HIGHLIGHTS

of agricultural research

VOL. 21, NO. 2/SUMMER 1974

Agricultural Experiment Station
AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

FOOD SUPPLY has assumed new importance throughout the world – even in this Nation. Recently, we invited two highly qualified men to address the faculty of the School of Agriculture and the Agricultural Experiment Station of Auburn University on the world food situation, and to discuss with us Auburn's role in the food chain.

R. DENNIS ROUSE

One was William Paddock, an international authority on the world food situation and co-author of the book *"Famine 1975! – America's Decision: Who Will Survive?"* The other was Claude I. Carter, an Auburn University School of Agriculture graduate, who has advanced to a position of principal administrative officer of a large diversified international food company.

These men were especially appropriate for the assignment. Dr. Paddock's book written in 1967 should be read or re-read by every person who has responsibilities in community, state, national, or international affairs. It can have an even greater effect on policy today than when it was published 7 years ago. Claude Carter's success in the food industry demonstrates his ability to project meaningful business decisions concerning food.

In his book, Bill Paddock predicted the "Atomic Age" would give way to the "Age of Food – nuclear weapons are worthless with starving people . . . food is life . . . food is wealth . . . food is power, because a nation without food is powerless."

In 1967, he wrote: "If a hungry nation were to give total time, attention and money to the single, narrow problem of increasing local food production – while at the same time striving to lower population growth – there could be hope of an escape from the impending famines." He is now convinced most hungry nations have waited too late – and realistically there are too many other demands. Trends of worldwide population increase cannot be slowed sufficiently to prevent a food shortage. Throughout the book it was emphasized that although research could not solve all problems, it is a major hope. He stressed that more resources should be directed toward research in production of agricultural products. This was still a major thesis of Dr. Paddock's talk.

Claude Carter concluded that the recruiting and training of the very finest young people for service in the broad area of food should have top priority to ensure that we do not fall short of our commitment. At Auburn, the School of Agriculture must accept this challenge and develop the kinds of instructional programs that will attract the most capable young men and women to this broad field. We are committed to this but we need the assistance of every reader of these comments.

The second priority listed by Carter was accelerated agricultural research. He placed major emphasis on reevaluating priorities and shifting support to the desperate problems of energy conservation and production of food.

A serious effort is being made by the experiment stations of this Nation to effect some appreciable shifts in priorities this year. We are requesting from Congress an increase of 30% in Federal funding of the State Agricultural Experiment Stations. Should Congress appreciate the seriousness of the food problem and appropriate these needed funds, the Alabama Agricultural Experiment Station with the proposed new Main Station field facilities will be able to move ahead in agricultural production research in a way that has not been previously feasible.

Copies of Mr. Carter's talk, *"Today's World Food Situation,"* are available on request from this Station's Editor.

may we introduce . . .

Emerson M. Evans, associate professor of Agronomy and Soils, is a native of Albertville in the heart of the Sand Mountain Area of Alabama. He earned his B.S. degree from Auburn University and his M.S. degree from Cornell University. He has done additional graduate work at Purdue University. His thesis for his Master's degree was "Organic Phosphorus in Soils." His area of specialization in his present position is forage crops management.

Evans teaches undergraduate courses and is currently doing research on forage crop systems for Alabama. He has many publications pertaining to his research on forage in Alabama.

Evans served in the Field Artillery as a 1st Lieutenant during World War II. He is a member of Alpha Zeta and Gamma Sigma Delta.

A story on a phase of his research program is featured on page 3.

HIGHLIGHTS of Agricultural Research

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ON THE COVER: With the present nitrogen shortage, research shows that winter legumes are still a good source of nitrogen. See story on some of the oldest research on rotations in the South, page 3.

WINTER LEGUMES can help SUPPLY NITROGEN NEEDS

E. M. EVANS and D. G. STURKIE[1]
Department of Agronomy and Soils

Winter legumes being turned under as a source of nitrogen in the Old Rotation experiment at Auburn.

A NITROGEN SHORTAGE and higher prices have caused attention to be focused on alternate means of supplying nitrogen to crops.

Winter legumes turned under for green manure is one method of replacing fertilizer nitrogen with a home-grown product. Results from the Old Rotation experiment at Auburn show clearly the value of winter legumes in a cropping system. The Old Rotation experiment was started by J. F. Duggar in 1896 primarily to determine how winter legumes could be utilized in the production of cotton and corn.

Under existing testing all plots were fertilized annually with adequate amounts of phosphorus and potassium. The soil was sampled periodically and limed as needed to maintain a favorable pH. Ammonium nitrate was the source of fertilizer nitrogen. Some plots received only nitrogen supplied by legumes. Winter legumes were a mixture of crimson clover and vetch.

Results shown are those obtained since the latest major revision in 1956 for continuous cotton and for the 2-year rotation of cotton and corn. Production of winter legumes averaged about 12,000 lb. of green weight per acre annually. Chemical analyses indicated this amount of green manure would equal about 120 lb. of nitrogen per acre annually. Results for continuous cotton are shown in Figure 1 – crop yields are averaged for 18 years (1956-73).

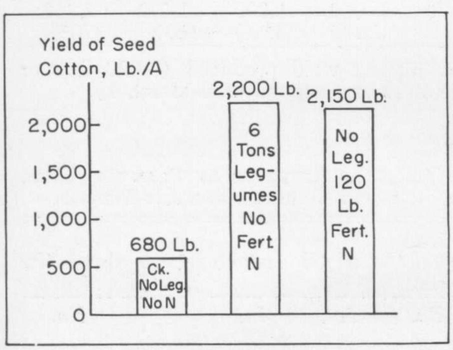


Fig. 1. Yield of seed cotton where a program of continuous cotton was followed.

Continuous Cotton

Without nitrogen fertilizer or winter legumes, the yield of seed cotton was less than one-third that obtained with fertilizer nitrogen or legumes. Yields from continuously grown cotton with legumes or cotton with commercial nitrogen at the 120-lb. rate were practically equal. The yield level was quite high for solid-planted cotton on upland soil.

Two-year Rotation

Rotating cotton plus winter legumes with corn plus winter legumes resulted in higher cotton yields than those produced by continuous cotton, Figure 2. Production averaged about 2 bales per acre of hand-picked cotton for the cotton, winter legumes-corn, winter legumes rotation. Yields of cotton were reduced in this rotation when 120 lb. of fertilizer nitrogen was added in addition to legumes. This reduction averaged about 470 lb. of seed cotton per acre annually and represents an important economic loss. Fertilizer nitrogen in addition to a good yield of green manure caused excessive vegetative growth with its accompanying problems of increased boll rot and difficulty in insect control.

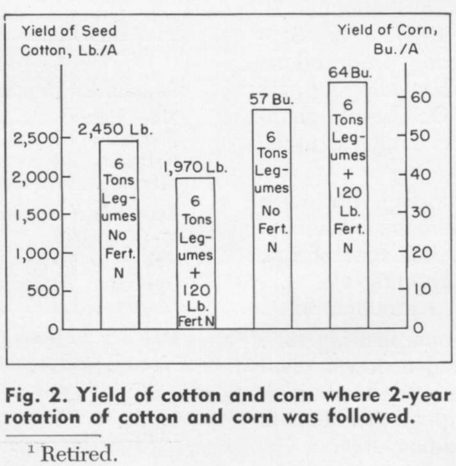


Fig. 2. Yield of cotton and corn where 2-year rotation of cotton and corn was followed.

[1] Retired.

In contrast to cotton, corn responded moderately to the application of fertilizer nitrogen in addition to winter legumes. In about one-half of the years reported, the yield increase was less than 5 bu. per acre. This small increase was likely not economical and indicated that some factor other than nitrogen rate (usually drought) limited corn yields about 50% of the time. Corn yields ranged from 11 to 110 bu. per acre so were not nearly as consistent as were cotton yields. The average yields were about 40% above the highest state average, however.

The opportunity exists for replacing a part of fertilizer nitrogen requirements by growing winter legumes for green manure. The practice can be used in a cropping system of continuous cotton but is much easier and more successful in a 2-year rotation of cotton and corn.

MANAGING RYE FOR FORAGE OR SEED

C. C. KING, *Dept. of Agronomy and Soils*

RYE OFTEN SERVES as both a grazing crop and a grain crop in Alabama. Grazing is begun in fall as soon as growth is sufficient. Then in late winter, grazing can be stopped to allow the rye to make seed.

Because of dual use of the crop, information was needed on how date of planting affected production of forage and grain and how grazing management affected seed production. Producers growing rye mainly for grazing want to know how early they should plant to get the most fall pasture, while seed producers need to know if early planting and grazing will reduce grain yield. These questions were investigated in a 5-year experiment at the Prattville Experiment Field. Planting dates of September 10, September 30, and October 20 were tried with four clipping management systems. (An earlier test had shown that seed yields decrease sharply if planting is delayed past October 20.)

One series of plots was left unclipped. Others were clipped every time forage reached 6 in. tall, with the last clipping date either February 10, February 20, or March 1.

Each year the test was planted on an area that had been fallowed and had received adequate fertilizer and lime. Wren's Abruzzi rye was planted at the rate of 100 lb. of seed per acre in rows 1 ft. apart. As soon as stands were obtained, plots to be clipped were topdressed with 55 lb. of nitrogen per acre. After the final clipping in late winter, each plot received an additional 55 lb. of N per acre.

Highest forage yield, 4,000 lb. dry matter per acre, was made when rye was planted September 10 and clipped until March 1, Table 1. The importance of early planting for early forage production is emphasized by data in the table, with the percentage figures showing relative yield of forage by clipping dates (in comparison with the total made by the September 10 planting).

By late December the relative yield of the September 10 planting was 30%, as compared with only 15% for the September 30 planting. The October 20 planting produced no measurable yield until after Christmas. When clipping was terminated March 1, the September 30 and October 20 planting had produced only 85% and 70%, respectively, as much forage as plots planted September 10.

Seed yields were greatly reduced by clipping, but were not affected by date of planting. This difference from clipping showed up in number of seed heads per foot of row and bushels per acre, Table 2. The longer clipping was continued, the more reduction there was in seed production.

Late planting resulted in more lodging, but planting date did not affect plant height. Clipping resulted in lower plant height and less lodging. Late planting delayed heading of unclipped rye but had no effect on when clipped rye headed. Date of last clipping had little effect on heading date.

Number of seed heads and seed yield were closely related. Therefore, it is concluded that clipping (or grazing) in early February causes the reduced seed yield by removing the plant tops containing flower initials (parts that will form heads). During the last 20 days of February, clipping reduced seed yield an average of about 0.35 bu. per day. Discontinuing clipping earlier than February 10 probably would reduce seed yield less but cause lower forage yields. Controlled grazing may be less damaging than clipping as done in the test because clipping abruptly removes much of the leaf area. Controlled grazing, on the other hand, maintains a stubble height of at least 3 to 4 in. In late January or early February, the decision needs to be made as to which is needed most: the extra grazing or the extra yield of seed that will result if grazing is stopped.

Based on the results described, these conclusions are made:

(1) Mid-September to mid-October plantings give top seed yields in central Alabama.

(2) Planting around September 10 gives maximum forage yield in central Alabama.

(3) Because of climatic differences, rye probably should be planted 1 to 2 weeks earlier in northern Alabama and 2 to 3 weeks later in southern Alabama than in central areas of the State.

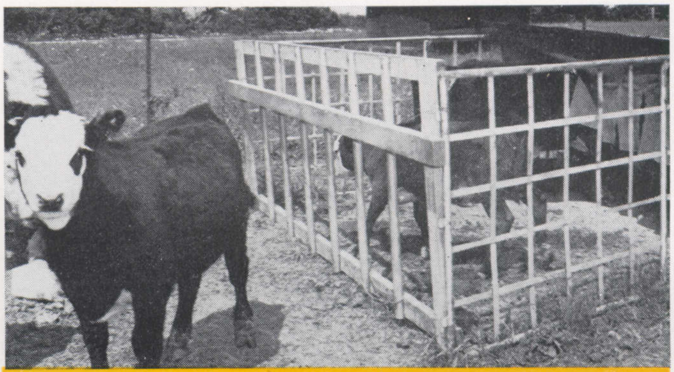
TABLE 1. RYE FORAGE YIELDS AS AFFECTED BY PLANTING DATE AND LENGTH OF CLIPPING PERIOD, PRATTVILLE FIELD

Date of planting	Yield of dry forage per acre				
	By Jan. 1	By Feb. 1	By Feb. 10	By Feb. 20	By Mar. 1
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Sept. 10	1,100 (30%)[1]	2,800 (70%)	3,400 (85%)	3,650 (90%)	4,000 (100%)
Sept. 30	600 (15%)	2,150 (55%)	2,750 (70%)	3,150 (80%)	3,350 (85%)
Oct. 20	0	900 (25%)	1,800 (45%)	2,400 (60%)	2,750 (70%)

[1] Percentage of the highest yield produced (4,000 lb. per acre when planted Sept. 10 and clipped until March 1).

TABLE 2. RYE SEED YIELDS AS AFFECTED BY PLANTING DATE AND CLIPPING MANAGEMENT DURING FALL AND WINTER

Last date clipped	Seed yield/ acre	Lodged	Height	Date 1/10 headed	Seed heads/ft. of row
	Bu.	*Pct.*	*In.*		*No.*
September 10 planting					
Not clipped	32	19	55	3-16	49
February 10	25	12	52	3-30	41
February 20	20	6	49	4-4	36
March 1	16	6	47	4-5	36
September 30 planting					
Not clipped	31	33	56	3-19	46
February 10	24	13	53	3-29	41
February 20	20	7	50	4-3	39
March 1	16	9	47	4-6	36
October 20 planting					
Not clipped	29	49	56	3-23	44
February 10	24	21	53	3-31	39
February 20	21	13	48	4-5	39
March 1	18	19	48	4-6	38



Value of Creep Feeding Depends on Conditions

W. B. ANTHONY, *Dept. of Animal and Dairy Sciences*
L. A. SMITH, *Black Belt Substation*

MERITS OF CREEP FEEDING have been widely debated among Southern beef producers. While supplemental feeding of nursing calves can be counted on to increase rate of growth, economics may not always show any advantage. Value of creep feeding is affected by such factors as amount and kind of feed furnished the dams and price of supplemental feed.

Creep feeding research by Auburn University Agricultural Experiment Station several years ago clearly revealed that supplemental feed should be offered the calf and not the cow. Later work established that small grain pastures could be utilized as creep feed for fall-born calves. Calves on creep grazing gained an average of 16 lb. more during winter than comparable calves that did not get creep. Creep grazed calves continued to grow a little faster, averaging 24 lb. per head heavier at weaning.

Creep Feeds Evaluated

Creep rations of varying protein contents were evaluated in a recent series of tests at the Black Belt Substation. Three treatment groups were included in a 4-year study: Group 1 – control, no supplemental feed; Group 2 – high protein-low energy; and Group 3 – low protein-high energy feed. Feed formulas are given below:

Ingredient	*High protein-low energy, Pct.*	*High energy-low protein, Pct.*
Dried whey	5.5	5.5
Dehydrated alfalfa meal	50.0	10.0
Cane molasses	10.0	10.0
Soybean meal (49%)	20.0	6.0
Ground ear corn	13.0	----
Ground shelled corn	----	65.0
Corn oil	----	2.0
Deflourinated phosphate	1.0	1.0
Salt, trace minerals	.5	.5
Vitamins A, D, and E	yes	yes
Analysis		
Crude protein, pct.	22.0	11.00
Metabolizable energy, kcal/lb.	865	1,374

Hereford or Hereford-Angus cows were artificially mated to Hereford bulls to produce fall born calves for the study. The cows were wintered on johnsongrass hay and supplement. Beginning in early spring all groups had access to caley pea grazing and afterwards to dallisgrass-clover pasture. The three groups of cattle were rotated among pastures to minimize forage quality differences.

Winter Gain Increased

Creep fed calves on both rations gained an average of 24 lb. per head more during winter than non-creeped calves, see table. Spring and summer gains, however, did not differ among the three groups. Final weaning weight (255 days) averaged lowest for the non-creep fed calves, 512 lb., as compared with 558 lb. for those getting the low protein-high energy creep. Feeding the high protein creep resulted in average final weight of 542 lb.

Winter feed consumption averaged 99 lb. per calf on the high protein creep and 129 lb. on the high energy-low protein feed. For the entire nursing period, it took 399 lb. of the high protein creep to produce 30 lb. of extra gain. With the low protein creep, 610 lb. feed produced 46 lb. extra gain. Feed efficiency figures were the same for both rations – 13.3 lb. feed per lb. of gain.

In this test, extra gain resulting from creep feeding did not pay for the feed. It is noted, however, that brood cows in the test grazed pastures that were excellent in both quality and quantity. Results might have been different had the pasture been of poor quality and in short supply.

Slaughter grade was increased by creep feeding. Calves fed the low protein-high energy feed had slightly more backfat than those on the high protein-low energy creep.

COMPARISON OF HIGH PROTEIN AND HIGH ENERGY CREEP FEEDS, 4-YEAR AVERAGE

Item	Control no creep	High protein-low energy	High energy-low protein
Animals, total no.	72	72	72
Winter period, days	89	89	88
Winter gain, lb.	122	146	146
Creep feed/calf, lb.	----	99	129
Weaning weight, lb.	512	542	558
Slaughter grade	high Good	low Choice	low Choice
Sonray backfat, mm.	3.3	4.1	5.3
Feed/extra lb. gain			
Winter, lb.	----	4.1	5.4
Spring-summer, lb.	----	33.3	16.6

Other Creep Feed Results

Feeding fall calves grain through winter only was compared with feeding until weaning in another test. Feeding only during winter increased weaning weight 33 lb. per calf, as compared with 75 lb. extra weight from continuous feeding until weaning. However, economics favored feeding grain only during winter.

Excellent quality of pastures throughout spring and summer helps explain why such large amounts of grain were required per pound of increased gain. Calves got adequate nutrients from pasture to make best gains, so creep feed was used inefficiently. Best use of grain was during the winter period when high quality grazing was not available.

Creep feeding tests are continuing in efforts to find more efficient systems of growing cattle rapidly to slaughter. Calves with high growth potential are being used, and efforts made to identify any important interactions between breed and feeding system.

Fig. 1. Mushroom (psilocybe cubensis) growing at site near Auburn.

Psilocybe cubensis

An Hallucinogenic Mushroom Occurring in Alabama

N. D. DAVIS, G. MORGAN-JONES, R. E. WAGENER,
A. J. LATHAM, and U. L DIENER
Department of Botany and Microbiology

IN THE SPRING of 1973 there were reports of persons in the Auburn area collecting supposedly hallucinogenic mushrooms in local pastures. Farmers complained of damaged fences and trespassing, and law enforcement officials made several cases, which in some instances involved charges of possession of dangerous drugs. A series of articles appeared in the Auburn Plainsman, Birmingham News, and other newspapers in Alabama and Florida concerning these mushrooms. At first, officials generally doubted that the mushrooms contained hallucinogens, but they were, nevertheless, concerned about the general dangers of mushroom poisoning. There is genuine risk that one can be poisoned eating mushrooms, or drinking concoctions prepared from mushrooms. This is particularly true of individuals who are not experienced mushroom hunters.

The mushroom-hunting fad was at first thought to be confined to south Alabama and Florida, but it became apparent that it had spread throughout Alabama. Early reports of the source and effects of the mushrooms conflicted, making identification difficult. An editor of the Auburn Plainsman suggested that it was time for University scientists to resolve the mushroom mystery, and the authors of this article accepted that challenge.

A literary review of hallucinogenic mushrooms revealed reports of the 1955 expeditions of Gordon Wasson to the mountains of Mexico in search of mythical "Magic Mushrooms". On one trip he was accompanied by a prominent French mycologist, Professor Heim. Their story was popularized by Life Magazine in 1955. Professor Heim described and named seven new species of hallucinogenic mushrooms, the best known of which is *Psilocybe mexicana.* This is the species that persons believed they were collecting in the Auburn area.

All available information was gathered from individuals around Auburn and a search was made for mushrooms to be studied. We eventually located a suitable habitat in an orchard near a lake, about 5 miles from Auburn (Fig. 1). On this site we found an abundant supply of the mushroom that had been described to us (Fig. 2). It was characterized by a light golden-brown cap, fading near the margin, and it generally, but not always, possessed a distinct ring on the stem. The gills on the underside of its cap were gray to black. The spore print (Fig. 2) was dark and exhibited a purplish cast at the margins when viewed under natural light. Stems usually turned bluish when bruised. Clusters of the mushrooms are often found on or near dung, which explains the popularity of cow pastures for mushroom-hunting forays.

Dr. Gareth Morgan-Jones, associate professor of mycology at Auburn, identified the mushroom to be *Psilocybe cubensis.* This identification was subsequently confirmed by Professor Alexander Smith at the University of Michigan. *Psilocybe cubensis* is one of the seven hallucinogenic species originally found in Mexico by Wasson and described by Professor Heim.

Chemical analysis revealed that *Psilocybe cubensis* collected in the Auburn vicinity contained from 2.7 to 3.9 mg. of the hallucinogenic compound psilocybin per gram of mushroom. This compares with about 5 mg/g determined for those found in Mexico in 1955.

Mushrooms other than Psilocybe cubensis were found growing in various pastures. Some of these have been reported to be poisonous and probably account for occasional reports of illness among mushroom hunters.

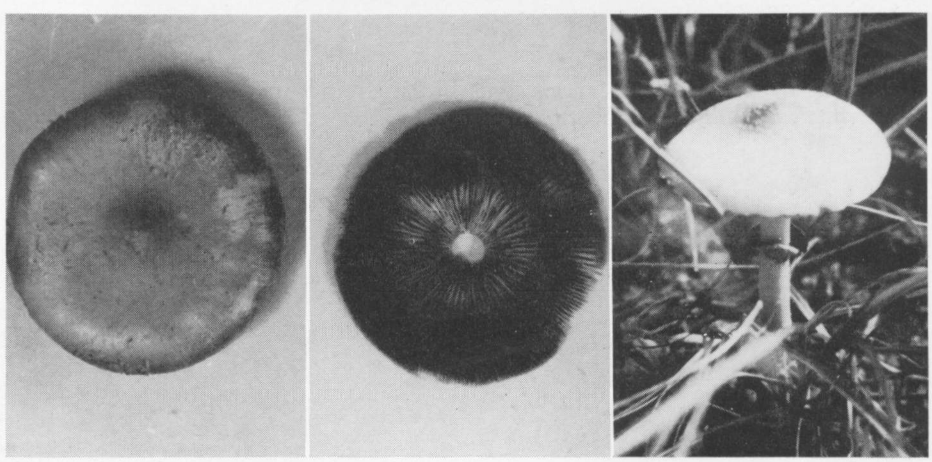
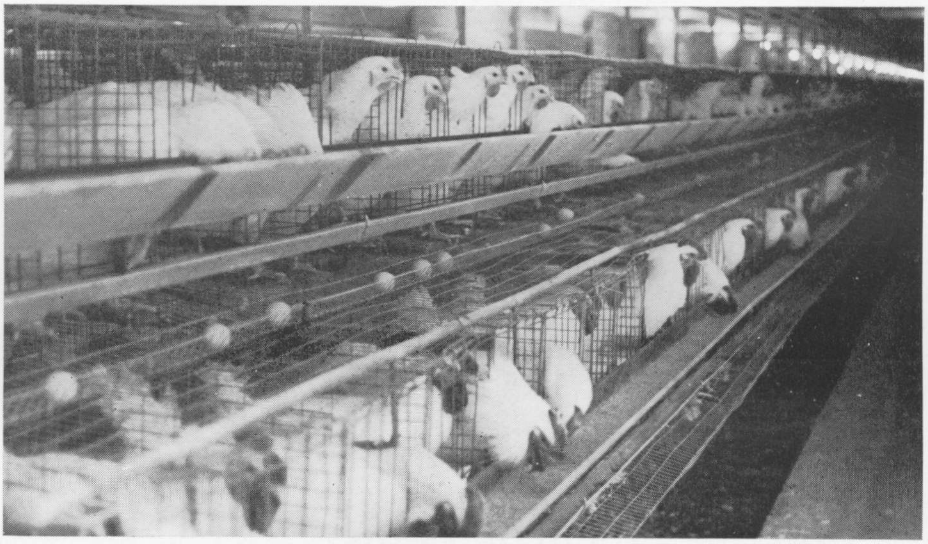


Fig. 2. Shown (left and center) are spore prints of Psilocybe cubensis found growing near Auburn. Shown (right) is a sample of the mushroom, which was found growing in a pasture near Auburn.

Artificial Insemination of Broiler Breeders



G. R. McDANIEL
Dept. of Poultry Science

ARTIFICIAL INSEMINATION – commonly labeled A.I. – has been an accepted practice in the turkey industry for several years. Now there is considerable interest in its use by the broiler industry for commercial production of broiler hatching eggs.

Being able to keep broiler breeder hens in cages is a major reason for wanting to use A.I. Producing hatching eggs in cages has advantages of cleaner eggs, less feed per dozen eggs (0.6 to 0.8 lb. less), a greater percentage of hatchable eggs (98%), more rapid improvement in growth rate, and improved body conformation of offspring.

A.I. offers a tremendous advantage over natural mating in getting best use of superior breeding stock. With conventional mating, the most desirable males (in body weight and conformation characteristics) sire the fewest offspring and the least desirable ones sire the greatest number.

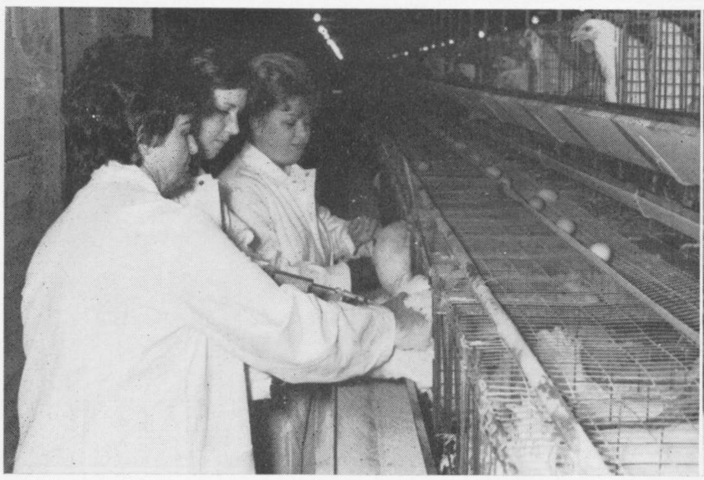
In addition to the physical barrier to genetic progress, greater selection pressure can be applied because fewer males are needed with A.I. In an A.I. program, 1 male is adequate for 40 females, as opposed to 1 male to 10 females for natural matings.

A disadvantage of the A.I. program at the commercial level is the labor involved in inseminating. Labor savings are possible, however, as shown by results of trials with broiler breeders maintained in a 5,000-cage unit. Use of inseminating equipment developed at Auburn University (by poultry scientists in cooperation with engineers) and refinement of techniques resulted in overall labor being cut in half. Development of a semen extender that allows 1:1 dilution without reducing hatchability provided further reduction in labor requirement for inseminating.

With present equipment, four people can make an efficient inseminating crew: one to collect semen, one to inseminate, and two to hold females. Present equipment is being re-evaluated, however, and new ideas in equipment and techniques are being developed and tested in efforts to further increase efficiency.

In the first trials conducted, hatchability of total eggs set was disappointing because of early embryonic mortality at 1 to 6 days of age. No explanation for this occurrence has been found. In the second set of trials presently underway, hatchability has been equal to or better than that for floor operations.

Results to date have been encouraging, leading to the conclusion that commercial production of hatching eggs in cages will be practical in the future as A.I. methods are perfected.



Four people using inseminating equipment and techniques developed and refined at Auburn University make an efficient team for inseminating broiler breeders in cages. One worker (right) collects semen and others (left) perform insemination.

A Method for Producing Larger Bluegill in Farm Ponds

W. D. DAVIES, *Department of Fisheries and Allied Aquacultures*

It is now possible to stock either a new or recently renovated farm pond with largemouth bass and bluegill, so that bluegill will average greater than 0.25 lb. during the first summer of fishing. This is accomplished by overcrowding the bass population and stocking bluegill at the recommended rate of 1,000 to 1,500 fingerlings per acre. The best procedure for overcrowding bass is to stock two to four adult bass (greater than 10″ in length) per acre before the spawning season. In Alabama, bass usually begin to sweep beds during the first week in April. For best results bluegill fingerlings should be stocked in the fall or earlier winter of the previous year.

If the pond is small (from 1 to 3 acres), it is important that approximately equal numbers of male and female bass be stocked, and for ponds one acre or less, 2 pairs should be stocked. Sexually mature males and females can be separated by observing the scaleless area around the vent. If the area is "oval" rather than "round", the fish is very likely a female.

Ponds stocked per acre with 1,000 fathead minnows along with bass and bluegill are usually more successful. Fathead minnows provide additional forage which ensures good fingerling bass survival.

Why Stock Adult Bass?

Studies at Auburn University's Fisheries Research unit have shown that stocking a few adult fish results in high production of bass fingerlings. During the first growing season, these fingerlings become staggered in size. The population then is able to forage on varied sizes of bluegill, thus effectively reducing the number of bluegill. With less competition for food, the remaining bluegill grow at a greater rate than those from a conventionally stocked pond where only 100 bass fingerlings are stocked per acre with 1,000 bluegill. The Table gives average weights from fishing for a pond stocked to produce larger bluegill and for a conventionally stocked pond. The same effect is not accomplished by stocking 200-400 bass fingerlings from bass brood ponds. A population established in this manner often results in bass of similar size that soon eliminate the size bluegill in the population that can be used as forage. As a result, the majority of bass stunt at a particular size and cannot grow larger to feed on larger bluegill. Also, a greater than desirable number of bluegill escape predation, and become stunted at a size too large to be used as forage by bass.

Average Weight of Bluegill in Pounds From Fishing

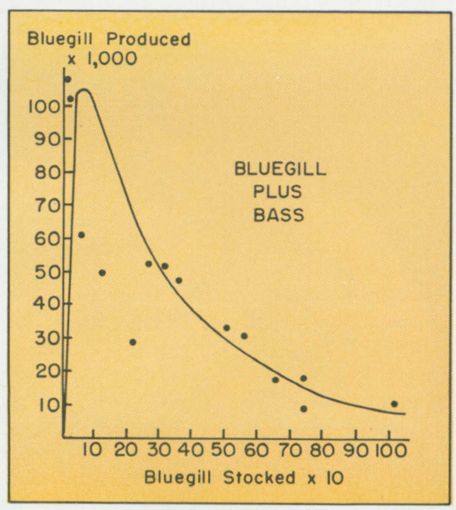
Stocking method	Year after stocking			
	1st	2nd	3rd	4th
3 adult bass plus 1,000 fingerling bluegill per acre, 9.75-acre fertilized farm pond	0.31	0.46	0.61	0.63
100 fingerling bass plus 1,000 fingerling bluegill per acre, 2.50-acre fertilized farm pond	0.19	0.23	0.26	----

Why Stock So Many Bluegill?

Bluegill must be stocked at a rate ranging from 1,000 to 1,500 fingerlings per acre so that crowding forces a reduction in the number of recruits entering the population. The late Dr. H. S. Swingle conducted experiments where 100 to 1,000 bluegill fingerlings and 100 bass fingerlings were stocked per acre. After these populations spawned, the ponds were drained and the number of young-of-the-year was determined. As is evident in the figure, bluegill reproduction is more effectively controlled when fingerlings are stocked at a rate of 1,000 per acre. Experience has shown that when bluegill fingerlings are stocked in ponds at lower rates, or when a few adult bluegill are stocked, bass cannot effectively control their numbers. When this occurs, bluegill become overcrowded and stunted which results in poor fishing.

Restrictions for Fishing Overcrowded Bass Ponds

Bass-bluegill populations overcrowded with bass are not as productive as balanced bass-bluegill populations; as a result some restraints on fishing are necessary. Optimum rates of harvest have not been determined; however, some guidelines for fishing these populations can be offered. Experience has shown that fertilized ponds stocked in this manner continue to produce good bluegill fishing if the catch is limited to not more than 25 lb. of bass and 75 lb. of bluegill per acre per year. Ideally a quota system which distributes the catch evenly over the fishing season should be used.



Bluegill reproduction is more effectively controlled by bass when bluegill fingerlings are stocked at a rate of 1,000 per acre.

The Effects of Carbaryl (Sevin) On Pod-Set of Soybeans

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CARBARYL (SEVIN®), if applied to apples at a certain time during bloom, will cause some of the fruit to abort; thus thinning the apples and allowing those that remain to grow to a larger, more desirable size. If applied at the proper time and rate, carbaryl will cause almost all crab apples to abort; thus allowing the tree to flower beautifully in the spring and eliminating the homeowner problem of cleaning up unwanted fruit. On pears, carbaryl may cause the fruit to hang loosely and fall at the least disturbance, which is undesirable. On these closely related plants, carbaryl has a definite effect on fruit set. With proper usage, this effect can be (and usually is) very desirable, but improperly used the effect can be undesirable.

In recent years farmers who have become aware of the above facts have been bothered by the question, "Well, if carbaryl causes a reduction of fruit set on apples, couldn't the same thing happen on soybeans?" After considerable testing at Auburn University's Agricultural Experiment Station it would appear that the answer is a definite, "no." Even at high rates (up to 4 lb. AI per acre) and with repeated applications from first bloom to harvest, no reduction in pod set was caused by the application of carbaryl.

A total of six experiments, located at several Substations, and utilizing various experimental techniques were conducted to clear-up this matter. As an example, one of these experiments will be presented here.

This experiment was conducted at the Auburn University Gulf Coast Substation near Fairhope, Alabama, during the summer of 1970, to determine if applications of various rates of carbaryl would affect soybean yields or size of mature seeds. Carbaryl was applied as a foliar spray at the following rates: 1 lb./acre, 2 lb./acre, and 4 lb./acre. There were four treatments including one untreated check. Treatments were replicated 4 times in complete randomized blocks.

The soybeans in this experiment were tended using accepted cultural practices. Applications of carbaryl were begun at first bloom using a Hahn Hi-Boy sprayer which was calibrated to deliver 20 gal. of mixed spray per acre. Treatments were applied 6 times at weekly intervals (August 6, August 13, August 20, August 27, September 3, and September 10).

Yield data were obtained by harvesting the middle 16 ft. of one inside row of each plot. The soybeans were harvested in each plot by hand, threshed with a small combine, weighed in the laboratory, and yield data recorded. Since seeds were thoroughly dry before harvest and held in the laboratory for several weeks before weighing, moisture content was assumed to be uniform at the time of weighing.

Results and Discussions

Yield data revealed an overall mean of 42.7 bu./acre. The yield means ranged from 41.8 bu./acre from plots treated with carbaryl at the rate of 2 lb./acre to 43.3 bu./acre from untreated check plots (Table 1). There were no significant differences among these means.

The overall mean of the weight of 100 seeds was 16.7 g. The mean extremes were 16.3 g. for seeds from plots treated with carbaryl at the rate of 2 lb./acre and 17.6 g. for seeds from the untreated check plots (Table 2). There were no significant differences among the means.

Previous unpublished research conducted over a 2-year period by the authors, support the results which are reported above. The results of the series of experiments indicate that carbaryl when applied at or near recommended rates does not adversely affect soybean yields. No significant insect populations were present on any of these beans before or during the experiment.

TABLE 1. THE MEAN SOYBEAN YIELD IN BU./ACRE AFTER INDICATED TREATMENTS. TREATMENTS APPLIED ON AUGUST 6, AUGUST 13, AUGUST 20, AUGUST 27, SEPTEMBER 3, AND SEPTEMBER 10, 1970

Treatment*	$\bar{x}$
Carbaryl WP 1 lb./acre	43.0a
Carbaryl WP 2 lb./acre	41.8a
Carbaryl WP 4 lb./acre	42.6a
Untreated checks	43.3a

* Means which share a common letter are not significantly different at the 5% level.

TABLE 2. THE MEAN WEIGHTS IN GRAMS OF 100 SEEDS AFTER INDICATED TREATMENTS. TREATMENTS APPLIED ON AUGUST 6, AUGUST 13, AUGUST 20, AUGUST 27, SEPTEMBER 3, AND SEPTEMBER 10, 1970

Treatment*	$\bar{x}$
Carbaryl WP 1 lb./acre	16.4a
Carbaryl WP 2 lb./acre	16.3a
Carbaryl WP 4 lb./acre	16.5a
Untreated checks	17.6a

* Means which share a common letter are not significantly different at the 5% level.

COST of LIVING CHANGES

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"It takes all my income to live." You have probably heard this statement many times.

Consumer prices are constantly changing. If one is to understand price changes, they must be properly measured. The consumer price index is the indicator used to measure changes in prices of many items bought by consumers. In recent years the index number is based on the year 1967 being equal to 100. In other words, with this as with other indexes, one can read directly the percentage change from the base period.

The consumer price index in 1973 averaged 133.1; this meant consumer prices were slightly over 33% above the 1967 level. The consumer price index is calculated each month by personnel of the Bureau of Labor Statistics, Department of Commerce.

Consumer Price Index, U.S., Selected Years (1967 = 100)

Year	All items	Food	Housing	Apparel and upkeep	Transportation	Health and recreation
1960	89	88	90	90	90	85
1965	94	94	95	94	96	93
1970	116	115	119	116	113	116
1971	121	118	124	120	119	122
1972	125	124	129	122	120	126
1973	133	141	135	127	124	130
Increase 1960-73, pct.	50	61	50	42	38	53
Average increase per year, pct.	3.8	4.7	3.8	3.2	2.9	4.1

The consumer price index represents the change in prices of goods and services purchased by families of urban wage earners and clerical workers and by single persons living alone. Prior to the revision of December 1963, the coverage was restricted to families of two or more persons.

It is not accurate simply to get prices on items bought by consumers at a given time and average them to derive a consumer price index. A careful weighting system must be used. Weights used in calculating the index are based on studies of actual expenditures by wage earners and clerical workers.

For example, food purchased is an important item in the consumer price index. It carries a weight of 22.4%. Within the food category, the breakdown includes food away from home and food at home. Food used at home is further classified into commodity or item groups such as cereal and bakery products; meats, poultry, and fish; and dairy products.

The quantities and qualities of items in the "market basket" used in the consumer price index remain the same between consecutive pricing periods. Thus, the index measures the effect of price change only on the cost of living of the families it represents. The index does not measure changes in the total amount families spend for living. Indexes that are regularly calculated for a number of U.S. cities do not measure relative differences in prices of living costs among cities; however, such comparisons are sometimes made. Comparisons among cities are limited because of differences in weights for various items within cities.

About 400 items of goods and services are included in the index, with several qualities of the same item priced in some cases. Steps are taken to see that the same or comparable items are priced each time. Sales taxes are reflected where applicable.

The national index is based on prices collected in 56 areas. Foods, fuels, and a few other items are priced monthly beginning the first consecutive Tuesday, Wednesday, and Thursday. Prices of most other goods and services are obtained monthly in the five largest areas but less frequently in other areas. Finally, price information for the separate areas is combined with weights for each area based on population to obtain the national figure.

The 1973 consumer price index average was 133 (1967 = 100) compared to 89 in 1960, an increase of 50% in 13 years or a simple average of 3.8% per year, see table. The increase from 1972 to 1973 was 6.4%. The increase from January to December in 1973 was 8.5%, see table.

Based on increases in the cost of living as indicated, one normally concludes that if his income has not increased by the same percentage as the consumer price index, he has fallen behind in purchasing power. In the U.S., it is reported that about 5.7 million workers, or about 6% of the civilian employed labor force, have union contracts that call for wage increases when the cost of living index goes up. Many others receiving various kinds of income are also affected.

As the cost of living index increases, the purchasing power of the dollar or value of the dollar goes down. Thus, in 1973 the dollar was worth only $0.75 compared to 1967.

Food is an important item in the cost of living index. From 1960 to 1973, food increased in cost at a simple annual average rate of 4.7%. However, from January to December of 1973, food increased 17.7%. The increase in food prices in 1973 was at the most rapid rate that has occurred in over a quarter of a century. Increases resulted from strong demand for food and reduced supplies of food both in the U.S. and abroad.

The individual item showing the greatest increase in cost during 1973 was fuel and oil with a 43.2% increase. The health and recreation category of consumer prices was the only one that showed about the same percentage increase during 1973 as prevailed for the previous 13 years, 1960 to 1973.

In the years ahead consumer prices will continue to change.

Consumer Price Index, U.S., 1973 (1967 = 100)

Item	Jan.	Dec.	Percent change
All items	127.7	138.5	8.5
Food	128.6	151.3	17.7
Housing, total	131.4	140.6	7.0
Rent	121.5	126.9	4.4
Fuel and oil	120.7	172.8	43.2
Gas and electricity	124.1	131.0	5.6
Apparel and upkeep	123.0	130.5	6.1
Transportation	121.0	126.7	4.7
Health and recreation, total	127.8	133.0	4.1
Medical care	134.9	141.4	4.8
Personal care	121.8	129.2	6.1
Reading and recreation	124.1	127.6	2.8

BEEF PRODUCTION from a DOUBLE CROPPING SYSTEM

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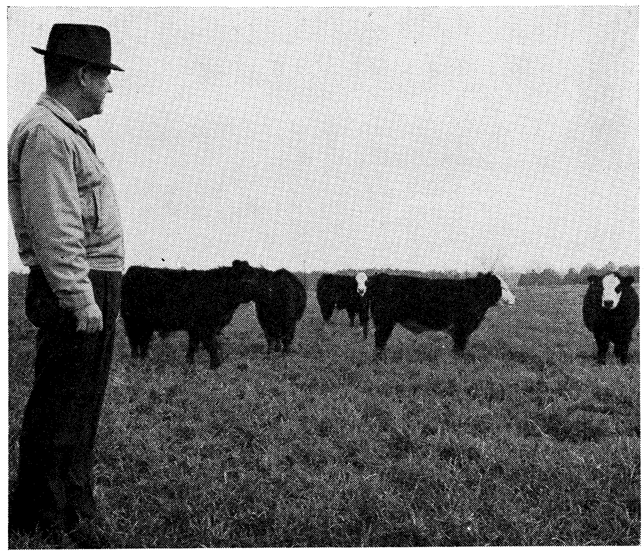

Calves are shown grazing cool-season annuals in a double cropping system at the Lower Coastal Plain Substation.

IN A DOUBLE-CROPPING SYSTEM with corn grown for silage followed by cool-season annuals for grazing, both crops have been effectively utilized in growing-finishing systems for production of slaughter beef.

However, if the cool-season annual crop is harvested for silage instead of being grazed, the land could be planted to sorghum for grain. Feeds produced as a result of this multi-cropping system when properly supplemented can be effectively used in producing slaughter beef.

Five acres of well-drained fine sandy loam soil located on the Lower Coastal Plain Substation, Camden, were used to investigate the possibility of such a multi-cropping system. The initial planting for this test was in the spring of 1970 and the cropping sequence shown in the table was followed for 2 years.

Corn harvested as silage had an average yield of 11 tons per acre during the 2 years. This silage had an average grain content of 44% (dry basis) and 34% dry matter (DM) at harvest. Yearling beef steers with an average initial weight of about 600 lb. gained 2.1 lb. daily when fed 41 lb. of corn silage and limited concentrates (2 lb. corn + 1.5 lb. CSM).

Rye yielded 6.7 tons of 19% DM silage per acre. Ground corn was added to the rye at time of ensiling at the rate of 100 lb. per ton of green material. Yearling steers (760 lb.) gained an average of 2.4 lb. daily when fed 57 lb. of this enriched silage, 7.5 lb. of corn, and 1.5 lb. of cottonseed meal.

Sorghum for grain was planted only 1 year out of the 2-year test because replanting of corn in the second year subsequently delayed its harvest. With late corn harvest, insufficient time remained to plant and harvest a sorghum crop.

Potential beef yields per unit of land can be calculated from feed production and utilization data. Values resulting from dividing crop yields by feed conversions are high because feed conversion data were obtained from the feeding of these forages with energy and protein supplements. Therefore, similar supplementation would have to be provided for the calculated yields of beef to be realized. Then, too, this method makes no allowance for shrinkage in the actual feeding process.

Potential yields of 1,912 and 1,607 lb. of beef per acre annually were estimated for 1970 and 1971, respectively. In order for an acre of land to produce the equivalent in terms of total digestible nutrients, it would have to produce about 150 bu. of corn grain. Animal gain from cool-season annual grazing such as rye-ryegrass-clover has averaged about 415 lb. per acre at several locations in Alabama. In an 8-year test at the Tennessee Valley Substation, rye or vetch seeded in Coastal bermudagrass sod substantially increased beef production per acre on the perennial grass pasture. Yearling steers grazing the combination summer perennial-winter annual produced an average of 512 lb. of gain per acre.

Even though the potential yield of animal product is much higher under the multiple cropping system, production costs would be much greater than those for the grazing system. Increased crop yields would make the harvested feed system more competitive. Certain practices that were not included in this test (higher plant populations, higher fertilization rate, use of irrigation) might justify greater expenditure by increasing the crop yields.

CROP SEQUENCE, FEED PRODUCTION, AND BEEF YIELD, LOWER COASTAL PLAIN

Season	Crop planted	Fertilizer/acre			Crop yield/ acre	Potential beef yield/ acre[1]
		N	P_2O_5	K_2O		
		Lb.	*Lb.*	*Lb.*	*Tons*	*Lb.*
Spring-summer '70	Corn (silage)	118	54	54	9.93	1,038[2]
Summer '70	Sorghum (grain)	90	56	56	31.38 bu.	176
Fall '70	Rye (silage)	140	50	50	7.54	698[3]
Spring-summer '71	Corn (silage)	120	60	60	12.05	1,130[2]
Summer '71	None[4]					
Fall '71	Rye (silage)	140	49	49	5.81	477[3]

[1] Calculated: crop yields divided by feed conversion data obtained from animal trials.
[2] An average of 2,007 lb. of corn silage, 107 lb. of ground corn, and 74 lb. of CSM was required per cwt. of gain. The silage averaged 34% dry matter and 44% grain on a dry basis.
[3] An average of 2,299 lb. of rye silage, 320 lb. of ground corn, and 62 lb. of CSM was required per cwt. of gain. Rye silage had an average dry matter content of 19%.
[4] Corn was replanted in the spring of 1971 and was harvested too late for planting and harvesting of sorghum.

Swine Perform Well on Bird-Resistant Grain Sroghum with Added Fat and Protein

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NOW THAT BIRD-RESISTANT grain sorghums are available, there is renewed interest in use of grain sorghum in swine rations. Heavy crop losses caused by birds feeding on the heads has been a major reason that grain sorghum has not been accepted in the Southeast as in the Southwest. Low corn yields in the South make it desirable to find a substitute grain to provide ration energy, however, and grain sorghum is viewed as a possibility.

Research at other experiment stations across the country revealed that grain sorghum has a slightly higher crude protein content than corn, but only about 95% as much energy value. This has caused reduced average daily gains and poorer feed efficiency by hogs. Use of fats and oils is one way to increase ration energy and has been shown to improve pig performance. Additional emphasis has been given to the ratio of protein to energy in swine rations since pigs reduce intake on high energy rations.

All of these considerations were included in the design of feeding trials at the Sand Mountain Substation, Crossville. Bird-resistant grain sorghum was evaluated as the energy source for rations, along with determinations of how level of supplemental fat and percentage of crude protein affected rate and efficiency of gain and carcass quality.

Four test rations were fed in the four trials that used a total of 483 pigs. The test pigs averaged 51 lb. and were fed to a final weight of 220 lb. They were fed in self feeders on solid concrete floors.

In each trial, equal numbers of pigs were assigned to four lots on the basis of weight, age, sex, litter, and breed composition. The lots were randomly assigned to the four experimental rations identified in Table 1.

Ration 1 was considered the control ration for comparing with the others. Ration 4 had the same ratio of calories to specific nutrients as the control ration.

Pigs fed rations 1, 3, and 4 gained faster on less feed than those fed Ration 2. Thus, adding fat and protein to bird-resistant grain sorghum rations improved rate of gain and feed efficiency. Backfat thickness of pigs on rations containing added fat (rations 3 and 4) was not significantly different from that of pigs fed the corn-soybean meal ration without added fat (Ration 1).

Highest feed requirement per pound of gain was on Ration 2, the grain sorghum ration without added fat. Pigs on this feed required 40, 31, and 27%, respectively, more feed per unit of gain than those fed rations 4, 1, and 3. Pigs wasted much of the sorghum-soybean meal ration without added fat (Ration 2) by rooting it from the feeders. This indicates unpalatability of the bird-resistant grain sorghum. Results further indicate that the palatability problem can be alleviated by adding animal fat to the ration.

The standard 14% corn-soybean meal ration was the most economical per cwt. of gain of any ration in the study. Adding fat to the grain sorghum rations increased cost, but this was more than offset by the savings in feed per unit of gain. Even with the palatability problem of grain sorghum, the best feed conversion was recorded with Ration 4, the grain sorghum ration with added fat and protein.

These results indicate that certain bird-resistant grain sorghums are acceptable for use in swine rations if palatability problems are overcome. Adding fat and protein to rations containing grain sorghum reduced feed requirements and costs per unit of gain.

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TABLE 1. COMPOSITION OF TEST RATIONS

Ingredient	Content			
	Ration 1	Ration 2	Ration 3	Ration 4
	Pct.	*Pct.*	*Pct.*	*Pct.*
Ground yellow corn	80.0	----	----	----
Ground grain sorghum	----	80.0	67.5	63.0
Soybean meal (44%)	15.0	15.0	17.5	21.0
Alfalfa meal (17%)	2.5	2.5	2.5	3.0
Fat (animal)	----	----	10.0	10.0
Ground limestone	1.0	1.0	1.0	1.2
Dicalcium phosphate	1.5	1.5	1.5	1.7
Trace-mineralized salt[1]	.5	.5	.5	.75
Vitamin premix[2]	.1	.1	.1	.12
Antibiotics (Aureomycin-10)	.1	.1	.1	.12
Calculated analysis				
Crude protein, pct.	14.0	16.0	16.0	17.0
Calcium, pct.	.76	.77	.78	.91
Phosphorus, pct.	.61	.66	.58	.64

[1] Contains 1.0% manganese, 0.8% zinc, 0.8% iron, and 0.01% cobalt, and 97.4% salt.

[2] Each pound supplied the following: vitamin A and D_2, 1,000,000 and 600,000 USP units, respectively; riboflavin, 2,000 mg.; niacin, 9,000 mg.; D-pantothenic acid, 4,000 mg.; choline chloride, 12,000 mg.; vitamin B_{12}, 5 mg.; and folic acid, 60 mg.

TABLE 2. PERFORMANCE OF PIGS FED RATIONS CONTAINING BIRD-RESISTANT GRAIN SORGHUM

Item	Result			
	Ration 1, corn-SBM	Ration 2, sorghum-SBM	Ration 3, sorghum-SBM+ fat	Ration 4, sorghum-SBM+ fat+ protein
No. pigs	122	121	116	124
Initial wt., lb.	51	51	51	51
Final wt., lb.	224	219	222	222
Days on feed	116	121	117	115
Av. daily gain, lb.	1.51	1.41	1.48	1.50
Backfat, in.	1.01	.92	1.03	1.00
Daily feed consumption, lb.	6.19	7.59	6.22	5.73
Feed/cwt. gain, lb.	413	540	424	386
Feed cost/cwt.[1]	$6.08	$5.89	$7.42	$7.52
Feed cost/cwt. gain	$25.11	$31.81	$31.46	$29.03

[1] Feed costs per cwt. include $5.62 for corn, $5.37 for grain sorghum, $8.15 for soybean meal, $5.80 for 17% alfalfa meal, $20.00 for animal fat, $1.35 for ground limestone, $8.70 for dicalcium phosphate, $3.60 for trace-mineralized salt, $26.00 for vitamin premix, and $28.00 for Aureomycin-10 (prices as of March 15, 1974).

Farm to Market Milk Assembly—Costly Marketing Function

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GETTING MILK from farm to plant costs Alabama dairymen a lot of money. In 1973, for example, milk assembly costs amounted to about 4% of milk income. Under current cooperative marketing arrangements for milk in Alabama, most hauling is done by haulers under contract to the cooperative.

As coops assumed hauling functions beginning in the late 1960's, inequities in rates charged members became apparent. Rates were frequently inconsistent among producers on the basis of volume shipped and distance to market. Income generated by hauling charges was not adequately related to cost of assembly.

Sharply rising fuel costs and other expenses of milk haulers intensified the problem of income not being related to assembly costs. This aspect of the milk assembly problem was studied by Auburn University Agricultural Experiment Station. This report, based on the fall 1973 study, concerns average route costs in relation to distance zones.

The study covered six routes that picked up milk from 51 producers located within a single supply area of the State. Routes were run every other day, with three run each day. During a 31-day month in which volume information was gathered, 4,233,850 lb. of milk were assembled from the 51 producers. Average size of load was 45,525 lb.—94.8% of tank capacity. Three tractors and three 48,000-lb. capacity tanks were used, requiring four drivers.

Route costs were synthesized by distance zones, based on operating costs from haulers' records, volume data, and producer location. Four assumptions were used in developing assembly costs for the 51 producers:

(1) One load of milk per day picked up and hauled to a plant in the market.

(2) The three tractors and tanks were used with loads averaging 90% of capacity, 43,200 lb.

(3) Volume for the 31 days totaled 4,233,850 lb., which would require five extra loads with each load at 90% capacity.

(4) As far as practical, routes were according to distance zones from the market. Four zones were defined, based on 25-mile increments, with the two outer zones combined because of limited numbers beyond 50 miles, Table 1.

Daily cost of operation ranged from $108.86 for a route in zone 1 (under 25 miles) to $163.64 in the outer area, Table 2. Cost per route day averaged $120.26 for all routes. Labor was highest with 32% of cost, followed by 30% for operating cost and 20% for truck and tank costs.

Route cost differences among zones reflected greater operating and labor costs as distance increased. Operating costs averaged about 22¢ per mile at time of study, with fuel amounting to 7.59¢, tires 7.96¢, repairs 5.00¢, and oil, filters, lubrication, and washing adding 1.50¢.

Fuel cost was figured on the basis of 4.6 miles per gal. Price was 34.9¢ per gal. at time of the study, which results in the 7.59¢ per mile cost shown. Increases in fuel cost and other operating expenses have pushed total operating cost above 25¢ per mile in 1974.

Total labor cost per route day went up as mileage increased because more time was required. Labor cost (including fringe benefits and indirect labor cost) averaged $4.31 per hour. Labor and operating costs were defined as the variable cost items. They amounted to 58% of total cost for zone 1 routes but 72% for routes covering longest distance. In addition to zone distance affecting route cost, the more distant zones also had lower density of milk producers. This meant greater mileage and more cost to complete a load of milk.

Original cost of tractors was $22,000 to $23,000. Trucks were assumed to have 4 years of use and a 10% salvage value. Average daily depreciation per route load was $13.56. Tanks were leased for approximately $330 per month, or $10.85 per route day.

Overhead costs were estimated as 10% of all costs and allocated to each route as a fixed cost. Hauling firms recently studied reported a wide range in overhead cost. Some small firms allocated negligible cost to overhead and failed to list some true overhead expenses. In other instances overhead appeared excessive. License and taxes on truck and tank were approximately $520 per year, mostly for truck license.

Average assembly cost per hundredweight ranged from 25.2¢ in zone 1 to 37.9¢ on the longest route. The average for all routes was 27.8¢.

A return to management for capital invested and risk incurred is necessary to attract firms into milk assembly. At the time of the study, haulers in the area earned an average return of slightly over 5%, with producers paying an average of 29.3¢ per cwt. If 15% of total costs were considered a satisfactory average return to hauling firms, producers in this area would be charged an average of about 32¢ per cwt. instead of the 29.3¢ that was actually being paid.

Since the time of the study, hauling rates paid by coop producer members have been adjusted.

TABLE 1. VOLUME OF MILK SALES, LOADS AND MILES PER ROUTE IN EACH ZONE FOR 51 PRODUCERS, 31-DAY PERIOD, ALABAMA

Zone, miles	Number of producers	Total sales	Number of loads[1]	Av. miles per route
	No.	*Lb.*	*No.*	*Miles*
1—under 25	33	2,431,277	56	125
2—25 to 50	12	1,287,535	30	175
3—50 to 100[2]	6	515,038	12	325[3]
TOTAL OR AV.	51	4,233,850	98	165

[1] Load of 43,200 lb., or 90% of tank capacity.
[2] Combination of 50-75 and 75-100 mile zones.
[3] Based on longest route operated in supply area.

TABLE 2. AVERAGE LOAD COST BY COST ITEM AND DISTANCE ZONE, 31-DAY PERIOD, ALABAMA

Cost item	Cost by distance zone			
	Under 25 miles	25-50 miles	50-100 miles	Av. per load
Labor	$35.90	$40.21	$46.68	$38.54
Operating cost[1]	27.50	38.50	71.50	36.26
Tractor and tank				
Depreciation on tractor	13.56	13.56	13.56	13.56
Lease cost of tank	10.85	10.85	10.85	10.85
Interest in investment	2.32	2.32	2.32	2.32
Insurance	6.37	6.37	6.37	6.37
License and taxes	1.43	1.43	1.43	1.43
Overhead cost[2]	10.93	10.93	10.93	10.93
Total	108.86	124.17	163.64	120.26
Cost per cwt.	.252	.287	.379	.278

[1] 22¢ per mile.
[2] 10% of all other costs.

IMPACT of WITHIN-STATE TOURIST EXPENDITURES on LOCAL ECONOMY

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TOURISM is big business in Alabama. Benefits of tourist travel in Alabama were strongly illustrated during the recent gasoline shortage.

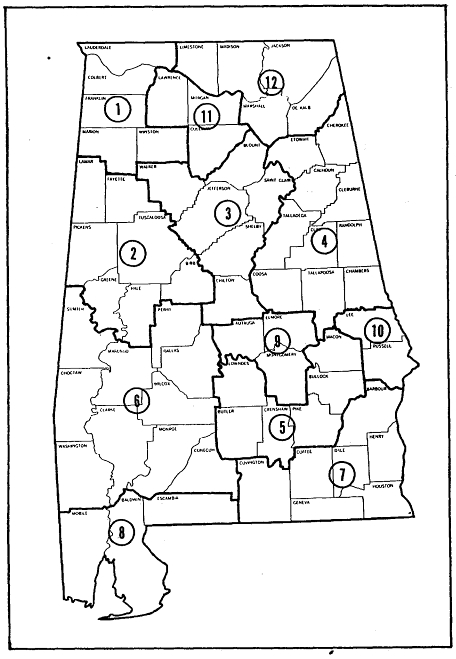
With allocations based on historical usage, Alabama's supplies were augmented due to heavy vacation travel into and across the State during the previous year. During 1974, however, the number of out-of-state visitors to and through Alabama may not sustain the rate of increase of previous years.

A recent study of tourism was conducted by the Department of Agricultural Economics and Rural Sociology for the Alabama State Department of Conservation. Data from this study indicated that an area's tourism should be classified in two groups according to tourist origin: out-of-state visitors and visitors from within Alabama. The recreational activities within a local area by the two types of tourists were very similar, although out-of-state tourists engaged in sightseeing and visited historical sites at higher rates than within-state visitors.

Within-state visitors to all areas averaged expenditures of $3.89 per person each day. For an average stay in an area expenditures were about $10.50. The expenditures by within-state visitors did not include the cost of transportation or items purchased in the home area. While food brought from home and gas and oil expenses represented costs to the visitor, they did not necessarily represent revenue to the district where recreational activities occurred. Many of the day visitors prepared picnic lunches and made only insignificant or no purchases in the recreational area. When the cost of transportation and items purchased out of the area were included, expenditures per person averaged $5.17 per day or $15.47 for a trip of average length.

Many factors influence the impact of expenditures by within-state visitors in a local area, the most important of these being the number of visitors and amount of their expenditures. Yet, if more residents are traveling out of an area than visitors are traveling into it, the outflow may offset any gains registered by the inflow. The percentage of visitation and average expenditures among the 12 Alabama planning and development districts listed in the table reveal such a situation.

On a statewide basis, within-state tourism cancels in terms of both the number of individuals and the amount of expenditures. For example, when 1,000 state residents visited sites outside of their home district, the State sustained a loss of 1,000 resident recreational days while gaining 1,000 non-resident recreational days. On a district level the expenditure patterns are significant, since individual districts stand to gain or lose on the net exchange. Districts 4, 8, and 11 received the highest net gain from within-state tourism, while Districts 1, 3, and 12 sustained net losses, as shown in the table. District 1 sustained a net loss because travelers from the District spent more than travelers to the District. District 3 sustained a large loss because the volume of travelers from the district was over five times as great as the number traveling to the District. District 12 had approximately twice as many travelers from as to the district.



Shown here are Alabama planning and development districts.

Recreational expenditures of travelers would create economic activity even though the inflow and outflow of travelers in each district were exactly equal. The amount of spending by travelers above the amount that would have been spent if those travelers had remained in their home district represents a net addition to economic activity in the state.

Within-state travelers generally visit recreational sites away from the home area when local facilities are lacking, low quality, or overcrowded. Saltwater and reservoir activities, for instance, are only available on the Gulf and along the river systems. In addition, some recreationists consider the trip as a significant portion of the outdoor recreation experience. Districts with unfavorable within-state tourism expenditure ratios generally have relatively high resident demand for existing facilities and often have significant numbers of out-of-state visitors.

PERCENTAGE OF WITHIN STATE VISITORS, AVERAGE EXPENDITURES PER DAY AND NET DAILY GAIN OR LOSS PER 1,000 TRAVELERS TO AND FROM ALABAMA PLANNING AND DEVELOPMENT DISTRICTS, 1972

District No.	To district		From district		Net gain or loss per 1,000 visitors
	Percent	Expenditure person/day	Percent	Expenditure person/day	
	Percent	*$*	*Percent*	*$*	*$*
1	4.0	5.50	4.0	6.71	— 48.10
2	7.7	6.00	5.0	4.52	236.00
3	7.0	4.30	37.1	5.31	—1,668.69
4	25.2	3.90	10.5	5.33	423.15
5	2.6	4.30	1.7	5.60	16.60
6	4.9	4.30	3.9	4.72	26.62
7	4.9	6.60	2.2	5.70	198.00
8	9.6	7.45	5.7	6.51	344.13
9	6.4	8.21	8.7	4.85	103.49
10	3.3	6.20	3.8	4.61	29.42
11	16.9	3.90	3.7	5.63	450.79
12	7.5	6.00	13.7	4.10	— 111.41
TOTAL	100.0	5.17	100.0	5.17	0

The Development of Benomyl-Tolerant Strains of Cercospora Leafspot of Peanuts

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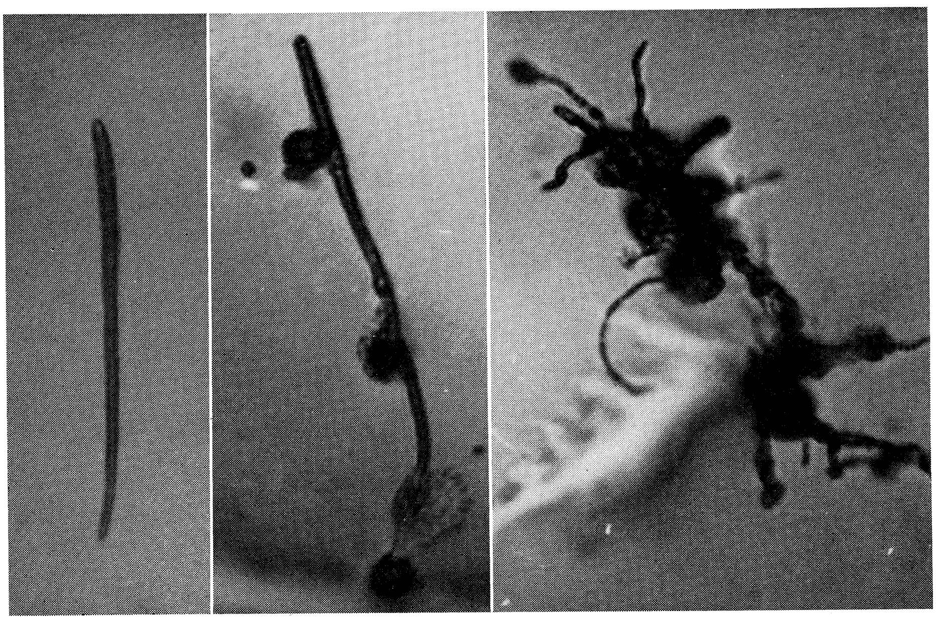
THE CONTROL of early and late leafspot of peanuts caused by the fungi *Cercospora arachidicola* and *Cercosporidium personatum,* results in significant increases in yield. Benlate® with its systemic action has been one of the most effective and widely used fungicides in leafspot control programs. However, in the summer of 1973 a few areas in Alabama reported a breakdown in leafspot control in spite of recommended applications of Benlate. Plant pathologists at Auburn University immediately started research to determine the reason for this loss of disease control.

Infected peanut leaves were taken from three different locations: Area 1, where no Benlate had ever been used for leafspot control; Area 2, where Benlate was being used with good control; Area 3, where Benlate was being used but not giving adequate control. The leaves were taken to the laboratory and put in a humid chamber for 4 days to induce development of spores on infection spots. Spores were removed from the spots and placed on Benlate-agar to find out whether the fungicide affected germination and growth of the fungus. The concentration of the fungicide in the agar was about 10 times greater than concentrations that are normally necessary to inhibit development of *Cercospora* spores. Spores also were tested on media containing another systemic, Topsin®, and a non-systemic, Bravo®.

Spores on Bravo-agar failed to germinate (Fig. left), whereas spores on Benlate showed some signs of activity. Those most susceptible to the fungicide produced round protrusions but developed no further (Fig. center). Those with a degree of tolerance put out germ tubes and grew for a short time before ceasing development (Fig. right). Spores tolerant to 5 p.p.m. active Benlate in agar grew, and produced viable colonies on the Benlate-agar.



Spores on Bravo-agar (left) failed to germinate. Round protusions were produced on spores most susceptible to Benlate, but they developed no further (center). Those with a degree of tolerance put out germ tubes and grew for a short time before ceasing development (right).

THE PERCENT OF VIABLE SPORES OF *Cercospora arachidicola* SHOWING SHORT-TERM AND CONTINUED GROWTH ON FUNGICIDE-CONTAINING AGAR

Medium	Area	Short-term growth	Continued growth
		Pct.	*Pct.*
PDA[1]	1,2,3,	0	100
PDA + Bravo[2]	2	0	0
PDA + Benlate[3]	1	1	0
PDA + Benlate[3]	2	82	1
PDA + Benlate[3]	3	56	44

[1] Potato Dextrose Agar.
[2] Bravo 6 F incorporated in PDA at concentration of 0.5 u/ml of active ingredient.
[3] Benlate 50 WP incorporated in PDA at concentration of 5 ug/ml of active ingredient.

A very low percent of spores isolated from Area 1 (see table) made short-term growth which indicated that even where no Benlate had been used, perhaps there was a slight degree of tolerance to the fungicide. In Area 2, 82% of spores that were isolated made short-term growth and 1% continued to grow, which showed the presence of a low level of tolerance. However, in this area Benlate was still effective for leafspot control. On the other hand, the 44% of spores from Area 3 which continued to grow, demonstrated a high level of tolerance which manifested itself in an obvious breakdown of control under field conditions.

A possible explanation for this phenomenon is that before Benlate was used, a very low percent of resistant strains of *Cercospora* already existed. When Benlate was used continuously, it suppressed the susceptible strains allowing the tolerant ones to build up. Over two or three seasons the tolerant strains increased to the extent where Benlate was no longer effective.

Since tests indicate that the systemics, Topsin and Bay Dam 18654 act in much the same manner as Benlate, it would be wise to discontinue the use of these fungicides at the first sign of breakdown of leafspot control and change to another recommended material.

Control of Foliage Blight and Borers of Arizona Cypress Seedlings in the Nursery

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Department of Forestry

ARIZONA CYPRESS have been used for Christmas trees for many years in Alabama. However, poor form, poor color, and multiple stems have limited its popularity in recent years. A breeding program, initiated in 1964, is designed to reduce these problems.

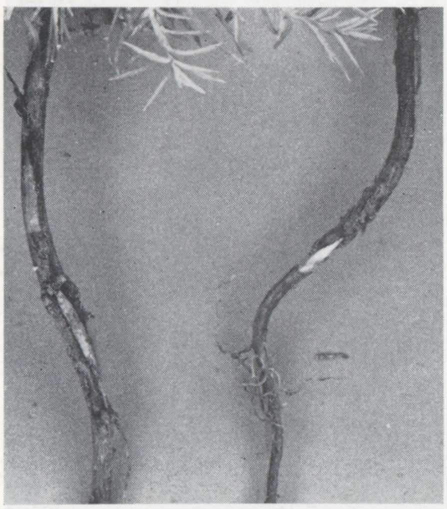

Fig. 1. Typical root feeding damage of the lesser corn stalk borer.

Fig. 2. Foliage damage by the lesser corn stalk borer.

Root and foliage feeding by the lesser corn stalk borer (Figs. 1 and 2), and several foliage blights have severely limited nursery production of the species. Control of these pests was attempted in the state nursery at Auburn, in 1972 and 1973 by using two fungicides superimposed on two insecticides in a split-plot design.

Dieldrin in granule form was applied before planting at 1 lb. Active Ingredient (AI) per acre. BHC was applied at the same rate bi-weekly from June to mid-August, then weekly until mid-October. The fungicides, Benlate and Difolatan, were applied bi-weekly from June to mid-October at the rates of .4 and 2.5 lb. AI per acre, respectively.

Seedlings from the various treatments were lifted in mid-October and inspected for borer damage, foliage condition and mortality. Results are listed in the Table. The "perfect" class had less than 5% of their foliage dead or necrotic.

Although BHC reduced borer root and top damage in relation to treatments with Dieldrin or no insecticide, there was little increase in the percentage of seedlings in the perfect class and no reduction in mortality. Benlate treatments had the best survival and the highest percentage of perfect seedlings in both years, although the advantage over Difolatan in 1973 was slight. Mortality on all plots was lower in 1973, possibly because of more favorable weather than in 1972.

Although borer attacks on seedlings were common in both years, there was little permanent damage when the trees were adequately protected from fungi. Benlate seems to give the protection necessary to grow healthy seedlings.

MEANS OF TREATMENT COMBINATIONS GIVEN IN PERCENT OF SEEDLINGS SAMPLED

Insecticide	Fungicide	Root damage		Top damage		Perfect		Dead	
		1972	1973	1972	1973	1972	1973	1972	1973
BHC	Benlate	21	9	62	39	90	65	1	5
	Difolatan	26	16	56	31	10	67	14	—
	None	28	10	61	37	1	15	51	32
Dieldrin	Benlate	42	25	55	61	77	63	3	6
	Difolatan	37	31	64	48	10	58	14	10
	None	33	23	61	54	1	29	39	18
None	Benlate	33	32	63	58	79	58	1	8
	Difolatan	40	26	56	48	9	61	11	8
	None	32	24	57	48	2	29	60	16
	Overall Average	33	22	60	47	31	45	21	12

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