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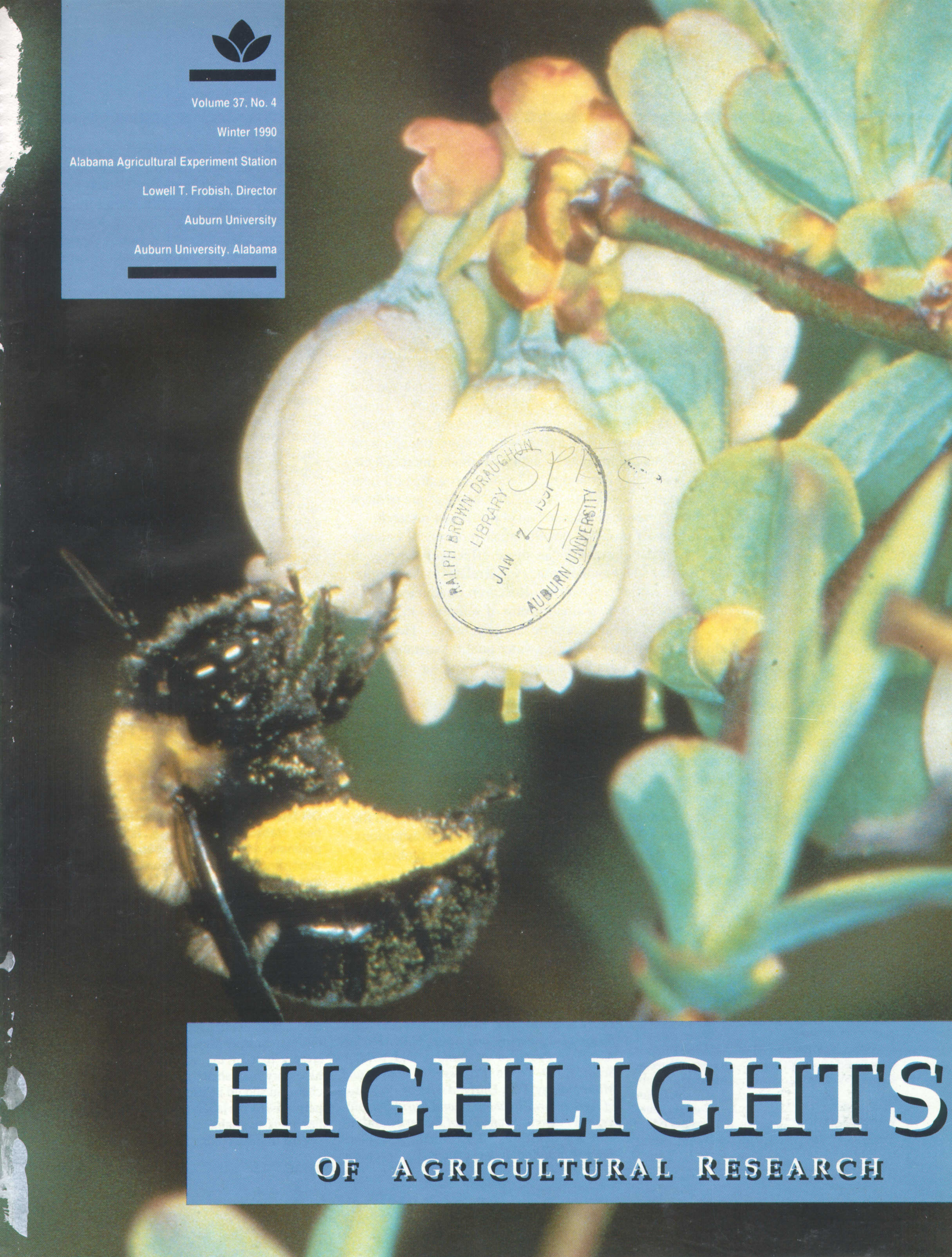
Alabama Agricultural Experiment Station

Lowell T. Frobish, Director

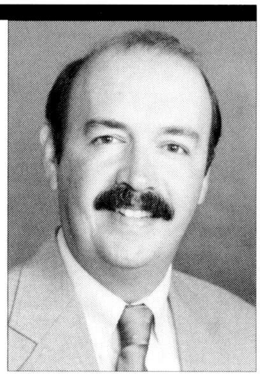
Auburn University

Auburn University, Alabama



HIGHLIGHTS
OF AGRICULTURAL RESEARCH

DIRECTOR'S COMMENTS



RUSSELL B. MUNTIFERING

IN THIS ISSUE of *Highlights of Agricultural Research*, I have the unique pleasure of being introduced to our readership as well as writing the section normally reserved for comments by the Director of AAES. Let me begin by telling you how glad I am to be here and how extremely proud I am to be a new member of the outstanding research team at Auburn University and the AAES. This research program has achieved State, national, and international recognition for its excellence in years past, and tremendous potential exists for further enhancing our research and development capabilities in the years ahead.

We often hear the question, "What is the proper balance between basic and applied research?" This is difficult to answer because we are often unable to distinguish between them on any simply objective basis. In my own research career, for example, there was really no way of knowing, except on a strictly subjective basis, whether my program dealing with forage digestion in ruminants endeavored to advance fundamental understanding of rumen microbial enzyme systems (i.e., basic), develop practical and economical feeding programs for beef cattle and sheep (i.e., applied), or both. The terms "basic" and "applied" are perhaps more appropriately used to describe approaches to rather than objectives of research.

Rather than deal with the question of program development in terms of balance between basic and applied research, I believe we can more effectively approach research program development from the standpoint of strategy as it relates to the solution of practical problems facing people in the real world. Research conducted by an individual scientist within one discipline or by a small group of scientists in closely related disciplines remains a cornerstone of scientific advancement. However, problems in food and agriculture are multifaceted (e.g., water quality, sustainability of the natural resource base, etc.) and require a more integrated "team" or "systems" approach.

Research programs in the future will need to be increasingly interdisciplinary and interdepartmental in nature, even to the extent of involving other agencies and/or institutions. Closer coordination will be needed with other State Agricultural Experiment Stations, USDA/ARS, and other Alabama universities to facilitate more effective team-building and avoid wasteful duplication of research efforts. Consequently, the major question to research program development will not be one of balance among orientations of various elements comprising the team (as in basic versus applied), but whether all the necessary functional elements (relevant scientific disciplines, other agencies/institutions, and Extension) are represented on the team and properly focused on a given problem.

Russell B. Muntifering
Associate Director

MAY WE INTRODUCE

Dr. Russell B. Muntifering, who joined the Alabama Agricultural Experiment Station as Associate Director on September 1, 1990. He came to Auburn from Montana State University, where he had served as Associate Director of that state's Agricultural Experiment Station since February 1988.

As a member of the administrative team that directs the AAES research programs, Muntifering will be responsible for developing and implementing a comprehensive review and evaluation system for AAES-funded projects. He will also have special responsibilities in the area of contracts and grants, involving the development of programs to enhance extramural funding and the identification of teams of scientists for pursuing extramural funding opportunities.

Muntifering is a graduate of the University of California at Davis (B.S. 1973 and M.S. 1975) and the University of Arizona (Ph.D. 1980). He was on the University of Kentucky Animal Sciences Department faculty during 1980-88, where he earned a national and international reputation for his research accomplishments in the area of animal nutrition. He has served in numerous leadership positions in the nation's system of State Agricultural Experiment Stations.

ON THE COVER. The southeastern blueberry bee, *Habropoda laboriosa*, is the primary pollinator of rabbiteye blueberries in Alabama, according to research reported on page 4 of this issue of *Highlights*.

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

J. S. Richburg III, R. H. Walker, and D. R. Wyatt

New Herbicide Affects Bahiagrass Cultivars Differently

BAHIAGRASS is commonly used in the Southeast for permanent pastures, hay, general purpose turfgrass, and as a rotation crop. However, when it becomes established in bermudagrass hayfields, bahiagrass is a pest that reduces yield and quality. In Alabama Agricultural Experiment Station tests, a new herbicide, Ally®, has provided excellent control about 40 days after application, but activity of the new material varies among bahiagrass cultivars.

BAHIAGRASS CULTIVAR RESPONSE TO ALLY HERBICIDE, TALLASSEE, 1990

Cultivar and Ally rate, oz./acre	Bahiagrass control			Leaf canopy height		
	24 DAT[1]	40 DAT	66 DAT	24 DAT	40 DAT	66 DAT
	Pct.	*Pct.*	*Pct.*	*In.*	*In.*	*In.*
Tifton 9						
0.00	0	0	0	12.4	15.9	15.7
0.42	72	95	99	5.2	4.5[2]	3.7[2]
0.85	79	97	99	4.8	4.1[2]	3.4[2]
Pensacola						
0.00	0	0	0	11.0	12.6	12.2
0.42	65	89	99	4.3	3.9[2]	3.0[2]
0.85	70	91	99	4.5	3.7[2]	3.1[2]
Argentine						
0.00	0	0	0	8.1	9.4	8.9
0.42	28	61	53	3.6	3.1[3]	5.4[4]
0.85	39	75	88	3.7	3.5[3]	2.9[3]

[1]DAT = days after herbicide treatment.
[2]Shorter heights indicate death of grass.
[3]Mixture of dead and green tissue.
[4]Regrowth after herbicide treatment.

Ally, which was granted Federal registration in the spring of 1990, is recommended for bahiagrass control at 0.3 oz. of formulated material per acre. In the tests, it provided excellent control of bahiagrass, but uncontrolled plants of what appeared to be broaderleaf cultivars reduced overall effectiveness.

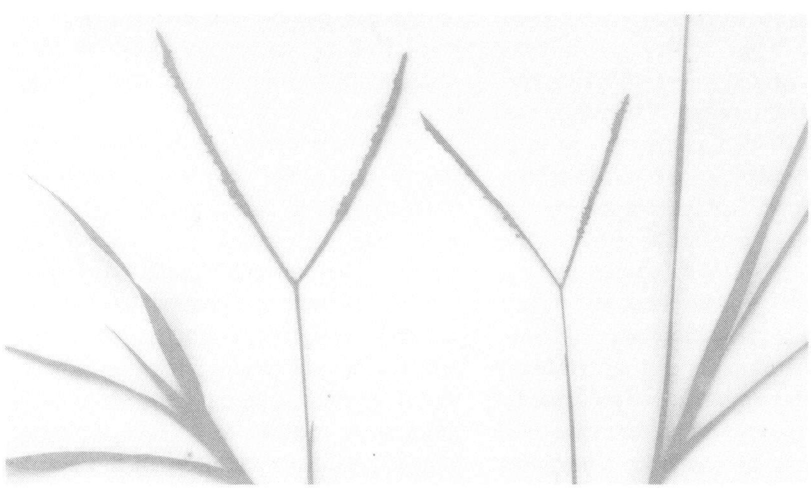
In the Experiment Station test, two rates (0.42 and 0.85 oz.) of Ally were applied to 1-year-old sods of Argentine, Pensacola, and Tifton 9 bahiagrass cultivars. Higher than recommended rates were used to determine the degree of tolerance. All treatments were delivered in a volume of 15 gal. per acre. Ortho X-77 nonionic surfactant was included at 0.25% by volume with all treatments. Weather conditions for the 66 days following applications were hot and dry, with 4.15 in. of rainfall.

Sixty-six days after treatment, Ally at 0.42 oz. controlled 99% of Pensacola and Tifton 9 bahiagrass. There was no significant increase in control with 0.85 oz. As reported in the table, however, Ally provided only 53% and 88% control of Argentine bahiagrass with 0.42 and 0.85 oz. per acre, respectively, 66 days after treatment.

Leaf canopy height of nontreated Pensacola, Tifton 9, and Argentine bahiagrass increased threefold from the initial measurements. Leaf canopy heights of all treated cultivars did not increase after treatment with either rate of Ally 40 days after treatments. Leaf canopy heights taken 40 and 66 days after treatment showed some dead tissue on Pensacola and Tifton 9 cultivars. However, approximately 60 days after treatment, regrowth of Argentine bahiagrass was observed with the 0.42-oz. rate. Leaf canopy heights taken 40 and 66 days after treatment with 0.85 oz. showed both dead and green tissue, as reported in the table.

Ally rapidly inhibited plant growth after treatment, but effective control of Pensacola and Tifton 9 cultivars was not obtained until 6 weeks later. However, regrowth and lack of control indicates Argentine bahiagrass is more tolerant of Ally. This research indicates the importance of knowing which cultivar of bahiagrass is involved when using Ally. Reduced effectiveness can be expected with broader leaf cultivars, such as Argentine.

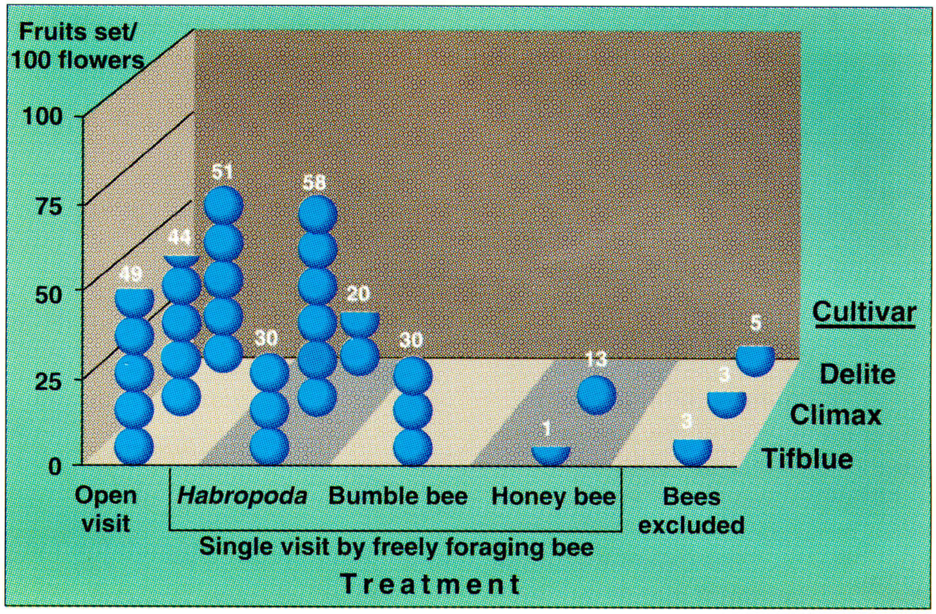
Richburg is Graduate Assistant, Walker is Professor, and Wyatt is Graduate Research Assistant of Agronomy and Soils.



Argentine bahiagrass (left) has shorter, wider leaf blades than Pensacola bahiagrass (right).

J. H. Cane and J. A. Payne

Native Bee Pollinates Rabbiteye Blueberry



Pollination frequency of rabbiteye blueberries by bee species.

RABBITEYE blueberries have become an important crop throughout Alabama. Commercial production is centered in Escambia County in the south and Clay County in the north-central part of the State. Despite its growing popularity, little was known about pollination of this fruit by native bees until recent cooperative research by the Alabama Agricultural Experiment Station and USDA Southeastern Fruit and Tree Nut Laboratory determined how and which bees are effective pollinators of southeastern blueberries.

Single bumblebees are efficient pollinators of blueberries.

Rabbiteye blueberries are most effectively pollinated by bees that vibrate the flowers to release pollen. Bees shiver their flight muscles to produce the vibration, yielding an audible, high-pitched buzzing sound. Flowers of other fruit crops, such as peaches, are readily pollinated by honeybees and other bees that do not buzz flowers. However, pollen-bearing anthers of the blueberry flower, like those of tomatoes, are peculiarly constructed. Pollen is held internally, and can only exit via pores at each anther's tip. Pollen jets out when flowers are vibrated, as by a buzzing bee.

Most of the 26 species of bees collected at rabbiteye flowers during this research were too uncommon to be significant blueberry pollinators. Bee species that regularly collect blueberry pollen do so by buzzing the flowers as they imbibe nectar. Notable exceptions are carpenter bees and honeybees. Carpenter bees invariably rob blueberry nectar by piercing a slit (robbery hole) in the flower and are of no value for pollination. Honeybees prefer to use these holes to access the blueberry's nectaries. Even at intact virgin blueberry flowers, single floral visits of honeybees may yield no more rabbiteye blueberries than that expected when all bees are excluded from a bush, as illustrated by the graph.

Individual bumblebees can be excellent pollinators of wild and domestic blueberries. However, because rabbiteye blueberries bloom early in the spring, only queens which have wintered over are active (colonies are not perennial). Each large bumblebee queen represents a potential future colony of hundreds of smaller workers, but only later in the season. Pollination experiments reported in the graph show that bumblebee queens can efficiently pollinate rabbiteye blueberries. However, their sparsity limits their commercial pollination value.

The most widespread, abundant, and efficient pollinator of planted rabbiteye blueberries is the native southeastern blueberry bee, *Habropoda laboriosa* (cover photo). They resemble small bumblebee workers (which are present later in the season). This bee is not known to use robbery holes. Females buzz most flowers that they visit, foraging daily from early morning to sunset. In 4 years of single-visit experiments included in the graph, this bee has consistently been an efficient pollinator of rabbiteye blueberries.

Since the southeastern blueberry bee was previously not recognized as a pollinator of blueberries, its biology was unknown. Researchers have since documented females digging subterranean nest tunnels 1-2 ft. deep in sandy soils. This bee, like many solitary bees, has but one generation per year. Adults emerge during blueberry flowering time and are active for 3-5 weeks. Males, which have a pale spot on their faces, emerge first and search for females at flowers.

Two years of weekly censuses in four different habitats in Georgia and Alabama show that female southeastern blueberry bees specialize on wild and domestic blueberry flowers for their pollen and nectar needs. Unlike honeybees and bumblebees, they are not drawn to other concurrently flowering plants that compete with blueberries for pollinators. When blueberries are unavailable, however, female southeastern blueberry bees can turn to oak catkins for pollen and to redbud, jessamine, and rarely plum or peach flowers for nectar.

Cane is Associate Professor of Entomology; Payne is Research Entomologist, USDA Southeastern Fruit and Tree Nut Laboratory, Byron, Georgia.

T. P. Mack and M. G. Miller

Long-lasting Granular Insecticide The Most Effective Against Lesser Cornstalk Borers

When to apply granular insecticides to control lesser cornstalk borers (LCB) in peanuts often becomes a balancing act for growers. Late applications may allow LCB to damage peanuts before chemicals are applied and too early application may mean the insecticide degrades and LCB damage peanuts late in the season. Recent Alabama Agricultural Experiment Station (AAES) research indicates none of the currently available insecticides consistently last the necessary 60 days to provide adequate protection to pods. Lorsban® provided 19 to 50 days of control against infestations of LCB, depending upon environmental conditions, and was consistently the longest lasting insecticide available.

Soil sample from which lesser cornstalk borers were collected.

Since there are no insecticides to protect peanuts for the 60-day duration of time that LCB may feed on the crop, time of application of available materials is critical. It is equally critical for growers to know how long these insecticides remain toxic to LCB. However, determining length of effectiveness of a soil insecticide against a pest insect is challenging, due to immigration and emigration of the pest, predation and disease impact on pest abundance, and the effects of soil temperature and moisture on pesticide degradation. A bioassay developed by the AAES allows researchers to overcome many of these problems and determine the length of effectiveness of several common granular insecticides against LCB.

Experiments were conducted at the Wiregrass Substation, Headland, in conventionally tilled and planted Florunner peanuts in 1988 and 1989. Plots were eight rows wide by 50 ft. long. Treatments consisted of an untreated control, and each of the following granular insecticides: Lorsban, Dyfonate®, XRD-429, Mocap®, Force®, and Fortress®. Of these materials, only Lorsban and Dyfonate are labeled for use on peanuts. Insecticides were applied with a small-plot granular applicator.

The length of effectiveness of each insecticide was determined in the laboratory by collecting soil from each field plot and by exposing small larvae to it. One soil sample was collected from each plot about every 2 weeks. Each sample was collected by taking a 12-in.-wide by 4-in.-long by 1-in.-deep subsample from three randomly selected rows within each plot, as illustrated by the figure. The biweekly collection of soil from the field allowed researchers to determine the length of effectiveness of each insecticide under field conditions, since the collected soil had been exposed to the same conditions as normal soil in the field.

Toxicity was evaluated as follows: Small larvae were placed in 2-oz. plastic cups that were filled with a sample of field-collected soil to a depth of 0.5 in. Sorghum seedlings were placed in each cup as a food source for the larvae. Cups were kept in a controlled environment chamber for the assays, and the number of living larvae in each cup was determined at 72 hours. An effective treatment was defined as a treatment that decreased the percent survival of larvae compared with that of larvae exposed to untreated soil. Treatment effectiveness was evaluated for each of the biweekly sampling dates.

In 1988, 59 to 85% of larvae survived a 72-hour exposure to soil from untreated plots. Dyfonate and Lorsban were the only treatments that reduced larval survival at 5 days after application. Only Lorsban reduced survival at 19 days after application. No treatments reduced larval survival at 33 days after application.

Results in the table show that survival of larvae in untreated soil in 1989 ranged from 78 to 96%. Lorsban, XRD-429, and Dyfonate reduced larval survival at 6, 19, and 25 days after application. Lorsban was the only insecticide tested that reduced larval survival at 39 and 53 days after application, and it was the only insecticide that was effective for more than 14 days in both years of the test.

Mean Percent Survival of Lesser Cornstalk Borer Larvae Exposed to Insecticide-Treated Soil in Alabama, 1989

Insecticide, a.i./acre	Survival, by days after treatment					
	0	6	19	25	39	53
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Untreated	78	93	96	96	89	81
Lorsban[1] 15 G, 2.0 lb.	4	7	0	0	4	29
XRD-429 2G, 1.0 lb.	11	30	37	37	85	81
Dyfonate[1] 10G, 2.0 lb.	7	0	14	33	88	78
Force 1.5G, 0.3 lb.	26	59	33	81	78	88
Fortress 10G, 0.5 lb.	0	33	81	81	85	88
Mocap 15G, 3.0 lb.	74	85	89	78	85	89

[1]Labeled for use on peanuts.

Mack is Associate Professor and Miller is Research Associate of Entomology.

K. S. Rao and D. A. Roland, Sr.

Too Little Phosphorus in Laying Hen Diets Increases Risk of Bone and Kidney Problems

PROVIDING the correct amount of phosphorus in laying hen diets represents a serious problem for the poultry industry. Phosphorus is a costly feed ingredient, so using excess amounts is an unnecessary cost. On the other hand, using too little phosphorus can increase the risk of bone and kidney disorders of hens. Such health problems can result in much greater financial losses than the cost of adding adequate dietary phosphorus to layer feed.

Producers are taking risks when feeding marginal levels of phosphorus.

The biochemical reaction brought about by a dietary deficiency of phosphorus was identified in a recent Alabama Agricultural Experiment Station study. Reducing dietary phosphorus to deficient levels caused the hens' urine to contain 3 to 5 times the normal concentration of calcium. This excess calcium in the urine in some situations may cause severe kidney disorders. In addition, increased excretion of calcium may deplete the calcium reserves from bones, causing weak bones. These conditions reduce egg production and the productive lifetime of hens, representing a sizable economic loss to egg producers.

The effect of dietary phosphorus deficiency was studied by comparing four dietary treatments fed to Hyline W36 hens. The test diets were combinations of two levels of calcium (4% and 6%)[1] with two levels of total phosphorus (0.3% and 0.6%)[2]. The four treatments were: (1) 0.3% phosphorus with 4% calcium, (2) 0.3% phosphorus with 6% calcium, (3) 0.6% phosphorus with 4% calcium, and (4) 0.6% phosphorus with 6% calcium.

Results were measured in terms of blood and urine analyses, since these measurements are related to bone and kidney conditions. Urine and blood samples were collected from each feeding group at time of egg laying and 7, 14, and 21 hours later. These collections were made at 3 and 10 days after feeding the experimental diets.

The analyses measured urine pH, urine calcium, blood plasma inorganic phosphorus, and plasma ionic calcium. The data, given in the table, show large differences between the deficient (0.3%) and adequate (0.6%) phosphorus levels in the diet. These differences reflect the detrimental effects of the phosphorus-deficient diets. Differences in blood and urine analyses resulting from calcium dietary differences are also obvious in the data.

Effect of Phosphorus (P) and Calcium (Ca) Levels in Diet on Urinary Ca, Plasma Ionic Ca (Ca^{++}), and Inorganic P (Pi) of Commercial Layers

Measure	Content[1] (milligrams/deciliter), by dietary level of Ca and P			
	4% Ca & 0.6% P	4% Ca & 0.3% P	6% Ca & 0.6% P	6% Ca & 0.3% P
3rd day sampling				
Plasma Ca^{++}	6.2	6.3	6.3	6.6
Plasma Pi	4.8	3.3	4.7	2.4
Urinary Ca	48.7	140.2	64.9	214.4
10th day sampling				
Plasma Ca^{++}	5.8	6.4	6.4	6.5
Plasma Pi	6.7	4.1	7.1	3.8
Urinary Ca	41.6	98.8	67.4	154.0

[1]Average of samples collected 0, 7, 14, and 21 hours after egg laying.

Feeding the low dietary level of phosphorus (0.3%) caused two calcium-associated problems, regardless of calcium level fed: (1) calcium content of the urine was increased, and (2) urine was alkaline throughout the cycle of ovulation through lay. These two happenings may lead to kidney damage since alkaline urine that contains high amounts of calcium causes the formation of solids that may block the narrow tubules and ureters. This is the first reported finding of high urinary Ca in laying hens caused by low dietary phosphorus.

Extra calcium in the diet magnified the detrimental effect of deficient dietary phosphorus, as shown by data in the table. Low phosphorus with 4% calcium increased calcium content of urine threefold, whereas the same phosphorus level with 6% calcium increased it fivefold. This was the result with third-day urine samples. On the tenth day, highest calcium concentrations in urine were in hens consuming a diet with inadequate phosphorus (0.3%) and excess calcium (6%). These results suggest that hens consuming a diet containing low phosphorus and excess calcium would be under highest risk to suffer from kidney disorders.

Deficient phosphorus in the diet resulted in hens having lower concentrations of plasma inorganic phosphorus than with hens fed adequate phosphorus. This is believed to be the primary cause in stimulating hens to increase calcium excretion through the urine. It is not known whether this excess calcium comes from bone reserves directly or from the digestive system. In either case it is undesirable; if from feed it is uneconomical because of the calcium requirement for bone and egg shell formation, if from bone reserves it is damaging to hens.

Several factors may be involved in whether a feed formulation provides adequate phosphorus or is deficient. Among these are (1) variation in feed consumption because of environmental changes, (2) natural variation in individual feed consumption, and (3) variation in phosphorus bioavailability from plant and animal sources. Based on the results reported, however, producers are taking risks when feeding marginal levels of phosphorus.

[1]Calcium—4% is adequate, 6% is excess.
[2]Phosphorus—0.3% is inadequate, 0.6% is adequate.

Rao is Post-Doctoral Research Fellow and Roland is Professor of Poultry Science.

J. A. Plumb and Y. J. Brady

Diseases of Catfish Follow Seasonal Trend

INFECTIOUS diseases are among the greatest deterrents to further expansion and intensification of Alabama's growing channel catfish culture enterprise. Growth in total production since 1970 has come from farmers converting row crop and pasture lands to ponds and from intensification of culture systems. Higher stocking and feeding rates from intensified production result in greater production per acre, but also lead to conditions conducive to increased incidence of infectious diseases.

During 1983-89, the infectious disease incidence of catfish in Alabama was studied in an Alabama Agricultural Experiment Station survey of the industry. Data were collected from the Fish Disease Diagnostic Laboratory at Auburn and from the Fish Farming Center in Greensboro. Catfish production data (pounds of fish passing through processing plants) were supplied by the Alabama Cooperative Extension Service.

Approximately 700 catfish disease cases were detected in Alabama in 1983, but by 1989 these numbers had risen to 1,393 cases. As illustrated by figure 1, this upward trend in disease incidence occurred concurrently with the expansion of the aquacultural industry. The disease cases included those caused by viruses, bacteria, fungi, and parasites, along with numerous non-infectious problems.

Although the number of catfish disease cases nearly doubled during the 7-year survey period, production of catfish in Alabama nearly tripled. This relationship is demonstrated by the ratio of pounds of fish produced per disease case in 1983 when it was 24,096 lb. per diagnosed disease incident to 1989 when the production was 32,304 lb. per case. (The ratio of disease cases was 4.15 per 100,000 lb. of fish in 1983, but only 3.10 cases per 100,000 lb. in 1989.)

As reported in the table, bacterial diseases were the most important group of pathogens throughout the study, but parasitic problems were only slightly less except in 1988 and 1989. Routine and non-infectious problems contributed over 40% of the cases early in the study, but only 20% in 1988 and 1989. These findings, along with disease incidence reduction data, indicate fish farmers improved their ability to prevent water quality deterioration and other environmental problems that promote disease development during the survey years.

Disease Trends in the Catfish Industry from 1983 Through 1989

Disease types	Incidence, by year						
	1983	1984	1985	1986	1987	1988	1989
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Routine and non-infectious diseases	44	43	38	34	31	20	20
Infectious diseases							
Bacterial	30	33	30	38	40	54	50
Parasitic	24	23	31	27	28	25	28
Virus	2	1	1	1	1	1	2
Total number of cases[1]	*703*	*739*	*968*	*992*	*1,171*	*1,309*	*1,393*

[1]Each case represents the examination of one or more fish from a single pond on a given day.

Infectious diseases of catfish in Alabama are seasonal and generally begin to increase in April when water temperatures begin to warm, figure 2. This time of year coincides with spawning season when there is an abundance of young, highly disease-susceptible fish. In addition, spawning activities incite some infectious diseases and fish that have been kept through a winter have lower natural resistance.

The incidence of disease reached a peak in June when over 20% of the annual cases occurred. As water temperatures reached a maximum in July and August, the higher temperature had a beneficial effect on the catfish and a detrimental effect on many fish pathogens. As water temperatures decreased in September and October, the disease incidence increased before declining to its lowest level of the year in winter.

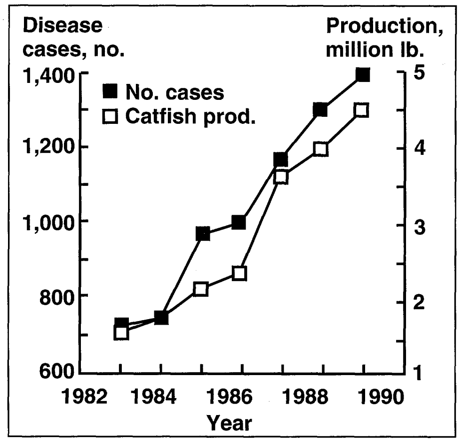


FIG. 1. Number of diseased catfish and catfish production in Alabama, 1982-90.

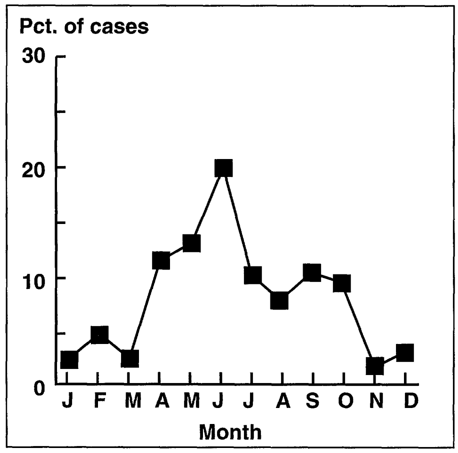


FIG. 2. Monthly occurrence of catfish disease cases in Alabama.

During the 7-year survey, it was learned that enteric septicemia of catfish (caused by *Edwardsiella ictaluri*) was the most frequent and serious disease. This is a seasonal disease that occurs when water temperatures are from 72 to 82°F; therefore, it contributed substantially to the two disease incidence peaks during May and June and September and October, figure 2.

These results showing the seasonal occurrence of infectious disease of cultured catfish offer fish farmers opportunities to minimize the impact of these diseases through careful management and properly timed disease prevention practices.

Plumb is Professor and Brady is Assistant Professor of Fisheries and Allied Aquacultures.

C. C. Mitchell and G. L. Mullins

Sulfur Fertilization Needed by Wheat on Coastal Plain Soils

Wheat stand shows the effects of sulfur deficiency.

IN LATE WINTER and early spring, growers sometimes observe sulfur (S) deficiencies in wheat grown on Coastal Plain soils in south Alabama. Rapid, above-ground growth during late winter, limited root growth into S-rich subsoils, and low S in the sandy topsoils promote S deficiencies in wheat at this time of year.

Sulfur is currently recommended at 10 lb. S per acre for all crops and soils of Alabama. Source, time, and method of application are not specified by the Auburn University Soil Testing Laboratory. By the time S deficiencies are observed in the field, growers may have already applied a topdressing of nitrogen (N).

To help growers identify appropriate S sources, rates, and time of application for winter wheat on Coastal Plain soils, a study was done by the Alabama Agricultural Experiment Station at two locations (Brewton Experiment Field and Wiregrass Substation) for 3 years.

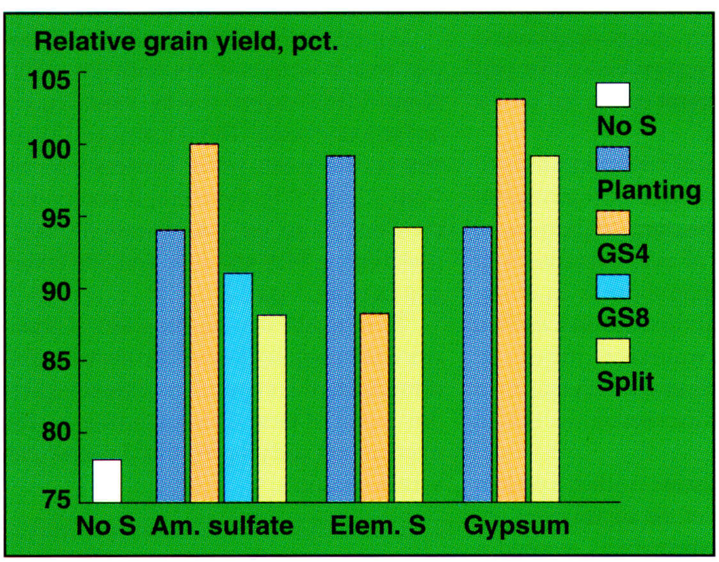
Three sources of S were evaluated:

1. Ammonium sulfate (24% S) at rates to supply 0, 10, 20, and 40 lb. S per acre.
2. Elemental S as dry, wettable powder (90% S) applied at 20 lb. S per acre.
3. Agricultural gypsum (16% S) at 20 lb. S per acre.

All materials were applied at planting, at Feeke's growth stage 4 (GS4), or as a split application (half at planting and half at GS4). Feeke's growth stage 4, the recommended time for normal N topdressing, is when the plant is fully tillered but just before rapid spring growth begins. Ammonium sulfate was also applied at Feeke's growth stage 8 (GS8), a stage immediately before flag-leaf emergence. The purpose of the GS8 application was to evaluate the effect of a late, corrective S application. Supplemental N as ammonium nitrate was applied to supply a total of 20 lb. N per acre at planting in the fall and 70 lb. N per acre at GS4.

Caldwell wheat was planted in 1986 and McNair 1003 wheat was planted in 1987 and 1988. Plant analysis was used to monitor N and S concentrations in whole plants. Soil samples were taken to 18 in. and tested for extractable sulfate S after the second year of the test.

Yield increases in response to S fertilization were obtained each year at each location. The highest yields (50 bu. per acre) were produced at Brewton in 1989. The highest average relative yield during the 3-year study was produced when either ammonium sulfate or gypsum was applied as a topdressing at GS4, as shown in the graph. Elemental S applied at planting and gypsum applied in split applications produced average yields only slightly less than the sulfate source at GS4. The application of S at GS4 is consistent with the recommended timing of topdress N application on wheat in Georgia and Alabama.



Sources and times of sulfur application to wheat at Brewton.

A delay in applying S in years when S deficiencies may occur could result in significant yield and profit losses. However, a GS8 application could salvage an S-deficient crop. As expected, a reduced yield potential due to S deficiency could not be totally corrected by a late application of ammonium sulfate at GS8.

Ammonium sulfate applied at GS4 produced maximum grain yields at a rate of approximately 25 lb. S per acre. If ammonium sulfate was applied in split applications, about 40 lb. S per acre were needed to produce the same yield because much of the fall-applied S was leached out of the rooting zone by the time rapid spring growth began.

These results suggest that applying at least 20 lb. S per acre as a sulfate source when topdressing wheat at Feeke's growth stage 4 can help avoid S deficiency on sandy Coastal Plain soils. Rates as high as 40 lb. S per acre may be needed if S is applied in split applications. Elemental S could be applied at planting. A corrective S application at GS8 will not compensate for a preventative S application at GS4. In these experiments, soil tests could not be used to predict S fertilization response on sandy, Coastal Plain soils, but whole plant samples were useful in identifying S deficiencies.

Mitchell and Mullins are Assistant Professors of Agronomy and Soils.

J. R. Weeks, J. C. French, and A. K. Hagan

Virus Vectoring Thrips Common in Alabama Peanut Fields

TOMATO SPOTTED wilt virus (TSWV) remains a serious threat to Alabama peanuts. Though the virus is widespread in Alabama, it has not caused serious yield losses comparable to those occurring in Texas in the mid-1980's and more recently in Georgia. However, because of the potential for destruction, Alabama Agricultural Experiment Station research continues to seek more information about TSWV.

Tobacco thrips and western flower thrips, two of five species known to vector TSWV in peanuts, have commonly occurred in peanut samples taken in Alabama since 1987. Tobacco thrips, figure 1, was consistently the most abundant species found, as noted in the table. Prior to 1987, western flower thrips was not known to infest Alabama peanut fields. Two other species of the same genus as tobacco thrips commonly occur, but are not known to be vectors of TSWV.

Since tobacco and western flower thrips have been the most abundant species found in weekly samples, the potential exists for significant spread of TSWV. However, results indicate thrips populations peak 2-4 weeks after peanut emergence and decline sharply after 6 weeks, figure 2. Based on early TSWV infection, 1% or less of thrips migrating into peanut fields caused the initial infection levels found in peanuts in early June.

Tests were conducted at the Wiregrass Substation in Headland and at three grower sites. Five samples were taken from each plot and five peanut terminals were taken from each sample. These terminals were washed in an alcohol solution and thrips were filtered out and counted.

Thrips damage to peanuts is characterized by feeding in the unfolded new leaves. This causes scarred, deformed leaves, illustrated in figure 3, and results in seedling peanuts being stunted.

Insecticide treatments also are being evaluated for control of thrips and subsequent effect on TSWV. Tests were conducted in 1988 and 1989 to evaluate the efficacy of in-furrow-applied insecticides and foliar sprays to control thrips. Although most treatments reduced thrips populations, these reductions had no significant effect on the level of TSWV found in those plots. Since TSWV infection levels have remained below 5% each year since 1986 in Alabama peanuts, there appears to be no economic benefit to using supplemental applications of insecticides to reduce thrips populations.

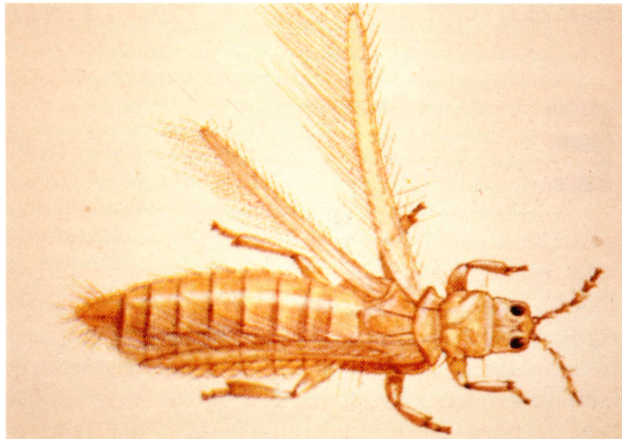


FIG. 1. Thrips in the adult stage.

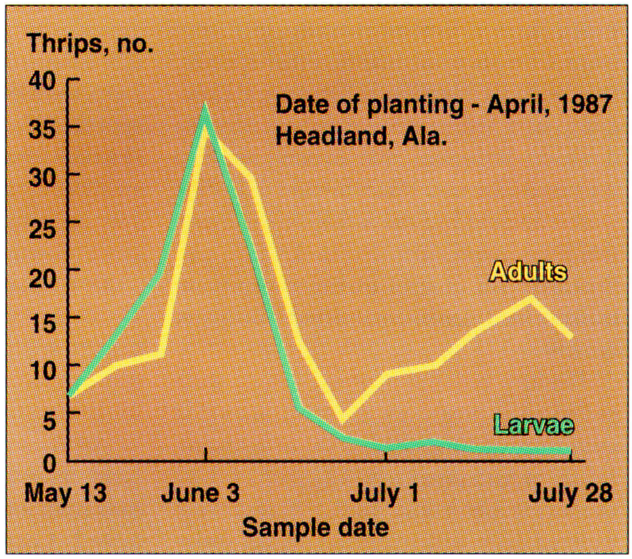


FIG. 2. Seasonal abundance of thrips on peanuts.

Species of Thrips Found on Peanuts in Alabama, 1989

Date	Total thrips/5 blooms	Tobacco thrips	Western flower thrips	Other non-vectors
	No.	*Pct.*	*Pct.*	*Pct.*
5/15	7.0	69	28	3
5/23	3.6	86	13	1
5/30	5.0	80	18	2
6/6	34.0	69	25	6
6/13	9.0	62	27	11
6/20	7.7	65	14	21
6/27	14.5	64	6	30
7/6	10.7	50	9	41
7/12	15.3	71	7	22
7/19	30.0	88	4	8
7/26	21.0	93	3	4

FIG. 3. Typical peanut foliage damage caused by thrips.

Weeks is Associate Professor and French is Professor of Entomology; Hagan is Associate Professor of Plant Pathology.

A. K. Hagan, J. W. Olive, and W. J. Foster

NEW FUNGICIDES CONTROL LEAF SPOT ON PHOTINIA

ENTOMOSPORIUM leaf spot is a common and often destructive disease of red tip photinia in Alabama. Erratic control of the disease on nursery stock treated with registered fungicides has increased concern among nurserymen. In Alabama Agricultural Experiment Station tests, Nova®, a nonregistered sterol-biosynthesis inhibiting fungicide, provided slightly better leaf spot control on photinia than the registered fungicides.

Daconil® is the most commonly used fungicide for Entomosporium leaf spot control on photinia, and on other species, such as India hawthorne, loquat, and flowering pears, which also are damaged by this disease. Triforine® and Zyban® are also registered for use. Daconil and Triforine were compared to the sterol-biosynthesis inhibiting fungicides Nova, Lynx®, and Spotless® for control of Entomosporium leafspot and detrimental effects on plant growth.

Healthy red tip photinia liners were potted in a pine bark medium amended with 6 lb. of limestone, 2 lb. of gypsum, 1.5 lb. of Micromax, and 12 lb. of 17-7-12 Osmocote per cubic yard. Plants were watered daily with overhead impact sprinklers and Entomosporium leaf spot was introduced into blocks of test plants.

Disease incidence was measured on a visual rating scale of 1-12, in which 1 = 0% and 12=100% of leaves infected. Growth index was calculated by the formula height + width 1 + width 2 ÷ 3. Disease ratings and plant dimensions were taken both years approximately 2 weeks after the final fungicide application.

In 1988, three rates of Spotless 25W, Lynx 1.2E, and Nova 40W and a single rate of Daconil 2787 4.17F and Triforine 1.6E, applied at 2-week intervals from April 7 through August 28, were evaluated. All fungicides reduced leaf spot incidence compared with the nonsprayed control plants; however, there were significant differences in disease control among the fungicide treatments, table 1.

Overall, Nova gave the best protection from Entomosporium leaf spot and proved equally effective in reducing disease at three different application rates. In addition, no effects on plant growth were seen with any application rate of Nova. Levels of disease control with all rates of Nova were superior to those given by Daconil and Triforine.

Although Spotless reduced the incidence of Entomosporium leaf spot, plant growth was greatly reduced at all rates of this fungicide. Triforine and all rates of Lynx were less effective in controlling leaf spot than Nova and Daconil. Surprisingly, Daconil-sprayed plants were about 20% smaller than unsprayed control plants. Lynx and Triforine had no adverse effects on plant growth.

In 1989, three rates of Nova applied at 1-, 2-, and 4-week intervals, along with weekly applications of Daconil and Triforine from May 9 to July 28, were evaluated for control of Entomosporium leaf spot.

All rates of Nova applied at 1- and 2-week intervals effectively protected photinia from infection by the leaf spot fungus, table 2. Leaf spotting increased sharply as the interval between applications was increased from 2 to 4 weeks. Weekly applications of all rates of Nova gave disease control similar to that provided by Daconil, and only the highest rate (10 oz. per 100 gal. of water) applied weekly reduced growth. Triforine failed to control this disease.

Nova, across a range of application rates, gave clearly superior protection against Entomosporium leaf spot than the other sterol-biosynthesis inhibiting fungicides tested. The other fungicides tested did not reduce disease as effectively as Nova or Daconil, or they greatly reduced plant growth. Leaf spot control with Nova was equal to slightly better than with Daconil at identical spray intervals and was superior to control with Triforine. However, plant growth was slightly reduced by weekly applications of some rates of Nova.

TABLE 1. EFFECTS OF SEVERAL NEW FUNGICIDES ON ENTOMOSPORIUM LEAF SPOT AND ON GROWTH OF PHOTINIA, 1988

Fungicide and rate/100 gal.	Disease incidence[1]	Growth index[2]
Spotless 25W[3]		
0.25 lb.	4.5	28.2
0.5 lb.	3.4	24.6
1.0 lb.	2.8	20.8
Lynx 1.2E		
0.2 fl. oz.	5.1	61.5
0.4 fl. oz.	4.5	53.8
0.8 fl. oz.	6.0	56.1
Nova 40W[3]		
2.5 oz.	1.9	68.6
5.0 oz.	2.1	62.3
10.0 oz.	2.0	56.1
Daconil 2787 4.17F		
2.0 pt.	3.6	49.1
Triforine 1.6E		
12.0 fl. oz.	6.5	58.5
Nonsprayed control	8.5	58.5

[1]Disease incidence was measured on a scale of 1-12 (1=0% and 12=100% of the leaves diseased).
[2]Growth index = height + width 1 + width 2 ÷ 3.
[3]Penetrator 3 adjuvant was added to all Spotless and Nova tank-mixes at a rate of 0.5% (v/v).

TABLE 2. EFFECTS OF APPLICATION RATE AND SPRAY INTERVAL OF NOVA FUNGICIDE ON ENTOMOSPORIUM LEAF SPOT AND GROWTH OF PHOTINIA, 1989

Fungicide and rate/100 gal.	Disease incidence[1]	Growth index[2]
Nova 40W, 2.5 oz.[3]		
Sprayed weekly	1.0	56.4
Sprayed every 2 weeks	1.8	59.3
Sprayed every 4 weeks	5.3	60.4
Nova 40W, 5.0 oz.[3]		
Sprayed weekly	1.0	49.6
Sprayed every 2 weeks	1.0	50.7
Sprayed every 4 weeks	3.0	60.4
Nova 40W, 10.0 oz.		
Sprayed weekly	1.0	40.1
Sprayed every 2 weeks	1.0	62.4
Sprayed every 4 weeks	4.1	54.9
Daconil 2787 4.17F, 2.0 pt.		
Sprayed weekly	1.3	57.8
Triforine 1.6E, 12 fl. oz.		
Sprayed weekly	4.1	57.0
Nonsprayed control	7.1	58.8

[1]Disease incidence was measured on a scale of 1-12 (1=0% and 12= 100% of leaves diseased).
[2]Growth index = height + width 1 + width 2 ÷ 3.
[3]Penetrator 3 adjuvant was added to all Spotless and Nova tank-mixes at a rate of 0.5% (v/v).

Hagan is Associate Professor of Plant Pathology; Olive is Superintendent and Foster is former Superintendent of the Ornamental Horticulture Substation.

R. H. Walker, D. R. Wyatt, and J. S. Richburg III

HOELON® EFFECTIVELY CONTROLS ANNUAL RYEGRASS IN WHEAT

ANNUAL RYEGRASS is a widespread weed that is detrimental to wheat production in Alabama. In fact, just 40 annual ryegrass plants per square yard reduce yields 19-26%. Therefore, control of this weed pest in wheat is justified.

Use of Hoelon® (diclofop) to control annual ryegrass has given promising results in tests during the past 2 years at the Alabama Agricultural Experiment Station. Two rates and four application timings were evaluated at the Prattville Experiment Field, Prattville, and Plant Breeding Unit, Tallassee, in 1988-89 and at the Black Belt Substation, Marion Junction, in 1989-90. Rates of Hoelon applied (noted in the table) were:

- 0.5 and 1.0 lb. active ingredient (a.i.) per acre surface applied preemergence (PRE) immediately after planting.
- 0.5 and 1.0 lb. a.i. postemergence (POT) at either the 2-leaf, 4-leaf, or 8-leaf ryegrass stage.
- A nontreated control and a hand-weeded control were used for comparison.

Wheat seed were planted at the rate of 70 lb. per acre in 7-in. rows and annual ryegrass seed (20 lb. per acre) were planted to provide weed populations. Planting dates and dates of herbicide application are listed in the box below for each location:

Prattville

Planting dates—9/22/88 and 10/22/89
PRE app.—9/23/88 and 10/22/89
POT app.—10/13, 10/26, and 11/11/89
12/4/89 and 1/3 and 2/6/90

Tallassee

Planting dates—10/28/88 and 10/25/89
PRE app.—11/1/88 and 10/25/89
POT app.—11/22 and 12/8/88 and 1/12/89
11/24/89 and 1/22 and 2/26/90

Marion Junction

Planting date—10/30/89
PRE app.—10/30/89
POT app.—12/5/89 and 2/28 and 3/13/90

Details on weed control, wheat yield, and test weight of wheat are recorded in the table.

In general, good weed control (up to 98%) resulted from Hoelon applications at two of the three locations, with the following exceptions:

1. At Prattville, the 0.5-lb. rate POT at the 4-leaf stage and the 0.5and 1.0-lb. rates POT at the 8-leaf stage gave only intermediate (80-85%) control.
2. At Tallassee, the 0.5-lb. rate POT to the 8-leaf stage gave an average of 76% control.
3. At Marion Junction, control was only 63% from the 0.5-lb. rate and 75% from the 1.0-lb. rate applied POT at the 8-leaf ryegrass stage.

Yields at Prattville and Tallassee were generally higher from postemergence applications than from preemergence treatments. At Marion Junction, yields were lower from the 1.0-lb. rate applied at the 4-leaf stage and from both rates at the 8-leaf stage. Variations at all locations are obvious in the table data.

Test weight for wheat showed little effect from annual ryegrass or the herbicide treatment. Hoelon-treated wheat at Prattville averaged 56-57 lb. per bushel, which was about the same as for nontreated or hand-weeded plots. Test weights, like yields, were lower at Tallassee, a reflection of delayed harvests caused by excessive rain in 1988-89. Test weights at Marion Junction were similar to those at Tallassee.

Results reported indicate that best control of annual ryegrass in wheat appeared to result from postemergence applications of Hoelon at 0.5 lb. a.i. per acre applied to 2- or 4-leaf ryegrass. Equal control at the 8-leaf stage required the 1-lb. a.i. per acre rate. The 1.0-lb. rate applied preemergence may have advantages for use in the Black Belt area because of difficulties with postemergence applications on sticky clay soils of the area.

Walker is Professor and Wyatt and Richburg are Graduate Research Assistants of Agronomy and Soils.

RYEGRASS CONTROL, WHEAT YIELD, AND TEST WEIGHT AS AFFECTED BY HOELON USE, THREE LOCATIONS, 1988-90

Hoelon rate/acre and application timing	Prattville, 2-year av.			Tallassee, 2-year av.			Marion Junction, 2-year av.		
	Control at harvest	Yield/ acre	Test weight/ bu.	Control at harvest	Yield/ acre	Test weight/ bu.	Control at harvest	Yield/ acre	Test weight/ bu.
	Pct.	*Bu.*	*Lb.*	*Pct.*	*Bu.*	*Lb.*	*Pct.*	*Bu.*	*Lb.*
Preemergence (PRE)									
0.5[1] lb.	93	58	57	92	55	50	86	48	46
1.0 lb.	98	61	56	96	54	50	95	51	50
Postemergence (POT)									
0.5 lb., 2-leaf	93	66	57	97	62	50	93	52	51
1.0 lb., 2-leaf	98	63	57	98	59	50	93	52	49
0.5 lb., 4-leaf	85	70	57	86	50	53	83	52	50
1.0 lb., 4-leaf	98	65	57	97	54	51	88	38	44
0.5 lb., 8-leaf	80	69	56	76	53	50	63	47	49
1.0 lb., 8-leaf	82	68	56	91	50	51	75	46	51
Hand weeded	90	68	57	83	58	50	93	49	48
Nontreated	0	58	56	0	47	49	0	38	42

[1]Rate of 0.5 lb. active ingredient per acre = 1.33 pt. Hoelon 3EC

M. C. Craig-Schmidt, T. A. Powe, J. A. Johnson, and H. C. Chaung

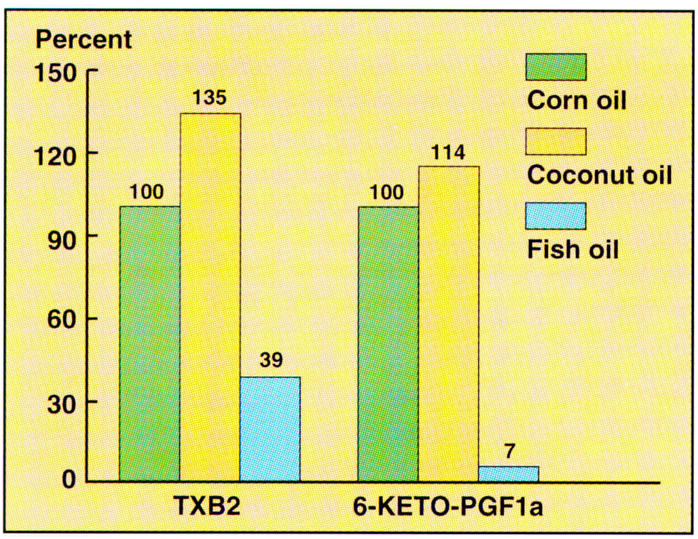
Fish Oil In Infant Diets May Benefit Lung Development

A GENERATION AGO mothers dutifully dosed their infants with cod liver oil to keep them healthy. But that practice went the way of high rear fins on automobiles. Now there is a new and growing interest in adding fish oil to infant formula for a different kind of health benefit.

Fish oils contain omega-3 fatty acids, and small amounts of these are present in breast milk. Thus, nutritionists have proposed that a source of these fatty acids be added to infant formula. These compounds are believed to play an essential role in the developing eyesight of infants, but the current interest is in protecting the health of lungs of newborns.

Newborn pigs were used as the model for studying the effects of fish oil on infants.

Omega-3 fatty acids in fish oil have the potential to serve as therapeutic agents in combating respiratory disease in the newborn. In asthma and other respiratory diseases, excessive amounts of compounds called eicosanoids are produced by the lungs. One of these, thromboxane A_2, causes narrowing of the airways in the lungs, thus making breathing more difficult. If omega-3 fatty acids provided in the diet could reduce production of thromboxane A_2 in the lungs, this would be beneficial to the infant suffering from respiratory disease.



Effects of dietary fish oil, coconut oil, and corn oil on lungs of infants were compared in the Auburn study.

Using newborn pigs as a model for the human infant, research at the Alabama Agricultural Experiment Station has investigated the effects of dietary fish oil on the production of thromboxane A_2 and other eicosanoids in the lung. Newborn pigs were chosen as the experimental animal because their physiology is similar to that of human infants in many respects.

Twelve male pigs (three from each of four litters) were assigned at 1 day of age to one of three milk-based dietary treatments:

1. Formula containing 20% of the solids as corn oil.
2. Formula containing 18% of solids as coconut oil and 2% as corn oil to provide adequate essential fatty acids. Coconut oil was chosen because its content of linoleic acid, the dietary precursor of eicosanoids, is similar to that of fish oil.
3. Formula containing 18% of solids as fish oil and 2% as corn oil.

Piglets were bottle-fed for 28 days. Lungs were examined and tested for their ability to produce eicosanoids. Two eicosanoids, thromboxane A_2 and prostacyclin, were measured in the inactive forms (thromboxane B_2 and 6-keto-prostaglandin $F_{1\alpha}$, respectively).

Effects of feeding fish oil were evaluated by comparing eicosanoid production in the fish oil treatment with that in animals fed standard corn oil-containing diets. Using a value of 100 for the corn oil diet group, production of the two eicosanoids was only 39% and 7%, respectively, when fish oil was fed. With coconut oil in the diet, production of the two eicosanoids was 135 and 114%, as illustrated in the graph.

Results of this research established that lung eicosanoid production can be manipulated by the choice of dietary fat. For an infant suffering from respiratory disease, feeding a formula containing fish oil may be beneficial because thromboxane production is suppressed. The question of whether fish oil supplementation is beneficial to the overall health of the infant, however, has not yet been answered.

Craig-Schmidt is Associate Professor of Nutrition and Foods; Powe is Associate Professor of Large Animal Surgery and Medicine; Johnson is Technician and Chaung is Graduate Student of Nutrition and Foods.

D. R. Brown, D. J. Eakes, and B. K. Behe

Moisture Stress Effective for Height Control of Vegetable Transplants

When consumers shop for vegetable transplants, they tend to prefer smaller, more compact plants. To achieve this ideal plant size, producers of vegetable transplants have often used chemical growth regulators. Daminozide (B-Nine®) was a common choice until recent label changes prohibited its use for vegetable transplants. This change effectively limited growers' choices for growth regulation and increased the need for alternatives that are economical, effective, and environmentally sound.

Several reports have proposed the use of moisture stress as an alternative to chemical growth regulators for height control. This procedure involves limiting the amount of moisture available to the plants so growth is stunted but plant visual quality is not impaired. Since little information comparing this option to the application of growth-regulating substances was available, an Alabama Agricultural Experiment Station study was conducted to compare moisture stress to B-Nine as a means of height control on two vegetable transplants in two commonly used commercial media.

Uniform plugs of Big Boy tomato and California Wonder pepper were transplanted into cell packs (48 cells per tray) on May 15, 1990. Cell packs contained either Fafard #3, a peat:pine bark commercial media mix, or Pro-Mix BX, a peat:perlite commercial mix. Plants were produced in a polyethylene greenhouse equipped with a fan and pad cooling system.

Treatments included moisture stress, two rates of B-Nine, and a control. Moisture stress plants were allowed to visibly wilt between irrigations, while the remaining treatments received irrigation to maintain a moist media surface. B-Nine treatments were applied until runoff (or drip) at rates of 2,500 and 5,000 parts per million (p.p.m.) when plants were at the 2-4 trueleaf stage. The 2,500 p.p.m. B-Nine treatment was applied again 3 weeks after the first application. All treatments were initiated on May 22, 1990. On June 15, 1990, plant height and internode number were determined.

Moisture stress reduced plant height for tomatoes compared to the other height control treatments. Moisture-stressed tomatoes grown in the Fafard medium had a 12% reduction in height compared to the two applications of B-Nine treatment of 2,500 p.p.m. In comparison, when grown in Pro-Mix, both moisture stress and B-Nine at the 2,500 p.p.m. rate reduced plant height by about 15% when compared to 5,000 p.p.m. B-Nine and control plants. None of the treatments affected the number of nodes produced per plant. Consequently, plants in treatments that reduced plant height had a fuller canopy.

Moisture stress reduced height of pepper plants grown in the Fafard medium by 16%, but had little effect on plants grown in the Pro-Mix medium. Regardless of media type, two applications of 2,500 p.p.m. B-Nine produced the shortest plants. Moisture-stressed plants were 6% and 15% taller in the Fafard and Pro-Mix soil mixes, respectively, compared to the 2,500 p.p.m. B-Nine plants. As with tomatoes, the number of nodes per plant was similar among treatments, resulting in fuller plants from treatments that reduced plant height.

Results from this study indicate that moisture stress is a viable alternative to the use of B-Nine for height control in vegetable transplants. However, the effectiveness of moisture stress is dependent upon the media and species used. It appears that moisture stress will have a greater height-control influence on plants with high water requirements grown in media that have poor water-holding capacity. Consideration of the wilting process of each plant species and the water-holding capacity of the growth medium is essential for successful use of this technique. Allowing plants to become too wilted to rehydrate could result in severe leaf loss or plant death.

The effect of moisture stress compared to other types of growth regulation on vegetable plants.

Brown is Graduate Research Assistant and Eakes and Behe are Assistant Professors of Horticulture.

D. I. Bransby and W. A. Griffey

CREEP FEEDING PROFITABLE ON INFECTED FESCUE

RESULTS from numerous experiments have shown that creep feeding may or may not be profitable, depending on such factors as creep diet, pasture species, breed of cattle, and time of year. However, a recent Alabama Agricultural Experiment Station study conducted at the Upper Coastal Plain Substation, Winfield, showed that creep feeding was profitable on infected fescue.

The experimental site was on a moderately to poorly drained flood plain. Existing pastures containing predominantly Kentucky 31 fescue were fenced to create eight fields ranging in size from 2 to 9 acres. The proportion of fescue in the pastures ranged from 80 to 90% at the start of the experiment, and 90 to 100% of fescue plants in each pasture were infected with the endophytic fungus, *Acremonium coenophialum*. Dallisgrass and common bermudagrass provided the remainder of the pasture dry matter.

Pastures were mowed in the fall and received 100 lb. nitrogen (N) per acre from ammonium nitrate in the fall and spring. Potassium and phosphorous were applied according to soil test recommendations.

Each pasture was stocked with 6 cow-calf pairs in the first week of April in 1989 and 1990 to create stocking rates of 0.7, 1.0, 1.5, and 2.0 pairs per acre. This relatively late commencement of grazing was necessitated by the need to rebreed cows before the experiment started. Pairs were assigned to treatments so that weight and sex of the fall-born calves and cow weights were evenly distributed across treatment groups. In 1989, the experiment was grazed by mature Hereford cows nursing calves sired by Simmental bulls. In 1990, first-calf Gelbveigh X Hereford X Angus heifers and their calves were used.

Pastures were continuously grazed from April until weaning in August each year. Animals were weighed approximately every 30 days during this period. The grazing period was, on average, 134 days. One pasture of each stocking rate served as a control in which animals were allowed access to grazing only. In a second pasture of each stocking rate, calves were allowed access to shelled corn in a creep feeder throughout the grazing period. No additional protein was provided, and a record was kept of how much corn was fed in each pasture which contained a creep feeder.

Results are presented in the table by stocking rate as an average of the two grazing seasons, although there was a greater benefit from creep feeding in 1989 than in 1990. Average daily gain (ADG) of calves decreased slightly with increased stocking rate, but this response was surprisingly small despite the extremely high stocking rates (2.0 cow-calf pairs per acre) applied. These high stocking rates were made possible by allowing forage to accumulate in fall and early spring before grazing commenced. Under normal fall and spring grazing regimes, stocking rates of 1.0 to 1.5 cow-calf pairs would be more realistic.

CALF AVERAGE DAILY GAIN (ADG) AND CALF GAIN PER ACRE FOR COW-CALF PAIRS GRAZING INFECTED FESCUE AT FOUR STOCKING RATES WITH AND WITHOUT CREEP FEED

Treatment	Result, by no. of cow-calf pairs/acre			
	0.7	1.0	1.5	2.0
		Average daily gain, lb.		
No creep feed	1.49	1.46	1.40	1.34
Creed feed	2.08	2.01	1.90	1.79
		Gain per acre, lb.		
No creep feed	134	196	281	359
Creep feed	187	269	382	480

On average, creep feeding increased ADG by 0.53 lb. per day averaged for all stocking rates. This difference did not change much as stocking rate increased. Intake of creep feed averaged 4.56 lb. per head per day, and also did not change much among stocking rates. Again, these results are surprising because it might be expected that the extremely short pasture which resulted from heavy grazing at the highest stocking rate would lead to greater creep feed consumption and a greater ADG response to creep feeding than at the low stocking rate.

Gain per acre increased with stocking rate for both the control and creep feeding treatments. At the lowest stocking rate, creep feeding resulted in a 40% increase in gain per acre, while at the highest stocking rate this advantage was 34%, as shown in the table. Stocking rate also influenced pasture species composition. At low stocking rates, fescue increased to over 95%, but at high stocking rates it decreased to around 50% while dallisgrass and common bermudagrass increased.

During the 134-day grazing period, the 0.53-1b.-per-day advantage in ADG provided by creep feeding resulted in a 71-1b. increase in weaning weight. The creep feed conversion ratio was 8.6 lb. corn per additional pound of gain. If corn is valued at $80 per ton ($2.24 per bushel), the cost per additional pound of gain from creep feeding would be 34¢. Furthermore, if weaned calves are valued at $1 per pound, creep feeding in this experiment would have increased net return to land, capital, and labor by $46.86 per head. If creep feeding had been started earlier, the benefits might have been even greater. Based on these results, economic prospects for creep feeding on infected fescue pastures look attractive.

Bransby is Professor of Agronomy and Soils; Griffey is Superintendent of the Upper Coastal Plain Substation.

C. Oberholster, D.I. Bransby, and W.H. Gregory

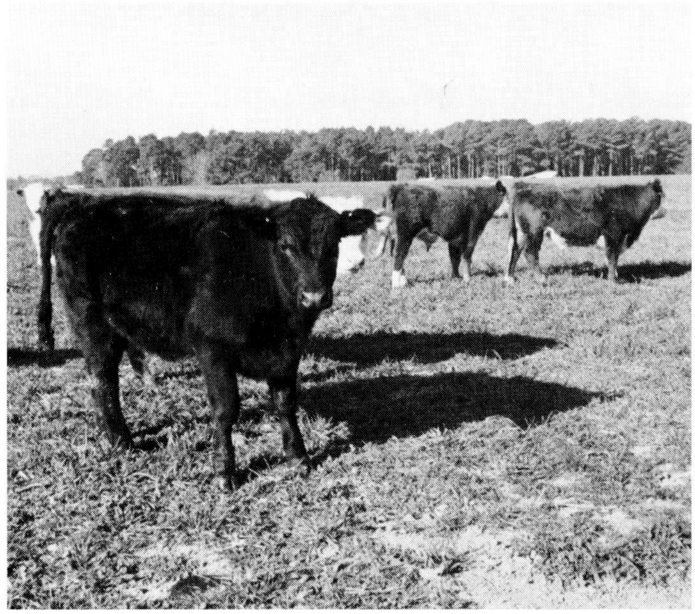
Advantages of Growth Promotants Can Be Short-lived in Stockers

GROWTH PROMOTANTS are in common use in the beef industry and have frequently provided a 10 to 15% increase in average daily gain (ADG) of cattle in feedlots. However, an Alabama Agricultural Experiment Station study at the E.V. Smith Research Center, Shorter, indicated that the advantage of growth promotants can be short-lived in stockers.

The experimental site was located on a moderately to poorly drained flood plain of the Tallapoosa River. Sixteen fields which averaged about 2 acres were prepared for seeding in fall of 1987 and 1988. Mixed pastures of Bonel rye, Marshall ryegrass, and McNair 1003 wheat were seeded at rates of 45, 25, and 45 lb. per acre, respectively. All pastures were fertilized with 100 lb. nitrogen (N) per acre at planting in the fall and 50 lb. N per acre in March. Phosphorous and potassium were applied in the fall according to soil test recommendations.

Experimental animals were Angus and Angus X Hereford steers. During winter these animals were fed hay and a grain ration to maintain weight or to gain at a low rate. After light grazing in fall and winter with surplus animals, the experiment started when pasture growth in spring was 8-10 in. tall. The average weight of steers was 647 lb. when grazing started. Pastures were grazed for 90 and 76 days in 1988 and 1989, respectively, and animals were weighed approximately every 30 days. Treatments in the study included animals with or without a standard ear implant (36 milligrams) of Zeranol® growth promotant at the start of grazing, and stocked at four levels, 1, 2, 3, and 3.7 steers per acre. Steers were not reimplanted during the study.

A commonly held view is that growth promotants are likely to be more effective when animals are well fed than when nutrients are limited. Associated implications for grazing conditions are that the increase in gain caused by use of growth promotants should be greater at low stocking rates than at high stocking rates. However, in this study there was no evidence of such a trend in either year. Consequently, ADG data presented in the table are an average across all stocking rates.



The use of growth promotants resulted in only limited benefits for stocker cattle.

During the first 30-day period, Zeranol provided a 0.49- and 0.45-lb. increase in ADG in 1988 and 1989, respectively. On average, this represented a 15% increase in gain. However, for the whole grazing period there was no clear difference in ADG between animals that were implanted with Zeranol and animals which were not implanted. This means that animals with Zeranol implants gained less than control animals in the latter part of the grazing period.

There may be several reasons for the short-lived response to Zeranol in this study. First, there is some evidence from other research that implanting for a second or third time is often not as effective as the first implant. Therefore, if the experimental animals used in this study had been previously implanted, this might have limited the effectiveness of the experimental implants. However, no previous records were available for these animals because they were purchased from sale yards.

Second, results from recent studies suggest that reimplantation after 60 days (instead of the 90-day period recommended at the time the study was conducted) is necessary to maximize effectiveness of Zeranol. Finally, the relatively high daily gains observed in the first 30-day period (compared to the whole period) imply that compensatory growth and/or differences in gut fill may have been involved in treatment differences.

Regardless of the reason for these results, this study showed a consistent pattern during two separate grazing seasons using different animals in each year. This indicates that there is a need for further research on the effectiveness of growth promotants under grazing conditions and the effectiveness of reimplantation after 60 days.

Average Daily Gain (ADG) of Steers With or Without Zeranol Implants

Treatment	ADG, by grazing period	
	First 30 days	Whole grazing period
	Lb.	*Lb.*
1988		
No Zeranol	3.32	1.80
Zeranol	3.81	1.90
1989		
No Zeranol	2.77	1.40
Zeranol	3.22	1.28
2-year av.		
No Zeranol	3.05	1.60
Zeranol	3.52	1.59

Oberholster is Graduate Research Assistant and Bransby is Professor of Agronomy and Soils; Gregory is Superintendent of the Beef Unit, E.V. Smith Research Center.

G.J. Keever, C.F. Deneke, and C.L. Browne

ALICE DU PONT MANDEVILLA RESPONDS TO GROWTH REGULATOR

THE NAME Alice du Pont may sound like a society matron, but nurserymen know it as the cultivar name of an important crop. Alice du Pont mandevilla is a vigorous vining plant that produces large pinkish-red blooms, as seen in the photo.

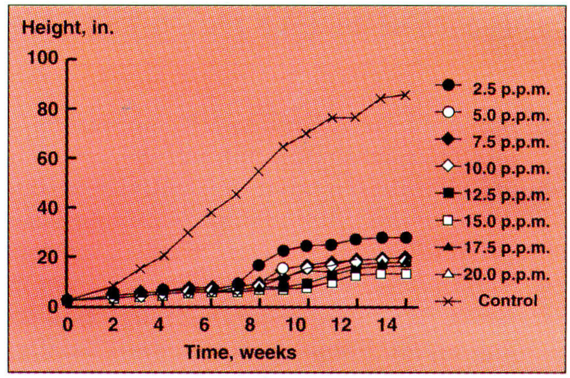
Alice du Pont mandevilla.

A member of the mandevilla genus, which includes more than 100 species of tropical and subtropical twining vines and shrubs, Alice du Pont is useful for arbors, trellises, or other structures which the plant can climb and twine around. Although popular since it was introduced in the early 1900's, it has become an increasingly popular selection for use as a potted plant or an annual outdoor plant in temperate regions of the United States.

Alabama nursery owners have begun to grow more and more of these plants in containers to meet market demands. Consumers are primarily interested in manageable plants in flower, but the plant's growth habit creates problems. To produce flowering plants, growers frequently contend with excess vegetative growth that twines around other plants and structures.

Finding a way to control this growth without injuring the plant or inhibiting its flowering ability would be a great advantage for Alice du Pont growers. Research at the Alabama Agricultural Experiment Station has studied the use of multiple applications of Sumagic®, a new triazole growth retardant, to suppress vegetative growth and achieve compact, flowering plants. Results are encouraging.

In two experiments conducted in 1989, rooted cuttings of Alice du Pont were potted into #1 containers of amended 7 pine bark:1 sand medium. Plants were pruned to two nodes before Sumagic was applied and were fertilized weekly with 300 parts per million (p.p.m.) nitrogen (N) from a 20-10-20 fertilizer.



Height of Alice du Pont in response to multiple applications of Sumagic.

Plant height was measured weekly until plants were in full flower, at which time flower diameter and days to flower were determined.

Preliminary work included a single application of 30 p.p.m. or more Sumagic. This retarded growth excessively for at least 6 weeks, after which plants began to exhibit normal growth. All rates of Sumagic induced leaf cupping, delayed flowering, and reduced bloom size.

In the first experiment, one or two applications of 0, 5, 10, 15, or 20 p.p.m. Sumagic were applied. The second application was applied to all treatments (rates) when plants treated with 10 or 15 p.p.m. began to regrow normally. In the second experiment, applications of Sumagic from 0 to 20 p.p.m. in 2.5-p.p.m. increments were repeated as necessary when plants within a treatment (rate) resumed a normal growth pattern.

Single applications of 5, 10, 15, or 20 p.p.m. Sumagic did not provide acceptable control of internode elongation. With two applications of Sumagic, 5 p.p.m. was inadequate, 10 and 15 p.p.m. were acceptable, and 20 p.p.m. was excessive in controlling shoot elongation. In the second experiment, multiple applications of all tested rates of Sumagic effectively suppressed elongation, as shown in the graph. As the concentration of Sumagic increased, the interval between applications increased from 28.5 days with 2.5 p.p.m. to 39.5 days with 20 p.p.m.

Multiple applications of Sumagic from 2.5 to 20 p.p.m. reapplied when shoots begin to elongate proved to be an effective means of controlling excessive vegetative growth of mandevilla. This treatment may provide growers with an additional management tool in the production of this flowering horticultural annual.

Keever is Associate Professor, Deneke is Assistant Professor, and Browne is Technician of Horticulture.

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