



HIGHLIGHTS

of Agricultural Research

Vol. 35, No. 3
Alabama Agricultural Experiment Station
Lowell T. Frobish, Director

Fall 1988
Auburn University
Auburn University, Alabama

Director's Comments

"Water, water everywhere, nor any drop to drink."

This well-known line from *The Ancient Mariner* takes on a different meaning in drought years like 1988. While most of us haven't worried about water to drink, water scarcity has been a reality for agriculture. Water has not been everywhere in Alabama this year, and there certainly has been no water to spare. It seems that we either have too much water or there is a shortage, never just the right amount.

More and more we realize that water is our most valuable natural resource. Unfortunately, many of us take water for granted, being concerned about conservation only when droughts occur.

Perhaps, we should not assume that there will always be an abundant source of water. This is especially important in the case of groundwater, the source on which man depends heavily. Approximately 86% of our total water resource is found in underground aquifers. One-half of the United States population depends on wells for drinking water. In times of drought, the quantity and quality of this water source become extremely important.

In its ongoing efforts to serve Alabama's agricultural and forest industries, the Alabama Agricultural Experiment Station conducts research on water conservation. Our research programs encompass the effects of soil characteristics and profile on surface and groundwater movement; effects of cover crop management on water conservation; the effect of soil temperature and particle size on water, nutrient, and chemical movement through the soil; more efficient utilization of water in food processing; and water quality and conservation in fish production.

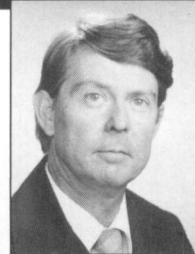
In addition to conserving rainwater, we need to be more concerned about water quality. During the past decade, studies have clearly shown that nitrates and some pesticides are being delivered into groundwater from routine agricultural and forestry practices. Agricultural and forestry non-point source problems are complex because of the interaction of cropping systems, tillage, chemical type and placement, and timing and method of fertilizer application, as well as the interaction of soil with climatic factors.

We are expanding our research effort on water conservation. The goals of this research are to conserve and protect the water supply to insure adequate water for agriculture and forestry use and to provide quality water to enhance the lives of all Alabamians. Such research is critical to all segments of the economy, not just to agriculture and forestry.



LOWELL T. FROBISH

MAY WE INTRODUCE



Dr. Ed Moran, Professor of Poultry Science. A native of New Jersey, Moran came to Auburn in 1986 from the University of Guelph in Ontario, Canada. During his 15-year tenure at the Candian University, Moran earned an international reputation for his work in poultry nutrition.

Moran, who has worked extensively with both turkeys and chickens, earned an undergraduate degree in agriculture with a poultry minor from Rutgers University. He also earned a masters and a doctorate in animal sciences from Washington State University.

Though a nutritionist by training, Moran also gained international acclaim for his work in poultry processing. Since coming to Auburn, he has worked extensively on the impact of various feeds and feed additives on the quality and quantity of broilers. One aspect of his research on the effects of dietary lysine on broiler production is reported on page 12 of this issue of *Highlights*.



ON THE COVER. Crop rotation increased cotton yields only slightly in Tennessee Valley research, as noted in story on page 5.

FALL 1988 VOL. 35, No. 3

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

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HUNDREDS of acres of pecans are planted each year in Alabama. Since such plantings represent a long-term investment, it is important to follow practices that allow the young trees to make rapid growth to bearing size.

Weed control and irrigation are two management areas in which decisions must be made. Since information concerning the effects of weeds and irrigation on young pecans is needed, a study was conducted by the Alabama Agricultural Experiment Station to determine the effects of these two factors on pecan production.

Field tests were begun at the Gulf Coast Substation, Fairhope, in spring 1986 using newly transplanted pecans to evaluate various weed control methods on both irrigated and nonirrigated trees. Results indicate that total chemical control of weeds may be the best form of weed control, particularly in nonirrigated orchards.

Bare-root Desirable variety pecan trees were planted in a 30 ft. by 35 ft. spacing, and weed control treatments and irrigation variables were assigned to individual trees. Drip irrigation using 5 emitters per tree was installed on half the trees. Weed control treatments for both irrigation regimes consisted of:

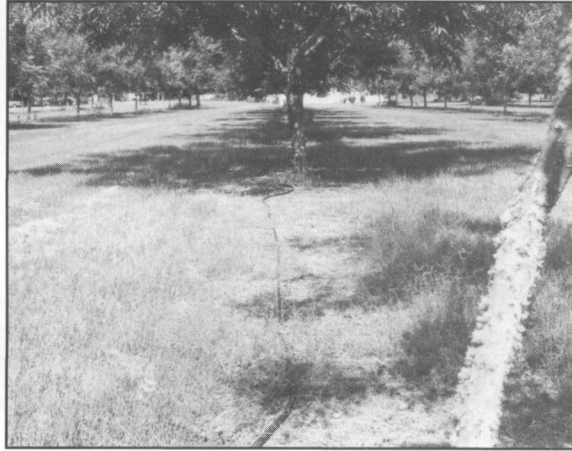
1. No weed control.
2. Disking once a month.
3. Mowing twice a month.
4. Grass control only with herbicides.
5. Total weed control with herbicides.

Herbicide treatments were confined to a 10 ft. by 10 ft. square centered on the tree. Treatments were repeated four times, with each treatment applied to both irrigated and nonirrigated trees. Tree trunk diameter, which indicates overall tree growth, was measured 24 in. above soil level at planting (February 1986) and again in February 1987 and 1988.

Grass control was obtained using a combination of Surflan® and Fusilade® treatments in each year. Total chemical control was obtained the first year using a combination of Surflan, Gramoxone®, Roundup®, and Solicam® at different times of the year. Total chemical treatments for trees entering the second and third year were identical to the first except Simazine® was added.

After the first year's growth, untreated trees which were irrigated had

Total Chemical Weed Control Aids Pecan Tree Growth



M.G. PATTERSON
W.D. GOFF,
N.R. McDANIEL,
L.M. CURTIS, and
T.W. TYSON

EFFECTS OF WEEDS, HERBICIDES, AND IRRIGATION ON NEWLY PLANTED PECAN TREES

Treatment ¹	Increase in trunk diameter		
	1st year	2nd year	Total
	Pct.	Pct.	Pct.
Irrigated			
Untreated.....	12.1	42.4	59.7
Mowing.....	12.8	40.1	58.8
Disking.....	18.6	80.7	114.4
Grass control...	22.4	79.8	120.1
Total control....	22.4	91.6	134.4
Average.....	17.7	66.9	97.5
Nonirrigated			
Untreated.....	5.9	51.6	54.1
Mowing.....	8.0	42.1	53.5
Disking.....	11.9	76.8	97.9
Grass control...	8.1	73.4	87.5
Total control....	15.5	92.6	122.5
Average.....	9.9	67.3	83.1

¹See descriptions of treatments in text.

increased in diameter 12.1%, as shown in the table, while nonirrigated, untreated trees increased less than half as much as the irrigated trees. Mowing resulted in a 12.8% growth increase for irrigated trees and an 8% increase for nonirrigated trees. Disking boosted trunk diameter growth 18.6% for irrigated trees and about 12% for nonirrigated trees. Irrigated trees receiving only grass control increased 22.4% and nonirrigated trees increased 8.1%. Total chemical control resulted in a 22.4% growth increase for irrigated trees, almost 7% more than for nonirrigated trees.

Second year growth was considerably greater than the first year's for all treatments. The diameters of irrigated

and nonirrigated trees increased from 40% for untreated trees to more than 90% for trees undergoing total chemical control.

Total growth over the 2-year period shows total chemical control treatments in both irrigated and nonirrigated trees provided increases in diameter over twice that of untreated trees or trees which were mowed for weed control. Mowing, a practice used in many young orchards, was not beneficial primarily because it did not control grasses. Irrigation provided a distinct advantage in the first year when rainfall was limited to 55 in. but had little effect in 1987, primarily because the research area received 80 in. of rainfall that year.

These results suggest that total chemical control provides more advantage for young pecan tree growth than mowing and disking, and that total chemical control is especially important for nonirrigated trees. Irrigation was helpful during the year of establishment, especially where annual and perennial grasses were controlled with herbicides.

The cost effectiveness of these systems will not be measured until the trees begin to bear, but early results suggest that efficient orchard floor management beginning at planting can help trees reach production age faster.

Patterson is Assistant Professor of Agronomy and Soils; Goff is Horticulturist-Pecans; McDaniel is Associate Superintendent of the Gulf Coast Substation; Curtis and Tyson are Extension Agricultural Engineers.

New Herbicide Compared to Standard for Ornamentals Weed Control



C.H. GILLIAM, G.R. WEHTJE, J.T. EASON, T.V. HICKS, and D.C. FARE

ACHIEVING satisfactory weed control in field-grown ornamentals generally requires repeated applications of one or more herbicides. Three flowable, soil-applied herbicides that are commonly used by growers include Surflan®, Princep®, and Goal®. Surflan is a non-volatile dinitroaniline and is effective against annual broadleaf and grass species. Princep, a triazine, is also active against broadleaf species but can cause injury to some woody ornamental plants. Goal, a diphenyl ether, is similar to Princep and is also effective against broadleaf weeds; it is not used regularly by growers because of its limited registration and its reputation for being excessively injurious to some ornamentals.

Snapshot®, a new soil-active herbicide being developed for weed control in ornamentals, may offer another alter-

native for nurserymen. Snapshot is a combination product of Surflan and a new herbicide, isobaxen, also known as Gallery®. Since both broadleaf herbicides Princep and Goal may cause plant injury, there is strong interest in Snapshot because of its reported safety. There is hope that it can fill the need for a safe broadleaf herbicide which can be applied to a wide range of ornamental plants.

A 2-year study was conducted by the Alabama Agricultural Experiment Station to evaluate the effectiveness and toxicity of Snapshot on ornamental production and to compare its performance to that of other herbicide systems. Uniform, well-rooted specimens of boxwood, holly, nandina, and viburnum were planted in March 1986 at the Sand Mountain Substation, Crossville, in fine sandy loam Hartsells soil.

The test area was heavily infested with crabgrass, redroot pigweed, entire leaf morningglory, and prickly sida. Initial herbicide treatments were made the day after planting and subsequent treatments were made in mid-July 1986 and March and July of 1987.

Application, as shown in the table, included two rates of Snapshot

The tests were performed on a variety of ornamental plants, as pictured above.

and one rate of Surflan. Also tested were combinations of Surflan with Princep and Goal and one test that included both a Surflan and Princep combination treatment with a Surflan and Goal treatment. Hand weeded and unweeded plots were used as controls for the study.

During both years, all herbicide treatments provided comparable grass and broadleaf control and none of the treatments resulted in any visual injury to the test plant species. Even the application of Goal during July did not cause plant injury or reduced growth, an unexpected result which may be attributed to the semi-dormant condition of the plants following their spring growth flush.

Results of this study indicate that Snapshot has potential for use as a pre-emergence applied herbicide in field-grown ornamentals, even though it is no more effective than the other herbicide programs. If further testing on more sensitive ornamentals establishes its safety, it may offer producers an alternative choice when Princep and Goal cannot be safely used.

Gilliam is Associate Professor of Horticulture; Wehtje is Associate Professor of Agronomy and Soils; Eason is Superintendent of the Sand Mountain Substation; Hicks is Research Associate of Agronomy and Soils; Fare is Research Associate of Horticulture.

WEED CONTROL AS INFLUENCED BY HERBICIDE APPLICATION				
Herbicide rate/acre (active ingredient) and application time	Weed control			
	Grass		Broadleaf	
	1986	1987	1986	1987
	Pct.	Pct.	Pct.	Pct.
Snapshot, 4 lb., March and July	99	100	86	99
Snapshot, 8 lb., March and July	100	100	91	100
Surflan, 4 lb., March and July	98	100	84	100
Surflan + Princep, 3 lb. + 1 lb., March and July	96	100	91	100
Surflan + Goal, 3 lb. + 1 lb., March and July	97	100	100	97
Surflan + Goal, 3 lb. + 1 lb. in March and Surflan + Princep, 3 lb. + 1 lb. in July	99	100	86	100
Hand weeded	57	43	25	66
Nonweeded	0	0	0	0

GROWING COTTON year after year on the same land was widely blamed for declines in cotton yields that occurred during the mid-1970's. Many previous studies had demonstrated the yield increasing benefits of crop rotation, and rotating cotton land was generally thought to be an effective way to increase cotton yields. But results of a 1979-87 Alabama Agricultural Experiment Station study found only small cotton yield increases from various rotations on a Decatur silt loam soil at the Tennessee Valley Substation, Belle Mina.

The new study included rotation with soybeans, corn, wheat, and alfalfa. Earlier rotation research had not included soybeans since they were not a viable crop at that time. Also, earlier rotation studies did not have the cotton production technology now available. The test area was located on a Decatur silt loam soil which had previously been in continuous cotton production.

Experimental treatments included (1) continuous cotton, (2) continuous soybeans, (3) cotton followed by soybeans, (4) cotton followed by corn, (5) cotton followed by wheat followed by double-cropped soybeans, and (6) alfalfa 3 years followed by continuous cotton. Also included for comparison was a skip-row planting (two rows planted-one row skipped pattern). Recommended varieties, seeding rates, fertilization, and weed and insect control practices were followed.

Cotton yields were increased by the various rotations, but not to the extent expected. The average cotton yield increases by rotation with soybeans, corn, and wheat-double-cropped soybeans were 5%, 2%, and 7%, respectively, see table. The poor increase by the cotton-corn rotation was particularly surprising since corn is considered the better rotational crop to break cotton disease and nematode cycles. The best cotton yield increase in response to rotation occurred in 1985, which was the best cotton production year in Alabama history.

Cotton yields following alfalfa were also disappointing. The first year, following 3 years in alfalfa, cotton was fertilized with the normal nitrogen (N) rate, 60 lb. per acre. This N plus the residual N supplied by the alfalfa produced rank cotton growth and reduced cotton yields. During the next 2 years, cotton following alfalfa yielded 7%



Cotton Yield Response to Rotations Small in Tennessee Valley Research

C.H. BURMESTER, L.J. CHAPMAN, W.B. WEBSTER, and V.H. CALVERT

SEED COTTON PRODUCTION AS INFLUENCED BY ROTATIONS, TENNESSEE VALLEY SUBSTATION, 1980-87

Rotation	Seed cotton yield/acre ¹								
	1980	1981	1982	1983	1984	1985	1986	1987	Av., 1980-87
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Continuous cotton	2,150	2,260	3,130	2,010	3,130	2,760	1,550	1,970	2,370
Cotton-soybeans	2,410	2,600	3,100	2,090	3,220	3,010	1,470	2,030	2,490
	(28)	(43)	(56)	(13)	(41)	(36)	(27)	(16)	(33)
Cotton-corn	2,330	2,400	3,130	1,920	3,130	2,870	1,520	2,000	2,410
Cotton-wheat-soybeans	2,440	2,550	3,160	2,370	3,160	3,240	1,400	2,020	2,540
	(28)	(30)	(25)	(14)	(23)	(34)	(21)	(21)	(24)
Alfalfa-cotton	—	—	—	1,780	3,320	2,990	1,400	—	2,370
Cotton, 2X1 skip	2,180	2,370	2,710	1,550	2,660	2,460	1,400	—	2,190
Continuous soybeans, bu.	29	41	54	11	38	34	29	15	31

¹Soybean yields (bushels per acre) are in parenthesis.

more than continuous cotton. In 1986, cotton yields were slightly less than continuous cotton.

Skip-row (2x1) cotton was planted through 1986. The average yield, based on total land area, was 90% as much as the continuous cotton.

Although the experiment mainly concerned cotton yield, it was noted that soybean yields were increased 4% by rotation with cotton. Soybeans double-cropped with wheat yielded 75% as much as full season soybeans over the 8-year study.

Soil samples were taken from each plot in fall 1986 to determine any differences in soil fertility caused by the rotations. Only in the alfalfa-cotton rotation was any significant difference found. Soil-test potassium levels were "medium" (137 lb. per acre) in the alfalfa-cotton plots, while all other plots

rated "high" (230 lb.). Thus, removing alfalfa forage each of the 3 years resulted in the removal of a large amount of potassium. This is why cotton and other crops following hay crops often suffer from potassium deficiency.

Results of this 8-year study show that rotations do increase cotton yields at this location, but not to the extent found in earlier studies. Soil fertility levels remained unchanged due to the rotations except for low soil potassium levels following alfalfa production. Results might be different at other locations and on other soils, where more severe nematode and disease problems could increase the value of rotations.

Burmester and Chapman are Agronomist and Acting Department Head of Agronomy and Soils; Webster and Calvert are Superintendent and former Associate Superintendent, Tennessee Valley Substation.

SURVEYS of farmers in Alabama and elsewhere have identified uncertainty about expected product prices as the number one problem disrupting production plans of farmers. Thus, many farmers rank information on product prices to be received as first in relative importance. Correct timing of sales may enable farmers to receive profitable prices for the commodities they produce. The traditional cash sales at harvest cause farmers to be price-takers, thus unsure of what prices will be received for the commodities produced.

A recent Alabama Agricultural Experiment Station study evaluated cash forward contracts, which assure the farmer what prices will be received for given commodities on delivery of an agreed upon quantity and quality at a specific time. However, cash forward contracts involve risk in the event of reduced yield. If yields are low, the farmer would be required to buy from another source to meet contracted volume or face a penalty in the amount of the difference in market and contracted prices, plus liquidated damages.

The price data used in this study were obtained from the *Grain Marketing News* (previously *Crops Marketing News*), a weekly publication of the Alabama Cooperative Extension Service. The price data were analyzed over an 8-year period (1978-85) by classifying the production cycle of specific crops into three marketing periods: preplanting, midseason, and postharvest. Production, financial, and machinery records of a crop farm in Colbert County were integrated with the price data (as reported for north Alabama) in developing this empirical analysis.

Based on the three marketing periods, six marketing strategies were delineated: (1) cash market sales of all outputs at harvest; (2) contracting all expected outputs at preplanting new-crop prices; (3)

Available Crop Marketing Alternatives Valuable to Alabama Farmers

E.F. KOLAJO, J.R. HURST,
and N.R. MARTIN

contracting all expected outputs at midseason new-crop prices; (4) contracting one-half of expected outputs at preplanting new-crop prices and market sales of remainder at harvest prices; (5) contracting one-half of expected outputs at midseason new-crop prices and market sales of remainder at harvest prices; and (6) contracting one-third each of expected outputs at preplanting new-crop prices, midseason new-crop prices, and harvest cash prices.

Expected yields were derived from 5-year moving averages of the Colbert County yield data. Given the cropping patterns of the case farm, it was assumed that the farmer produced annually at least 150 acres of cotton, 100 acres of soybeans, 50 acres of corn, and 100 acres of wheat. More than specified acres of any crop could be cultivated based on optimistic price expectations and provided such expansion was consistent with the farmer's overall liquidity and solvency position.

With the use of a multiperiod linear programming model, the six marketing alternatives were analyzed to determine each strategy's contribution to short-run profits and to the overall growth of the farm. Results of the analysis in the table

indicate that marketing strategy 1 (cash sales at harvest only) was the worst of all strategies compared. Marketing strategy 2 (contracting all expected outputs at preplanting prices) excelled all other strategies over the study period by all measures. When the strategies were evaluated in terms of potential for increasing the farm land base, strategies 3, 4, and 6 were similar.

The base farm size for all the strategies at the beginning of the study was 600 acres. However, the average farm size operated over the 8-year period under the six marketing strategies ranged from 777 acres (for strategy 1) to 807 acres (for strategy 2).

The average net return per acre farmed was as high as \$185 for strategy 2, down to the minimum of \$161 for strategy 1. Evaluating each marketing strategy's contribution to the long-term growth of the farm, strategy 2 supported the highest rate of growth in net worth (15.8%), followed by strategies 3 and 4 (13.3%), then in decreasing order by strategies 6, 5, and 1.

Results indicate that the potential for higher returns and higher rates of growth is correlated with marketing strategies which included total or greater cash forward contract price components. In other words, cash forward contracting provided better profits and faster rates of growth than the traditional cash sales at market prices. Even when yield loss risks are incorporated, the results are also consistent with the overall conclusion as shown in the table.

This study indicates that Alabama farmers can benefit from the use of cash forward contracts both for improved profits and as a price-risk management tool. Other studies have shown that the use of forward contracts in combination with futures market hedging and commodity options may be economically rewarding as well. However, commodity trading in the futures market requires a close familiarity with the "basis" concept and margin requirements, but cash forward contracting is relatively easy to use. Moreover, the price information contained in the *Grain Marketing News* can serve as a useful market planning guide.

Kolajo is Research Associate, Hurst is Economist, and Martin is Professor of Agricultural Economics and Rural Sociology.

CONTRIBUTIONS OF ALTERNATIVE MARKETING STRATEGIES TO FARM PROFITS AND GROWTH, COLBERT COUNTY, ALABAMA, 1978-85

Item	Result, by marketing strategy					
	1	2	3	4	5	6
Average land purchase, acres/year	44	49	46	46	45	46
Average farm size ¹ , acres/year	777	807	806	793	788	775
Average net return, dollars/acre	161	181	178	169	168	176
Average yield risk loss, dollars/acre	0	-13.5	-9.75	-4.0	-4.86	-6.13
Average growth in net worth, percent/year	12.0	15.8	13.3	13.3	12.6	13.2

¹Land purchase was an alternative in each production year. The amount and timing of land purchases determined the average farm size (acres) over the period of analysis for each marketing strategy.

Standard Vaccination not Adequate to Protect Chicks Against Variant IBDV



J.J. GIAMBRONE and J.A. CLOSSER

INFECTIONOUS BURSAL disease (IBD), a serious disease problem of young chickens, is on the increase. This is true despite the advances in vaccine development, improved detection methods, and improved sanitation and hygiene procedures used to control the disease.

IBD infections in young chickens are common but often not recognized. These unrecognized (subclinical) infections lead to destruction of the bursa of Fabricius, resulting in an increased susceptibility to disease and poor response to vaccine. One cause of increased incidence of the unrecognized form of the disease is the existence of variant serologic viruses which can infect birds that have been protected through vaccination against the common types.

There are two common types (serotypes) of IBDV. Serotype 1 viruses infect only chickens and serotype 2 affects both chickens and turkeys. These serotypes are less than 10% related; therefore, cross protection by vaccine prepared to protect against each is minimal. Variant IBD viruses, which are related to but different from serotype 1, have been isolated from farms throughout the United States. These viruses, classified as subtypes of serotype 1, are between 10% and 70% related. Therefore, vaccines containing standard serotype 1 viruses provide only partial protection against variants. Variant IBD viruses are highly invasive, causing rapid destruction of the bursa and depression of the bird's ability to resist a variety of infectious diseases.

An IBD variant virus was isolated in research at the Alabama Agricultural Experiment Station, and subsequently tested for its reaction to a commercial IBDV vaccine.

The variant virus was isolated using broilers that were free of pathogens—

sentinel specific pathogen free (SPF) broilers. The SPF birds were vaccinated at 1 week with a commercial vaccine and kept in isolation. At 1 week after vaccination, the birds were placed in a commercial broiler house. Two weeks later, the sentinels were returned and the variant virus recovered from the bursa. This new variant virus was used to infect vaccinated SPF birds, then reisolated and used to reinfect other vaccinated SPF birds. Each time the virus destroyed the capability of the bursa of Fabricius to function.

The next step in the research was to test the ability of a commercial vaccine to prevent the unrecognized form of IBD induced by this variant. Two groups of 45 SPF broilers were used. Group 1 received a vaccine at 7 days and group 2 no vaccine. At 2 weeks after vaccination, each group was further divided into three subgroups. Then attempts were made to infect one subgroup with serotype 1 virus and one with the variant virus; the third subgroup was used as a noninfected control. At 2 weeks after challenge, birds were killed and weighed; the bursa were then weighed and processed for microscopic examination. Blood was tested for antibodies against IBDV at the time of exposure.

Data in the table indicate that the vaccine provided

good protection against the standard IBDV. Group 1A had few microscopic abnormalities, a low number of shrunken bursae, and high ratio of bursal weight to body weight, compared to subgroup 2A. However, this protection was reduced against the variant. Birds in group 2B had more severe microscopic abnormalities, more shrunken bursae, and lower bursae to body weight ratios than birds in subgroup 1A, which were vaccinated and challenged with the standard IBDV. Unchallenged birds had no shrunken bursae, high bursae to body weight ratios, and the fewest microscopic defects.

Results from the Experiment Station tests indicate that the commercial vaccine will not sufficiently protect against the variant IBD virus. Future studies will determine whether newly developed commercial variant vaccines provide protection against this variant.

Giambrone is Associate Professor and Closser is Research Associate of Poultry Science.

EFFECTIVENESS OF IBDV VACCINATION AGAINST CHALLENGE

Group	IBDV challenge	IBDV antibody	Micro lesions, score ¹	Body wt. ratio x 1,000 ²	Gross lesions ³
		<i>No.</i>			<i>No.</i>
IBDV vaccinated					
1A	Standard	42	1.10	3.05	2/15
1B	Variant	67	2.80	1.35	10/15
1C	None	39	.95	3.00	0/15
Not vaccinated					
2A	Standard	0	3.00	1.80	15/15
2B	Variant	0	3.20	.95	15/15
2C	None	0	0	3.32	0/15

¹Scored from 0 to 4 based on increasing severity.

²Bursal weight divided by body weight.

³Number of birds with shrunken bursa (less than 1 gram)/total number of birds.



Pheromone Traps Inadequate for Sampling Lesser Cornstalk Borer

ACCURATE sampling of lesser cornstalk borer in peanuts is critical since damage in heavily infested fields can exceed 70%. Larvae feed inside stems and usually live underground, making sampling at this stage difficult and time consuming. Sampling adult moths, figure 1, which have distinctive size, shape, and coloration, is an alternative being tested at the Alabama Agricultural Experiment Station. Commercially available pheromone traps, figure 2, which contain a flypaper-like adhesive and a chemical sex attractant, were used to trap lesser cornstalk borer moths. Based on on-site sampling of adult moths by trained entomologists, the traps have been unreliable in monitoring large population increases of this pest.

Field studies were conducted at the Wiregrass Substation in Headland in 1984-86 in conventionally tilled and planted Florunner peanuts. Four pheromone traps per field were examined twice weekly throughout the growing season each year. The pheromone source (a chemically impregnated rubber septum) was changed weekly, and sticky traps were changed when approximately 100 moths were captured.

The number of male moths per trap per night was compared to the number of moths per yard of row determined by flushing moths from peanut plants, figure 3. Two people each used a yardstick to agitate peanut plants in two 300-ft. rows, and researchers identified and counted the number of moths flying from the disturbed plants. Flushing was conducted weekly at dawn, when adult moths are still active.

Few adults were found in weekly flush sampling in 1984 and 1985, which were years of low lesser cornstalk borer populations. The average number of moths flushed each week in 1984 and 1985 ranged from approximately 0 to 0.4 per yard. The population in the hot, dry summer of 1986 was much greater than the previous years' populations, and ranged from 0 to 1.2 moths per yard. Cooperative Extension Service recommendations specify that insecticides should be applied when fresh damage or larvae are found on 30% or more of the plants in a field. This threshold level was reached on June 2, 1986, when the larval population, as determined by soil sieving, was approximately one per yard. The larval population eventually increased to over 14 per yard on August 7, so the large adult moth population did produce a large population of larvae.

The number of male lesser cornstalk borer moths per trap per night varied

with time and year, and ranged from 0 to 43. Male moth abundance exceeded 20 per trap per night only three times from 1984 to 1986, so moth abundance was usually low. No pheromone trap catches exceeded 20 per trap per night in the population outbreak year, 1986. Instead, trap catches fluctuated greatly from date to date, ranging from 2.5 to 14.5 in August 1986.

The number of moths per pheromone trap per night was statistically related to the number per yard determined by flushing in only 1 of the 3 years, and trap catches were not similar to flush counts in the population outbreak year of 1986. In short, it was not possible to accurately determine with pheromone traps if a large number of the moths were in a field. A possible explanation for this result is that the sex attractant in the trap may not be exactly the same chemical that a female moth produces.

Pheromone traps are useful because they can quickly inform growers of the presence of lesser cornstalk borer moths. This information can be important because if no moths have been caught in a trap for the previous 30 days, then the chances are small that a large population of larvae is present. However, this is the most damaging insect pest of peanuts in the State, and the Auburn study indicates that pheromone traps should not be depended on to determine when a large number of lesser cornstalk borer moths are present in an Alabama peanut field.

Mack is Associate Professor of Entomology and Backman is Laboratory Technician II.

FIG.3 (above). Researchers flush lesser cornstalk borer moths from peanut plants. **FIG.1 (below).** Adult lesser cornstalk borer moth. **FIG.2 (right).** Commercial pheromone traps used in Auburn test.



Well Managed Beef Herd Gets Limited Benefit from Hormone Treatment

D.A. COLEMAN, F.F. BARTOL, W.A. GRIFFEY, and H.E. BURGESS

FIRST SERVICE PREGNANCY RATES FOR CATTLE ON FA TREATMENTS

Treatment	Number ¹	Percent
Untreated control	20/28	71.4
0.05 mg	23/30	76.7
0.10 mg	23/28	82.1

¹Values represent number of cattle confirmed pregnant from first service compared to total number bred in each treatment group

WITH PROPER management and attention to detail, Alabama's cattle producers should attain 60% to 70% first service pregnancy rates in cattle when using artificial insemination (AI). The current average is only about 50%. Improper timing of insemination with ovulation or lack of hormonal support for the pregnancy after conception may contribute to lower pregnancy rates from AI.

Some experts have suggested that treating cows routinely with a gonadotropin-releasing hormone at the time of AI might improve pregnancy rates. Such treatments could work by stimulating the release of luteinizing hormone and forcing ovulation to occur at the optimum time for fertilization or by stimulating enough progesterone production to support the pregnancy. However, few controlled studies have been conducted to test these possibilities.

Two studies were conducted by the Alabama Agricultural Experiment Station to evaluate the effects of fertirelin acetate (FA), a synthetic form of gonadotropin-releasing hormone. This material is slightly more potent than the natural hormone, but it has not been tested widely in this country for its effects on cattle fertility.

The first study evaluated the effects of FA on luteinizing hormone and progesterone patterns using 16 reproductively sound crossbred beef heifers which were estrous synchronized using a standard double injection of prostaglandin. Following the second injection, heifers were observed for estrus four times daily for a minimum of 30 minutes each time. Eight heifers were given

intramuscular injections of 0.1 mg FA 6 or 12 hours after the first detection of estrus, while the other 8 were given control injections of saline. These treatment intervals were chosen to approximate the time when an animal would normally be artificially inseminated. Blood samples were collected just prior to treatment with FA or saline and every 15 minutes for the next 2 hours to monitor the release of luteinizing hormone. Additional blood samples were taken daily for the next 3 to 4 weeks to monitor the effects of FA on plasma progesterone concentrations.

In this study, treatment with FA was effective in inducing a sudden release of luteinizing hormone. However, plasma progesterone concentration in treated animals did not differ from those of control animals. This suggests that treatment with FA at the time of breeding could synchronize ovulation more tightly with insemination, but FA does not display any long lasting positive effect on progesterone production for pregnancy support.

The second study looked at the effects of FA on pregnancy rate using 96 reproductively sound Hereford and crossbred beef cows 48 to 123 days postpartum. These cows were divided into three treatment groups and received one of the following treatments: (1) untreated controls; (2) 0.05 mg FA; or (3) 0.1 mg FA. Cows were initially estrous synchronized using either a 7-day observation period followed by a single injection of prostaglandin or by using two injections of prostaglandin given 11 days apart. All cows were observed for estrus twice daily at approximately 6 a.m. and 6

p.m. for at least 30 minutes and were bred 12 hours after first observation of standing estrus. Treatments were administered at the time of AI.

The animals were maintained under routine management and feeding procedures and were observed an additional 30 days for return of estrus. They were checked for pregnancy between 35 and 50 days after breeding. Pregnancy test results were confirmed later by delivery of a calf.

In this study, 86 of the 96 cows (89.6%) were observed in estrus and inseminated following the estrous synchronization period. Pregnancy rate was not affected by breed, parity, AI service sire, AI technician, days open at first service, or whether first service followed a natural or prostaglandin-induced estrus. There was little effect of FA on pregnancy rates, as shown in the table.

Collectively, data from these two studies suggest that prophylactic treatment of all cows with FA at the time of breeding is not necessary in a well managed beef herd since no benefits were received to offset the cost of the treatment. However, treatment might be beneficial in herds with below average conception rates or in cows identified as having low fertility. The respectable overall estrous detection rate shown in the study adds support for the use of estrous synchronization and artificial insemination in Alabama beef cattle herds.

Coleman and Bartol are Assistant Professors of Animal and Dairy Sciences; Griffey is Superintendent of the Piedmont Station; Burgess is Associate Superintendent of the Tennessee Valley Substation (formerly at Piedmont Substation).

Effective Fungicides Identified for Pecan Disease Control



EVALUATION OF SELECTED FUNGICIDES FOR CONTROL OF SCAB ON THREE CULTIVARS OF PECANS AT THE GULF COAST SUBSTATION, 1987

Treatment and rate/acre ¹	Scab infection		
	Clean	Light	Heavy
	Pct.	Pct.	Pct.
Cherokee			
Bravo 720 A, 4 pt.	25.4	60.8	13.8
LS84-608, 30.7 fl. oz.	12.2	62.0	25.8
Super-Tin 4L, 12.2 fl. oz.	79.8	18.4	1.8
Control (no fungicide)	0	0	100.0
Cape Fear			
Bravo 720 A, 4 pt.	96.4	3.6	0
LS84-608, 30.7 fl. oz.	59.8	40.0	.2
Super-Tin 4L, 12.2 fl. oz.	99.4	.6	0
Control (no fungicide)	1.8	31.2	67.0
Cheyenne			
Bravo 720 A, 4 pt.	100.0	0	0
LS84-608, 30.7 fl. oz.	92.6	7.2	.2
Super-Tin 4L, 12.2 fl. oz.	97.4	2.6	0
Control (no fungicide)8	62.8	36.4

¹Bravo 720 A was applied every 14 days; LS84-608 and Super Tin 4L were each applied three times at 14-day intervals and then every 21 days.

A.J. LATHAM, E.L. CARDEN, and N.R. McDANIEL

LACK OF acceptable disease resistance of pecan varieties and prevailing conditions that favor disease development make fungicide use necessary for pecan producers. Therefore, research is necessary to identify safe and effective fungicides from among those available for use. This research must be continuous because fungi may develop resistance to certain chemicals and others lose registration as a result of research that indicates potential health hazards.

The Alabama Agricultural Experiment Station has a long history of research on control of pecan scab. Early-year research was conducted with cooperating growers in Baldwin, Macon, and Mobile counties before Experiment Station orchards were available. During that time, the fungicides benomyl (Benlate®) and thiophanate-methyl (Topsin M®) were evaluated. Data acquired from these evaluations promoted their registration and use for Alabama pecan growers.

Benlate has since become ineffective in many areas for grower use as a result of increases in strains of the fungi that are resistant to this fungicide. Also, dodine (Cyprex®) was found to be toxic to certain cultivars of pecan, hence use of this fungicide has been discontinued. In tests since 1979, propiconazole (Orbit®) has shown consistent reliability for control of scab and other pecan

diseases. This fungicide has been registered and is available for grower use.

During the past 8 to 10 years, pecan diseases have been controlled largely by the triphenyltin hydroxide fungicides, Du-Ter®, Super-Tin®, and Triple Tin®. This material is currently the "standard" control.

Research on alternative fungicides for pecan disease control is now centered at the Gulf Coast Substation, Fairhope, on the highly scab-susceptible cultivar Cherokee. Other cultivars are included in the planting to provide disease comparisons, and to provide a variety of pecan germplasm to aid in discovery of other pecan diseases.

In the latest test, treatments were applied on a 14- to 21-day schedule with an air-blast sprayer to four-tree plots established in a randomized design. Fungicides tested were: chlorothalonil (Bravo 720A®), LS84-608, and triphenyltin hydroxide. Unsprayed trees were included for controls. Data were recorded on August 25 and 26 as Class 0 (clean, no scab on shuck); Class 1 (trace to 10% scabbed shuck); Class 2 (11 to 25%); Class 3 (26 to 50%); and Class 4 (51 to 100% scabbed shuck). "Light" scab infection represents a summation of classes 1 and 2; "heavy" scab infection represents a summation of classes 3 and 4. Data on three of the tested fungicides are reported in the table.

As shown by these data, 100% of the nuts were heavily scabbed in unsprayed Cherokee plots, as compared to 67.0% and 36.4% in the less susceptible cultivars Cape Fear and Cheyenne, respectively. These large differences in scab infection would be expected to affect results from fungicide spraying, and this shows up in the data.

Applications of Bravo and LS84-608 gave, respectively, 25.4% and 12.2% clean nut shucks on Cherokee, 96.4% and 59.8% clean nut shucks on Cape Fear, and 100.0% and 92.6% scab on Cheyenne. The standard treatment for comparison, Super-Tin 4L, showed a similar trend, but was much more effective on the susceptible Cherokee cultivar than Bravo 720 A and LS84-608.

Basing evaluations only on the more resistant pecans, such as Cheyenne or Cape Fear in this test, could lead to erroneous conclusions. For example, a fungicide with excellent performance on such resistant varieties could be registered for use and marketed. It obviously would be largely ineffective on susceptible cultivars, representing a loss to growers who tried it. Losses would also be experienced by the company that developed the product when growers stopped using it because of poor disease control.

Latham is Associate Professor of Plant Pathology; Carden and McDaniel are Superintendent and Associate Superintendent, respectively, of the Gulf Coast Substation.

FARM INCOME is no longer adequate to meet the needs of many farm families. Thus, off-the-farm employment has become a way of life in the United States. A 1985 study found that one-half of total cash income available to U.S. farm families was from non-farm sources. Furthermore, according to the 1978 Census of Agriculture, on 52% of all U.S. farms, the husband or wife, or both, were employed off the farm.

Although husband and wife working away from home is typical of all population groups, associated problems may be different for farm families. Both husband and wife have responsibilities for the farm operation, so the off-farm employment puts added pressure on time for farm and family activities. To provide insights into how such off-farm employment affects farm families, a regional project was carried out by agricultural experiment stations across the South. The Alabama Agricultural Experiment Station's portion of the study gathered information about practices and attitudes of Alabama farm families.

Questionnaires were mailed to both husbands and wives of randomly selected families in the State. Completed questionnaires were returned by 111 couples, which provided data about types of employment, incomes, motivations, and attitudes.

Off-Farm Employment Important to Farm Family Living Standard

C. WARFIELD

farm families need skills in time and stress management to soften the impact of such stress on family relationships.

Approximately one-fourth of the men and women held professional or managerial jobs. Clerical or office jobs were reported by nearly half of the women, but by only a few of the men. Self-employment was reported by a small percentage of husbands and wives. Half of the employed men and one-fourth of the women classified themselves as laborers.

Farm women in this sample generally received lower salaries than their husbands for off-the-farm jobs. Twice as many women as men received income of less than \$7,500 for their off-the-farm employment. In contrast, twice as many men as women received incomes of \$25,000 or more. This reflects differences in the types of jobs held by each since the percentages of men and women

ment, or family member(s) did not want them to work off the farm. Less than 5% cited such reasons as lack of available jobs, education, or transportation for not working off the farm.

There is an obvious need for improved skills in both farm and household financial management. Dissatisfaction with farm income was expressed by 72% of the men and 65% of the women in this study; approximately 20% of both were satisfied. On the other hand, 26% of the men and 40% of the women were satisfied with their off-the-farm income; only 10% said they were dissatisfied. Thus, the off-the-farm employment of farm couples in this sample may help to explain why approximately one-half of the men and women indicated they were satisfied with their present standard of living. (Standard of living was defined as the goods and services the families consumed and the way they were now living.)

A majority of both men and women are satisfied with their retirement plans. Only 20% voiced dissatisfaction, while approximately 60% said they were satisfied.

Farm families face most of the same problems faced by urban families, but they also must deal with distinct farm-related problems. Off-the-farm employment to supplement family income is one way they deal with their problems. Though the level of income from off-the-farm employment is generally lower for the farm wife than for the farm husband, she tends to be more satisfied with her income than he does.

It is evident that off-the-farm employment income from both husband and wife is an important element in providing satisfaction with farm families' standard of living.

*Off-farm jobs were reported by
1/3 of the men and
1/2 of the women surveyed.*

Off-farm employment was reported by one-third of the men and one-half of the women. Such employment is not a recent phenomenon caused by the 1980's farm crisis. Instead, 75% of the employed men and 58% of the employed women had held off-the-farm jobs for 10 years or more.

Full-time employment of at least 40 hours per week was reported by 63% of the employed women and 78% of the men. Approximately half of both men and women had worked at off-the-farm jobs for at least 45 weeks the previous year. Thus, there was a significant commitment of time from both spouses, time which also had to be shared with farm tasks and family tasks. Therefore,

employed full-time and the number of weeks worked per year were fairly similar.

Questions were also included to help researchers understand the motivations and attitudes of these farm couples concerning off-the-farm employment. When questioned about the most important reasons for holding an off-the-farm job, three-fourths of the husbands and wives said they worked to supplement the farm income.

Among those not employed off the farm, 43% of the men and 20% of the women indicated they did not have time to work both on and off the farm. Other reasons given for not working off the farm included health reasons, retire-

Warfield is Associate Professor of Consumer Affairs.

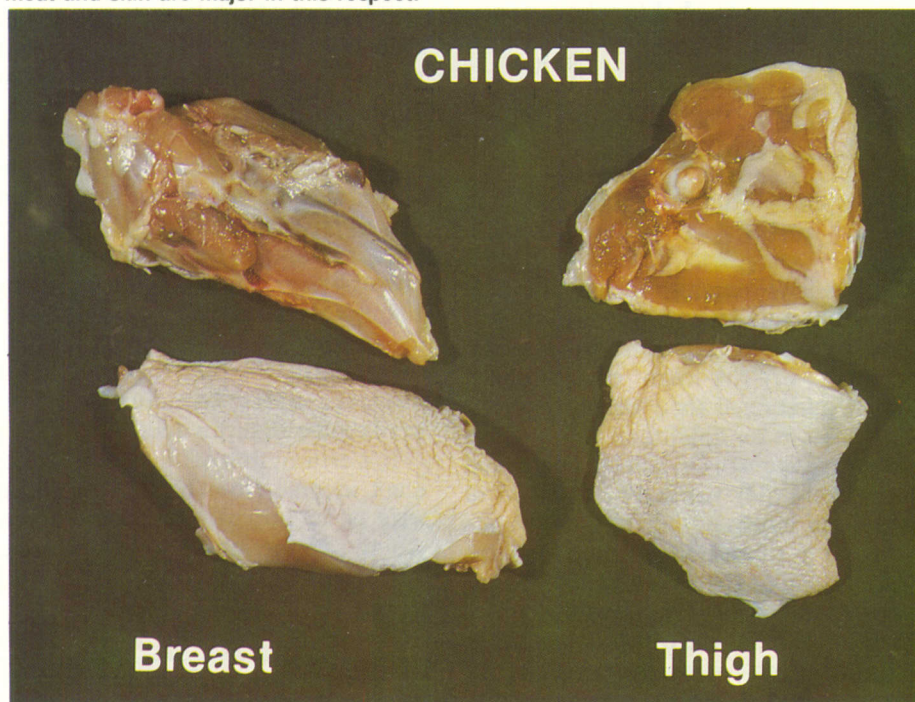
Inadequate Dietary Lysine Reduces Broiler Carcass Quality

E.T. MORAN

CONSUMERS demand high quality broilers with a high meat yield and low fat content. Protein in the feed given to birds prior to marketing plays a major role in the amount and composition of broiler meat, but for dietary protein to be effective, each of the constituent amino acid building blocks must meet the broiler's requirement. Lysine, which is low in most commercial feedstuffs, is a crucial amino acid because a large quantity is used to synthesize muscle. Supplementing feed with purified lysine is expensive, and the final level in the feed is likely to be marginal.

Research in the Alabama Agricultural Experiment Station was conducted to determine the impact of marginal dietary lysine on broiler meat relative to live performance. Commercial strain chicks were placed in floor pens and fed a nutritionally adequate feed for the first 28 days. Feed given the subsequent 14 days was formulated to be submarginal in lysine (0.85%), then purified lysine was added to attain marginal (0.95%) and adequate (1.05%) levels, see table.

Breast and thigh cuts from a broiler show a lack of fat deposits in breast meat, while thigh meat and skin are major in this respect.



Lysine treatment ¹	Live wt. at 42 days	Feed/gain ratio, ² 28-42 days	Proportion of fat in carcass ³			Breast yield and composition ⁴			
			Breast	Thigh	Skin	Pct. of total carcass	Composition		
			Pct.	Pct.	Pct.		Meat	Skin	Bone
Males									
0.85%	3.82	2.34	7.0	11.5	80.6	28.7	69.8	10.0	20.2
0.95%	3.86	2.26	6.7	11.1	79.8	28.8	71.7	9.0	19.3
1.05%	3.89	2.14	6.6	10.8	79.3	29.9	71.9	8.6	19.5
Females									
0.85%	3.13	2.41	7.3	12.4	82.5	30.8	71.9	10.6	17.5
0.95%	3.20	2.27	7.2	11.9	81.7	30.8	74.6	9.0	16.4
1.05%	3.16	2.26	7.3	11.7	81.2	31.5	75.0	8.5	16.5

¹Level in feed that meets National Research Council recommendations (21-42 days).
²Pounds of feed consumed per pound of gain.
³Dry weight basis.
⁴Cooked.

Birds were marketed at 42 days, and though no differences in body weight occurred because of lysine, conversion of feed to weight gain was improved with supplemental lysine. After slaughter, no differences were observed in the percentage yield of chilled ready-to-cook carcass which could be attributed to lysine.

Sample chilled carcasses were taken to measure fat in breast meat, thigh meat,

and skin. As lysine level increased, the amount of fat in skin and thigh meat decreased, whereas fat in breast meat was low and remained unchanged. Absence of change with breast meat is understandable because no fat deposits exist, while thighs have intermuscular fat deposits and skin is extensive in this respect.

Cutting other sample carcasses into portions recognized by the consumer (breasts, drums, thighs, wings, etc.) revealed that lysine level altered the yield in some cases. This effect was especially important with the breast. Yield of the high value breast increased, with a corresponding decrease in back yield, as lysine increased. Cooking the parts did not change lysine's effect on the yield of parts.

Cooking permits each cut to be separated into meat, skin, and bone. Differences in the proportions of these tissues occurred with a few cuts which could be attributed to lysine level. Again, the breast was most affected, with meat increasing as lysine levels increased, but skin was the opposite.

Overall results indicate the inadequate dietary lysine in feed prior to marketing will adversely affect carcass quality of broilers before it affects live weight. The changes are particularly important because breast meat is reduced to the greatest extent while skin and fat increase.

Moran is Professor of Poultry Science.



Daily Feeding Proves Best for Broiler Breeder Pullets

G.R. McDANIEL

FEEDING broiler pullets to obtain optimum breeding efficiency is an elusive "art." In the past four decades, genetic selection has provided poultry producers with superior birds that can reach market size in about half the time of their predecessors. But the rapid growth rates of these birds have also caused problems with excessive weight gains that can adversely affect reproductive efficiency. To combat this problem, poultrymen who produce replacement breeding stock (primary breeders) explored many feeding options and many found that a skip-a-day program improved feed performance.

In the past, available equipment

limited distribution of small amounts of feed evenly through a poultry house. Because of this, more aggressive birds consumed a larger share of the feed and this resulted in nonuniform flocks. Producers found that the skip-a-day program, which allowed them to feed the birds twice the normal daily amount of feed every other day, improved flock uniformity. However, this method did not offer the most efficient form of feed utilization for the birds because they tended to overconsume one day and suffer inadequacies the next.

Recent innovations in feeding systems now offer breeders a chance to use the everyday feeding option. To find out

what feeding system is the most efficient, a study was initiated by the Alabama Agricultural Experiment Station comparing a skip-a-day feeding system with everyday feeding systems.

Two thousand birds were divided into two equal-sized groups with one group fed on an everyday system and the other placed on the skip-a-day system. The amount of feed delivered to the birds was determined by using

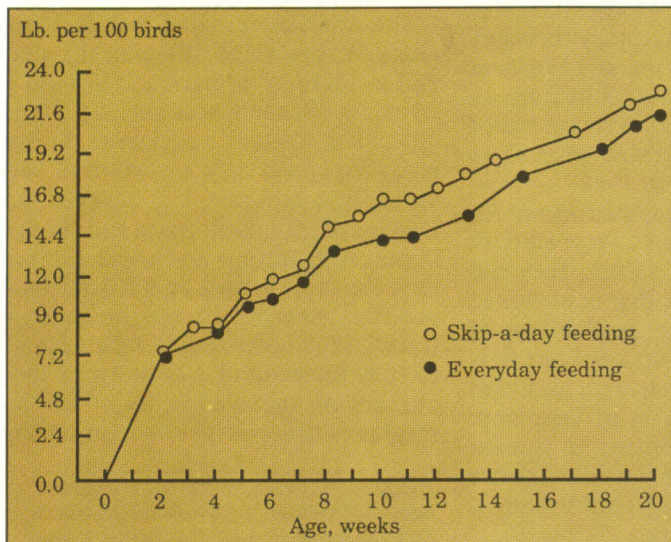
body standards established for the breeds. A sample of chicks from each pen was weighed each week and, if the birds were not consistent with target weight, feed was adjusted accordingly. Chicks were started on 22 hours of light for the first 5 days then shifted to 8 hours of light and 16 hours of dark until 20 weeks of age.

Results of the study, as shown in the figure, showed that after 5 weeks, more feed was required to maintain target body weight on the skip-a-day program than on the everyday program. This may be because birds on the skip-a-day program overconsumed feed, allowing much of it to be poorly digested or completely undigested, whereas birds on the everyday system were able to utilize the feed value more efficiently. The maximum difference in feed required to maintain body weight occurred between 9 and 15 weeks of age, with the birds fed everyday requiring 2.4 lb. less feed per day for each 100 birds at 13 weeks of age. Between 16 and 20 weeks of age there appeared to be less difference between average daily feed requirements.

Overall, birds fed on the everyday program required over 3 lb. less feed per bird to reach the desired body weight than those on the skip-a-day program and still obtained acceptable uniformity. This suggests that feeding replacement breeder stock daily can result in large financial savings for the producer and the entire poultry industry.

McDaniel is Professor of Poultry Science.

Feed requirements of birds on skip-a-day and everyday feeding programs.



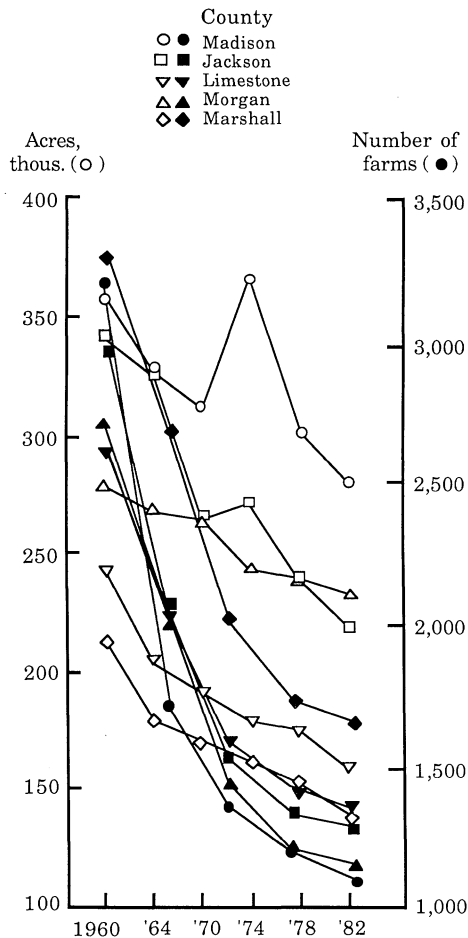
Price and Availability of Farmland Affected by Nearby Population Centers

AGRICULTURAL land markets in close proximity to urban areas and dense population centers have experienced much change in recent decades. This has happened as businesses and people have migrated from urban areas to the quieter, more aesthetically pleasing suburbia and countryside. Due in part to this exodus, almost 3 million acres of U.S. farmland are converted each year to nonfarm uses. To analyze the impact of this transition on the availability and value of agricultural land, the Alabama Agricultural Experiment Station initiated a study of the Huntsville area.

Huntsville's rapid growth from a predominantly farm-oriented community to a center of high technology and development provided a unique opportunity to study an area in transition. Between 1960 and 1980, some 300,102 acres of farmland in the five-county area around Huntsville (Jackson, Limestone, Madison, Marshall, and Morgan counties) were lost to urban growth as the population grew from 72,365 people in 1960 to 149,014 in 1984. Much of this growth stemmed from the development of NASA and the space program in Huntsville.

To analyze the impact of this change, the rural and urban transition was traced. Factors that influenced such changes were identified using (1) county tax assessor offices and questionnaires for randomly selected tracts of property located in the five-county area within a 25-mile radius of the city, (2) appraisal and farm sales reports for the five-county area as compiled by the Farm Credit System, and (3) government documents, including economic and demographic information, for the five-county area. The first source of data was used to trace ownership and value changes for selected parcels of land from 1960 through 1986. The latter two sources were used to estimate the impact land use and locational factors have on availability and value of agricultural land.

Substantial declines in the number of farms and total farmland inventory in the Huntsville area were noted from



1960 to 1982, as shown in the figure. On a county basis, declines in farm numbers were fairly consistent. Modest increases in total farmland inventory between 1970 and 1974 in Jackson and Madison counties represented deviations from an overall downward trend. Average size of farms in the area increased from 82 to 112 acres from 1960 to 1982.

While statistical models estimated for the area did not explain a large amount of variation in land values, they did isolate several factors that contributed to variations in the availability of agricultural land. For the aggregate five-county model, six factors were identified as influencing the value of farmland: size of tract; percent of tract in cultivation; percent of tract in pasture; distance to urban periphery; degree of urban influence; and time trend.

W.C. UPSHAW and J.L. ADRIAN

Tract size typically shows a negative relationship to value per acre, with values generally increasing as tract size decreases. Pasture and cultivation uses of tracts added substantially to value relative to other agricultural uses, primarily forestry. For each additional percent of a tract allocated to cultivation or pasture uses, value increased by \$9.17 and \$9.34, respectively.

As would be expected, values were highest for tracts near the urban periphery and, as distance increased, per acre values declined. Degree of urban influence and land use variables also showed positive impacts on value. Tracts experiencing high and moderate urban influences had per acre values \$571 higher than similar tracts with only slight or no nonfarm influences. Over the period of analysis, values trended upward about \$29 per acre per year, on average.

Value of agricultural land in the county, county population, and per capita income for the county were three variables used to explain the availability of agricultural land in the area. The quantity of agricultural land decreased by 96 acres for each dollar increase in average per acre value of farmland. Increases in county population and per capita income were inversely related to the availability of agricultural land.

The analysis revealed that there are many factors which influence the value and availability of agricultural land in a rapidly changing area such as Huntsville. The factors considered in this study explained only a portion of such variability; however, it is believed that location of individual tracts and changes in per capita income and population will have the most impact on the conversion process. Analysis of the rural/urban transition process should be continued to fully understand the impact of these changes on the availability of agricultural products and its effect on society.

Upshaw is Graduate Research Assistant and Adrian is Professor of Agricultural Economics and Rural Sociology.

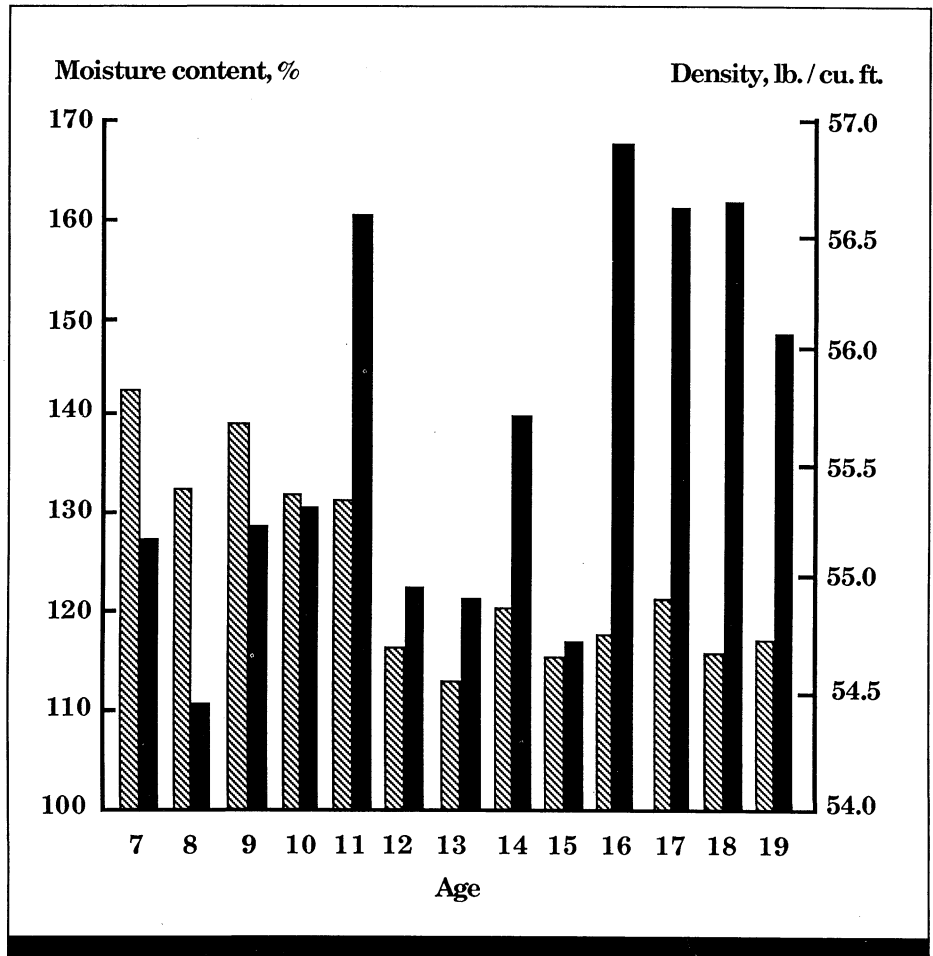
ESTIMATING the volume of wood in a load of logs has always presented a problem. Underlying factors include multiple products (lumber, pulp, and fuelwood), numerous units for each product (e.g. Doyle and Scribner board foot log rules, cubic feet, cords, and cunits), and variation among trees. A common practice used to avoid some of these problems is to weigh a load of logs and estimate the volume using a conversion factor. The volume thus determined would vary from company to company and also according to whether the estimator is buying or selling logs.

Unfortunately, the use of weight is not without its own associated problems. The variation in green weight per unit of volume makes it difficult to establish a specific conversion factor. Major factors causing variation are moisture content and wood density. These factors are influenced by species, age, geographic location, genetic variation, and site conditions.

As part of a recent weight/volume study to verify several different equations used by forest products companies for pine weight and volume estimation, 214 plantation-grown loblolly pine trees from throughout west-central Alabama were felled and destructively sampled. These trees were growing on a variety of sites from rich bottomlands to dry ridge tops. Trees averaged 7.6 in. DBH (diameter breast height) and ranged from 4.8 to 13.0 in.; age averaged 12 years old, ranging from 6 to 20 years. Tree heights averaged 47.5 ft. and ranged from 24.7 to 70.9 ft.

Density, moisture content, and specific gravity were plotted against DBH class and age to examine these relationships. Plots of density and moisture content showed an increase with increasing diameter, while specific gravity remained fairly constant. With increasing age, density and specific gravity increased gradually and moisture content decreased. The figure demonstrates this for moisture content and density for tree merchantable height. The specific gravities and moisture contents calculated from this study compare favorably to similar studies with loblolly pine for these particular wood properties.

For the landowner or timber harvester, it is important to remember that



Conversion Factors Helpful in Estimating Wood Volume

J. KUSH and R.S. MELDAHL

SUMMARY OF TREE WEIGHTS, VOLUMES, MOISTURE CONTENT, SPECIFIC GRAVITY, PERCENT WOOD, AND PERCENT BARK ESTIMATES BASED ON TREE MERCHANTABLE HEIGHT

Measure	Mean	Minimum	Maximum
Total density, lb./cu. ft.	55.4	46.2	61.0
Wood density, lb./cu. ft.	60.4	47.8	65.4
Moisture content, %	124.6	79.2	168.2
Total specific gravity41	.34	.46
Wood specific gravity43	.36	.52
Percent wood, %	89.0	82.7	93.7
Percent bark, %	11.0	6.3	17.3
Total green weight, lb.	362	61	1,395
Wood green weight, lb.	325	52	1,300
Dry weight, lb.	163	28	591
Volume outside bark, cu. ft.	6.06	1.10	22.10
Volume inside bark, cu. ft.	4.96	.80	19.00

The graph shows moisture content and density used in pine tree conversion factors.

lower density, and a corresponding lower fiber yield on a per pound basis. When all the variables are included, conversion factors can perform reasonably well. However, the Auburn study indicates that in specific instances considerable variation may exist and both buyer and

seller should bear this in mind when dealing in wood products.

Kush is Research Associate and Meldahl is Assistant Professor of Forestry.



POLYUNSATURATED FATTY ACID (PUFA) CONTENTS OF CULTURED CATFISH FED A PRACTICAL DIET SUPPLEMENTED WITH MENHADEN FISH OIL AND SEA-CAUGHT SALMON

PUFA	PUFA content of catfish				Content of salmon
	Control feed	Fish oil supplemented			
		2%	4%	6%	
Total%	17.0	19.0	20.5	21.5	21
n-3%	3.0	5.7	8.4	10.1	15
n-6%	12.3	10.4	9.8	9.0	5
n-3/n-6 ratio	.2	.5	.9	1.1	3

Content of Omega-3-Fatty Acids Can be Increased in Farm-Raised Catfish

R.T. LOVELL and T. MOHAMMED

THERE is some evidence that omega-3 polyunsaturated fatty acids (n-3 PUFA) in fish oils reduce risk of heart disease in humans by lowering cholesterol levels and prolonging clotting time of the blood. Marine fish have traditionally been associated with oils high in the n-3 PUFA, however, wild freshwater fishes also contain high percentages of omega-3 polyunsaturated fatty acids in their oil.

The n-3 PUFA in fish are derived from fresh and salt water algae, through the food chain. Cultured fish that are fed grain-soybean meal-based feeds have a fatty acid composition that is much lower in n-3 PUFA's than sea caught fish; in fact, the fatty acid profile of farm-raised catfish is similar to that of grain-fed livestock. Because the fatty acid composition of fat in animals is influenced by the diet, a study was conducted at the Alabama Agricultural Experiment Station to determine if the amount of n-3 PUFA's in catfish could be changed by manipulating the diet.

Four test diets were fed to channel catfish in 0.1-acre earthen ponds for a 12-week summer feeding period. The control diet was a standard catfish feed containing 50% soybean meal, 40% corn, 8% fish meal, and 2% vitamins and minerals. Three percentages of menhaden (a fish common to the Gulf of Mexico) oil, 2, 4, and 6, were added to the basal diet replacing corn. Menhaden oil is high in n-3 PUFA, containing approximately 15%. At the end of the feeding period, the fish were analyzed for fatty acid composition. They

were also evaluated for taste and chemical indicators of potential for oxidative deterioration in flavor in frozen storage.

Data in the table indicate that cultured catfish fed a commercial type (control) feed contain much less n-3 PUFA than sea-caught salmon, which are high in n-3 PUFA. It also shows, however, that adding 2-6% fish oil to a catfish feed will increase the n-3 PUFA content to 38, 56, and 67% of wild salmon. This indicates that n-3 PUFA in cultured catfish can be significantly increased by dietary manipulation. Although n-3 PUFA content was increased, n-6 PUFA (omega-6 polyunsaturated fatty acid) content, which usually decreases proportionately as N-3 PUFA increases, was not reduced as much. The n-3 to n-6 ratio in the catfish was increased to only 36% of that in the salmon.

Taste tests revealed that the catfish fed menhaden oil had a "fishy" flavor which intensified with amount of fish oil in the feed. This was considered undesir-

able for the normally mild-flavored cultured catfish. Fat content in the flesh of the catfish ranged from 6.6% in the control fish to 12.1% in the fish fed 6% fish oil. Iodine number, which indicates amount of unsaturation of fat, increased from 85 for the control fish to 103 for those fed 6% fish oil. The increase in body fat and fat unsaturation will increase the susceptibility of the fish to oxidative rancidity in frozen storage.

Thus, the advantages of increasing n-3 PUFA content of farm-raised catfish by adding fish oil to feeds must be compared with the adverse effects on taste of the fish. These results indicate that feeding marine fish oil to cultured catfish to increase n-3 PUFA should be deferred until it is determined whether the amount of n-3 PUFA that must be consumed to significantly reduce the risk of heart disease is great enough to adversely affect taste and quality of catfish.

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