided excellent horseweed control and no visible crop injury at the February 1 or March 1 dates in 1987, table 1. Delaying 2,4-D applications until April 1 in 1987 resulted in phytotoxicity to the cotton crop and reduced horseweed control. Application of 1.0 lb. per acre in 1988 provided excellent control of horseweed at all dates and no crop injury was observed. April applications at the low rate resulted in less control, primarily because weeds were too large at this date. Crop injury at Prattville and Headland was not observed, regardless of rate or time of application.

Seed cotton yields from 2,4-D-treated plots were equal to the control plots at both Prattville and Headland in 1988, table 2. Seed cotton yields at Belle Mina were higher from 2,4-D-treated plots than the control in 1987 and 1988. This was probably due to the horseweed competition from uncontrolled plants infesting the control plots.

These results indicate that horseweed can be controlled effectively without injuring cotton using 1.0 lb. per acre 2,4-D amine applied either February 1 or March 1, when cotton is planted in late April.

TABLE 1. HORSEWEED CONTROL AND COTTON INJURY FROM PREPLANT 2,4-D AT BELLE MINA

Rate/acre	Crop injury, by application date			Weed control, by application date		
	Feb.	Mar.	Apr.	Feb.	Mar.	Apr.
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
			1987			
0.5 lb.	0	0	5	99	99	84
1.0 lb.	0	0	23	99	99	95
Control	-	-	0	-	-	65
			1988			
0.5 lb.	0	0	0	70	83	60
1.0 lb.	0	0	0	99	98	98
Control	-	-	0	-	-	0

TABLE 2. EFFECT OF 2,4-D PREPLANT APPLICATIONS ON SEED COTTON YIELD

Rate/acre	Seed cotton yield/acre, by application date			
	Feb.	Mar.	Apr.	Av.
	Lb.	*Lb.*	*Lb.*	*Lb.*
		1987		
Belle Mina				
0.5 lb.	1,656	1,744	1,613	1,671
1.0 lb.	1,591	1,700	1,337	1,543
Control	--	--	--	1,191
		1988		
Belle Mina				
0.5 lb.	836	799	966	867
1.0 lb.	611	1,090	1,177	959
Control	--	--	--	414
Prattville				
0.5 lb.	2,398	1,976	2,057	2,144
1.0 lb.	1,853	2,369	2,463	2,228
Control	--	--	--	2,507
Headland				
0.5 lb.	1,444	1,992	1,888	1,775
1.0 lb.	1,863	1,904	2,05	1,941
Control	--	--	--	1,742

Patterson is Assistant Professor of Agronomy and Soils; Webster is Superintendent of the Tennessee Valley Substation; Moore is Superintendent of the Prattville Experiment Field; Wells is Associate Superintendent of the Wiregrass Substation.

Minimum tillage plantings of cotton may require special preplant treatments to control horseweed.

J.L. DUSI

ALABAMA BLACK BEARS LIVE IN HARMONY WITH MAN

Young black bear that was trapped, sedated, and fitted with a radio transmitter.

THE BLACK BEAR, the largest carnivore in the Eastern United States, is a notable part of Alabama's wildlife heritage. Bears were once common in the State, but as forests were cut and agriculture developed, bears became isolated in the swamps and forested river bottoms mainly along the Mobile, Tensaw, Tombigbee, and Alabama rivers in southwestern Alabama. Though the recent return of agricultural land to forests has enlargened the statewide range of black bears, most Alabamians will never see one, because these animals are so shy.

Because of increased highway mortality of bears in the State and newspaper reports of sightings, the Alabama Agricultural Experiment Station, in cooperation with the Alabama Department of Natural Resources, conducted a black bear ecology study. Most of the field work was done in a 25-sq.-mi. area located northwest of Saraland in Mobile County.

Five bears were trapped during the study and were sedated, measured, and fitted with radio collars, as shown in the photograph. A small tooth was extracted from each to help determine the bears' ages. The radio-tagged bears were tracked and their winter and summer home ranges determined. The habitat where bears were most frequently found was analyzed and their food habits studied by examining their fecal pellets.

The largest summer home range (8 sq. mi.) was that of a 2-year-old male. The summer range for four females varied from 0.9 to 7.2 sq. mi. Winter ranges for all bears varied from 0.1 to 0.4 sq. mi.

The bears did not hibernate in winter, but stayed in the swamps, moving little, unless disturbed. They were not typical carnivores because they fed on acorns, berries, or fruit during most of the year, and ate many insects, especially beetles.

The key to bear abundance in southwestern Alabama appears to be the extensive area of swamps, with thick shrubby undergrowth of "titi" that is impenetrable without using a machete. Titi makes a safe retreat for bears, but unfortunately, in Alabama, it occurs only in swampy areas in southwestern counties.

Despite increasing numbers and distribution, black bears in Alabama are still mainly confined to the southwestern counties. Bears statewide are protected by State game laws and violators have been prosecuted. Results of the AAES study indicate that human contact with bears is limited to cases in which bears seek food from open garbage, honey from bee hives, or stored corn. In such cases, electric fences have proven effective in keeping bears out.

Dusi is Professor of Zoology and Wildlife Science.

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