highlights
of agricultural research

Vol. 27 No. 1 Spring 1980

AGRICULTURAL EXPERIMENT STATION AUBURN UNIVERSITY

R. DENNIS ROUSE, DIRECTOR AUBURN, ALABAMA

DIRECTOR'S COMMENTS

THE FIRST 1980 issue of the weekly newsletter to all staff of the School of Agriculture and Agricultural Experiment Station carried a message with this introductory sentence: "During 1980, there should be one overriding concern for every employee of the Agricultural Experiment Station and the School of Agriculture — ENERGY."

American agriculture is the most highly mechanized on earth and at the same time the most productive per unit of human labor, and I hope it will always be. It has reached this level of efficiency in human labor because of the goal of equality of all people in this republic and because it is just plain good business. It has been a goal of this Agricultural Experiment Station, I believe since its beginning, to reduce human drudgery and increase efficiency of human labor associated with agriculture. I hope we will always have as a major goal reduction of the amount of human labor required per unit of output.

R. DENNIS ROUSE

We should have as much dedication to increasing efficiency of energy use in American agriculture. The goal to decrease human labor input and concurrently decrease stored energy input is not incompatible as some think. Production can be highly mechanized *and* energy efficient.

When we look at all mechanization that is part of American agricultural productivity, it is easy to conclude that tractors and other motorized equipment are the major consumers of energy on the farm. The facts show less than half the energy used in agricultural production is consumed by mechanized equipment. The big energy cost on the farm is in chemicals that complement machines — fertilizer, lime, and pest management chemicals. Research scientists, teachers, professional agriculturists, chemical companies, farm managers, and farm workers all have responsibilities to recognize the opportunity for decreasing energy costs through wise use of chemicals in agricultural production. This begins with careful attention to soil and water conservation practices that result in minimal loss of soil and soil fertility. Some production practices that offer real opportunities for conserving energy are: applying lime to keep soil at optimum pH, using fertilizer most efficiently ("soil test — do not guess"), following rotations and cultural practices to minimize amounts of chemicals needed for nutrients and pest management, applying chemicals based on carefully determined needs and most timely and efficiently for economic benefits, harvesting for maximum efficiency, and marketing the product produced.

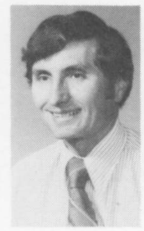
Ways to reduce energy inputs through reduced fuel consumption by tractors and machinery also deserve careful attention. Reducing the number of trips over land, using tractors properly sized for the job, operating at efficient speeds, and keeping the tractor and equipment properly serviced and adjusted are things that can contribute greatly to more efficient fuel consumption.

Most above listed opportunities for reducing energy for agriculture are not new, but they have not always received proper attention in the past because most people have not been energy conscious. They are readily applicable without further research.

I, along with the Agricultural Experiment Station scientists, welcome ideas for research with the objective of increasing labor efficiency-decreasing labor requirements — and ideas for research with the objective of increasing energy efficiency-decreasing energy cost— in agricultural production. We are committed fully to utilizing resources of the Agricultural Experiment Station to foster and support research designed to increase efficiency and effectiveness of energy use.

may we introduce . . .

Dr. David G. Topel, new head of the Department of Animal and Dairy Sciences. A native of Lake Mills, Wisconsin, Dr. Topel comes to Auburn from Iowa State University where he served as professor of Animal Science and Food Technology. While at Iowa State he initiated and developed the first undergraduate Animal Science course in Growth and Composition of Animals. Dr. Topel received his B.S. degree in 1960 from the University of Wisconsin, his M.S. from Kansas State University in 1962, and his Doctor of Philosophy at Michigan State University in 1965. During his studies at Michigan State he served as an instructor in Food Science. He began work at Iowa State in 1965 as assistant professor and ascended the ranks as associate professor in 1968 and full professor in 1973.



Dr. Topel is a member of several professional and honorary societies and has authored numerous papers and research publications.

HIGHLIGHTS of Agricultural Research

SPRING 1980 VOL. 27, NO. 1

A quarterly report of research published by the Agricultural Experiment Station of Auburn University, Auburn, Alabama.

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Information contained herein is available to all without regard to race, color, or national origin.

ON THE COVER: Twenty years results at the Lower Coastal Plain Substation, Camden, have proved that slaughter beef can be profitably produced on winter grazing.

GASOHOL

Its Use in Farm Engines

Gasohol testing in tractors is now in progress at Auburn University Agricultural Experiment Station.

SHANNON VINYARD and ELMO RENOLL
Department of Agricultural Engineering

FOR THE FARMER who is considering using gasohol in place of gasoline, there are some important questions to be answered. Will it harm the engine? Will the cold weather cause starting problems? Will the tractor develop its full horsepower?

The answers to these questions are not always clear-cut. For example, tests in automotive engines have provided conflicting results. In some cases fuel economy has increased, in other cases, decreased. Tractor tests are not as numerous, and some of the following results were not expected.

When we buy fuel we are really buying heat energy which the tractor converts into horsepower or work. As indicated in the table, a gallon of alcohol has about two-thirds the heat energy of a gallon of gasoline. This means that 50% more alcohol would be needed to get the same amount of work done. Since gasohol contains 10% ethyl alcohol and 90% unleaded gasoline, it has approximately 97% of the energy contained in a gallon of regular gasoline, as shown in the table. So, more gasohol is expected to be used in doing the same work. This fact is backed by engine tests at Auburn and other universities showing that fuel flow must be increased from 1½ to 3½% over varying loads to obtain the same power output that is available using gasoline.

One assumption often made is that gasohol burns in the engine with the same efficiency as does gasoline. Preliminary tests at Auburn University Agricultural Experiment Station indicate this may not be true. Though it took more gasohol to get the same power output, the "thermal efficiency" of the engine when burning gasohol was slightly higher.

Thermal efficiency is a measure of how efficiently an engine burns fuel to make power. It is defined as the work output divided by the energy input to the engine. Thus, a higher thermal efficiency means increased output (work) for the same input (energy). Typical values of thermal efficiency are around 20-25% for gasoline engines and 25-30% for diesel engines. The rest of the energy leaves the engine as hot exhaust gases, through the radiator to the air, or direct radiation, and is not available for work. So with up to 80% of the energy in a gallon of fuel being wasted, any improvement in thermal efficiency is gladly welcomed.

The increased thermal efficiency while burning gasohol is thought to be for several reasons. First, alcohol has a higher flame speed and a lower flame temperature than gasoline. This faster flame speed would leave less chance for heat to be wasted by heating the engine pieces or by going out the exhaust. Second, alcohol burns at a 9:1 air-fuel ratio by weight as compared to 15:1 for gasoline. This would leave more oxygen available for more complete combustion (and sometimes less pollution). Third, alcohol absorbs more heat as it vaporizes than does gasoline, which would reduce the work required to compress the mixture inside the engine cylinder.

Horsepower-hours per gallon is another way of measuring the efficiency of an engine. This is the horsepower that an engine will produce for an hour on a gallon of fuel. Tests in tractor engines with gasohol show a decrease in horsepower-hours per gallon from 1.2 to 2.5% over varying loads as compared to gasoline. So while the engine may be more efficient on an energy basis, we purchase fuel by the gallon and not by the Btu, and it still takes more gallons to do the same work.

ENERGY CONTENT OF FUELS

Fuel	Btu/gal.
Gasoline	124,000
Ethyl alcohol	84,000
Gasohol	120,000

Will gasohol cause cold weather starting problems? Probably not. Though gasoline will evaporate two or three times faster than alcohol, gasohol evaporates faster than either alcohol or gasoline. This increased volatility caused by mixing the two components should aid cold weather starting. It could also lead to storage problems on the farm due to higher evaporation losses of fuel.

What about problems with engine wear? Preliminary tests showed no significant differences in engine wear between gasohol and gasoline. These tests included cylinder wear and carbon deposits on spark plugs, valves, and valve seats. No reports of engine corrosion because of alcohol have been documented.

There is a potential problem with clogged fuel filters. Since alcohol is an excellent solvent, it may dissolve gums and deposits left by gasoline which could clog filters and strainers. It can also cause problems by dissolving rubber hoses and seals. After the engine and fuel system are cleaned, though, engine performance will be unaffected.

Gasohol may be the fuel of the future for spark-ignition engines, but not without some shortcomings. One of the biggest criticisms of gasohol is that it may take more energy to produce a gallon of alcohol than it provides for use. Increases in thermal efficiency have been found by using gasohol because of better burning characteristics of alcohol, but decreases in horsepower output and increased fuel consumption are to be expected commensurate with the lower heat energy of the alcohol. Gasohol may result in better cold weather starting, but may also cause problems with fuel systems.

Response of soybeans to molybdenum on Eutaw Clay (pH 5.0) at the Black Belt Substation.

Molybdenum Deficiency *TRIGGERED BY* Low Soil pH

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J. T. EASON, Sand Mountain Substation
J. G. STARLING, Wiregrass Substation
J. A. PITTS, Brewton Experiment Field

THERE IS ABOUT one pound of molybdenum (Mo) in each 500 tons of plant material. This tiny amount of molybdenum is required by all plants. Legumes, such as soybeans, require greater amounts of molybdenum than do most other plants. One reason is that the Rhizobium bacteria in the root nodules of legumes require molybdenum to fix atmospheric nitrogen. Where molybdenum is deficient, legumes often show symptoms of nitrogen deficiency, as shown in the photograph.

Most mineral soils contain an adequate supply of molybdenum for plant growth, provided the soil pH is greater than 5.5. At lower pH's molybdenum is less soluble and may be unavailable to plants. Of the commonly grown legumes, soybeans is the crop most likely to show molybdenum deficiency on very acid soils. To determine soybeans' need for molybdenum on Alabama soils, 16 field experiments were conducted between 1963 and 1978 by the Auburn University Agricultural Experiment Station. The last three of these were begun in 1975 by the late John I. Wear at the Sand Mountain Substation, Wiregrass Substation, and Brewton Experiment Field.

Results for these last three experiments are given in tables 1, 2, and 3. Even though the soil pH was low enough to be considered marginal for soybean growth at two locations, no responses to molybdenum were found. This is consistent with the results of the first 13 field experiments where no responses to molybdenum were obtained when the soil pH was optimum for soybeans (5.8-6.5). Three of these first 13 experiments were on acid soils (pH = 5.0), and responses to molybdenum were obtained, as illustrated by the photograph.

Since liming an acid soil also makes phosphorus more available and controls the toxic effects of aluminum and manganese, experiments frequently produce a response to lime where no response to molybdenum is obtained. On acid soils showing response to molybdenum, the deficiency can usually be corrected by either applying molybdenum or by liming the soil to make molybdenum more available.

Soybeans also need lime for other reasons and are frequently grown in rotation with other crops that respond to lime. Therefore, since molybdenum deficiency in soybeans on acid soils can be corrected by either applying molybdenum or by liming, use of lime to maintain the optimum pH appears to be the more practical approach in most cases.

TABLE 1. RESPONSE OF ESSEX SOYBEANS TO MOLYBDENUM AND LIME WHEN GROWN ON HARTSELLS FINE SANDY LOAM[1] AT SAND MOUNTAIN SUBSTATION

Treatment		Yield/acre				
Lime[2]	Mo[3]	1975	1976	1977	1978	Av.
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*
No	No	41	36	30	25	33
No	Yes	41	37	30	23	33
Yes	No	41	37	32	29	35
Yes	Yes	42	37	33	26	35

[1]Check plot pH = 5.4 (1978).
[2]Limed to soil test recommendation in 1975 and 1978.
[3]Seed treated with 1 oz. of sodium molybdate dissolved in ½ pt. of water per bushel of seed.

TABLE 2. RESPONSE OF BRAGG SOYBEANS TO MOLYBDENUM AND LIME WHEN GROWN ON DOTHAN SANDY LOAM[1] AT WIREGRASS SUBSTATION

Treatment		Yield/acre			
Lime[2]	Mo[3]	1975	1976	1978	Av.
		Bu.	*Bu.*	*Bu.*	*Bu.*
No	No	41	43	22	35
No	Yes	40	42	20	34
Yes	No	43	45	25	38
Yes	Yes	41	42	25	36

[1]Check plot pH = 6.1 (1978).
[2]Limed to soil test recommendation in 1975 and 1978.
[3]Seed treated with 1 oz. of sodium molybdate dissolved in ½ pt. of water per bushel of seed.

TABLE 3. RESPONSE OF HUTTON SOYBEANS TO MOLYBDENUM AND LIME WHEN GROWN ON BENNDALE FINE SANDY LOAM[1] AT BREWTON EXPERIMENT FIELD

Treatment		Yield/acre			
Lime[2]	Mo[3]	1975	1976	1977	Av.
		Bu.	*Bu.*	*Bu.*	*Bu.*
No	No	41	41	45	42
No	Yes	38	41	42	40
Yes	No	43	46	43	44
Yes	Yes	42	46	45	45

[1]Check plot pH = 5.4 (1977).
[2]Limed to soil test recommendations in 1975.
[3]Seed treated with 1 oz. of sodium molybdate dissolved in ½ pt. of water per bushel of seed.

Improved Goosegrass Control in Bermudagrass Turf

RAY DICKENS and R. H. WALKER
Department of Agronomy and Soils

GOOSEGRASS IS ONE of the world's worst grass weeds. It has broad tolerance to moisture, temperature, soil fertility, and defoliation. As a result, it is found in diverse areas throughout the South. Goosegrass is characterized as a tufted, annual, warm season grass, with the scientific name *Eleusine indica* (L.) Gaertn.

Sports turf and lawns are especially vulnerable to this troublesome weed since it can withstand much trampling. Often goosegrass is the only plant surviving in such high traffic areas as golf fairways and tees and athletic fields. It also is a major problem during turfgrass establishment. As a consequence, goosegrass is the most troublesome warm season weed that turfgrass managers encounter in the South.

Historically, DSMA and MSMA have been the major post-emergence applied herbicides for control of goosegrass in bermudagrass turf. These herbicides are economical chemicals, but they require multiple applications (often monthly) at rates of 2-3 lb. per acre to control goosegrass. These rates and frequencies often cause unacceptable injury to the turf.

Recent investigations suggest that methazole (Probe®) and metribuzin (Lexone® or Sencor®) applied post-emergence will control goosegrass without causing serious injury to bermudagrass. Results further suggest that much larger and more mature goosegrass can be controlled with these herbicides.

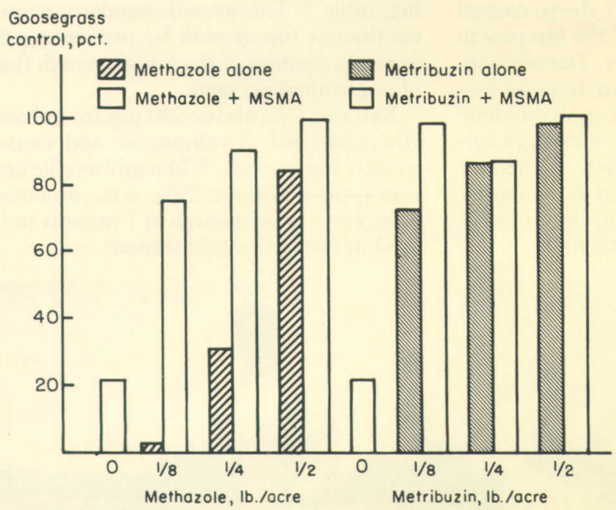


FIG. 1. Effect of methazole and metribuzin rates on goosegrass control in bermudagrass turf.

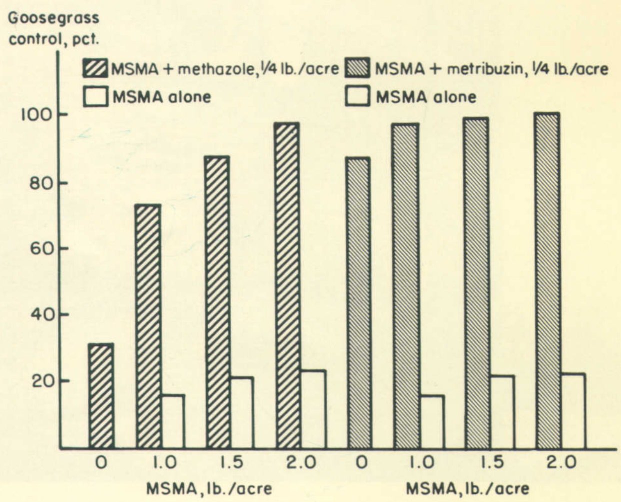


FIG. 2. Effect of MSMA rate on goosegrass control obtained from methazole and metribuzin.

Experiments with methazole and metribuzin were conducted at the Auburn University Agricultural Experiment Station in 1977. The materials were tried alone and in combination with MSMA for goosegrass control in Tifway (419) bermuda.

The different herbicidal treatments were applied as a spray (11 gal. per acre) to replicated plots of bermudagrass infested with goosegrass ranging in size from 5 to 20 leaves. Infestation averaged 2-3 plants per square foot of turf area. A non-ionic surfactant (X-77) was added to all sprays at ½% by volume.

Ratings of goosegrass control and turf injury were made 2 weeks after application. Both methazole and metribuzin (applied alone) were more effective than MSMA against goosegrass, figure 1. Metribuzin at ¼ lb. and methazole at ½ lb. per acre provided acceptable control with a single application.

Using MSMA in combination with methazole or metribuzin appeared to offer advantages. By adding MSMA, the rates of either methazole or metribuzin could be reduced 50% with no reduction in control. In addition, the mixture gave more consistent control of larger and more mature goosegrass.

Methazole or metribuzin applied at ½ lb. per acre or less, alone or in combination with MSMA, was no more injurious to bermudagrass than MSMA applied alone at 2 lb. per acre. Additional studies indicated that the rate of MSMA could be reduced in the combination treatments. A rate of 1.5 lb. per acre was adequate in combination with methazole, while only 1.0 lb. per acre was required with metribuzin, figure 2.

Frequently chemical combinations produce additive effects (where the combination gives better control than either herbicide applied alone but less than the sum of the control of the two independently). Less frequently, synergism results from combining chemicals (control obtained is greater than the sum of that produced by the two chemicals independently). Combining metribuzin with MSMA appeared to produce the expected additive effect. When methazole was added to MSMA, however, synergism resulted.

Pending label approval, these combinations promise more effective control of goosegrass in bermudagrass turf.

TUBE-GROWN PECAN TREE May Solve Some Problems in Orchard Establishment

HARRY J. AMLING, Department of Horticulture

THE BARE-ROOTED pecan tree may someday give way to container-grown planting stock. Preliminary results of Auburn University Agricultural Experiment Station research indicate that container-grown trees may avoid some of the problems growers have with traditional bare-rooted planting stock.

Bare-rooted trees are subject to mishandling damage—drying out of roots and destruction of lateral roots. Survival of such trees can be less than 50% in a commercial orchard. At current tree costs, such low survival rates make pecan orchard establishment costs expensive. With the current shift from low density plantings (11-17 trees per acre) to medium and high density orchards (34-85 or more per acre), establishment costs become substantial.

Auburn research with container-grown tree production was begun in efforts to develop lower cost methods of orchard establishment. Initial objectives were to develop a system whereby year-old container-grown seedlings could be transplanted with minor disturbance of roots, grown under drip irrigation, and grafted within 2 years after planting.

Sufficient tree height and trunk caliber at planting are needed for subsequent maintenance and propagation. Pecan seedlings grow to a height of 7-10 in. during the first growing season, but this is inadequate for orchard establishment even under good management. In sharp contrast, the tap root can grow 36-40 in. the first 12 months after germination. Consequently, container depth was found to be important.

Short containers (12-24 in. deep) caused an undesirable spiralling of the tap root in the bottom of the container. Deeper containers reduced this problem, but cost was prohibitive. Then tubular polyethylene was tried, and this "tube" container appeared to solve the problem. Container diameter was not as critical as container depth if the seedlings were grown for only 1 year before planting in the field.

TABLE 1. EFFECTS OF VARIOUS MEDIA MIXES ON TOP GROWTH OF CONTAINER-GROWN ELLIOTT PECAN SEEDLINGS[1]

Media mix	Height
	In.
Pine bark alone (pH 5.8)	12.5
Pine bark + Veterra 2 (pH 5.9)[2]	13.5
Pine bark-soil, 15:1 (pH 5.9)	12.4
Pine bark-soil, 7:1 (pH 5.9)	13.4
Pine bark-soil, 3:1 (pH 6.3)	14.1
Pine bark-soil, 1:1 (pH 6.1)	12.6

[1]Dolomitic lime, Osmocote 18-6-12, fritted trace elements, Sesquestrene 330 Fe, $MnSO_4$, $ZnSO_4$, and superphosphate added to media.
[2]Hydrogel soil amendment supplied by Union Carbide Corp.

TABLE 2. EFFECT OF GIBBERELLIC ACID (GA_3) ON GROWTH OF CONTAINER-GROWN ELLIOTT PECAN SEEDLINGS[1]

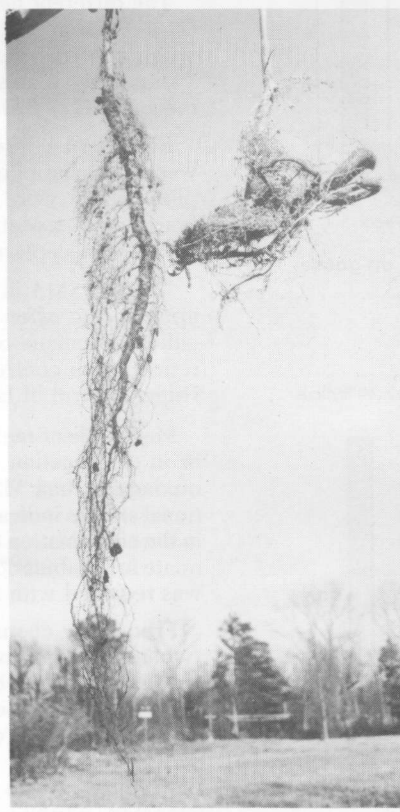
Rate and number of applications	No. of nodes	Ht.	Dry top wt.	Root wt.
	Av.	*In.*	*g*	*g*
No treatment	8.3	10.7	1.5	16.6
250 p.p.m. (1)	11.3	16.4	4.2	21.0
250 p.p.m. (2)	13.6	19.6	5.5	23.2
500 p.p.m. (1)	13.4	23.3	5.0	21.7
1,000 p.p.m. (1)	13.4	24.8	5.5	20.4

[1]Duration of the experiment was 7 months.

In growing media comparisons, pine bark alone was about as good as mixtures of pine bark and soil or pine bark and hydrogel (Viterra 2), table 1. Use of the Viterra 2-pine bark mix reduced watering needs but did not affect growth.

Use of gibberellic acid (GA_3) to speed top growth showed promise of reducing time required to produce a tree for planting, table 2. This growth regulator caused continuous top growth by preventing the normal cessation of the initial growth flush of a germinating seed.

Rates of GA_3 above 250 p.p.m. induced abnormal leaf development and caused spindly top growth. When gibberellic acid was applied twice at 250 p.p.m., however, trees grew large enough in 7 months to be used in orchard establishment.

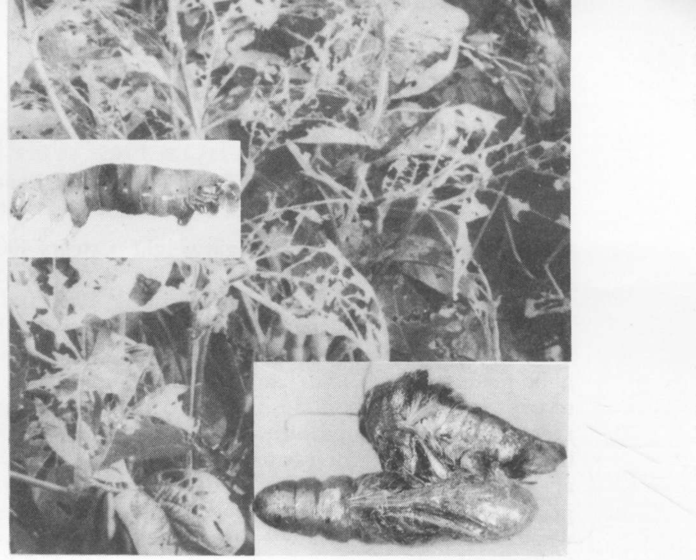


Good survival and fast tree growth of 2-year-old planting (right photo) shows advantage of tube-grown nursery stock. Comparison of tube-grown and standard container-grown trees (left photo) shows good root growth of tube tree (left) as compared with curled taproot of tree grown in shallow container.

DIMILIN®

A New Approach to Insect Control

MAX H. BASS, TIM REED, and JIM CONLEY
Department of Zoology-Entomology



Upper left, adult soybean looper; upper left inset, fatal abnormality of the prepupal stage of the looper; lower right inset is fatal abnormality of the pupal stage of the looper caused by application of dimilin; and center photo is damaged soybean plant.

MOST INSECTICIDES are toxic to insects and humans in much the same way but, fortunately, they are usually *more* toxic to insects.

This differential toxicity allows the use of insecticides with relative safety. However, entomologists agree that an ideal insecticide would be one highly toxic to insects but with a mode of action that makes it non-toxic to humans and other warm-blooded animals. Diflubenzuron (commonly known as Dimilin®) is such a compound.

Dimilin is manufactured by the Thompson-Hayward Chemical Company and its mode of action is to inhibit chitin formation in the insect's exoskeleton. After ingesting Dimilin the insect is apparently unaffected until it molts its old exoskeleton and attempts to form a new one. The insect then cannot synthesize the chitin necessary for the formation of a new exoskeleton and so it dies. Warm-blooded animals do not synthesize chitin and therefore this mode of action offers no hazard to birds or mammals.

In the Laboratory

The mode of action of Dimilin has been investigated by Auburn researchers over the last 3 years using the soybean looper as the test insect. After ingesting lethal amounts of Dimilin, soybean loopers were unable to molt properly. They developed hemolymph (insect blood) leakages behind the head during the molt and mortality resulted. Those fed smaller dosages survived as larvae but usually developed fatal abnormalities in the prepupal, pupal, or adult stages.

Consumption of sub-lethal dosages of Dimilin slowed larval development and also reduced total food consumption. Therefore, even if larvae did not consume enough Dimilin to cause mortality, their potential for damaging the crop was still reduced.

LD_{50} values (LD_{50} = lethal dose for 50% of the population) were determined for each instar of soybean looper larvae. LD_{50} values were surprisingly low for all instars, and in terms of field control the amount of Dimilin necessary to reach the LD_{50} level varied from instar to instar, but was less than 1 oz. per acre. Earlier instars required less Dimilin for control than later instars. These results indicated that a low rate of Dimilin applied to a crop while infesting larvae are quite small might be as effective in reducing foliage loss as a high rate applied after the majority of the larvae have reached the 5th instar. (Most foliage feeding larvae have 6 instars.)

In the Field

During the summer of 1979, field tests were conducted by the Auburn University Agricultural Experiment Station to compare the effects of Dimilin and methyl parathion on both the beneficial and destructive insect complex on soybeans. The experiment was conducted at the Black Belt Substation at Marion Junction. Treatments were: Dimilin, at 1 and 2 oz. per acre, methyl parathion at 1 lb. per acre, and an untreated check. Treatments were replicated and randomized. Plots were 1 acre in size. Insect populations were sampled at weekly intervals throughout the season to determine population levels of both beneficial and destructive insects.

At early bloom, normal populations of insect parasites and predators were present, but no economic levels of destructive forms had appeared. At that time the plots were sprayed for the first time. The application of the two rates of Dimilin did not result in a significant reduction of beneficial species, but the application of methyl parathion resulted in a drastic reduction in beneficials. Two weeks later, a second application was made. Again, beneficial insect populations were seemingly unaffected by Dimilin, but were decimated by methyl parathion.

Two weeks after the second application of insecticides the population of beneficials on the methyl parathion treated plots had begun to recover. At that time a soybean looper infestation also began to develop in all plots. Over the following 2 weeks the looper infestation increased, ran its course, and caused considerable foliage loss on the plots treated with methyl parathion and the check plots. On the plots treated with 1 oz. per acre of Dimilin, a few loopers were seen. On plots treated with 2 oz. per acre of Dimilin, even fewer loopers were observed.

On October 19, all plots were harvested, with the following results:

Treatment	*Av. yield in bushels per acre*
Dimilin 2 oz. per acre	42.38
Dimilin 1 oz. per acre	37.72
Check	35.66
Methyl parathion 1 lb. per acre	28.60

The 2 oz. per acre rate of Dimilin apparently prevented the soybean looper outbreak which began 2 weeks after the last application. The 1-oz. per acre rate of Dimilin, while statistically inferior (based on yields) to the 2-oz. per acre rate, still afforded excellent control and good yields. The methyl parathion treatment resulted in no control of the soybean looper and these plots sustained greater foliage loss than the check plots, probably because of the reduction in beneficial insects present.

In summary, the conventional insecticide, applied at a time when it was not needed, had no good effect on crop yields and, in fact appeared to suppress those yields. Dimilin, on the other hand, did not suppress beneficial insect populations and remained effective against a destructive foliage feeding caterpillar for a much longer period than would have been expected. A much needed new insecticide of a totally different type appears to be on the horizon.

Note: Dimilin is not presently labeled for use on soybeans.

Price relationships between stocker and feeder cattle winter grazed in Alabama

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DANIEL LINTON, Cooperative Extension Service

THE ECONOMICS of carrying lightweight (300-450 lb.) stocker calves to heavier feeder weights (600-750 lb.) on various feeding programs has proven successful at several locations within the State. With good management, calves can make gains of over 1.7 lb. per day on lush wheat, rye, ryegrass, and clover pastures. To ensure the greatest return, good enterprise management requires an understanding of price relationships between grades and weights of cattle and a knowledge of when to buy and sell.

Profitability for alternative winter grazing systems for stocker steers has fluctuated with periods of the cattle cycle. The average fall price, September through November, for Choice grade steers 400-500 lb. has moved with the general trend in the cattle price cycle, figure 1. Variation in price during the fall months widens during the expansion phase as in 1972 and 1973 when variation in price between months was approximately $20 per cwt. at the Montgomery market. During the spring months of March through May, the average price for Choice feeder steers 600-700 lb. moved closer together with less seasonal variation between months during all phases of the cattle cycle. Marketing strategies are important because of volatility in fall stocker prices observed during rising price periods in the cattle cycle.

Price movements for Good grade stocker steers 300-400 lb. and Choice grade steers 400-500 lb. have fluctuated relative to each other over the cattle cycle from 1969 to 1979. The price of Choice steers 400-500 lb. was on the average $1.50 per cwt. above Good steers of 300-400 lb. for the 11-year period, figure 2. Variation in the spring price between Choice feeder steers (600-700 lb.) and Good steers (500-600 lb.) was smaller than the fall price margin for stocker steers for the 11-year period. The average price for Choice feeder steers was $1.81 per cwt. above the Good graded lightweight steers, figure 2. The price margin for Alabama cattle will change from year to year influenced primarily by the cost of feed grains in the Midwest.

A major concern for Alabama livestock producers is when to purchase stocker calves in the fall and when to sell the following spring. Placing Choice stocker steers (400-500 lb.) on forage or feed in September or October and selling Choice 600-700 lb. steers in March or April yielded the greatest return overall for the 11-year base period. Purchasing steers in November and selling in any month resulted in lower price ratios, table 1. The variation (s.d.) in the annual price ratios for each marketing strategy varied between 18 and 25% from the mean price for the 11-year period.

Spring prices for Good feeder steers as a percent of fall prices of Good stocker steers (300-400 lb.) were generally higher than percentages for Choice stocker steers to feeder steer ratios, table 2. Purchasing Good stocker steers in October and selling in April yielded the highest return for each classification by animal weight and grade. These combinations had the greatest price variations (s.d.) from the mean price for the 11-year period between 30-39%, implying greater risks with the higher rate of returns for producers than observed for Choice stocker steers in table 1. The greatest return for Alabama producers for the 11-year period was to purchase Good stocker steers (300-400 lb.) in October to reach Choice grade (600-700 lb.) for sale in the month of April. This strategy would likely require some supplemental feeding along with quality forage.

In each distinct phase of the cattle cycle, raising Good graded steers (300-400 lb.) to Good feeder steers (500-600 lb.) yielded a higher gross return than grazing heavier cattle of Choice grade. Price relationships indicate higher returns but with greater variation for lightweight stocker steers that grade Good. The best month to purchase stocker steers was October and the best month to sell feeder steers was April.

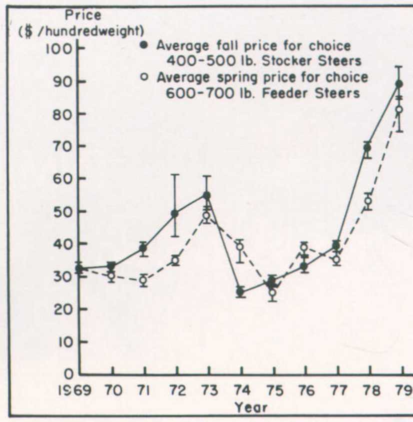

FIG. 1. Average price with seasonal variation for Choice 400-500 lb. stocker steers in the fall and Choice 600-700 lb. feeder steers in the spring at Montgomery, 1969-1979.

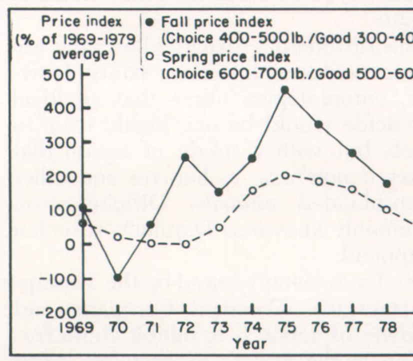

FIG. 2. The index for the average price differential between grade and weight of steers in the fall and the spring months from 1969 to 1979.

TABLE 1. PRICES OF SPRING CHOICE FEEDER STEERS AS A PERCENT OF FALL CHOICE STOCKER STEERS (400-500 LB.) IN ALABAMA, 1969-1979

		Choice feeder steers					
		600-700 lb. weight			700-800 lb. weight		
Month		March	April	May	March	April	May
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
September	mean	100	101	99	95	98	97
	s.d.[1]	23	24	24	23	24	24
October	mean	100	101	99	95	98	97
	s.d.[1]	22	24	24	23	25	25
November	mean	95	97	95	90	94	93
	s.d.[1]	18	21	21	19	21	23

[1]Standard deviation (s.d.) is the variation in monthly prices compared to the mean price for the 11-year period. The higher the s.d. the greater the price volatility from year to year.

TABLE 2. PRICES FOR SPRING GOOD AND CHOICE FEEDER STEERS AS A PERCENT OF FALL GOOD STOCKER STEERS (300-400 LB.) IN ALABAMA, 1969-1979

		Good feeder steers						Choice feeder steers		
		500-600 lb. weight			600-700 lb. weight			600-700 lb. weight		
Month		March	April	May	March	April	May	March	April	May
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
September	mean	102	104	101	97	100	97	107	109	107
	s.d.[1]	29	30	31	27	30	31	31	35	34
October	mean	107	109	105	101	105	101	113	115	112
	s.d.[1]	33	33	34	30	34	34	36	39	38
November	mean	102	104	100	97	101	97	108	110	108
	s.d.[1]	25	27	28	24	28	29	28	32	33

[1]Standard deviation (s.d.) is the variation in monthly prices compared to the mean price for the 11-year period. The higher the s.d. the greater the price volatility from year to year.

"READ SIGN" for early detection of pine bark beetles in shade and high value pines

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BARK BEETLES attack pines quietly, their presence often going undetected until change in crown color from green to red becomes conspicuous in dead and dying trees.

During the warm months when beetles are continuously active, change in crown color may become noticeable in 20 to 30 days following initial attack. In fall and winter, crowns of trees containing overwintering beetles may sometimes remain green 2 to 4 months after infestation, turning red in late winter or early spring. In either case, at this point of discovery trees are dead and beetles have often completed development and new adults have emerged to attack uninfested trees.

Success in control of black turpentine beetle and prevention of spread of southern pine beetle and *Ips* engravers to uninfested trees depends to a large extent on early detection of beetle activity, i.e., prior to appearance of red crowns.

Although less conspicuous than red foliage, certain other signs are often evident to give earlier warning of bark beetle presence. Black turpentine and southern pine beetles leave obvious primary evidence of attack in form of resin masses (pitch tubes) on the bark. Pitch tubes are the result of resin exudation at points of attack that form rapidly after attacking beetles reach the inner bark. Black turpentine beetle pitch tubes, figure 1, are large, up to walnut size, and are confined to the lower trunk. Those of southern pine beetles, figure 2, are smaller, ⅛-¼ in. diameter, and are most abundant along the mid bole, but may extend from 2-3 ft. above ground up into the lower crown.

Ips engraver beetles normally attack trees of very low vigor and resin flow is seldom sufficient to produce visible pitch tubes. Reddish-brown boring dust, however, is usually evident in bark crevices below points of attack.

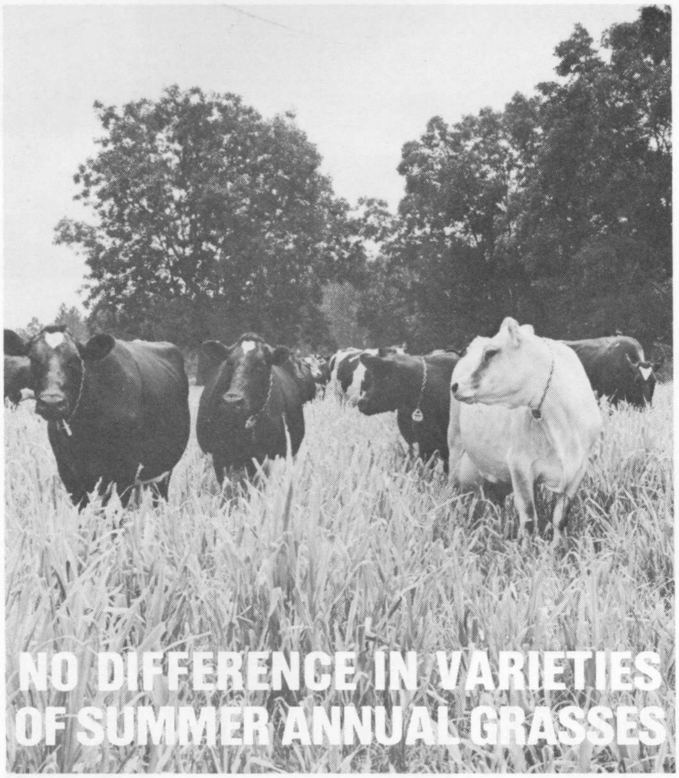
Pines freshly attacked by bark beetles, especially southern pine beetle and *Ips*, are quickly attractive to many other insect species. Presence and activity of several of these insects may serve as secondary indicators of bark beetle presence. Ambrosia beetles and pinhole borers quickly invade pines dying from bark beetle attack. These borers tunnel in the sapwood of the lower trunk, pushing out highly visible fine white wood dust which collects at the base of the tree, figure 3.

Insect predators and parasites are also often promptly attracted to new beetle infestations. While the bark beetles may be hidden under the bark, adults of certain of these predators and parasites, figure 4, may be readily observed on trunks of infested trees. Concentrations of such natural enemies indicate presence of their hosts, bark beetles.

Additionally, woodpeckers can contribute to detection of trees harboring overwintering southern pine beetles. These birds often prey heavily on overwintering beetle brood, dislodging many bark flakes in extracting forms from under bark. Accumulation of abnormal amounts of bark around bases of trees, figure 5, may mean woodpeckers and bark beetles.

Thus, signs of bark beetle presence are usually evident prior to reddening of tree crowns. Reading such signs can lead to early discovery of beetles.

FIGS. 1-5. (1) Black turpentine beetle pitch tubes; (2) southern pine beetle pitch tubes; (3) ambrosia beetle wood dust at base of tree; (4) wasp parasite (5X actual size) and beetle predator (2X actual size) common on bark beetle-infested trees; and (5) bark accumulation resulting from woodpecker predation.



NO DIFFERENCE IN VARIETIES OF SUMMER ANNUAL GRASSES

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SORGHUM-SUDANS AND PEARLMILLET produce large amounts of forage in a short time in summer. And one variety will make about the same as another.

This lack of variety difference has shown up over many years of trials by the Auburn University Agricultural Experiment Station at a number of Alabama locations. Differences in area of adaptation between sorghum-sudan and pearlmillet have shown up, but there have been no consistent differences in forage yield among varieties.

Production of different varieties has been measured in small plot trials at four locations. Both sorghum-sudan and pearlmillet plots were clipped three to six times each season to determine production. Nitrogen at 50 lb. per acre was applied at planting and after each harvest.

Although variety trials have been done for many years, seed companies frequently change varieties offered. As a result, direct comparison among varieties is generally possible for only 2 to 3 years. Thus, data reported in the tables are for newer varieties that have been planted during the past 2 or 3 years.

Pearlmillet has consistently outyielded sorghum-sudan at the Gulf Coast Substation, Fairhope, table 1. However, there has been little difference in yield among the pearlmillet varieties.

Sorghum-sudan varieties have differed little in yield over the years at the Black Belt Substation, Marion Junction. On prairie soils of the Black Belt, pearlmillet production has been poorer than sorghum-sudan yield, so pearlmillet varieties have not been included in recent-year trials. At the Upper Coastal Plain Substation, Winfield, yields of the two summer annual grasses have been similar.

TABLE 1. TOTAL FORAGE YIELDS OF SUMMER ANNUAL GRASSES AT FOUR LOCATIONS OVER 2 AND 3 YEARS

Variety	Dry yield of forage/acre, by location			
	Tallassee 3-year av.	2-year av. Winfield	2-year av. Marion Junction	2-year av. Fairhope
	Lb.	*Lb.*	*Lb.*	*Lb.*
Sweet M sorghum-sudan	9,370	6,240	7,260	--
Funks 83F sorghum-sudan	8,840	5,940	8,320	--
Funks 86F sorghum-sudan	8,610	6,040	8,320	--
Summergrazer sorghum-sudan	8,610	5,420	6,820	--
MorSu II sorghum-sudan	8,350	5,780	8,290	--
Southgraze millet	8,320	8,810	--	15,060
Funks FP-1 sorghum-sudan	8,220	5,500	7,590	--
Gahi-3 millet	8,120	8,470	--	14,590
Millhy 99 millet	8,050	7,900	--	14,300
Sordan 77 sorghum-sudan	7,860	6,340	7,770	8,520
Pearlex 24 millet	7,140	7,780	--	14,200

In areas outside the Black Belt where pearlmillet is well adapted, the Tifleaf-1 variety warrants consideration. Grazing trials in Georgia have demonstrated superior animal gains on this variety.

Three-year average yields at the Plant Breeding Unit, Tallassee, suggest that several sorghum-sudan varieties are more productive than other entries. However, the year-to-year inconsistency in forage production indicates that the 3-year results must be considered inconclusive, table 2. For instance, Sweet M sorghum-sudan was the highest yielding variety during 2 years, but in 1977 it ranked well below several pearlmillet varieties. Such inconsistency from year to year has been typical over the long-time trials, making it impossible to recommend one variety over another.

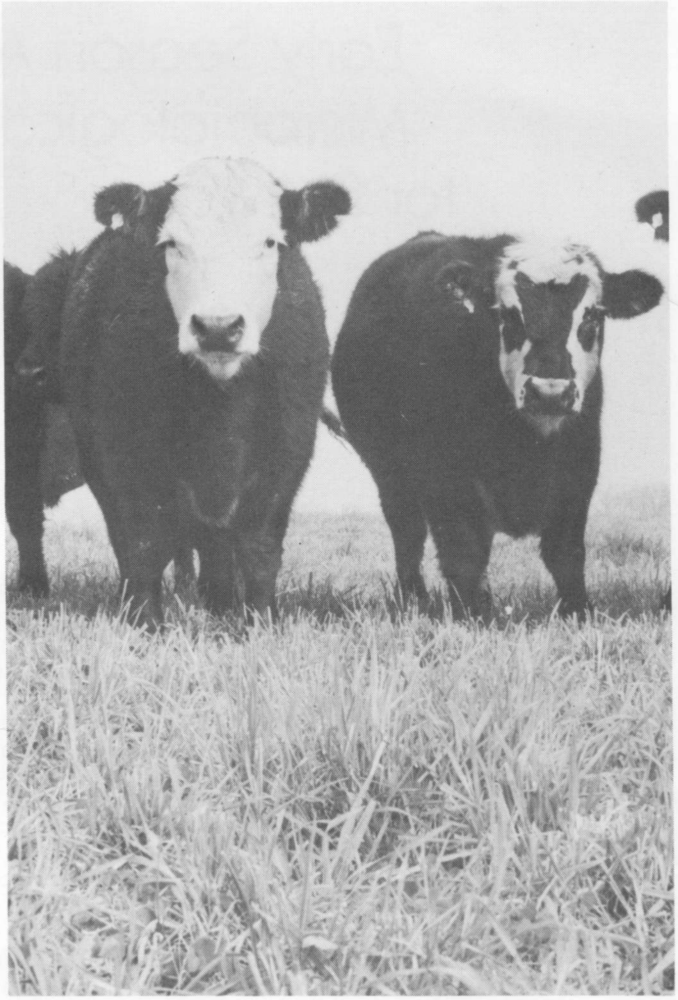
What accounts for this great year-to-year variation? Probably differences in temperature and rainfall, factors that affect incidence of diseases, weed competition, and regrowth of the grass. In addition, cutting or grazing management can greatly affect productivity.

Under farm conditions, management likely has more effect on forage yield than the variety planted. Therefore, recommendation of specific summer annual grass varieties based on small plot clipping trials is questionable.

TABLE 2. TOTAL FORAGE YIELD OF SUMMER ANNUAL GRASSES IN EACH OF THREE YEARS AT PLANT BREEDING UNIT

Variety	Dry yield of forage/acre, by year		
	1977	1978	1979
	Lb.	*Lb.*	*Lb.*
Sweet M sorghum-sudan	7,250	13,870	7,060
Funks 83F sorghum-sudan	7,080	13,320	6,120
Funks 86F sorghum-sudan	7,190	12,770	5,870
Summergrazer sorghum-sudan	6,050	12,230	6,940
MorSu II sorghum-sudan	7,260	12,120	5,680
Southgraze millet	9,200	10,240	5,490
Funks FP-1 sorghum-sudan	6,540	11,920	6,190
Gahi-3 millet	9,660	10,940	3,780
Millhy 99 millet	10,030	10,550	3,580
Sordan 77 sorghum-sudan	5,920	12,120	5,540
Pearlex 24 millet	8,560	9,190	3,660

Angus x Hereford steers had a high percentage of Choice carcasses at the end of the cool season grazing period.



FINISHING STEERS ON COOL SEASON GRAZING

value of small grain-ryegrass-clover grazing for yearling beef steers established in long-time project

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PRODUCTION OF slaughter beef on cool season grazing is a well documented success story. Twenty years of experience by the Auburn University Agricultural Experiment Station have established that yearling beef steers can be finished to Choice or Good grade on small grain-ryegrass-clover grazing.

A 12-acre area of sandy loam soil at the Lower Coastal Plain Substation has been used continuously since 1960 to provide information on cool season grazing. During the first 14 years, rye or oats was planted alternately (to minimize diseases) in combination with ryegrass and crimson clover. Since then, wheat and rye have been alternated in combination with ryegrass and arrowleaf clover.

The land area was used exclusively for production of the annual pasture to be grazed by steers. Land preparation was started in July, followed by shallow cultivation to control weeds and conserve moisture. Mineral fertilizer was applied prior to planting according to soil test recommendations. Oats (100 lb.) or Abruzzi rye (60 lb.) or wheat (60 lb.) was seeded with crimson clover (15 lb.) or Yuchi arrowleaf clover (10 lb.) and ryegrass (15 lb.) between September 1 and 15. Approximately 50 lb. of nitrogen per acre was applied when the crops were up and another 50 lb. about February 15.

The pasture was stocked initially with one steer calf (583-lb. average) per acre, but more were added later to effectively utilize the forage. Maximum stocking rate was 1.75 steers per acre, but the average was 1.36 during the 19-year study.

Cattle remained on the pasture throughout the 190-day period (November 4-May 12). Supplemental feeding was done only when forage was insufficient. This occurred in 9 of the 19 test years, and feeding time averaged 42 days per year (maximum of 84 days).

Daily gain averaged 1.68 lb. for the 19-year test. This amounted to 438 lb. per acre. Both values include gain resulting from the supplemental feed fed on pasture.

Drylot feeding after grazing was practiced the first 5 years. Since that time, however, steers have been sold for slaughter directly off pasture. During the 14 years when cattle were slaughtered off pasture, 41% of the carcasses graded Choice, 53% were Good, and the remainder graded Standard.

Breed of cattle was found to affect the proportion of steers that graded Choice at the end of grazing. Use of Angus x Hereford steers, which mature at an early age, resulted in a higher proportion of Choice carcasses.

Net economic returns to land, labor, and operator's management averaged $62.47 per steer for 1970-78 ($83.29 per acre). The difference between purchase price and sale price for the 9 years was $1 per cwt. Thus, the net return was from the livestock enterprise and not from escalation in market price. Annual net returns to land, labor, and operator's management were positive in every year since 1970 except one (1973-74).

Results from this long-term test established that forage-fed beef can be successfully produced on small grain-clover pastures. Results suggest the following:

1. Early maturing cattle are desirable if they are to be slaughtered directly from grazing.

2. Proper land preparation, fertilization, seeding, and planting date are critical to success.

3. Forage must be grazed to a height of 4-6 in. for effective utilization.

Early Season Application of the Microbiological Insecticide Elcar for Bollworm Suppression in Cotton

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Department of Zoology-Entomology

THE NUCLEAR POLYHEDROSIS VIRUS isolated from the cotton bollworm, *Heliothis zea*, and currently marketed as Elcar® has been extensively field tested during its development from a crude laboratory preparation to its current form as a registered, formulated product.

Reports on its effectiveness have varied particularly as to its ability to control heavy worm populations. It is possible that its usefulness may be greatest against light populations which normally occur in early season when it is desirable to conserve beneficial insect populations.

Experiments were conducted by the Auburn University Agricultural Experiment Station at the Tennessee Valley Substation at Belle Mina in north Alabama and at the E. V. Smith Research Center in central Alabama to test this idea.

Heliothis control programs were: (1) early Elcar—60 grams of Elcar per acre applied when 5-10 *Heliothis* eggs or larvae were present per 100 terminals; (2) late Elcar—60 grams of Elcar per acre applied when more than 10% of the plant terminals were infested with *Heliothis* eggs or larvae or when more than 10% of the squares were damaged; (3) standard chemical treatment —EPN + methyl parathion (0.5 + 0.5 lb. a.i. per acre) at the same time as the late Elcar treatment. (4) untreated control — Each control program was replicated four times. When mean *Heliothis* damaged squares in either Elcar treatment exceeded 20%, they were treated in the same way as the chemical standard for the remainder of the season.

At the Tennessee Valley Substation all plots were 2 acres in size. Standard cultural practices were followed. The early Elcar treatment was made July 24. All treatments, including the 2nd early Elcar treatment, were applied August 1, and all plots except the untreated control plots were converted to EPN + MP August 7. Because of continued heavy *Heliothis* pressure 0.5 lb. a.i. per acre of chlorpyrifos was added to all treatment plots on a 5-7 day schedule from August 10-September 7, 1978.

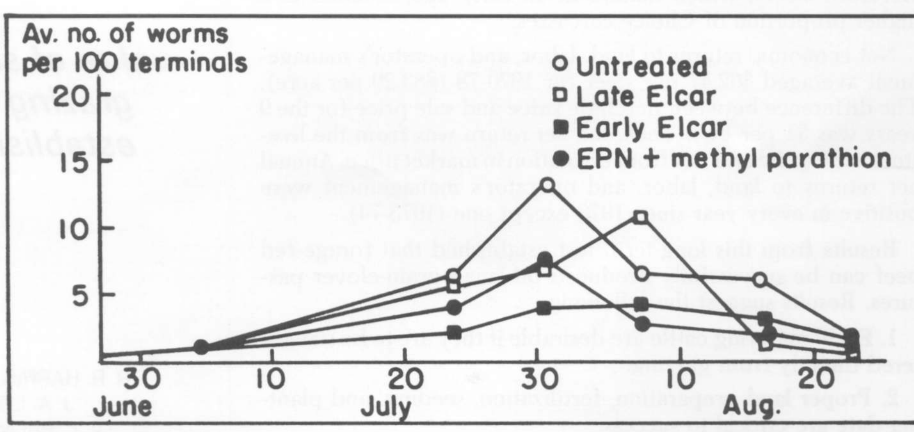
At the E. V. Smith Research Center plot sizes ranged from 2.4 to 3.5 acres. Early Elcar treatments were made on June 21, 29, and July 21. All treatments, including the 4th early Elcar treatment were applied July 27, but EPN + MP had to be applied to all treatment plots on a 5-7 day schedule from August 3-18. From August 24 until the end of the season EPN + MP was applied to all plots, including the "untreated controls." Chlorpyrifos at 0.5 lb. a.i. per acre was added to the EPN + MP treatment on August 31 and September 5.

Results

All treatments at both locations resulted in higher yields than in the untreated plots, see table. In addition, the early Elcar treatment resulted in higher (but not statistically significantly higher) yields than the full season chemical treatment. At E. V. Smith Research Center, a reduction in larval bollworm and budworm numbers was noted until mid-season, see figure, in the early Elcar treated plots relative to the other treatments. At Belle Mina, where fewer early Elcar treatments were applied, a similar response was not demonstrated. These results suggest that Elcar may be useful as an early season insecticide against low to moderate populations of bollworms and budworms. At the very least, its use is usually more desirable at this time than a chemical which would prematurely destroy beneficial insect populations and necessitate continued chemical applications.

YIELD OF SEED COTTON PER ACRE OBTAINED WITH DIFFERENT *HELIOTHIS* CONTROL PROGRAMS AT TWO LOCATIONS

Program	Yield per acre: Tennessee Valley Substation	Yield per acre: E.V. Smith Research Center
	Lb.	*Lb.*
Untreated	502	96
Early Elcar	1,516	412
Late Elcar	1,440	387
EPN + MP	1,213	353



Bollworm populations under 4 early season control programs at the E. V. Smith Research Center.

Consumption of and Expenditures for FARM PRODUCED FOODS

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WERE YOU AMONG those Americans who consumed their share of food that moved through the marketing system in 1978? Unless you received 1,440 lb. (3.95 lb. per day), you failed to get the average amount. Although significant changes took place in food consumption during the last 10 years, total consumption remained relatively stable, table 1.

There were changes in consumption among and within food groups. Domestic civilian consumption of food derived from animals continued at about 640 lb. in the past decade. Pork consumption declined 8.0%, while consumption of beef rose 8.9%. In the dairy group, consumption of fluid milk and cream declined, but the most significant changes were the increased consumption of cheese and decreased consumption of condensed and evaporated milk.

Poultry continued to be a popular food item. Young chickens comprised approximately 83% of the consumption of poultry. Consumer purchases of eggs maintained a downward trend throughout the decade, but that trend was reversed in 1979.

The pounds of both fruits and vegetables consumed increased, with fruits increasing relatively more than vegetables. Processed fruits and vegetables experienced greater increases than did fresh fruits and vegetables.

Consumers' life-styles and eating habits change slowly. However, during the past decade many developments influenced consumers' food purchases. Two key factors, population and disposable income, experienced growth during the period. Other factors that influenced food consumption patterns were urbanization, the changing nature of the family and household, number of wives working outside the home, education levels, and age distribution of the population. Public officials have put strong emphasis on improving food diets through nutritional and educational programs. Rising consumer incomes resulted in a substitution of the more expensive, animal protein foods for staple foods; a greater demand for convenience foods; and more eating out.

Consumer expenditures for all farm-produced foods in 1978 amounted to more than two and one-third times expenditures for farm foods in 1967, table 2. Most of the increase in dollars spent was due to rising prices and inflation. Adjustment of expenditure for food in 1978 by the Consumer Price Index (which measures changes in the prices of all consumer goods) revealed that there was only a 20% real increase in expenditures for food. Changes in expenditures for individual foods and among food groups corresponded fairly well to changes in per capita consumption of various foods. When the effect of price changes was removed, expenditures for eggs, fluid milk and cream, and grain mill products were less than expenditures for those products in 1967. Fresh fruits, processed vegetables, beef, and poultry were foods for which greater expenditures were made.

Changes in life styles and family mobility contributed to an increase in expenditures for food eaten away from home. In 1967, 27% of expenditures for farm foods was in places away from home. Twenty-two percent of away-from-home expenditures was in institutions, while 78% was in public eating places—restaurants, cafeterias, snack bars, etc. In 1978, 31% of food expenditures were in places away from home, and four-fifths of the 31% was in public eating places.

Popular choices of food eaten away from home were indicated by consumer expenditures. Of total expenditures for meat, 44% was spent at places away from home. Foods for which away-from-home expenditures were least were fruits and vegetables, 15%, and grain mill products, 18%. The proportions of expenditures made at institutions were lowest for meat and highest for fruits and vegetables.

Growth in the number of small-volume, self-service convenience stores has been the most spectacular in all of food distribution. From about 500 stores with combined annual sales in 1957 of $75 million, the industry grew to an estimated 33,900 stores with combined annual sales in excess of $10.7 billion (excluding gasoline sales of $5 billion) in 1978. Opposing forces exist that will determine future growth of convenience stores. Increasing numbers of one-stop shopping stores, price conscious food shoppers, and increased cost of energy are among the factors that point to mixed possibilities for growth in convenience stores.

Government policy has played an important role in determining what we eat and what foods cost. Commodity price support programs influence what is produced, hence what we eat. Grain policies influence livestock production, hence consumption of red meat. Export policies have made it possible (and impossible) for us to eat certain foods.

TABLE 1. PER CAPITA CONSUMPTION OF SELECTED FARM FOODS, UNITED STATES, 1968 AND 1978

Food item	Per capita consumption		Percentage change
	1968	1978	
	Lb.	*Lb.*	*Pct.*
All farm foods	1,408.0	1,440.0	2.3
Beef	81.7	88.9	8.9
Pork	61.4	56.5	-8.0
Fish	11.0	12.9	17.3
Poultry (chicken & turkey)	44.6	57.1	28.0
Eggs	40.1	34.6	-13.7
Condensed & evaporated milk	8.9	2.9	-67.4
Fluid milk & cream	304.0	288.9	-5.0
Cheese	10.6	17.4	64.2
Fresh fruits	76.9	80.3	4.4
Fresh vegetables	93.6	95.2	1.7
Processed fruits	50.9	55.2	8.4
Processed vegetables	60.1	63.9	6.3
Grain mill products	112.0	107.6	-3.9
Fats & oils	51.2	56.0	9.4

TABLE 2. CONSUMER EXPENDITURES FOR SELECTED DOMESTIC FARM FOODS, UNITED STATES, 1967 AND 1978

Food item	Expenditures		Percentage change	Change in 1978 expenditures adjusted by consumer price index
	1967	1978		
	Mil. Dol.		*Pct.*	*Pct.*
All farm foods	90,568	212,425	135	20
Beef	15,356	39,369	156	31
Pork	9,730	21,743	123	14
Poultry	4,313	10,864	152	29
Eggs	2,777	4,288	54	-21
Fluid milk & cream	8,205	12,696	55	-21
Fresh fruits	3,155	8,843	180	43
Fresh vegetables	5,819	13,773	137	21
Processed fruits	3,031	6,365	110	7
Processed vegetables	7,055	18,321	160	33
Grain milk products	3,364	6,222	85	- 5
Fats & oils	2,936	8,072	175	41

Evaluation of Nematicides for Control of ROOT-KNOT AND CYST NEMATODES IN SOYBEANS

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THE TWO MAJOR nematode problems of soybeans in Alabama are those caused by species of root-knot nematode *(Meloidogyne spp.)* and the cyst nematode, *Heterodera glycines*.

Control of these parasites has depended on development and use of resistant cultivars and on the use of the inexpensive fumigant nematicide DBCP (Nemagon®, Fumazone®). Recent removal of DBCP from field use because of its toxicological properties against humans raised questions regarding the relative efficacy of other nematicides for use on soybeans. To answer these questions trials were conducted by the Auburn University Agricultural Experiment Station[1] during the 1978 and 1979 season in a field heavily infested with a mixed nematode population consisting of the southern root-knot nematode *(Meloidogyne arenaria)* and race 3 of the cyst nematode, *Heterodera glycines*. The 1978 tests were conducted with the cultivar Ransom which is susceptible to both parasites and the 1979 experiments were with Bragg variety which has some tolerance to *M. arenaria* but susceptible to the cyst nematode. In every test each treatment and checks were represented by 8 plot replications and each plot consisted of two 36-in-rows, 20 feet long. Yield data were collected at maturity from the entire plot area. Each trial included plots with no nematicides as well as treatments with the fumigant EDB (Soilbrom 90® EC) known to result in good nematode control and yield increases. The performance of each nematicide was then assessed using the formula.

$$\text{Performance Index (Yield)} = \frac{(YN - YC) \times 100}{(YF - YC)}$$

Where YC = yield from check plots; YF = yield from plots treated with EDB (positive control); and YN = yield from nematicide treatment under study. The use of the formula then permitted us to rank performance of each nematicide treatment relative to that of a standard fumigant treatment (EDB). Index values obtained in this manner were then used to calculate a theoretical yield response based on 10 bu. per acre for control plots and 30 bu. per acre for the EDB treated plots (positive check). Data for fumigant nematicides, table 1, indicated that the highest performance indices were obtained with the EDB-containing fumigant, Soilbrom 90 EC; performance index for this material was somewhat better than that obtained with DBCP in 1978. Fumigants containing 1,3-dichloropropenes (D-D, Telone II) were inferior to Soilbrom 90 EC when compared on equal gallonage basis. Considerable phytotoxicity was observed in response to the use of Telone II at the 7 gal per acre rate in 1979.

Results obtained with granular nematicides, table 2, indicate that these materials when applied in a 12-in. band with light incorporation are inferior to Soilbrom 90 EC. With one exception (Furadan 10G), performance index values for systemic nematicides were directly related to the dosage applied. It is possible that with a better understanding of the mode of action, and of the pattern of distribution of systemic nematicides in soil the performance index of these materials could be improved. However, data obtained indicate that for the present, fumigant nematicides containing EDB are the nematicides of choice for control of *M. arenaria* + *H. glycines* combinations. Of the materials tested only Nemacur 15G and Temik 15G are registered for use by farmers. Our data suggest that new labels for use are needed to have materials capable of delivering maximal yields in fields with combinations of *M. arenaria* and *H. glycines*.

TABLE 1. RELATIVE PERFORMANCE OF AT-PLANT INJECTIONS OF FUMIGANT NEMATICIDES FOR CONTROL OF ROOT-KNOT *(MELOIDOGYNE ARENARIA)* AND CYST *(HETERODERA GLYCINES*, RACE 3) NEMATODES IN FIELD EXPERIMENTS DURING THE 1978 AND 1979 SEASONS

Treatments	Rate (gal./a.)	Yield perfor. index 1978*	1979*	Yields** (bu./a.) 1978	1979
Check		0	0	10.0	10.0
Soilbrom 90 EC	1	45.3	74.2	19.1	24.8
	2	100.0	100.0	30.0	30.0
	3	136.6	128.1	37.3	35.6
	4	184.7	146.6	46.9	39.3
DD	3	19.2	60.8	13.8	22.2
	5	25.6	82.6	15.1	26.5
	7	31.9	75.6	16.4	25.1
Telone II	3	19.2	77.6	13.8	25.5
	5	6.4	83.5	11.3	26.7
	7	70.7	20.3	24.1	14.1
DBCP	1	31.9	—	16.4	—

*1978 tests with Ransom soybeans and 1979 tests with the Bragg cultivar.
**Calculated using the performance index and setting 10 bu./a. for the check and 30 bu./a. for Soilbrom 90 EC at 2 gal./a. (positive check).

TABLE 2. PERFORMANCE OF AT-PLANT APPLICATIONS OF SYSTEMIC NEMATICIDES RELATIVE TO THAT OF EDB (SOILBROM 90 EC) FOR CONTROL OF ROOT-KNOT *(MELOIDOGYNE ARENARIA)* AND CYST *(HETERODERA GLYCINES*, RACE 3) NEMATODES IN FIELD EXPERIMENTS DURING THE 1978 AND 1979 SEASONS

Treatments	Rate (lb. a.i./a.)	Yield performance index 1978*	1978*	Yields** (bu./a.) 1978	1979
Check		0.0	0.0	10.0	10.0
Soilbrom 90 EC (gal.)	2	100.0	100.0	30.0	30.0
Nemacur 15G	1	18.1	17.3	13.6	13.5
	2	34.9	22.5	17.0	14.5
	3	43.0	46.6	18.6	19.3
Furadan 10G	1	61.5	24.4	22.3	14.9
	2	54.7	43.0	20.9	18.6
	3	69.4	66.3	23.9	23.3
Temik 15G	1	2.1	16.3	10.4	13.3
	2	50.5	34.9	20.1	17.0
	3	65.3	46.5	23.1	19.3

*1978 tests with Ransom soybeans and 1979 tests with the Bragg cultivar.
**Calculated using the performance index and setting 10 bu./a. for the check and 30 bu./a. for Soilbrom 90 EC at 2 gal./a. (positive check).

[1]Research supported by the Alabama Soybean Producers.

Planting Too Deep Reduces Soybean Stand

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PLANTING SOYBEAN SEED at the correct depth can help overcome some of the stand problems that have plagued growers in recent years. Research by the Auburn University Agricultural Experiment Station revealed that planting too deep can seriously reduce stands.

Scarcity of high quality seed also has been a problem as Alabama's soybean acreage skyrocketed from 1 million in 1974 to 2¼ million acres in 1979. How seed quality has affected stand is illustrated by 1977 experience on test plantings at 13 Experiment Station locations around the State. Field emergence was only 67% for the 48 varieties and lines planted. To get the desired stand of 6-8 plants per foot of row at 67% emergence would require planting 10-12 seed per foot. In 36-in. rows, this translates into 50-60 lb. of seed per acre. Increasing field emergence to 80% could cut seed requirement by 20%.

Soil moisture and condition of seedbed are other factors that affect stand. Without proper seedbed preparation ahead of planting and adequate soil moisture to assure germination, stands are certain to be poor.

Depth of Planting Studied

How depth of planting can affect field emergence and final stand of soybeans was determined in new Experiment Station tests in north, central, and south Alabama. Two high quality certified seed lots of Bragg soybeans—93% (A) and 83% (B) germination in the laboratory—were planted.

Planting dates were June 10 at the Tennessee Valley Substation, Belle Mina; June 1 and 13 and July 6 at the E. V. Smith Research Center, Shorter; and June 30 at the Gulf Coast Substation, Fairhope. Each seed lot was planted at ¾, 1½, and 2¼ in. depth at the rate of 10 seed per foot of row. A double disk opener planter having both seed and soil packer wheels was used.

Seedling counts were made 15 days after the planting date. Only the seedlings whose cotyledons had cleared the ground were considered to be emerged.

Soil moisture was good at all locations at time of planting, but loss of moisture due to tillage was encountered at the Tennessee Valley and Gulf Coast substations and at the July 6 planting at the E. V. Smith Research Center. Moisture was found to be particularly critical at the ¾-in. depth but adequate for emergence at the 1½ and 2¼-in. depths.

EFFECT OF THREE PLANTING DEPTHS ON PERCENTAGE EMERGENCE OF SOYBEAN SEEDLINGS, TWO SEED LOTS, FIVE LOCATIONS

Location and date of planting	Seed lot[1]	Emergence, by planting depth		
		¾ in.	1½ in.	2¼ in.
		Pct.	*Pct.*	*Pct.*
Tennessee Valley Substation				
June 10	A	81	88	83
	B	58	80	74
E. V. Smith Research Center				
June 1	A	93	83	69
	B	80	80	49
June 13	A	87	95	49
	B	86	94	53
July 6	A	90	95	60
	B	74	88	66
Gulf Coast Substation				
July 30	A	60	87	74
	B	72	79	65

[1]Lot A had 93% germination and lot B had 83% germination in laboratory tests.

Poor stand of row at right resulted from planting too deep. Proper planting depth resulted in good stand at left.

Good Results With 1½-in. Depth

Despite drought conditions, seedling emergence ranged from 79 to 95% for both seed lots at the 1½-in. depth of planting, as shown by data in the table. Emergence from the 2¼-in. depth was equal or only slightly better than from the ¾-in. depth at the Belle Mina and Fairhope locations but poorer at the E. V. Smith Research Center. Variation in emergence at the ¾-in. depth was due to lack of rainfall for 15, 8, and 7 days, respectively, at Fairhope, Belle Mina, and Shorter (third planting).

Seedbed conditions for the June 1 and 13 plantings at the E. V. Smith Research Center were excellent. Rain occurred within 1 day after planting. Where soil moisture was good, there was no difference in emergence from ¾ and 1½-in. planting depth at June 1 and 13 plantings at the Shorter location. This was true for both seed lots. However, the 2¼-in. planting depth gave poor emergence at this location.

In the tests reported, the best field emergence was from 1½-in. depth of planting. Planting at slightly shallower depth resulted in fair emergence, but the deeper planting (2¼-in.) had poor emergence.

Better emergence from correct depth planting means that fewer seed per acre are required for a good stand. Thus, more acres can be planted with the available seed supply.

BLACK COLLEGE STUDENTS IN AGRICULTURE

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FOR THE MOST of early American History, black people were rural residents employed in agriculture.

Following emancipation in 1863, many blacks viewed ownership of farm land as an essential element in the realization of their newly-gained freedoms. Agriculture was the primary industry of the nation and was one activity about which blacks possessed skill and experience. Many blacks saw the future in terms of land ownership and farming.

Over the years, the desirability of farming as an occupation has waned among blacks. Currently less than 2% of the nation's farmers are black. They farm less than 0.5% of the land under cultivation and contribute less than 0.1% to the value of agricultural products sold. The decline of black land ownership is a major concern for black leaders today.

Between 1940 and 1970, the number of farms in the United States declined sharply, but the decrease in ownership of farmland and its operation by blacks occurred at a much faster rate than was true for whites. Because the majority of farms operated by blacks were small units, they declined nationally at a rate of 87% during this 30-year period. The decline was even more severe in Alabama, as less than 5,000 black-operated farms remained and only one-fifth of these had annual sales in excess of $2,500 in 1974.

Given the marked decline in black people's participation in production agriculture, it is important to consider the current status of agricultural education as it relates to the training of black youth for agricultural occupations. One aspect of this training occurs at the college or university level. This discussion focuses on black students attending both 1862 and 1890 Land Grant institutions throughout the Southern region. For the vast majority of black youth, this education is provided by the 1890 Land-Grant institution in each state. In Alabama, this is Alabama A&M University at Huntsville.

During the spring of 1978 a mail questionnaire was sent to students enrolled in Schools or Colleges of Agriculture at all 1862 (predominantly white) and 1890 (predominantly black) institutions in the South. In Alabama, they include Auburn and Alabama A&M Universities. All agriculture students were contacted at the smaller 1890 institutions and a 15% sample at the much larger 1862 institutions. The total sample included 2,379 students, of which 590 were black. In Alabama, 64 black students responded to the study.

Approximately 80% of black agriculture students in the South are enrolled in four curricula. The most popular curriculum is Vocational Agriculture (26.8%), followed by Agricultural Business and Economics (19%), Agronomy (18.3%) and Animal and Dairy Sciences (16.6%).

Looking at other characteristics of black agriculture students in the South, a number of distinctive attributes are noted in table.

About one-fourth of the students have been raised on a farm or in a rural nonfarm area (another 37.8%). More than a third of their fathers were farm-reared. Because of the prevalence of rural and farm backgrounds among black students, their parents often own farmland (40.6%) but only 12.3% of their parents had income from farming.

SELECTED BACKGROUND CHARACTERISTICS OF BLACK AGRICULTURE STUDENTS AT LAND-GRANT SCHOOLS IN THE SOUTHERN REGION AND ALABAMA

Characteristic	Black agriculture students	
	So. Reg.	Alabama
	Pct.	*Pct.*
Raised on a farm	25.9	25.6
Raised rural nonfarm	37.8	25.6
Father farm-reared	37.4	33.3
Parents with farmland	40.6	42.8
Parents with farm income	12.3	58.1
Father a college graduate	10.2	6.6
Family income above $20,000	17.0	3.2
Parents as a primary source of college funds	57.6	59.8
Loans or grants as a source of college funds	71.7	76.6
Desire advanced degree in agriculture	78.1	89.1
Might own farm someday	61.9	53.1
Desire to live on farm	19.4	18.4
Expect to work in farming or agricultural production	7.3	4.7
Expect non-agricultural occupation	28.4	49.0
Expect to work in agricultural research, education, or extension	27.9	25.0
Expect to obtain a post-graduate degree	81.9	79.7
Number of respondents	590	64

Today's black agriculture students frequently represent the first generation to attend college, as only 10% of their fathers had done so. This difference was strongly reflected in family economic resources. Only 17% indicated that their families had incomes above $20,000 in 1977. With lower family incomes, black students often were not able to rely on family resources as the sole source of college funds, as almost three-fourths reported receiving some form of financial assistance.

Most of the black students had a significant commitment to a career in agriculture. More than three-fourths indicated a desire to attain an advanced degree in some agricultural subject area. Over 60% wanted to own a farm someday. At the same time, only 19.4% of the black students actually desired to live on a farm.

The occupations most often expected by black agriculture students reflect the ongoing exodus of black people from agriculture and the declining number of black farms as only 7.3% expect to become farmers. Many expect to enter agricultural research, extension, or education careers (27.9%). A similar proportion (28.4%) expect to follow careers unrelated to agriculture. Clearly these results reflect the current decline in the number of black-operated farms in Southern agriculture and the poor assessment many black youth give to opportunities in farming.

Black agriculture students in Alabama were generally similar to the profile of black students in agriculture across the South. The Alabama students, however, were much more likely to indicate that their parents received some farm income and had somewhat lower parental education and family incomes. Finally, more Alabama students expected a nonagricultural occupation and somewhat fewer expected to work in farming or agricultural production.

In conclusion, the profile of black agriculture students in the South reveals that relatively few are committed to agricultural production as a career. Moreover, as the first generation of college students in their families, they place a high value on college education as a means for escaping the farm or rural area. Many do not intend to abandon agriculture completely but merely to enter one of the many related nonproduction occupations. Their orientation is toward white-collar, professional, and technical agricultural jobs.

Black students have a wide range of occupational opportunities available to them, both on farms and in the broad area of agribusiness. If the declining black presence in Southern agriculture and in the ownership of farmland is to be stemmed, the several Land-Grant institutions in the South will play an important role.

FEEDING REGIMES:

Their Effect on Reproductive Performance of Broiler Breeder Females

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CONSIDERABLE IMPROVEMENT has been made in the growth rate of the broiler in the past 10 years. There has been a vast amount of research in nutrition, genetics, physiology, disease control, and management that has contributed to this improved growth rate.

However, there has been a decline in the overall reproductive performance of broiler breeders in the past 3 or 4 years. This has come about by the decline in hatchability, more specifically the decline in fertility. Work at Auburn University Agricultural Experiment Station, studying the effect of various feeding regimes on the reproductive performance of broiler breeders, has been done in cages with females artificially inseminated. Experience with a large number of broiler breeder floor operations throughout the United States during the past few years allows us to interpret results from these caged breeders to give probable results in floor operations.

Restricting feed intake to control body weight in broiler breeders has been practiced for several years. However, there has been relatively little work reported on the effect of restricted feeding on reproductive performance. The Auburn experiments were designed to determine the effects of various levels of daily feed intake on the reproductive performance of broiler breeder hens.

The females used were reared on a conventional restricted skip-a-day program and were receiving approximately 44 lb. of feed per 100 hens on alternate days. At 24 weeks of age, the hens were divided into five treatments with eight replicates per treatment and 10 birds per replicate. The five feeding regimes used throughout the experiment are presented in table 1. Production and feed conversion data were summarized by 28-day periods beginning when the birds were 26 weeks of age and ending at 58 weeks. Data concerning fertility and hatch of fertile eggs were obtained from inseminations at 31 and 52 weeks of age.

Table 2 shows hen-day production, feed conversion, fertility, hatchability, shell quality, and egg weight by treatments. As can be noted from table 2, hen-day production and feed conversion were affected by total amount of feed consumed. These results suggest that, as far as overall efficiency is concerned, it may be possible to restrict broiler breeders more severely than those in treatment 5. Treatments 3 and 4 would be somewhat comparable to feeding rates in industry.

Hatchability and fertility of fertile eggs were also significantly affected by feeding regimes. Hatchability was significantly lower in treatment 1 as early as 31 weeks of age. These differences in hatch become more pronounced at 52 weeks of age. Significant differences in fertility by feeding regimes were observed at 52 weeks of age. Fertility differences in these experiments were a female effect and not a male effect since all birds were artificially inseminated. These results suggest that the female has a much greater effect on fertility than has been previously reported. In general, fertility problems have been associated with the male.

Feeding regimes also showed a significant effect on shell quality and egg weight. In recent years, shell quality has become a significant concern in broiler breeders. Egg breakage as a result of poor shells is a significant factor; however, far more costly is the poor hatch resulting from eggs of poor shell quality. In addition, syndrome(s) which are causing shell quality problems also have a significant effect on the fertility of the female. Feeding regimes had a significant effect on egg weight and chick weight as early as 31 weeks of age, with these differences becoming more pronounced as the birds become older. The results in this experiment are in agreement with subsequent experiments conducted at Auburn University.

TABLE 1. DAILY FEEDING REGIMES

Age (weeks)	Feeding regimes lb./100 hens/day				
	1	2	3	4	5
24....	28.6	28.6	28.6	28.6	28.6
25....	29.7	29.7	29.7	29.7	29.7
26....	31.9	31.9	31.9	31.9	31.9
27....	34.1	34.1	34.1	34.1	34.1
28-38....	FF*	FF	FF	35.0	31.9
38-40....	FF	40.7	39.8	34.7	31.5
40-42....	FF	39.8	38.9	34.4	31.1
42-44....	FF	38.8	36.5	34.1	30.7
44-46....	FF	37.7	34.2	33.8	30.4
46-48....	FF	36.9	31.9	33.5	30.0
48-50....	FF	35.9	31.9	33.2	29.6
50-52....	FF	34.9	31.9	32.9	29.2
52-54....	FF	33.9	31.9	32.6	28.8
54-56....	FF	33.0	31.9	32.2	28.4
56-58....	FF	31.9	31.9	31.9	28.0

*FF indicates full fed.

TABLE 2. EFFECT OF FEEDING REGIMES ON VARIOUS PRODUCTION PARAMETERS

Parameter	Time	Result, by treatment				
		1	2	3	4	5
Egg production, pct.	Overall	68.0	74.4	70.5	72.6	73.2
Feed conversion, lb./doz......	Overall	7.0	5.7	5.9	5.5	4.8
Fertility, pct.	31 weeks	91.1	95.5	94.8	96.9	94.9
Fertility, pct.	52 weeks	64.3	71.9	81.1	81.2	86.1
Hatchability, pct.	31 weeks	81.3	87.7	87.8	87.5	88.5
Hatchability, pct.	52 weeks	74.8	86.9	86.6	87.2	89.6
Specific gravity	31 weeks	1.087	1.088	1.088	1.088	1.088
Specific gravity	52 weeks	1.077	1.079	1.080	1.080	1.082
Egg weight, oz./doz.	31 weeks	25.62	25.66	25.66	24.99	24.99
Egg weight, oz./doz.	52 weeks	29.06	28.31	28.27	28.22	28.01

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Department of Home Economics Research

Fabric Grayness: Instrumental vs. Visual Ranking

SOILING AND/OR SOIL REMOVAL have been the focus of many textile research projects. The determination of the degree of soiling or soil removal can be made in several ways, including visual evaluation, chemical analysis, microscopic analysis, and instrumental evaluation of color differences or light reflectance.

Although all of the methods listed above can be used to evaluate soil removal, none is ideal for all situations. Chemical and microscopic analyses may be complex and time consuming. It is often difficult to get reproducible results if the specimens are visually evaluated. This is especially true if the specimens are colored, patterned, or both. Therefore, white fabrics and instrumental evaluation of light reflectance are often used.

However, the following questions may be and often are asked. What does this mean to the consumer? How do reflectance measurements correspond to visual evaluation of soil removal? What degree of difference in light reflectance is actually perceived by the consumer? To help answer these questions, a study was formulated to determine the ability of trained observers to detect measured differences in light reflectance.

Procedure

Three 50% cotton/50% polyester broadcloth fabrics were used. Fabric A was unfinished, B had a durable press finish, and C had a flame retardant finish. These fabrics had previously been used in a study of the effects of finishes on soiling and soil removal characteristics. Three types of soils had been used on each fabric. Four types of detergents and water of three hardness levels were used to launder soiled specimens. The soiling-laundering process was repeated for five cycles.

Reflectance readings were taken of the original unsoiled fabric and of specimens after each soiling and each laundering.

Findings

For the first experiment the range of reflectances was divided into 10 increments of 2.0 ± 0.1 reflectance units each. One specimen was randomly selected from the total number of specimens having the lowest reflectance value. This selection procedure was repeated for each of the succeeding 2.0 reflectance unit increments.

Four trained observers individually ranked the specimens from darkest to lightest. The specimens were illuminated by an overhead fluorescent light and the observers sat 4 ft. away from the vertical gray viewing board. The specimens were randomly arranged on the viewing board at the observers' eye level.

Rank order correlation was used to determine the ability of the observers to rank specimens in the same order as did the reflectance measurements. A significant rank order correlation meant it was highly unlikely the observers ranked the specimens in that order by chance; rather, the observers must have been able to perceive the differences in darkness represented by the differences in light reflectance values.

In the first experiment, no observer ranked the 10 specimens in perfect order. However, all attained significant rank order correlation coefficients ($P \leq .01$).

In this experiment, observers found it difficult to compare fabric C, which had a slight yellowish cast, to fabrics A and B. Therefore, another experiment was designed. In one ranking, only fabrics A and B were used. There were 10 specimens differing by 2.0 ± 0.1 reflectance units. The second ranking used six specimens of fabric C with 2.0 ± 0.1 reflectance units difference.

When ranking only fabrics A and B, one observer ranked all specimens in the proper order. The other observers attained significant ($P \leq .01$) rank order correlation in this comparison. When only fabric C was used for the ranking, three observers ranked the specimens perfectly from darkest to lightest.

To determine whether the observers could rank specimens with smaller differences in reflectance, two additional experiments were conducted. In the first, 10 specimens from fabrics A and B, differing from each other by 1.0 ± 0.1 reflectance unit, were ranked. In this experiment, all but one of the observers attained significant rank order correlations ($P \leq .01$).

In the second experiment each fabric was ranked separately. Ten specimens were used for each fabric with 1.0 ± 0.1 reflectance unit between each specimen. Each observer attained a significant rank order correlation ($P \leq .01$) for each fabric.

Summary

Trained observers were able to attain significant rank order correlations with the rankings as determined by reflectance values. Observers ranked specimens more accurately when only one fabric was used at a time and when the specimens differed from each other by a larger increment in reflectance values. However, these trained observers were able to detect small differences in light reflectance values.

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AUBURN, ALABAMA 36830
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PUBLICATION—Highlights of Agricultural Research 3/80

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