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HIGHLIGHTS

OF AGRICULTURAL RESEARCH

IN THIS ISSUE

ON THE COVER: Chrysanthemum production in a commercial nursery operation is featured on this issue's cover. AAES horticulture researchers have discovered some "chemical magic" that could change the way mums are produced and marketed. See the article on page 9.

DIRECTOR'S COMMENTS

This issue of Highlights will be the last of its kind. It will be replaced next quarter with a new, we hope better Highlights that will look a great deal different and read somewhat different.

Some of you will be helping us evaluate the things you like and dislike about the current Highlights, because every tenth person on our mailing list has received a questionnaire. When the new Highlights comes out in December, a similar questionnaire will be mailed.

We are committed to bringing you—our readers and supporters—the best possible research magazine. We believe we had a good one already, and we are fine-tuning it more than we are changing it.

It will look different due to a new design, with more modernized use of color and art. Some articles will be longer and some shorter—the big difference is not being tied to the one article per page style that has existed since Highlights began in 1954.

Another difference will be expansion of the Director's Comments. Faculty, Deans, and Department Head's will present timely subjects. Though I enjoy writing these columns, I suspect the space will be better served by providing additional research comments from our scientists.

In examining Highlights since 1954, changes in its appearance have been made about every 10 years. About 10 years ago, we began to use four-color illustrations on the cover and on some inside editorial pages. In the new issue, we will use color throughout the magazine. Improvements in printing technology allow us to do much of this work in our own office, thus increasing the cost only slightly.

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L.I. Chiba, H.W. Ivey, K.A. Cummins, and B.E. Gamble

Poultry Byproduct Can Be Used to Produce Leaner Pigs

Consumers prefer lean meat, swine producers thrive on more efficient production practices, and the poultry industry must find ways to dispose of waste products in an increasingly fragile environment. Findings from an AAES study benefit all three groups.

In recent experiments, researchers found that high-protein diets can reduce fat accumulation in pigs, even when the diets rely on low-quality protein sources such as feather meal. Diets supplemented with feather meal, a byproduct of poultry processing, were found to produce carcass quality equal to diets that contain soybean meal as the only protein supplement.

Researchers evaluated hydrolyzed feather meal as a source of extra dietary protein to enhance leanness of finisher pigs. Feather meal is high in total protein (80-85%) but deficient in some amino acids, most importantly lysine. A prelimary study indicated that pigs need about 0.73% dietary lysine for optimum overall performance. Therefore, a diet formulated to contain 0.73% lysine was chosen as the basis for a second study.

Goals of the second study were to compare feather meal to soybean meal as a source of extra protein and to determine whether leanness is improved by increased protein *per se* or by increased amino acid contents, lysine in particular. Diets tested in the study are described in the table.

"Medium" diets were considered to be the optimum in this study. It was expected that the "high" diets, which provided extra lysine and/or protein, would have no effect on the lean growth rate but would reduce the fat accumulation rate, thus improving leanness of finisher pigs. A slight depression in weight gain of pigs because of reduced fat accretion may not be that important considering today's consumer demands for lean meat products.

As anticipated, weight gain was less in pigs fed the high-protein/lysine soybean meal diet (High SBM) and the high-protein feather meal diet (Iso-N). This depression in weight gain was not observed in pigs fed the high-lysine feather meal diet (Iso-Lys), partly because of possible increases in the weights of internal organs for this group. There was no clear effect of dietary treatments on the efficiency of weight gain. Tenth rib back-fat was lower (0.97 versus 1.11 inches), and loin muscle area was larger (6.12 versus 5.74 square inches) in pigs fed the high diets. These results were reflected in percent carcass lean (54.9 versus 53.3%).

As the protein content of diets increases, a greater proportion of total energy is provided by protein. This decreases the amount of dietary energy that can be efficiently used by pigs, and it has been shown that protein is not a good source of energy. Also, pigs fed the high-protein diet are likely to use more energy, which may further reduce energy available for excess fat accretion. These are possible factors responsible for improved carcass quality.

In summary, weight gain of pigs generally decreased as dietary lysine and protein increased, thereby extending the feeding period slightly (2.3 days more to reach 239 pounds). However, carcass quality was improved by feeding "high" diets. In addition, the results indicate that a low-quality protein source can be used effectively in diets designed to enhance leanness of finisher pigs. Therefore, depending on the market incentive for producing lean pigs, providing extra dietary protein might be a viable alternative to improve carcass quality. Also, depending on the price of feather meal and how it is incorporated into the diet, the cost of swine feed can be reduced.

Effects of Dietary Soybean Meal and Hydrolyzed Feather Meal on Growth Performance and Carcass Traits of Finisher Pigs[1]

Variable	Feather meal					
	SBM		Iso-Lys		Iso-N	
	Med	High	Med	High	Med	High
Composition of diets[2]						
Crude protein (pct.)	15.0	16.7	18.7	24.3	15.0	16.7
Lysine (pct.)	0.73	0.85	0.73	0.85	0.65	0.70
Growth performance						
Weight gain (lb./day)	2.15	1.99	2.10	2.12	2.24	2.05
Gain to feed (lb./lb.)	0.30	0.28	0.28	0.29	0.31	0.29
Carcass traits						
10th rib backfat (in.)	1.07	0.99	1.17	0.95	1.11	0.97
Loin muscle area (sq. in.)	5.95	6.15	5.34	6.08	5.92	6.06
Pct. lean	53.8	54.7	52.4	55.0	53.7	54.9

[1]SBM=soybean meal; Iso-Lys = the same lysine content as the SBM diets; Iso-N = the same crude protein content as the SBM diets; Med = medium.
[2]To ensure an adequate supply of lysine or protein from common feedstuffs for pigs, corn and SBM provided 0.60% lysine and 13.2% protein to the Iso-Lys and Iso-N diets, respectively, and feather meal supplied additional lysine and protein.

Chiba is an Assistant Professor and Cummins is a Professor of Animal and Dairy Sciences. Ivey is Superintendent and Gamble is Assistant Superintendent of the Wiregrass Substation.

A.K. Hagan, K.L. Bowen, and J.R. Weeks

Crop Rotation a Powerful Weapon Against Peanut Pests

Crop rotation has long been recommended as a control for the destructive peanut pests white mold and nematodes. To determine the value of crop rotation as a peanut pest management tool, AAES studies were conducted in Alabama farm fields to determine the impact of cropping sequence on the occurrence of diseases and nematodes and to document pest-related yield loss.

Trials were conducted in 16 fields in 1991, 21 fields in 1992, and 22 fields in 1993. Fields had one of the following cropping histories: continuous peanut production including fallowed set aside land (three year minimum); one year of peanuts behind one year of corn, grain sorghum, or clean summer fallow; peanuts after two to three years of cotton or corn; and peanuts after bahiagrass (five-year minimum). White mold and limb rot incidence was measured after the peanuts were inverted. Defoliation from early leaf spot and root-knot juvenile numbers were assessed at the end of the growing season.

In 1991, white mold was largely absent, and yields were highest when peanuts were grown behind bahiagrass. When peanuts followed two or three years of corn or cotton, white mold incidence was higher and yields were lower when compared with those of peanuts grown behind bahiagrass. White mold peaked where peanuts were grown every other year. Despite increased white mold, yield in these fields was similar to those where peanuts were cropped every third year. Poorest yield, along with moderate white mold and severe nematode pressure, occurred in fields in continuous peanuts.

Summer 1992 was wetter and cooler than the previous year. Again, the incidence of white mold was low where peanuts were grown behind bahiagrass. Yields were reduced in several fields by early leafspot and limb rot. Despite higher levels of white mold, yields in fields rotated to peanuts every three years were similar to those for peanuts grown behind bahiagrass. One of nine fields accounted for nearly all the white mold recorded in the three-year rotation. Incidence of white mold was highest in those fields cropped to peanuts every other year. Also, yields in these fields were 300-400 pounds per acre lower. Lowest yields, seen in fields in continuous peanut production, were due to a combination of white mold and root-knot nematodes.

Unusually hot, dry summer weather in 1993 reduced peanut yields and also suppressed disease and nematode activity. No white mold was seen in peanuts grown behind bahiagrass, although yield in the single field in a bahiagrass-peanut rotation was limited by drought. Disease incidence was higher in peanuts cropped after two years of cotton or corn than behind bahiagrass, but yields remained high, due in part to several timely showers. Despite the drought, white mold incidence in fields where peanuts were grown every two years or every year was similar to those levels seen in the previous two years. Yields in both rotation categories were lower than those seen in peanuts grown after two years of corn or cotton.

Cropping Sequence and the Occurrence of White Mold in Peanuts

Sequence	1991		1992		1993	
	Hits	Yield	Hits	Yield	Hits	Yield
	No.[1]	*Lb./a.*	*No.*	*Lb./a.*	*No.*	*Lb./a.*
Peanuts after bahia	0.3	3,859	0.8	3,932	0	2,714
Peanuts every 3 yr.	5.5	3,692	4.6	4,035	3.9	3,274
Peanuts every 2 yr.	14.5	3,608	15.0	3,645	11.2	2,481
Continuous peanuts	5.8	3,222	11.9	3,229	10.8	2,350

[1]One hit = one foot of row with one or more diseased plants. Number in table indicates hits per 100 feet of row.

The cost for establishing bahiagrass, prorated over 10 years is about $85.75 per acre. While simply applying the newly labeled fungicide Folicur™ costs about $24 per acre (net), additional applications of Temik™ will be needed to control nematodes, which would cost up to $76 per acre per year. Despite the cost of growing bahiagrass or cotton, compelling reasons for employing crop rotation are an absence of destructive nematodes, elimination of costly pesticide inputs, better soil tilth, and diversification of farm income sources.

Crop rotation is a potent weapon against white mold and nematodes in peanuts. Peanuts grown behind bahiagrass, and to a lesser extent peanuts planted after two years of corn or cotton, suffered far less white mold damage, had lower root-knot larval populations, and produced more peanuts. Cropping peanuts every year or two years not only increased the risk of disease-related yield loss but also the need for costly control inputs.

White-mold-infected peanut plant.

Hagan is a Professor and Bowen is an Associate Professor of Plant Pathology. Weeks is an Associate Professor of Entomology.

G.W. Zehnder, E.J. Sikora, W.R. Goodman, and M.H. Hollingsworth

Insect Scouting Reduces Insecticide Use on Tomatoes

Fruitworm larvae feeding on a tomato.

Approximately 7,500 acres of fresh-market tomatoes valued at $50 million are grown annually in Alabama. However, marketable yields can be greatly reduced by the tomato fruitworm. A study at the AAES North Alabama Horticulture Substation in Cullman showed that scouting for this pest saves insecticide costs and increases net profit.

Fruitworm moths usually lay eggs on the upper tomato plant foliage next to the flowers. After hatching, larvae first feed on the foliage but later bore into the fruit. It is not uncommon to observe fruitworm feeding holes on all fruit when large populations of the insect are not controlled.

Many farmers spray synthetic insecticides one or more times a week, regardless of whether any fruitworms are actually present. Although these calendar-based practices are generally effective, frequent and unnecessary sprays are expensive, destroy beneficial insects, and can leave more insecticide residues on tomatoes.

The AAES study was designed to determine whether insecticides applied only when fruitworm eggs were detected would offer the same protection as calendar-based sprays. Researchers evaluated a synthetic insecticide, esfenvalerate, which is sold as Asana XL™; and a biological, environmentally safe insecticide, *Bacillus thuringiensis*, which is sold as Javelin WG™.

Spring and summer tomato plantings were established in 1992 and 1993. In the scouting treatment, foliage was examined twice weekly, and insecticides were applied only when eggs were detected. In calendar-based treatments, plants received weekly sprays of esfenvalerate beginning at flower or *B. thuringiensis* after the first eggs were spotted. Insecticides were applied according to label recommendations.

There were no marked differences in fruit damage among the treatments and all gave superior fruitworm control compared with nontreated plots (Table 1). Researchers found that applications of esfenvalerate can be reduced almost 60% with scouting, without any reduction in fruit quality or yield. *B. thuringiensis* was effective for fruitworm control, particularly if applications were based on scouting. Yields were equivalent in all treatments.

On average, per-acre insecticide cost savings associated with the use of scouting programs were $44.22 and $39 for esfenvalerate and *B. thuringiensis*, respectively (Table 2). Average net profits — considering machinery and labor costs — were $59.25 and $66.53 per acre higher for esfenvalerate and *B. thuringiensis*, respectively, when scouting was used. The cost of scouting was estimated to be only $6-$10 per acre.

Benefits of scouting were greatest in spring 1992, when fruitworm density was lowest. Scouting determined that fruitworm populations were low, so insecticide sprays were recommended infrequently. In a calendar-based program, sprays are applied on schedule to prevent possible damage, even if few insects are present.

These results exemplify the adage, "Knowledge is power." Knowledge of pest density gained from scouting can result in optimal use of insecticides and higher production profits.

Zehnder is an Associate Professor of Entomology. Sikora is an Assistant Professor of Plant Pathology. Goodman is an Assistant Professor of Agricultural Economics and Rural Sociology. Hollingsworth is Superintendent of the North Alabama Horticulture Substation.

Table 1. Percentage of Damaged Fruit in Scouting and Calendar-Based Tomato Fruitworm Control Programs

Treatment	Avg. worm-damaged fruit		Avg. sprays
	1992	1993	
	Pct.	*Pct.*	*No.*
Esfenvalerate (C)[1]	6.7	6.0	8.0
Esfenvalerate (S)[2]	3.5	2.8	3.25
B. thuringiensis (C)	12.0	5.8	7.0
B. thuringiensis (S)	7.7	6.0	4.0
Nontreated control	26.4	26.0	0

[1]C = calendar-based applications, sprayed once a week.
[2]S = applications based on scouting.

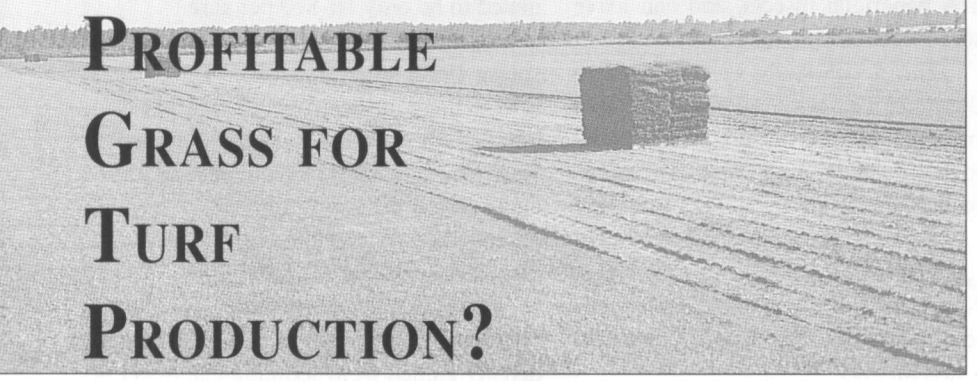
Table 2. Comparison of Insecticide Costs and Net Production Profits for Scouting and Calendar-Based Tomato Fruitworm Control Programs[1]

Treatment	Spring 1992[2]		Avg. over four seasons	
	Cost	Profit	Cost	Profit
	Dol./a.	*Dol./a.*	*Dol./a.*	*Dol./a.*
Esfenvalerate (C)[3]	83.79	1,215.16	74.48	1,218.04
Esfenvalerate (S)[4]	18.62	1,286.36	30.26	1,277.29
B. thuringiensis (C)	91.00	1,202.59	91.00	1,182.74
B. thuringiensis (S)	39.00	1,260.59	52.00	1,249.27

[1]Cost is per season cost of insecticide used in the spray program treatment. Net profit is per season return above all tomato production expenses, including machinery and labor costs, which is calculated based on a budget developed for Alabama fresh-market tomato production.
[2]Season with lowest fruitworm density.
[3]C = calendar-based applications, sprayed once a week.
[4]S = applications based on scouting.

J.L. Adrian, P.A. Duffy, and W.M. Loyd

Bermuda: Most Profitable Grass for Turf Production?



Turfgrass-sod has been one of the major growth enterprises in Alabama's agricultural sector, increasing from about 500 acres in the late 1960s to about 25,000 acres today. As production expands and markets mature, producers are increasingly concerned with the relative profitability of the major turfgrass species grown in the state: bermudagrass, zoysiagrass, and centipedegrass.

Bermudagrass has traditionally been the primary turfgrass grown in Alabama, but there is increasing interest among growers in the higher valued grasses. Bermudagrass typically has a wholesale price range of 65 cents to $1.20 per square yard, but zoysiagrass may range from $1.60 to $2.50, and centipedegrass from 80 cents to $2.10.

Given this price disparity, producers might consider growing centipede or zoysia to be the best option for maximizing net returns to a unit of land. However, considering only the relative prices of the grasses may lead to poor decisions. The higher valued grasses have production cycles two or more times longer than bermuda. Thus, the issue of which grass is the best choice for maximizing profits is unclear.

To address this issue, AAES economists developed a computer model to analyze how turfgrass price levels affect profit-maximizing, crop-mix decisions. Decisions on a 100-acre farm over a seven-year period were simulated. One goal was to determine the point at which it becomes economically feasible to switch production from bermuda to the higher valued grasses. The analysis is most applicable to southern Alabama and assumes that markets exist for grasses grown.

Among the many variables programmed into the model was the effect of seasonal fluctuations in the price of bermuda. The price of bermuda is generally at its peak in March and April but then often declines until the end of the growing season. The base, early-season price of bermuda was set at $1.00 per square yard, with seasonality reflected as a five-cents-per-month decline. Base prices for centipede and zoysia were $1.22 and $1.85 per square yard, respectively. At these base levels, net profits are maximized by devoting all 100 acres to bermuda.

Interestingly, 100 acres of bermuda remained the optimum choice until its price dropped to 60 cents per square yard (see table). At this price, 73.6 acres of bermuda were established in March of the first year, and 26.4 acres of zoysia were established in April. After March of the fourth year, all acres were planted in zoysia.

Holding the base price for centipede constant and simulating the seasonality of bermuda prices, zoysia reached $2.65 per square yard before it became feasible to initiate its production. At this price, 98 acres were allocated to bermuda and two acres to zoysia in the first year. This combination was maintained until September of year six when the two acres were reallocated to bermuda. Similarly, the price of centipede reached $2.72 before it became part of the optimum mix. At this price, 70 acres of bermuda and 30 acres of centipede were produced in all seven years.

Based on current market price ranges, price variations for these grasses have little effect on the profit-maximizing production mix. This analysis illustrates the importance of the grasses' relative production cycles in optimum turf combinations. Bermuda tends to dominate because its shorter production cycle has a timely influence on cash flow. However, demand conditions in particular markets or areas may affect this relationship.

Effects of Alternative Price Levels on Optimum Grass Combinations and Net Returns for a Simulated 100-Acre Turfgrass Farm[1,2]

Turf prices	Acreage	Net return
	No.	*Dol.*
Base situation[3]		
Bermuda ($1.00)	100	1,615,917
Centipede ($1.22)	0	
Zoysia ($1.85)	0	
Price sensitivity analysis on bermuda		
Bermuda ($.60)	73.6[4]	603,538
Centipede ($1.22)	26.4	
Zoysia ($1.85)	0	
Price sensitivity analysis on centipede		
Bermuda ($1.00)	70	1,635,933
Centipede ($2.72)	30[4]	
Zoysia ($1.85)	0	
Price sensitivity analysis on zoysia		
Bermuda ($1.00)	98	1,615,987
Centipede ($1.22)	0	
Zoysia ($2.65)	2[4]	

[1]These analyses assume seasonal price declines in bermudagrass of five cents per month.
[2]The goal of each analysis is to determine which combination of grasses maximizes profits at a given set of prices and resource contraints. The three price sensitivity scenarios depict the point at which it first becomes economically feasible to plant grasses other than bermuda. Net returns are for a seven-year period.
[3]These numbers were established as the base from which the price sensitivity analyses were made.
[4]These acreage combinations reflect the price level for the respective grass at which the optimal combination changed.

Adrian is a Professor, Duffy is an Associate Professor, and Lloyd is a former Graduate Research Assistant in Agricultural Economics and Rural Sociology.

J.L. Clark, P.A. Duffy, and G.J. Young

Cotton Farmers Face Small Risk In Expanding Farm Program Commodity Base

The expansion of cotton acreage in the Southeast has been attributed in part to the Southeastern Boll Weevil Eradication program, which has significantly increased yields and/or lowered pesticide costs in the region.

Cotton acreage eligible for enrollment in the eradication program, as well as the Farm Bill commodity program, is calculated as a moving average of acres planted for the three-year period before enrollment. In exchange for limiting cotton acreage to a portion of this "base," producers are eligible for deficiency payments. To expand base, farmers can plant cotton outside of the farm program for one or more years. However, many fear this practice exposes them to financial risk.

Evaluation of actual risks involved in base expansion is particularly important as the eradication program expands across the region. In an AAES study, researchers at AU and Auburn University at Montgomery compared the risk faced by base-expanding producers with a more conservative strategy of remaining within initial base levels.

Researchers used a whole-farm programming model to develop two five-year, profit-maximizing farm plans for a hypothetical 1,692-acre farm in Southwest Alabama. The first plan involved building base by dropping out of the cotton program for two years. The second plan involved staying inside program limits every year. Cotton, soybeans, and wheat are the crop alternatives for the farm. Variable costs of production and mean crop yields and prices were based on budgets from the Alabama Cooperative Extension Service. Fixed costs and other farm characteristics were based on data from the Alabama Farm Analysis Association. The hypothetical farm was assumed to have cotton base on half its cropland acres.

Each farm plan was simulated using FLIPSIM V, a firm level simulation model developed at Texas A&M. To simulate the risks of real-world farming, the model draws from the likely range of prices and yields a farmer would face. For each crop-mix scenario, the model measured (1) probability of farm survival, the farm's chances of remaining solvent throughout the simulation period; (2) probability of success, the potential of a farmer's equity earning potential exceeding 5% per year; and (3) average after-tax net present value, a current dollar measurement of after-tax returns.

Because farm debt significantly affects risk of failure, the two strategies were simulated for initial debt levels ranging from 20-80% of total assets. Long-term debt was incurred at an interest rate of 10% for 30 years. Intermediate capital could be borrowed for seven years at an annual rate of 12%, and operating capital could be borrowed at a 12% annual rate for six-month periods.

Results of Simulation of Base Expansion vs. No Base Expansion Over a Five-Year Horizon, 1,692-Acre Cotton Farm in Southwest Alabama[1]

	Expansion	No expansion
20% initial debt		
Probability of survival	100%	100%
Probability of success	85%	98%
After-tax net present value	$418,207	$361,807
40% initial debt		
Probability of survival	100%	100%
Probability of success	83%	87%
After-tax net present value	$329,393	$274,880
60% initial debt		
Probability of survival	90%	100%
Probability of success	69%	60%
After-tax net present value	$75,232	$80,255
80% initial debt		
Probability of survival	56%	66%
Probability of success	43%	32%
After-tax net present value	-$214,655	-$200,387

[1]Probability of survival is number of times out of 100 that the farm remains solvent for the full five years, under different possible yields and price combinations. Probability of success is percentage of times the farm achieves returns to equity higher than those that would have been achieved with an investment returning 5% per year.

Researchers found that probability of survival is not greatly affected by base expansion. When initial debt level is 20-40%, probability of survival is 100%, whether or not the farmer expands base. As debt level increases, probability of survival falls. Although risk of farm failure increases when base expansion is pursued, the risk is not dramatic (see table).

A farm that increases its net worth over the planning horizon is considered successful. Probability of economic success is highest for farms that remain in the program. But in most cases, the difference in success rate is not large.

For debt levels less than 60%, base expansion results in a considerably greater average after-tax net present value. At 60% and above, constant base results in a higher average after-tax net present value.

These results indicate that under 1990 Farm Bill provisions, base-expansion can be undertaken with only a small amount of increased risk of farm failure. Low-debt producers in particular should not fear exposure to risk in considering base expansion.

For policy makers these results are particularly important as the Boll Weevil Eradication program moves into North Alabama and Mississippi. While the increased yields associated with the program may be less in these areas, policy makers must consider the potential for more base expansion as the program is implemented. The upcoming 1995 Farm Bill, however, could significantly alter the incentives for base expansion.

Duffy and Young are Associate Professors of Agricultural Economics. Clark is an Associate Professor of Economics at AUM.

D.C. Fare, C.H. Gilliam, G.J. Keever, and J.W. Olive

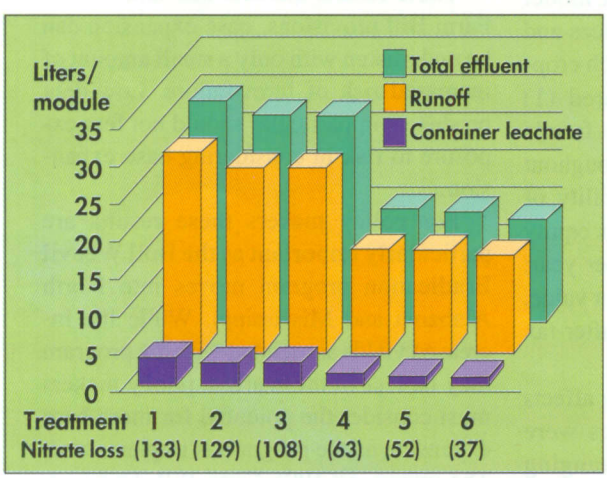
Nurseries Can Preserve Water Quality with Cyclic Irrigation

Successful production of container-grown ornamental plants requires adequate nutrients and water, but large volumes of overhead sprinkler irrigation can create a flow of nitrogen-laden effluent that is a threat to the environment. In AAES research, cyclic irrigation — watering in short, frequent intervals — reduced water runoff and nitrogen leaching.

Compacta holly plants were potted into an amended pine bark:peat growing medium in one-gallon containers. Two rates of controlled-release fertilizer were incorporated into the medium before potting: 16 and 12 pounds of 17-7-12 per cubic yard. The high- and low-fertilizer treatments were later topdressed with 0.6 and 0.8 ounce, respectively, of 17-7-12 per pot.

Water collection modules were constructed to collect container leachate and runoff. Irrigation treatments included 1.3 centimeters (one cm equals 0.39 inch) of water applied in a continuous one-hour application, two 30-minute cycles, or three 20-minute cycles; and 0.6 cm of water applied in a continuous 30-minute application, two 15-minute cycles, or three 10-minute cycles. All cyclic treatments had a one-hour resting phase between irrigations. Container leachate, water that drained out of containers; and irrigation runoff, water that fell between the pots, were monitored one hour after irrigation.

Container leachate volumes were 18% higher in the one-hour, 1.3-cm irrigation, when compared to the two- and three-cycle 1.3-cm treatments. Leachate volume was about the same in both 1.3-cm cyclic treatments. Fertilizer rates had no effect on leaching, regardless of the irrigation treatment.



Effects of six irrigation treatments on container leachate and irrigation runoff. Nitrate-N loss (milligrams per pot) for each treatment are in parentheses under the respective treatment numbers. Treatment 1 = 1.3 cm irrigation applied in a one-hour continuous application; 2 = 1.3 cm, two 30-minute cycles; 3 = 1.3 cm, three 20-minute cycles; 4 = 0.6 cm, one 30-minute application; 5 = 0.6 cm, two 15-minute cycles; 6 = 0.6 cm, three 10-minute cycles.

The 0.6-cm treatment applied in a single 30-minute irrigation resulted in 32% more container leachate than the 0.6-cm cyclic applications. Two 15-minute, 0.6-cm applications produced 50% more leachate than three 10-minute, 0.6-cm cycles.

Total effluent — container leachate plus irrigation runoff — was reduced about 10% by cyclic irrigation when 1.3 cm was applied. Reducing continuous irrigation from 1.3 cm to 0.6 cm reduced total effluent by 51%. Total effluent was 13% less in the 0.6-cm cyclic applications than in the 0.6-cm, 30-minute continuous irrigation. About 9% less total effluent was collected from the three-cycle, 0.6-cm irrigation than from the two-cycle, 0.6-cm treatment.

Regardless of the fertilizer rate, leachable nitrogen was dependent on the irrigation volume and the amount of container leachate. Thus, findings for the high- and low-fertilizer treatments were similar. Under continous irrigation, up to 63% of the total applied nitrogen fertilizer was leached as nitrate-N. Nitrate-N loss was reduced 11% when 1.3 cm of irrigation was applied in cycles. Nitrate-N leaching was reduced about 53% when continous irrigation volume was reduced from 1.3 cm to 0.6 cm. Nitrate-N loss was reduced 29% with 0.6-cm cyclic irrigations.

Cyclic irrigation and irrigation volume had no effect on the plant growth, root development, or overall quality of the holly plants grown in the study.

The average irrigation applied at container nurseries in Alabama is about 1.5 cm per day. Quality plants can be grown with much smaller irrigation volumes, thereby reducing container leachate. Irrigation applied in two or three cycles further reduces leachate volumes. With present water quality concerns in container production, these steps can be used as best management practices to reduce nitrogen loss from nurseries.

Fare, a former AU Research Associate, is an Assistant Professor of Plant and Soil Science at Tennessee Technological University. Gilliam and Keever are Professors of Horticulture. Olive is Superintendent of the Ornamental Horticulture Substation in Mobile.

K.C. Sanderson

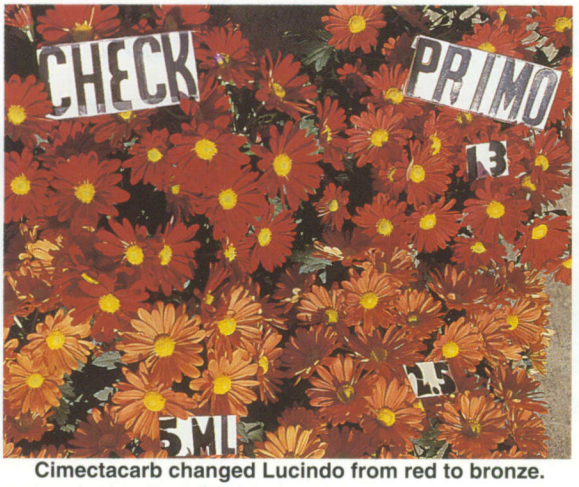
Chemical Changes Chrysanthemum Flower Color

Chrysanthemums are the second most popular flowering potted plants grown in Alabama, in part because they offer a wide range of colors. That popularity may be boosted by a little chemical magic that occurs when a new growth retardant is applied to the plants.

The source of this magic is cimectacarb, a chemical developed as a turfgrass growth retardant and marketed as Primo™ by the Ciba-Geigy company. It was found to change the color of certain chrysanthemum cultivars and also improve the overall appearance of the plants. AAES research is exploring its applications for the state's ornamental horticulture industry.

On chysanthemums, cimectacarb originally was tested as a growth regulator. Growers commonly use a chemical growth regulator to produce a compact plant that is proportionally sized to its pot. When cimectacarb was applied to chrysanthemums, it was noticed that the chemical uniformly changed the color of some cultivars. To learn more about this, a study was initiated to examine which cultivars were affected and how this new chemical affected both color and other qualities of potted chrysanthemums.

In two years of testing, approximately a dozen different cultivars have been treated. Rooted cuttings of Lucindo, Red Delano, Redding, and Regal Davis were planted four per six-inch pot containing two parts sphagnum peat moss, one part vermiculite, one part perlite, and one part topsoil by volume on Sept. 21. Plants were grown in a glass house operated at 62°F and the day length was supplemented from 10 p.m. to 2 a.m. using incandescent light until Sept. 28. Plants were pinched when new growth was 1-1.5 inches and the roots reached the bottom of the pot. Natural short days provided photoperiods for flowering. Peters Peatlite Special 20-19-18 was applied to the media every two weeks at the rate of two pounds per 100 gallons. When buds were 0.25 inch in diameter, the center bud on a shoot was removed to influence uniform flower development and fertilization was stopped.



Cimectacarb changed Lucindo from red to bronze.

On Nov. 2, cimectacarb was applied to the plants until runoff at rates of 150-600 parts per million (ppm) with a low-pressure, high- volume sprayer when new shoots were 1-1.5 inches long following a pinch. Cimectacarb spray solutions are milky white, making it easy to determine proper coverage. Sprays were allowed to remain on plants overnight. Plant height and canopy area were recorded when one-third of the flowers were open (Dec. 13-28).

The chemical appeared effective in changing the color of lavender and red cultivars and acted as an effective growth retardant. Flower color of Regal Davis, a red-purple mum, was changed to a clear pink. A pleasing bronze was obtained from the red mum Lucindo (see figure). Colors obtained with treatment of Red Delano and Redding were faded and not acceptable.

Generally, cimectacarb sprays were more effective as a retardant than the standard chrysanthemum retardant, daminozide or B-nine™, on all cultivars (see table). Plant heights and canopy areas of cimectacarb-treated plants were less than nontreated plants, with growth retardation increasing as cimectacarb rates increased. Height of Lucindo, Redding, and Regal Davis plants, and plant canopy area of Regal Davis plants treated with all rates of cimectacarb were retarded more than the heights and plant canopy areas of daminozide-treated plants.

No distortion or phytotoxic symptoms have been observed with cimectacarb sprays on chrysanthemum. However, high concentrations may reduce flower size and delay flowering. While controlled tests have not been conducted, cimectacarb does not appear to adversely affect keeping quality.

Research on cimectacarb is continuing. How cimectacarb changes flower color is not known, but it may interfere with the anthocyanin synthesis necessary for red-purple color. Tests on other plants whose marketability might be improved by additional colors are being conducted. Cimectacarb may open the way for additional color-changing chemicals and a whole new array of colors in plants.

Sanderson is a Professor of Horticulture.

Plant Heights and Canopy Area of Selected Chrysanthemum Cultivars Sprayed with Daminozide and Cimectacarb

Treatment (ppm)	Cultivars			
	Lucindo	Red Delano	Redding	Regal Davis
	Plant height (cm)			
None	30	34	32	28
5,000 daminozide	27	29	28	25
600 cimectacarb	25	24	24	17
300 cimectacarb	25	28	25	18
150 cimectacarb	25	28	26	21
	Plant canopy area (cm^2)			
None	1,766	2,294	2,040	1,663
5,000 daminozide	1,404	1,642	1,517	1,563
600 cimectacarb	1,068	1,436	1,240	854
300 cimectacarb	1,223	1,700	1,218	1,175
150 cimectacarb	1,229	1,768	1,370	1,315

E.C. Mora

Possible New Weapon Against AIDS and Animal Retroviruses Discovered

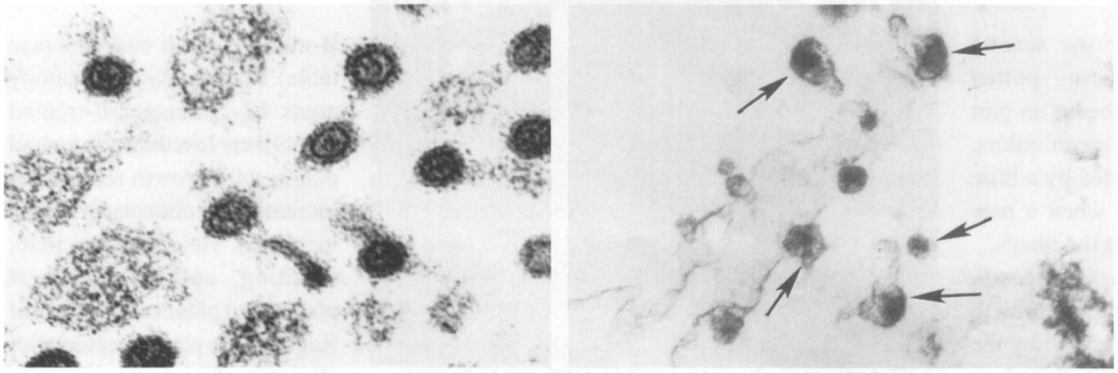


Figure 1 (left). Electron micrograph of normal mouse retrovirus in L1210 murine leukemia cell line. Enlarged by 60,420. Figure 2 (right). Micrograph of retrovirus destruction after treatment with plant extract MLH-4. All viral architecture has been altered. The outer shells and spikes are gone. The nucleic acid core is extruded out. In some areas, only virus "ghosts" are left. Many viruses appear to swell during destruction.

Plants have been used for medicinal purposes as far back as Genesis, but few antiviral plant compounds have ever been isolated. A long-term AAES investigation has discovered a plant extract that destroys retroviruses, a finding with possibly major importance to livestock industries and the war on AIDS.

The AU Poultry Science Department has screened plant compounds for more than 25 years, and only antibacterial, antifungal, and antiparasitic compounds were isolated. However, in early 1993, one material, designated "MLH-4," was found to destroy viruses that cause mouse leukemia. These viruses belong to the retrovirus group, which also includes the AIDS virus, HIV.

The antiviral plant extract was submitted to the National Institutes of Health (NIH) for evaluation as a possible compound usable for the control of AIDS. The NIH National Cancer Institute confirmed in tests last year and earlier this year that MLH-4 is moderately effective in controlling HIV under laboratory conditions.

NIH tests thousands of compounds each year with its AIDS antiviral screen. The national laboratory's drug discovery program has thus far found 1,038 of these compounds to be "active" and 1,365 to be "moderately active," the category in which MLH-4 was placed. Although NIH does not plan to perform secondary research on MLH-4, the agency's Drug Synthesis and Chemistry Branch requested additional information on the extract when its chemical structure is fully defined.

Retroviruses cause cancers and other serious diseases in many animals and humans. In humans, the retrovirus HIV creates tumors in antibody-producing white blood cells, thus damaging the immune system. In poultry, they cause various forms of cancer, costing producers millions of dollars a year. MLH-4 could benefit the animal industry, as well as the war on AIDS.

Using leukemia mouse cell cultures and electron microscopy, the Auburn lab determined that MLH-4 first denatured the outer structure of the retrovirus, making it noninfectious. The material between the outer envelope and the core was weakened and broke apart. This condition induced an emptying of most of the virus' internal contents, resulting in total virus destruction. Visualization of retrovirus destruction with the electron microscope was very important; this is the first time it has been reported.

As of this point, there is really no effective treatment for AIDS. The main compound now used is AZT, which has questionable results. AZT works by inhibiting the chemical process through which HIV attaches to white bloods cells. It slows the infection somewhat, but the virus is still alive and able to spread. MLH-4 seems effective at destroying retroviruses so that they cannot replicate.

Further research will be conducted to pursue development of MLH-4 for future human and animal use. Once the chemical structure of the compound has been mapped out, it will be submitted for patenting. Because of the necessary confidentiality surrounding patent application, the nature of the plant that yielded MLH-4 cannot be described here.

The procedure for locating such plants basically involves observing how a plant grows. Specifically, does it grow in an area alone, with no other plants? Some plants inhibit the growth of other plants. Does it appear to be resistant to disease? What is the duration of the plant's life? And, is the plant harmless to humans and animals? Over a long-term process, likely plants are critically evaluated to determine whether their chemical components are effective in controlling pathogens.

AU poultry science researchers have developed several viral and bacterial vaccines for chickens, achievements that played a major role in the development of the poultry industry in the Southeast. The discovery of MLH-4 continues AAES' commitment to advancing livestock industries, and it illustrates the fact that agricultural research often has major impacts on human health as well.

Mora is a Professor of Microbiology in the Department of Poultry Science.

J.H. Wilhoit, J.S. Bannon, and Q. Ling

Drop Applicator Developed for Poultry Litter

AAES research has been concentrating on finding new, environmentally safe ways to utilize poultry litter, a byproduct of the South's thriving poultry industry. Until recently, doing that research required hand-applying the litter to research plots because no equipment was available that could properly and easily apply the litter. Now a spreader has been developed that facilitates research with organic solid wastes and may also have commercial applications.

The consistency of poultry litter and other organic wastes is less uniform than that of manufactured fertilizers, so conventional application equipment cannot apply these products at controlled, uniform rates. Hand-applying litter to research plots is labor intensive, and rates are difficult to monitor. To address this problem, an AAES project was initiated to develop a drop applicator to spread litter.

Design criteria for this applicator included: an application rate of at least two tons per acre; litter applied in a swath approximately six feet wide; a hopper capacity of approximately one ton of poultry litter; and the equipment must be tractor-mounted to increase maneuverability.

A hopper with sides sloping inward to an opening of approximately one foot across at the bottom gave the required volume based on typical bulk density values for poultry litter. The choice of hopper capacity and configuration was based in part on load transfer considerations for making the unit tractor-mounted.

Metering poultry litter out of the hopper in a uniform swath proved to be more of a challenge than expected. Gravity flow with an agitator to meter litter out of a gate at the back of the hopper was first tried. With this arrangement, larger gate openings caused litter to flow freely, with no metering effect from the agitator, and smaller gate openings caused the litter to become packed into the bottom of the hopper, blocking flow completely.

The drop applicator was then modified by closing the gate at the back of the hopper, opening up the bottom, and mounting a platform with a floor chain looped around it under the opening. The floor chain was powered hydraulically, with the application rate controlled by adjusting the speed of the hydraulic motor. This new arrangement did a satisfactory job of metering out litter in a uniform layer across a swath approximately 5.5 feet wide, but tests indicated that the application rate fluctuated cyclically in the direction of travel due to the action of chain flights.

The original floor chain conveyor was made from cross bars spaced eight inches apart. Each time one of these bars passed over the edge of the platform, the flow of litter dropping off the platform to the ground stopped momentarily. The resulting fluctuation appeared inconsequential as the machine was observed, but it significantly reduced application rate for a distance of several feet because of the tractor's speed. Several different arrangements of chain flights were tried, but the problem persisted until a continuous-type conveyor, made from a mesh chain, was used. This arrangement allowed the litter to be applied at consistent rates with good uniformity both across the swath and in the direction of travel.

The drop applicator has now been used successfully for two seasons with poultry litter research. It also has been used with wood chips, and it should prove satisfactory for spreading other similar organic solid waste materials. It provides the uniformity and control required for carefully conducted research field studies and allows more extensive field research of this type.

The cost-effective and environmentally sound utilization of organic solid wastes is one of the foremost challenges facing agriculture and society today, so the research capability that this machine provides will be increasingly important. The lessons learned in developing this prototype also may help guide the design and development of equipment for more production-oriented situations. If equipment for efficiently and uniformly spreading these materials can be developed, the markets for utilizing organic solid wastes for turf, landscaping, or other similar purposes can be greatly expanded.

Wilhoit is an Assistant Professor and Ling is a Graduate Research Assistant in Agricultural Engineering. Bannon is Director of the E.V. Smith Research Center.

AAES drop applicator for spreading chicken litter and other organic solid wastes.

Strips of vegetation reduce pollutant concentrations in wastewater runoff.

D.T. Hill, G.L. Hawkins, E.W. Rochester, and C.W. Wood

Filter Strips Help Manage Waste Lagoon Effluent

Animal waste management lagoons can produce effluent that poses a serious environmental threat. AAES research indicates that vegetative filter strips (VFS) can help manage this problem.

VFS's are strips of vegetation planted next to agronomic production areas to control erosion or located adjacent to animal production facilities to control wastewater runoff. The one-year study evaluated the effectiveness of these strips in treating waste.

Wastewater was applied to 8X20-foot plots of bermudagrass adjoining the AAES Swine Nutrition Unit in Auburn. Six inches of effluent were applied weekly to plots sloped at 5 and 11%. This rate is designed by the U.S. Soil Conservation Service to supply ample wastewater to cover the disposal area, but produce little or no runoff.

Background samples of water seeping through the soil (soil percolate) were collected at three depths (one, three, and five feet) for six months before wastewater application. Runoff and soil percolate samples were collected for seven months after the initial application. Surface runoff samples were collected in large plastic barrels. Soil percolate samples were collected monthly from soil lysimeters installed at the three previously mentioned depths. All samples were analyzed for signs of pollution (see tables). Runoff data in Table 1 are based on four and 21 samples taken on the 5% and 11% slopes, respectively, during the 30 weeks of waste application. The small number of samples indicates that the VFS's were controlling runoff volume.

A few increases in nitrate and phosphate concentrations were due to buildup of these compounds on the application surface of the 11% slope and subsequent removal by the water flow down the plot area. All groundwater parameters, except nitrate, were reduced at the five-foot sampling depth for the 11% slope (Table 2). These reductions indicate that the compounds were removed as water flowed down through the soil. The nitrate increase is due to the conversion of total nitrogen.

The 5% slope displayed a much more variable performance. This reflects the slower movement of water down the reduced slope, as well as soil-related differences in the infiltration rates. The 5% plots were on Marvyn loamy sand, whereas the 11% plots were on Pacolet sandy loam.

Soil percolate nitrate at the five-foot depth increased approximately seven times on the 5% slope plots and more than 3.5 times on the 11% slope plots. These high nitrate concentrations on both slopes have the possibility of causing serious problems in groundwater contamination.

VFS's reduced volume of runoff and concentration of measured parameters, except for nitrate and phosphorus on the 11% slope. Increased concentrations of nitrate were noted at the five-foot soil profile level for both 11% and 5% slopes, representing a potential for groundwater pollution and indicating a need to reduce application volume for these soil types.

Hill is an Alumni Professor and Rochester is an Associate Professor of Agricultural Engineering. Hawkins is with the Alabama Department of Environmental Management. Wood is an Alumni Associate Professor of Agronomy and Soils.

Table 1. Summary of the Average Concentration (mg/L) of Chemical Parameters in Influent and Runoff with Percent Reduction[1]

Parameter	Influent[2]	11% Slope		5% Slope	
		Runoff	% Reduction[3]	Runoff	% Reduction
K	60.3	57.1	5	71.8	-19
TKN-N	103.2	69.5	33	100.1	3
NH_3-N	95.6	64.1	33	94.6	1
ON-N	8.0	5.5	31	5.5	31
NO_3-N	1.7	15.8	-829	0.9	47
COD	206.6	176.8	14	99.6	52
TP-P	27.5	30.1	-9	20.8	24

[1]K = potassium; TKN-N = total nitrogen; NH_3-N = ammonia; NO_3-N = nitrate; ON-N = organic nitrogen; COD = chemical oxygen demand; and TP-P = total phosphate.
[2]Influent is the nontreated wastewater applied to the fields.
[3]A negative percent reduction represents an increase in this parameter.

Table 2. Summary of the Average Concentration (mg/L) of Chemical Parameters in Lysimeter Samples (Background Data in Parentheses)[1,2]

Parameter	11% Slope			5% Slope		
	1 ft.[3]	3 ft.	5 ft.	1 ft.	3 ft.	5 ft.
K	44.2	41.0	13.5	43.9	35.1	28.0
TKN-N	(0.3) 0.2	(1.1) 0.4	(0.2) 0.1	(1.0) 3.4	(0.2) 3.4	(0.1) 2.6
NH_3-N	(0) 0.1	(0.1) 0.4	(0) 0	(0.1) 3.2	(0.1) 3.1	(0) 0.2
NO_3-N	(4.0) 74.5	(13.9) 54.7	(8.7) 31.2	(8.7) 75.8	(7.8) 61.6	(7.4) 55.4
ON-N	(0.3) 0	(1.0) 0	(0.9) 0.1	(0.9) 0.2	(0.1) 0.3	(0) 0.2
COD	(39.8) 54.0	(26.9) 22.2	(33.5) 12.8	(33.5) 45.0	(34.5) 21.7	(28.3) 23.5
TP-P	(0.1) 4.0	(0.1) .9	(0.1) 0.1	(0.1) 4.8	(0.1) 0.1	(0) 0

[1]K = potassium; TKN-N = total nitrogen; NH_3-N = ammonia; NO_3-N = nitrate; ON-N = organic nitrogen; COD = chemical oxygen demand; and TP-P = total phosphate.
[2]Background data were gathered for six months before application of wastewater.
[3]Depth of lysimeter placement.

D.A. Oswalt, J.J. DeMark, E.P. Benson, A.G. Appel

New Bait Proves Effective in Controlling Termites

Sentricon* bait stations could one day replace liquid insecticide barriers in termite control.

Subterranean termites, among the most damaging insects in the urban environment, can infest buildings and destroy structural timbers. AAES researchers have tested a new DowElanco termite bait product that could one day reduce or possibly replace the extensive use of liquid pesticides to control termites.

Termite control is now mainly accomplished by placing a continuous barrier of liquid insecticide in the soil between the structure and surrounding environment. An average-sized home may require more than 200 gallons of spray. Uniform chemical barriers effectively keep termites from entering structures, but the termite colonies remain in the nearby environment. If the barrier is not uniform, termites may enter structures through the treatment gaps.

A bait station recently developed by DowElanco contains the chitin synthesis inhibitor hexaflumuron, which kills termites by inhibiting the molting process. Hexaflumuron-treated wood is applied in a cylindrical bait station that is placed in the ground. AAES research has shown that the new product, Sentricon*, is effective in eliminating subterranean termite colonies.

To evaluate the effectiveness of Sentricon, wooden grade stakes were placed around the perimeter of Extension Hall on the Auburn campus to find termite colonies. Researchers found that one colony had been actively foraging within the building for more than 15 years.

Stakes were checked monthly starting in April 1993. When a termite-infested stake was found, the area around it was excavated, and a bottomless, plastic one-gallon bucket was placed in the ground. A preweighed, moist block of wood was placed in the bucket to serve as a food source. Termites from the infested stake were placed on the block to recruit other termites. Blocks from these stations were replaced monthly. In the laboratory, infested blocks were cleaned of all termites and debris, completely dried in an oven, and then weighed to determine monthly consumption by the termites.

The termite foraging area and colony size was determined by using a "triple-mark-recapture" method. Filter paper saturated with a blue dye solution was placed in a petri dish with termites collected from Extension Hall. After three days of feeding on the dye-saturated paper, the blue termites were returned to their original stations. By measuring the area enclosed by traps containing blue termites, researchers found that this colony of Eastern subterranean termites, *Reticulitermes flavipes*, was foraging in a 800-square-foot area. Colony size was estimated at 75,362 insects. Wood consumption was about half a gram per day, or approximately four inches of a 2X4 board per year.

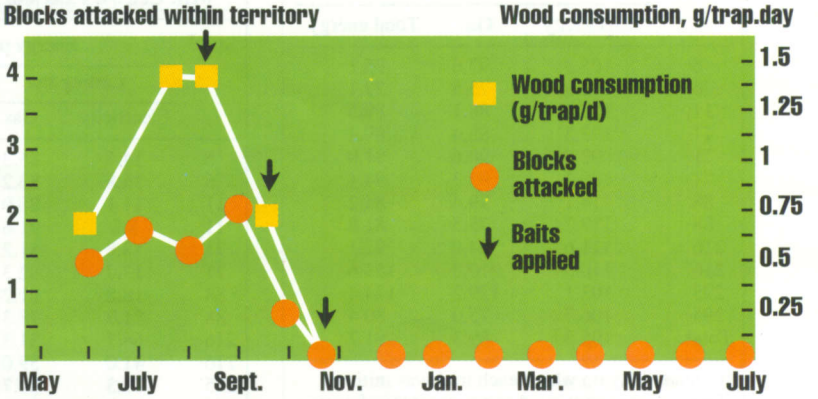
Sentricon prototypes were placed near the bucket monitoring stations. Sentricon stations first hold wooden monitoring devices designed to detect randomly foraging termites. This device is replaced with tubes containing hexaflumuron bait once termites are found in the stations. Stations were placed in the ground in May 1993 and checked monthly for termite infestation. The colony was baited with hexaflumuron in August, September, and November 1993.

In January 1994, the bait in the Sentricon stations was replaced with the wooden monitoring devices. Sentricon and bucket stations were monitored monthly. No termites have been found in the Sentricon or plastic bucket stations through August 1994. The colony is considered eliminated.

Termite baits are a new technology that will become useful as a tool to help prevent or control termite infestations. Baits are not currently a replacement for existing barrier control tactics, but may become the primary termite control method of the future.

Oswalt is a Masters Candidate and Appel is an Associate Professor in Entomology. DeMark and Benson are TS&D Specialists with DowElanco.

Sentricon is a trademark of DowElanco.



After bait stations were applied in September, October, and November 1993, no signs of wood consumption or infested monitoring stations were located.

C.A. Flood, Jr., J.L. Koon, R.D. Trumbull, and R.N. Brewer

Ceiling Fans Reduce Total Energy Use in Broiler Production

Alabama broiler producers must heat chicken houses for 10-28 days so that young birds can maintain body temperature and efficiently convert feed to meat. AAES research indicates that producers can provide the proper growing environment at a lower cost by installing ceiling fans.

Warm air rises naturally and is replaced by cooler air. Unless air is artificially circulated, temperatures at the ceiling are higher than temperatures near the floor. Thus, heat in the warmest air is not available to birds and additional heat must be supplied. Most heat loss while brooders are being used is through conduction from warmer air near ceilings and walls to cooler air outside the house. This temperature difference and the resulting heat loss is reduced by decreasing air temperature near the ceiling. Ceiling fans effectively circulate air and reduce temperatures near the ceiling.

To evaluate the effectiveness and affordability of using ceiling fans, a series of cool-weather tests was conducted at the AAES Poultry Research Unit. Tests were conducted in two divided commercial-type broiler houses with 40X65-foot growout rooms. Each room was equipped with two 8400-scfm ventilation fans controlled by both a thermostat and a percentage timer. Ventillation unit run time and usage of electricity and natural gas were measured for each room. Temperatures were monitored at various points from floor to ceiling along the centerline of each room.

In two tests, all four growout rooms were equipped with four conventional pancake-type gas brooders rated at 30,000 Btu per hour each. In four other tests, two rooms were converted to single forced-air, direct-fired furnaces rated at 168,000 Btu per hour each. Previous research revealed no significant differences in energy consumption between the two types of brooders.

Two of four rooms were each equipped with two ceiling fans designed for agricultural use. Fans were installed along the centerline of rooms a quarter of the distance from each end. Fans were operated at 85 rpm, which was sufficient to eliminate ceiling temperature gradients without creating measurable air velocities at bird level.

Results indicate that ceiling fans can be expected to increase total yearly electrical energy use by about 5.5%, decrease gas use by about 10.7%, and reduce total yearly energy use by about 8.3% (Table 1). Estimates of energy costs are not presented because they are directly dependent upon gas and electricity prices. Since prices paid by a particular farmer depend upon location and many other factors, these costs are quite variable.

In general, electricity accounted for a higher percentage of total energy consumption in houses with ceiling fans (Table 2). Gas and electricity consumption were nearly equal in tests started on calendar day 216, when outside temperatures were close to the desired inside temperature.

The average inside temperature for rooms with ceiling fans was 0.35°F less than rooms without ceiling fans. This finding indicates that lower fuel usage in ceiling fan rooms was not due to lower indoor-outdoor temperature differences.

Ventillation units ran slightly longer in rooms without ceiling fans. This factor accounts for a small portion of the greater gas use in the room with no ceiling fan.

In rooms with ceiling fans, the typical range of difference in temperature from floor to ceiling was 0-1.8°F. Without fans, the typical range was 3.5-5.5°F. This higher temperature gradient between ceiling and outside air in rooms with no ceiling fans accounts for some of the additional fuel required in these rooms.

In summary, the use of ceiling fans in broiler houses reduces total energy consumption without impacting bird performance as measured by market weight. Birds in rooms with ceiling fans averaged 5.36 pounds, while those in rooms without fans averaged 5.34 pounds.

Table 1. Energy Use In Rooms Equipped With Ceiling Fans Expressed as a Percentage of Energy Used in Rooms with No Fans

Start[1]	Ceiling fan energy use[2]		
	Electricity	Gas	Total energy
6	105.3	93.6	95.1
6	102.9	75.5	79.1
11	102.5	88.1	89.5
11	103.3	88.4	89.4
71	92.8	90.6	91.0
71	100.4	93.3	94.4
88	114.1	79.4	84.2
88	117.7	75.5	81.8
216	111.6	64.9	91.1
216	110.5	210.8	153.6
295	103.1	129.2	124.4
295	106.7	75.0	80.4
Total	105.5	89.3	91.7

[1]Calendar day on which each trial was initiated.
[2]Energy use is expressed as a percentage of energy used in rooms with no fans (i.e. 105.3% electricity use means that the ceiling fan room used 5.3% more than the no-fan room.)

Table 2. Partition of Energy Use Between Electricity and Gas for Rooms Equipped with Ceiling Fans and Rooms Using No Fans

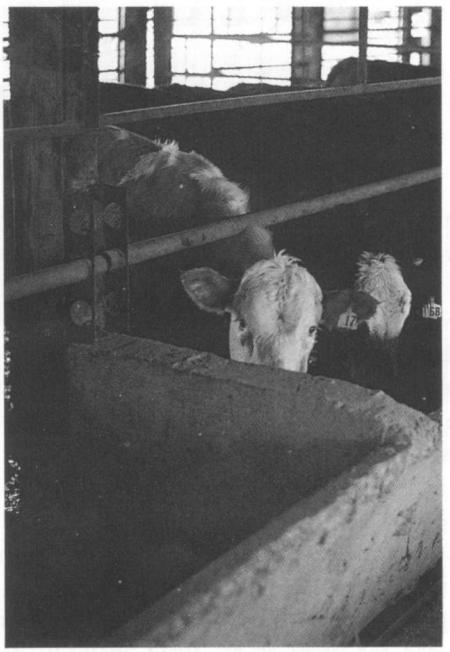
Start[1]	Energy partition (pct.)			
	Ceiling fan		No-fan	
	Electricity	Gas	Electricity	Gas
6	14.7	85.3	13.3	86.7
6	16.8	83.2	12.9	87.1
11	11.1	88.9	9.7	90.3
11	8.2	91.8	7.1	92.9
71	18.8	81.2	18.4	81.6
71	17.7	82.3	16.6	83.4
88	18.8	81.2	13.9	86.1
88	21.7	78.3	15.1	84.9
216	68.7	31.3	56.1	43.9
216	41.0	59.0	57.0	43.0
295	15.3	84.7	18.4	81.6
295	22.7	77.3	17.1	82.9
Total	17.3	82.7	15.0	85.0

[1]Calendar day on which each trial was initiated.

Flood and Koon are Associate Professors and Trumbull is a former Research Associate in Agricultural Engineering. Brewer is Department Head and Professor of Poultry Science.

D.L. Rankins, Jr., S.E. Peacock, and J.T. Eason

Special Diets Boost Growth of Stocker Calves



Each year, thousands of calves are purchased from sale barns during the fall and fed or grazed throughout the winter as stocker cattle to sell in the spring. Often these calves lose weight or make slow gains during the first month after purchase, but AAES research indicates that feeding them specially formulated diets can provide a boost in growth.

Most calves purchased at sales are newly weaned and have encountered numerous stressful events (shipping, vaccination, separation from mother, etc.) one to two weeks prior to purchase. Careful dietary management during the first 28 days is vital for reducing sickness and death. Several commercial receiving diets for young calves and several options for on-farm mixing are available to producers. A study was conducted at the Sand Mountain Substation in Crossville to evaluate four receiving diets for newly purchased calves.

Feed Consumption and Gains of Calves Fed Receiving Diets During First 28 Days After Purchase[1]

Intake	Diet			
	Commercial	On-farm(OF)	OF+molasses	OF+yeast culture
	Lb./day	*Lb./day*	*Lb./day*	*Lb./day*
Week 1	9.0	9.1	8.8	8.6
Week 2	9.5	9.5	10.1	10.4
Week 3	11.1	11.4	11.6	11.9
Week 4	13.8	12.9	13.8	12.8
Avg.	10.8	10.7	11.1	10.9
ADG[2]	3.11	3.41	3.00	3.02
Feed/gain	3.47	3.14	3.70	3.61

[1]Feed cost per pound gained was: Commercial = 40 cents; OF = 28 cents; OF+molasses = 33 cents; and OF+yeast culture = 32 cents.
[2]Average daily gain.

Ninety-six calves (average weight 300 pounds) were purchased in November 1993 from local stockyards and transported to the substation that evening. Half of the calves were purchased on Nov. 1 and the other half on Nov. 8. Calves were assigned to one of four receiving diets : (1) commercial pellets, Master Mix™ Stressfighter™ II; (2) 37% cracked corn, 30% ground alfalfa, 20% cottonseed hulls, 9% soybean meal and AS-700™, Dyna-K™, salt, and minerals; (3) diet 2 with 6% molasses added; and (4) diet 2 with 0.5 pound of Diamond V™ yeast culture added per head per day. The commercial pellets contained at least 12% crude protein, and the other three diets contained 14% protein. The diets were offered twice daily. For the first seven days each pen of calves also was offered 50 pounds of bermudagrass hay (approximately seven pounds per day), all of which was consumed.

All diets provided excellent results. Calves consumed from 8.6 to 9.1 pounds of dry matter per day during the first week, which is equivalent to approximately 3% of body weight. No differences were detected between males and females. For the entire 28-day trial, the calves gained more than three pounds per day while consuming 10.7 to 11.1 pounds of feed. This resulted in 3.1 to 3.7 pounds of feed per pound of gain (see table).

Using fall 1993 feed prices, the cost per pound of gain was approximately 30 cents for the three on-farm diets and 40 cents for the commercial pellets. Animal performance was not significantly different on any of the diets. The only major difference was in cost per pound of gain and, if on-farm mixing is not available, the additional $45 per ton may be acceptable for having the convenience of a pelleted, bagged feed.

Of the 48 calves purchased on Nov. 1, six showed signs of "shipping fever" during the first week and received an injection of Naxcel™. The second group of 48 calves exhibited more sickness, and all calves were given two injections of penicillin and vitamin B_{12} the first week on test. In addition, 10 calves received Naxcel™.

Newly purchased and transported calves usually consume only 0.5-1.5% of their body weight per day during the first one to two weeks on feed. In this trial, calves consumed more than 3% of body weight daily for the entire 28 days. This is probably attributable to good feed bunk management and immediate treatment of sick animals.

All four diets provided economical gains in these light-weight calves even though the diets cost $160 to $210 per ton. The reason is that this type of calf is very efficient at converting feed to body protein when sickness has been eliminated. Therefore, feeding diets designed specifically for receiving calves is well worth the extra feed cost. With a good dietary management and health program, newly received calves can gain rapidly during the first 28 days, rather than gaining slowly or losing weight.

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AU GroundCover: New Caley Pea a Boon for Producers

The use of legumes in forage and row crop production is nothing new to the Southeast, but many producers are expressing renewed interest in using legumes in place of commercial fertilizers to reduce production costs and protect the environment. Legume options will soon be expanded by the release of a new commercial caley pea cultivar — AU GroundCover.

AAES and Soil Conservation Service (SCS) researchers developed AU GroundCover, which will be available for the 1995 fall planting season. Although caley pea has been used for years as a livestock forage and cover crop in the Southeast, no commercial cultivars have been available. The only commercial source of seed has commonly been a mixture of vetch and caley pea.

Caley pea — also called wild winter pea, singletary pea, or rough pea — is a cool-season annual legume introduced from the Mediterranean. Research has shown that forage yields in johnsongrass and dallisgrass hayfields increase more with caley pea than with any other cool-season legume, and forage production season is lengthened when forages are grown in conjunction with this legume. Caley pea also is valuable as silage, a temporary ground cover, a green manure crop on land to be replanted in mid- to late spring, and a source of food for wildlife.

Caley pea grows well on the heavy clay soils of the lower Mississippi Delta and on calcareous clay soils of the Alabama and Mississippi Black Belt regions, where it is well adapted and readily reseeds. The caley pea's hard seed coat allows natural reseeding when stands are not heavily grazed before the seed production period. Caley pea can be successfully grown in areas too wet or too calcareous for most annual clovers, but also is tolerant of mildly acidic soils.

Development of AU GroundCover began in 1983 when a collection of caley pea and other legume cover crops was assembled at the SCS Americus Plant Material Center in Georgia for initial screening evaluations. Selected ecotypes, or localized plant types, were tested for forage yield, maturity, canopy height, composition, and diseases beginning in 1989. These tests were conducted in Americus and at AAES research units in Winfield, Belle Mina, Marion Junction, Tallassee, and Monroeville.

The AU GroundCover cultivar was developed from these selections and evaluated. During these evaluations, AU GroundCover yielded as much forage as commercial hairy vetch (see table) and performed well in clipping trials at each location. AU GroundCover has a crude protein content of about 20% at flowering time and flowers at about the same time as hairy vetch. The plants have purplish flowers, light green foliage, and develop canopies nearly 30 inches tall at flowering time.

AU GroundCover

Studies indicate that initial growth is slow until late winter, when rapid growth begins. The results also show that scarified seed should be used to initially establish stands.

The development of this new cultivar may be a boon for producers who are using legumes to boost production, reduce costs, and protect the environment.

Mosjidis is an Associate Professor and Ball is a Professor of Agronomy and Soils. Owsley and Kirkland are Manager and Assistant Manager, respectively, of the SCS Americus Plant Materials Center. Rogers is an SCS Agronomist based in Alabama.

Average Forage Yield of AU GroundCover and Commercial Hairy Vetch at Six Locations in 1992 and 1993

Entry	1992	1993
	Lb./a.	*Lb./a.*
AU GroundCover	3,169	3,159
Hairy vetch	3,748	2,837

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