VOL. 22, NO. 1/SPRING 1975

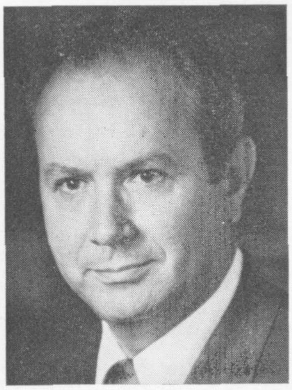
HIGHLIGHTS

of agricultural research

AGRICULTURAL EXPERIMENT STATION/AUBURN UNIVERSITY
R. Dennis Rouse, Director Auburn, Alabama

DIRECTOR'S COMMENTS

TWO YEARS AGO in this column I reviewed accomplishments of the Nation's agricultural experiment stations. At the same time, I told about the needs for relocating and modernizing Auburn's Main Station field research facilities. You, the Governor, and the Legislature responded to our request for capital improvement funds. How we are using these funds is reported in the page 3 sketch describing major land acquisitions and plans for its use. We are proceeding as rapidly as possible within limits of funds, planning, architects, and construction. I am confident we are developing the kind of research facility that Alabama needs.



R. DENNIS ROUSE

The year 1975 is a special one – the Centennial Year of the agricultural experiment station system. To recognize the beginning of this great movement, the Experiment Stations' Section of the National Association of State Universities and Land Grant Colleges in its 1972 meeting resolved "That this significant National Centennial be celebrated in 1975 with appropriate ceremonies and other commemorative acts."

One hundred years ago fertilizer was coming into use but farmers had no way of knowing whether it was rich Peruvian guano or a worthless imitation. The first report issued by the first agricultural experiment station (Connecticut) was an evaluation of a fertilizer being sold by Pollard Brothers Manufacturers and Dealers in Improved Fertilizer. The product was being offered for sale at $32 per ton, but the report said its analysis showed total plant food content of 4% and a value of $1.03 per ton – "not worth barreling."

In a recent address, Dr. James J. Horsfall, Director Emeritus of the Connecticut Station, compared conditions in England in 1798 with conditions in coastal United States in 1875 and now in 1975. He concluded that relative food supplies are not greatly different today. There were five options in 1798 and 1875, and the same five exist in 1975.

1. *Export surplus people.* This could be done in 1798 and 1875, but it is not an attractive alternative in 1975.
2. *Inhibit reproduction of population.* This is perhaps less of a "no-no" now than in 1798 or 1875.
3. *Prohibit export of food.* This option is being talked of today, but it proved impractical in 1798 and 1875. Such a dangerous option would require considerable care.
4. *Go industrial and buy food.* This, like option one, has much less possibility than in 1798 and 1875.
5. *Improve agriculture.* This was the best option in 1875 and appears best for 1975.

Interest in scientific approaches to agricultural production showed great increase when agricultural experiment stations had their start. Over the 100 years since, the Alabama Station (established in 1883) and those of other states have set a pace for agricultural production that has brought leaders and students from every nation in the world to learn our system.

If we are to achieve another breakthrough, the attitude of society must again change as in 1875. Society as a whole should recognize agriculture as a noble profession. Farmers should encourage their brightest sons and daughters to study agriculture. A much higher priority must be assigned to agricultural research.

Agricultural production and agricultural research have both worn the yoke of surplus production for over 20 years. Now there is talk about shortages and the need for a "reserve." If we are again to hear the accolades of reserves of food, increased emphasis must be placed on agricultural research.

may we introduce . . .

Dr. Gale A. Buchanan, author of the story on page 6, has gained national and international recognition for his weed control research at Auburn. He has made many contributions to the field of weed science through leadership roles in the Weed Science Society of America, and currently is editor of *Weeds Today,* a quarterly magazine of WSSA. His research on herbicidal weed control in cotton, peanuts, soybeans, and other crops has provided useful information to farmers of Alabama and the Southeast.

A native of Madison County, Florida, Buchanan came to Auburn 10 years ago after completing his doctoral study at Iowa State University. He is associate professor in the Department of Agronomy and Soils.

Buchanan was an honor student at University of Florida, where he received his B.S.A. degree in 1959 and M.S.A. in 1962, both with majors in agronomy. He was named the outstanding student in agronomy at University of Florida, where he was honored by membership in Phi Eta Sigma, Gamma Sigma Delta, and Scabbard and Blade, honor societies, and was president of the Agronomy Club.

He currently holds the rank of Major in the Alabama National Guard.

HIGHLIGHTS of Agricultural Research

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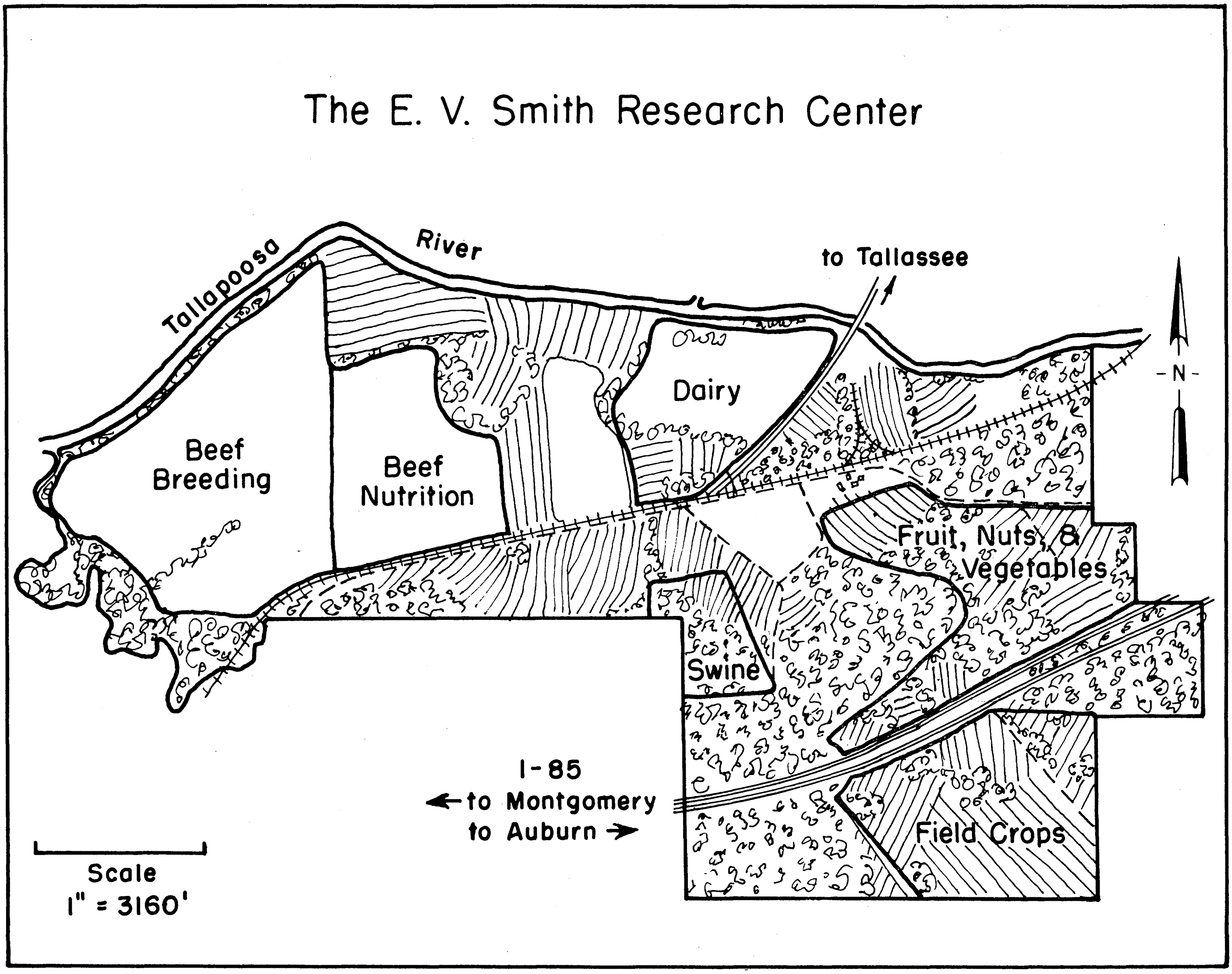
ON THE COVER. Apple color development resulting from ethephon spraying is illustrated by a comparison of green fruit from untreated tree (in hands) and red fruit on treated trees. See story on page 4.

AGRICULTURAL RESEARCH FOR THE FUTURE

ROY ROBERSON, *Department of Research Information*



IN AN EFFORT to further help Alabama and the world to produce more food and fiber, the Agricultural Experiment Station at Auburn has undertaken an extensive upgrading and modernization program, which will be highlighted by the transfer of field research facilities for field crops, fruit, nut, and vegetable crops, dairy and beef cattle nutrition and management, and beef cattle and swine breeding to a tract of 3,200 acres of recently purchased farmland about half way between Auburn and Montgomery.

The new land is located on Interstate Highway 85, with access from the Tuskegee-Franklin and Tallassee-Shorter Exits. The land will provide adequate acreage for the development of team research. The animal units there will be serviced by a modern feed mill and adequate land for the production of forage for feeding.

With the transfer of these research areas to the new land, an upgrading of Main Station research facilities will be possible. A Forest Products Lab is being constructed and the Poultry Farm, which was constructed in 1924, is being replaced by a new Poultry Science Field Laboratory. In a cooperative project with the Alabama Farm Bureau Federation, a new swine research facility is being constructed. In addition to these new facilities more land will be made available for forestry, wildlife, and fisheries research.

These improvements, necessitated by continual University expansion, the inadequacy of soil and topography for research, and the obsolescence of field facilities, are an investment in the future. It's an investment that is geared to ensure continued progress in all phases of research, and thus in the production of food and fiber that is so vital to us all.

Effectiveness of ethephon sprays on color development of Red Delicious apples is illustrated by this contrast. Green apples are being held alongside fruit on tree that was sprayed with 300 p.p.m. ethephon 8 days earlier.

Growth Regulator Sprays Improve Color, Quality of Alabama Grown Apples

W. A. DOZIER, JR., Department of Horticulture
W. A. GRIFFEY, H. E. BURGESS, and E. L. MAYTON*
Piedmont Substation

A SOLUTION TO THE PROBLEM of poor color development of Alabama apples may be just around the corner. Spraying with a growth regulator has effectively increased red color while speeding up maturity and enhancing eating quality in Auburn University Agricultural Experiment Station tests.

Overcoming Climate Effects

Red Delicious apples normally reach minimum maturity for harvest in central Alabama by August 18-24, depending on year and strain of Red Delicious. In most years, however, fruit color is poor and washed out at this time and does not meet the standards for high Federal grade. This poor color and quality wipes out the marketing advantage that Alabama growers should enjoy because of earlier apple maturity than in competing areas.

In efforts to overcome the color problem caused by the South's hot climate, foliar sprays of ethephon, (2-chloroethyl) phosphonic acid, were evaluated at the Piedmont Substation, Camp Hill. Rates up to 1,000 p.p.m. were tried, each with 20 p.p.m. 2,4,5-TP added to prevent fruit drop.

Red Delicious Responded

Fruit damage resulted from sprays of 500 p.p.m. ethephon, but concentrations up to 300 p.p.m. were safe and improved color and quality. August 6 application at a rate of 300 p.p.m. gave best results. Red color development was greatly enhanced, with increases in intensity of color, area of fruit with solid red blush, and total surface area of fruit with red color. Fruit quality and maturity were also improved, although there was a slight decrease in firmness, as shown below:

Ethephon concentration, p.p.m.	Quality measure		Red surface color	
	Firmness, lb.	Pct. soluble solids	Pct. solid blush	Pct. of surface covered
0	18.7	11.5	25	71
150	18.1	11.8	38	80
200	18.0	11.9	38	79
250	18.7	12.1	51	86
300	18.0	12.0	66	92

Fruit from trees sprayed with 300 p.p.m. ethephon were mature and ready for harvest 8 days after treatment. Non-treated fruit did not reach the same level of color and maturity until 12 days later than treated fruit.

Mollies Delicious Sensitive

The early ripening Mollies Delicious has good eating quality, but it develops poor color. This variety was found to be highly responsive to ethephon, making it necessary to use lower concentrations of spray to prevent fruit damage.

Rates as high as 300 p.p.m. were tried with Mollies Delicious, but 75-150 p.p.m. gave best results. July 6 application (2 weeks before anticipated harvest) gave best results with the 75-150 p.p.m. rates. The 150 p.p.m. rate enhanced red color, soluble solids, and maturity, but decreased firmness.

As with sprays for Red Delicious, a stop drop treatment with 20 p.p.m. 2,4,5-TP was used with the ethephon.

Rates higher than 150 p.p.m. in sprays caused rapid internal breakdown of Mollies Delicious fruit. In some years many of the fruit treated with 300 and 225 p.p.m. had internal breakdown 8-10 days after treatment; with 150 p.p.m., this effect rarely showed even after 16 days. Apples treated with 150 p.p.m. were ready for harvest 8-10 days after treatment, whereas non-treated apples had not reached the same maturity even after 11-13 additional days.

Effect of ethephon on Mollies Delicious is illustrated by the data below:

Ethephon concentration, p.p.m.	Quality measure		Red surface color	
	Firmness, lb.	Pct. soluble solids	Pct. solid blush	Pct. of surface covered
0	20.2	10.6	4	20
75	16.3	12.8	34	65
150	16.1	12.8	43	73
225	15.3	13.5	43	73
300	15.3	12.8	45	76

Current results indicate that Mollies Delicious should not be treated with rates higher than 75-150 p.p.m. ethephon and should be harvested 10-12 days after treatment.

* Retired.

New Vegetable Varieties Evaluated for Production in Alabama Gardens

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MARLIN HOLLINGSWORTH, *North Alabama Horticulture Substation*

HOME GARDENING is in. People who have never gardened before are joining the crowd to "grow their own" food and enjoy garden fresh vegetables.

Auburn University Agricultural Experiment Station is supporting this interest with continued research in many phases of vegetable production. An important part of this research is variety testing, a first step in determining the potential of new or improved vegetables for adaptability to Alabama.

Fertilization and liming of the bell pepper, eggplant, and cabbage variety trials reported were on the basis of needs as shown by soil tests. Soil was treated for nematodes, and spraying done as necessary for insect and disease control. The plots were irrigated as needed throughout the season.

Bell Pepper. California Wonder 300, Mercury, and Midway produced good yields of large, well shaped fruit, Table 1. Most varieties produced pods with 3-4 lobes each. Exceptions were Canape, Early Bountiful, and Hybrid No. 19, which had 2-3 lobes; Pick-A-Peck, which most often had 2 lobes; and Yolo Wonder L, a 3-lobe variety. (Pods with 4 lobes are considered more desirable for stuffing peppers since they stand on end more easily than the 2- or 3-lobe type.)

Pod wall thickness was 6-7 mm for all varieties except Canape and World Beater, which measured 5 mm.

Small fruited varieties Canape, Hybrid No. 19, Pick-A-Peck, and World Beater produced more pods per plant than the large fruited varieties. All varieties produced additional pods that were considered unmarketable by present standards, but which were suitable for home use.

Several varieties that turn red early could be desirable for adding color to salads or other dishes.

Eggplant. Jersey King Hybrid and Peerless Hybrid are similar and both performed well. Early Beauty Hybrid could be considered ornamental since it has a heavily pigmented purple plant. Other varieties in Table 2 also yielded well. Spines are characteristic of eggplant and occur on the fruit stem and plant. Early Beauty Hybrid and Long Purple were almost free of spines.

Hybrid Cabbage. Jet Pak has been the earliest maturing hybrid, Table 3. Green Boy and Tastie produced large heads and Stonehead consistently produced small heads. Early cutting is done when more green leaves are desired. Leaving in the garden longer than the days reported for harvest permits these varieties to produce large heads. Since hybrids tend to be uniform in maturing, planting more than one variety would extend the harvesting period. All hybrids were harvested only once, whereas Round Dutch was harvested three times.

TABLE CODE: Color—LG = light green, G = green, DG = dark green, BG = blue green, P = purple, B = very dark purple that could be considered black, DP = dark purple, PB = purple to black, and LP = light purple; eye appeal and plant vigor—1 = very poor, 2 = poor, 3 = fair, 4 = good, and 5 = excellent; Shape—R = round, E = elongated, and O = oval; season—E = early, M = midseason, and L = late.

TABLE 1. BELL PEPPER VARIETY TRIAL, NORTH ALABAMA HORTICULTURE SUBSTATION, CULLMAN, 1973-74

Variety	Pods per plant	Pod weight	Fruit color	Eye appeal	Pod length	Pod width
	No.	*Lb.*			*In.*	*In.*
California Wonder	5.5	0.27	G	3	2.75	2.75
California Wonder 300	9.1	.31[1]	DG	3.5	3.00	3.00
Canape	9.6	.21	DG[2]	2.5	3.50	2.00
Delaware Belle	8.8	.26	LG	4	2.75	2.75
Early Bountiful	8.6	.19	G[2]	2.5	3.00	2.25
Emerald Giant	7.2	.31	DG	4.5	3.00	3.25
Hybrid No. 19	11.2	.24	G[2]	3	3.50	2.75
Mercury	8.4	.33[1]	DG	4	3.00	3.00
Midway	8.3	.31[1]	G	3	2.50	3.00
Miss Belle	6.0	.31	DG	4	3.00	2.75
Pick-A-Peck	10.7	.20	G[2]	2.5	3.50	2.00
Titan	6.2	.31	G	4	3.25	3.00
Twilley's Big Pack	5.3	.27	G	4	3.00	3.00
World Beater	10.8	.24	LG	3	3.75	2.25
Yolo Select Pak	6.0	.30	DG	4.5	3.25	3.00
Yolo Wonder L	6.6	.30	G	3.5	3.00	3.00

[1] 1974 data only. [2] Turns red early.

TABLE 2. EGGPLANT VARIETY TRIAL, NORTH ALABAMA HORTICULTURE SUBSTATION, CULLMAN, 1973-74

Variety	Fruit per plant	Fruit size	Fruit color	Eye appeal	Shape	Spines[1]
	No.	*Lb.*				
Black Beauty	8	1.04	P	2.5	R	2
Black Magic Hybrid	8	1.19	P	2.5	R	3
Blacknite Hybrid	10	.73[2]	B	4.5	E	2
Blackoval Hybrid	12	1.05	DP	3.5	O	3
Early Beauty Hybrid	13	.56	P	2.5	O	5
Florida Highbush	8	1.03	PB	3	O	3.5
Florida Market	6	.97	DP	3.5	O	3
Hybrid No. 29	8	1.16	P	2.5	R	3.5
Jersey King Hybrid	12	.87	DP	4.5	E	3.5
Long Purple	5	.62	LP	2.5	E	4.5
Midnite Hybrid	9	1.15[2]	B	3.0	O	2
Mission Bell	9	.95	P	3.0	O	2
Peerless Hybrid	11	.87	DP	4.5	E	2
Pompano Pride	6	.99	DP	3.5	O	2

[1] 1 = many; 5 = few to none. [2] 1974 data only.

TABLE 3. HYBRID CABBAGE VARIETY TRIAL, AUBURN, 1973-74

Variety	Head size	Color	Season	Eye appeal	Plant vigor	Growing days
	Lb.					*No.*
Blue Chip	3.64	G	M	4	4.5	79
Green Boy	4.04[1]	BG	M	4	4.0	80
Headmaster	3.57	BG	L	3	4.5	86
Hercules	3.57[1]	G	M	3	3	80
Jet Pak	3.27	DG	E	4	4.0	70
King Cole	3.73	G	M	4	4.5	75
Market Prize	3.16	BG	M	4	4.5	81
Market Topper	3.31[1]	LG	M	3	3	76
Prime Pak	3.54	BG	L	4	4.5	83
Round Dutch[2]	3.29	G	M-L	3	4.5	85
Rio Verde	3.72[1]	BG	M	3	4.5	80
Sanible	3.78[1]	BG	M	3	4.0	76
Stonehead	2.88[1]	G	M	4	4.0	75
Tastie	4.17[1]	G	M	3	3.5	76

[1] 1974 data only. [2] Not a hybrid.

DESTUN and ZORIAL– New Herbicides for Use in Cotton

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Dept. of Agronomy and Soils

FOR THE FIRST TIME in almost a decade, there is something new in preemergence herbicides for cotton. Two herbicides scheduled for marketing in 1975 or 1976 differ widely in chemical structure from all currently used cotton herbicides. Both offer some new herbicidal properties.

The two new materials are: (1) perfluidone (1,1,1-trifluoro-N-[2-methyl-4-(phenylsulfonyl) phenyl] methanesulfonamide), which will be sold under the trade name Destun; and (2) norflurazon (4-chloro-5-(methylamino)-2-(a,a,a-trifluoro-*m*-tolyl)-3-(2H)-pyridazinone), having the trade name of Zorial. The two chemicals are similar in several respects: both are formulated as wettable powders, both are applied to the soil surface, and both are active against annual grass and many broadleaf weed species.

An important advantage of the new herbicides is their activity against nutsedge. This property alone would make them welcome additions to available cotton herbicides.

Perfluidone and norflurazon have been evaluated for 4 years or longer by the Auburn University Agricultural Experiment Station. Field experiments were conducted on Decatur clay loam at the Tennessee Valley Substation and on Lucedale sandy loam at the Prattville Experiment Field. Predominant weed species in test areas included large crabgrass, crowfootgrass, prickly sida, redroot pigweed, morningglories, and Pennsylvania smartweed.

Control of annual grasses was essentially complete with rates of perfluidone as low as 1.5 lb. per acre. For broadleaf weeds, however, rates lower than 3.0 lb. were not satisfactory (control measured at end of season).

Perfluidone caused substantial stunting of cotton, particularly at rates of 3.0 lb. per acre or higher. This stunting resulted in shorter plants at harvest but did not reduce yield of cotton, Table 1.

With norflurazon, a rate of 1 lb. per acre was usually sufficient for satisfactory control of annual grass weeds as measured at end of season. Rates lower than 3 lb. provided less than complete control of broadleaf weeds, however. This herbicide performed about the same when applied either as preemergence or preplant incorporated treatments.

Cotton tolerated rates of norflurazon as high as 4.0 lb. per acre without adverse effects on growth or yield.

Weed competition in the test fields was severe, reducing cotton yield by 90% without herbicide treatment or mechanical cultivation. There was no yield reduction from weeds when as much as 2 lb. per acre of norflurazone was used without cultivation. Yields were as high as when weed competition was eliminated by cultivation.

Cotton is generally more tolerant of norflurazon than of perfluidone. Norflurazone also gives better broadleaf weed control.

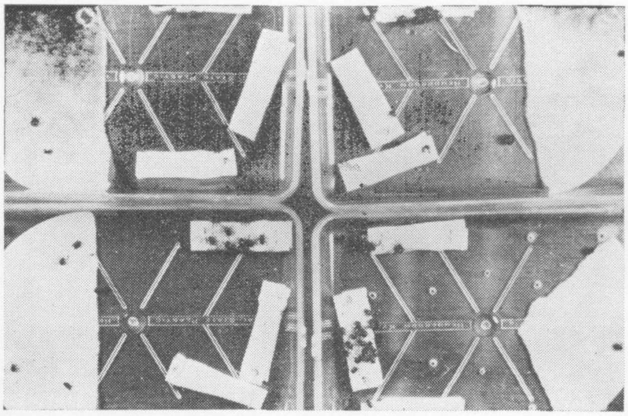
TABLE 1. EFFECT OF PREEMERGENCE APPLICATION OF PERFLUIDONE ON WEED CONTROL, CROP RESPONSE, AND COTTON YIELD, AVERAGE OF TWO LOCATIONS FOR 4 YEARS

Lb. per acre perfluidone	Weed counts[1]		Pct. weed control[2]				Crop injury[3]		Seed cotton/acre	
			Grass		Broadleaf					
	Grass	Broad-leaf	Early	Late	Early	Late	Early	Late	Culti-vated	Un-culti-vated
	No.	*No.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Lb.*	*Lb.*
None	413	404	0	0	0	0	0	0	1,844	311
1.5	69	76	97	83	71	39	10	16	----	----
2.0	25	203	99	96	73	40	5	6	2,057	2,139
2.5	19	161	100	96	88	43	6	6	----	----
3.0	23	138	99	98	82	50	26	33	----	----
4.0	10	117	100	98	93	82	19	15	1,750	1,828
6.0	5	20	100	96	99	91	25	34	2,007	2,046
8.0	1	44	100	100	100	96	32	24	1,944	1,727

TABLE 2. EFFECT OF PREEMERGENCE AND PREPLANT INCORPORATED APPLICATIONS OF NORFLURAZON ON WEED CONTROL, CROP RESPONSE, AND YIELD OF COTTON, AVERAGE OF TWO LOCATIONS FOR 5 YEARS

Lb. per acre norflurazon	Weed counts[1]		Pct. weed control[2]				Crop injury[3]		Seed cotton/acre	
			Grass		Broadleaf					
	Grass	Broad-leaf	Early	Late	Early	Late	Early	Late	Culti-vated	Un-culti-vated
	No.	*No.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Lb.*	*Lb.*
Preemergence										
None	665	434	0	0	0	0	0	0	2,799	355
1.0	11	103	96	88	83	48	6	0	3,028	2,460
1.5	0	16	100	96	98	70	0	0	----	----
2.0	1	18	100	93	96	79	0	0	3,177	2,722
3.0	1	5	100	100	100	100	0	0	4,083	3,889
4.0	1	6	100	100	99	99	10	0	3,097	3,387
8.0	0	6	100	100	100	100	58	30	----	----
Preplant incorporated										
None	509	743	0	0	0	0	0	0	2,499	224
1.0	44	297	99	73	79	50	0	0	3,179	2,460
2.0	0	198	100	100	93	85	10	3	2,645	2,781
3.0	5	22	100	99	99	75	5	0	3,637	3,500
4.0	2	7	100	100	100	97	9	1	3,655	3,539

[1] Number of weeds per 80 ft. of row, 12-in. band.
[2] 0 = no control; 100 = complete control.
[3] 0 = no injury; 100 = complete kill.



The Figure shows the preference of curculio for susceptible varieties of southernpeas. The insects are shown feeding on paper wrapped agar tubes that are made with hot water extracts of resistant and susceptible varieties.

INSECT RESISTANT SOUTHERNPEAS MAY LACK CHEMICAL ATTRACTANTS

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When exposed to equal infestations of insect pests, mainly the cowpea curculio, some southernpea varieties suffer much less damage than others. This resistance is believed to result from physical and/or chemical factors in the pods or peas. Pod thickness or the position of peas in the pod may prevent curculio from reaching the peas or the larvae from surviving, while the lack of chemical attractants in the pods may make them less attractive to insects and discourage their feeding.

To determine the importance of the chemical attractant or feeding stimulant factor, a variety of laboratory experiments was conducted at Auburn University Agricultural Experiment Station during the summers of 1973 and 74. Curculio larvae were collected as they emerged from infested peas and were placed in containers of soil. In about 20 days newly emerged adults were collected and placed in plastic containers with fresh pea pods or with filter paper tubes containing agar and hot water extracts of the pods as shown in the illustration. Pod punctures and feeding damage to fresh pod surfaces, or punctures in filter paper tubes were counted daily and experiments were repeated every other day for about 3 weeks. Table 1 shows curculio feeding response to fresh southernpeas when they were given a choice of the California Blackeye (CBE) variety, Ala. 963.8, or CR 22-2-21 breeding lines. There were fewer pod punctures and total pod surfaces consumed on the resistant breeding lines than on the susceptible variety. When the insects in each container were presented with only one pod at a time there were more total pod punctures on the resistant breeding lines, but the pod surface consumed was greater on the CBE, Table 2. Table 3 indicates the preference shown by curculio for agar plugs containing hot water extracts of CBE over plugs from resistant lines. The photograph above was made soon after the plugs were placed in the container and the insects are obviously showing this preference.

The feeding stimulant, or attractant, was found to be extractable in ether by a series of experiments summarized in Table 4.

Resistance in southernpeas to the attack of cowpea curculio depends in part on a reduced amount of chemical substances contained in the pods which act as attractants or feeding stimulants. Breeding lines Ala. 963.8 and CR22-2-21 have less of these substances than the California Blackeye variety. These chemicals are soluble in hot water and especially in ether and will stimulate curculio to feed on materials other than southernpeas.

TABLE 1. CURCULIO FEEDING RESPONSE THREE PODS PER DISH[1]

Variety	Punctures (P)	Feed holes[2] (FH)	Total damage P + FH
CBE	612	246	858
Ala. 963.8	597	145	742
CR22-2-21	376	162	538

[1] One pod each of the 3 var. Ten curculios per dish—fed 24 hrs., starved 24 hrs.—27 trials, 6 replications, Aug. 1973.

[2] Average feeding hole diameter was 2 mm. Larger pod surfaces consumed were estimated as multiples of 2 mm diameter holes.

TABLE 2. CURCULIO FEEDING RESPONSE (ONE POD PER DISH[1])

Variety	Punctures (P)	Feed holes[2] (FH)	FH/P
CBE	69	90	1.3/1
Ala. 963.8	227	49	0.22/1
CR22-2-21	173	77	0.44/1

[1] Fifteen Curculios per dish—fed 24 hrs., starved 24 hrs.—17 trials, 3-4 replications, Aug. 1973.

[2] Average feeding hole diameter was 2mm. Larger pod surfaces consumed were estimated as multiples of 2mm diameter holes.

TABLE 3. FEEDING RESPONSE OF COWPEA CURCULIOS ON AGAR PLUGS CONTAINING HOT WATER EXTRACTS[1] OF PODS OF CALIFORNIA BLACKEYE, ALA. 963.8, AND CR22-2-21 SOUTHERNPEAS

Variety	Feeding trials[2]		
	1	2	3
	Punctures per plug		
CBE	38.2	27.4	20.6
Ala. 963.8	10.4	9.8	4.4
CR22-2-21	9.0	0.8	0.2
Control (agar only)	0	0	0

[1] Agar plugs made with water in which pods with peas removed were boiled 3 min.

[2] Fifteen curculios per dish fed 24 hrs., starved 24 hrs.—3 trials, 5 replications, Oct. 1973.

TABLE 4. FEEDING RESPONSE OF COWPEA CURCULIOS ON AGAR PLUGS CONTAINING: A. HOT WATER EXTRACTS OF SOUTHERNPEA PODS. B. EXTRACT WITH ETHER SOLUBLES REMOVED. C. EXTRACTS AS IN B WITH ETHER SOLUBLES FROM MOST SUSCEPTIBLE VAR. ADDED TO EXTRACT OF MOST RESISTANT LINE[1]

Experiment[2]	Variety	Punctures per plug[3]
A	CBE	48.4
	Ala. 963.8	17.5
	CR22-2-21	8.4
B	CBE	12.6
	Ala. 963.8	5.1
	CR22-2-21	0.25
C	CBE	6.7
	Ala. 963.8	1.6
	CR22-2-21	3.3

[1] The difference in total feeding response between B and C is due to reduced vigor of the insects with age.

[2] A. Agar plugs made with water in which pods with peas removed were boiled 5 min. B. Hot water extracts were extracted with ether before agar plugs were made. C. The ether soluble materials from the CBE extract were added to the CR22-2-21 extract in B.

[3] Twenty curculios per dish—fed 24 hrs., starved 24 hrs. A 3 trials, 14 replications; B and C 2 trials, 14 replications. Aug., 1974.

Major Viral Diseases of Corn In Alabama

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Department of Botany and Microbiology

STUNTED AND DISCOLORED corn plants have been observed in Alabama fields for several years. Frequently, widespread occurrence of such diseased plants has been associated with sizeable reductions in quantity and quality of yield. Prior to the mid to late 1960's, such a disease was often diagnosed or referred to simply as "corn stunt," with the assumption that it was caused by the "corn stunt virus."

To date, three pathogens, maize dwarf mosaic virus (MDMV), maize chlorotic dwarf virus (MCDV), and the corn stunt spiroplasma, have been associated with stunted, discolored corn. Only MDMV and MCDV have been found in Alabama.[1] Corn stunt spiroplasma, although not a virus, is sread by leafhoppers and is now recognized as the cause of the disease originally described and named as corn stunt in the 1940's. However, the spiroplasma has not been implicated with stunting diseases of corn in many states including Alabama.

[1] A recent paper reported the association of a third virus in stunted corn in Alabama, but incidence and importance of this virus are unknown.

MDMV and MCDV appear to be the prevalent pathogens involved with stunted discolored corn in Alabama. Occurrence of both viruses in the same plant has often been noted. MCDV particles are small spheres about 25-30 nm (nanometer equals 1/1,000 micron) in diameter, and are similar to those shown in Figure 1-A. Although only discovered in the early 1970's, MCDV has now been found in practically every state in the south and midwest. MDMV particles are long flexuous rods measuring around 800 nm in length (Figure 1-B). This virus also is generally distributed throughout the United States.

Symptoms of infection by MDMV and MCDV are similar in appearance and sometimes difficult to distinguish. Those caused by MDMV first appear on youngest leaves as an irregular, light and dark green mosaic or mottle (Figure 2-A). Eventually, the entire plant may appear yellowish-green and somewhat stunted. The initial symptom of MCDV infection is a fine, chlorotic streaking over the smallest veins making them appear white and indistinguishable (Figure 2-B). This symptom is more apparent on the underside of a leaf. Stunting and leaf discoloration from yellow to purple have been observed in plants infected by MCDV.

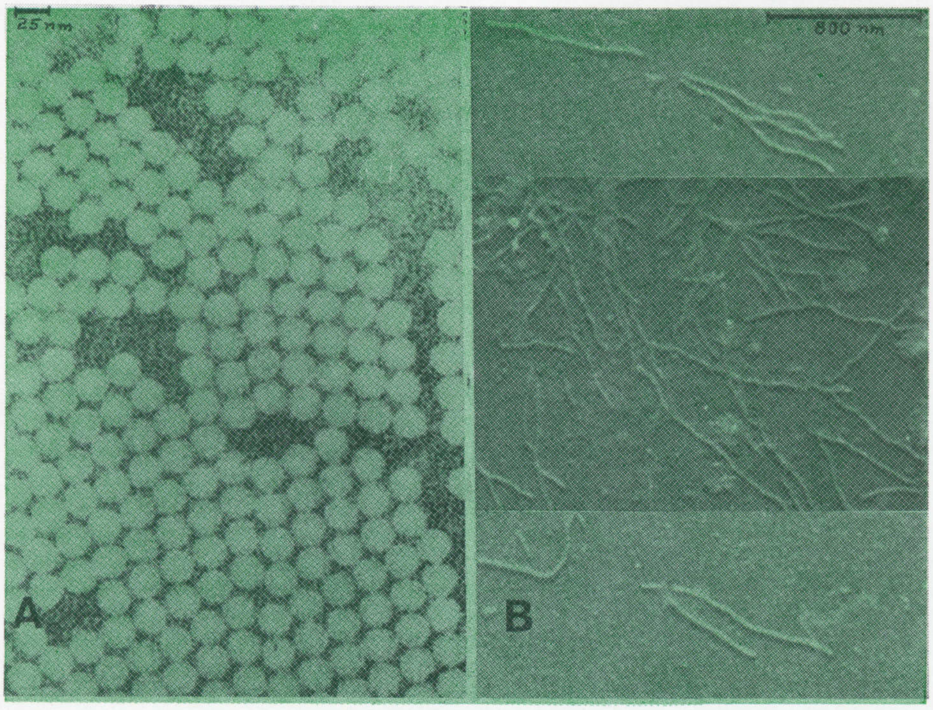


FIG. 1. Particles of two viruses that infect corn: (A) similar to MCDV and (B) MDMV.

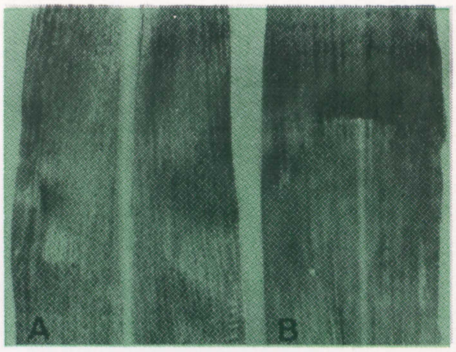
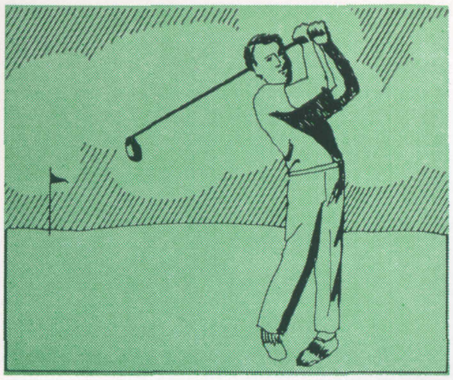


FIG 2. Symptoms of infection by (A) MDMV and (B) MCDV.

Both viruses are spread by feeding activities of insects, but not the same types of insects. MCDV is transmitted by certain species of leafhoppers, while MDMV is carried by some aphids. The manner in which each is carried by its vector also differs. MDMV is transmitted by aphids in a non-persistent or stylet-borne manner. In this relationship, aphids can acquire and transmit the virus during brief feeding probes of sometimes a few seconds in duration. The aphids very quickly lose the virus or ability to transmit it. By contrast, MCDV is transmitted by leafhoppers in a semi-persistent manner. Here, a longer feeding period is required to acquire and transmit the virus. But, the leafhoppers also retain the virus and the ability to transmit it for several hours.

The host ranges of MCDV and MDMV are similar. In addition to corn, both infect a wide range of wild and cultivated grasses including sorghum, johnsongrass, crabgrass, foxtails, and millets. In Alabama, johnsongrass is an important reservoir host for MDMV and probably also for MCDV.

Presently, use of resistant or tolerant corn hybrids is the most practical means of controlling these viral diseases. Several inbred lines and experimental hybrids have been evaluated for reaction to the viruses in Alabama and the nation, and some sources of resistance have been identified. Commercially available hybrids are also continually evaluated and several appear less susceptible than others. Use of insecticides may have some value against MCDV through control of the insect vector, but would be of little value in controlling the stylet-borne MDMV. Where feasible, control of johnsongrass will aid in reducing virus spread from this perennial reservoir host into the corn crop. Methods for controlling the viruses and vectors and their respective alternate hosts are being investigated for possible integration with host resistance in a pest management system.



PUBLIC GOLF COURSES in ALABAMA

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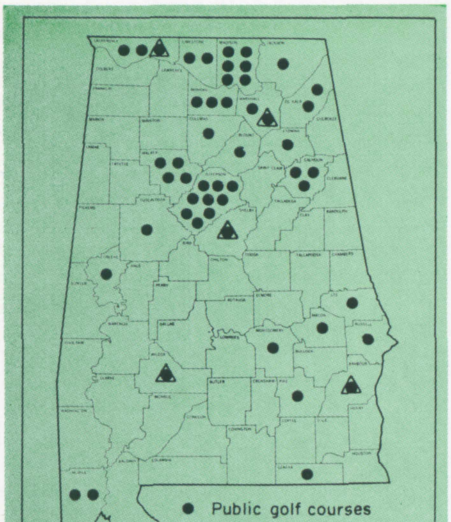
PROVISION of public golfing facilities has a long history in the United States. In fact, the first municipal golf course in the United States was built in New York in 1895. By 1972, 6,322 municipal and daily fee courses had been built.

Although municipalities were leaders in golf course development in Alabama in recent years, municipal and private daily fee courses comprised only a small percentage of the total golf courses in operation. However, public golf courses, including private daily fees, municipal, and other government owned courses open to the public, comprised about 56% of all golf courses in the United States in 1972. In Alabama only 27% of the golf courses were open to the public. Of five golf courses under construction in 1974, only one was to be open to the public.

During the last few years Alabama has instituted an extensive park development program. Public golf courses were included at parks in Marshall, Lauderdale, Shelby, Barbour, Wilcox, and Baldwin counties. In addition, several companies have developed courses for employees and subsequently opened the courses to the public. Several private courses are opened to the membership at selected times, such as evenings and weekends, and opened to public use at other times. Of the public golf courses in Alabama about 12% are State, 28% municipal, and 60% privately owned.



RURAL AND URBAN PUBLIC GOLF COURSES IN ALABAMA BY SIZE OF COURSE, 1974

Size of course	Rural	Urban	Total
Holes	*No.*	*No.*	*No.*
9	4	15	19
18	6	18	24
Par 3-9	0	7*	7
Par 3-18	0	2	22
TOTAL	10	42	52

* Includes one course under construction in 1974.

In 1974 Alabama had 52 golf courses open to the public, located in 25 counties, with 42 counties having no provision for public play. Many counties without public golf facilities have private courses, developed by individuals or groups to meet the local golfing demand.

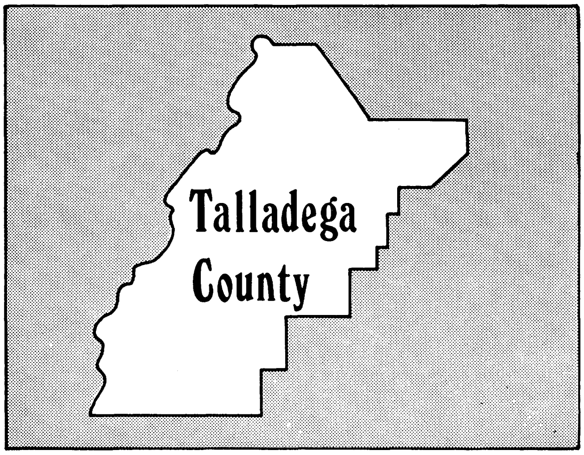
The National Golf Foundation has recommended 18 holes of golf per 25,000 people. Utilizing this recommended figure, Alabama would need about 138, 18-hole golf courses. Assuming public courses should represent about half of the needs, Alabama's 38 public 18-hole equivalents are approximately 30 less than the recommended number. On this basis golfing pressures on existing public golf facilities should be excessive, leading to early deterioration of courses. However, among the 52 public golf courses in Alabama, only 6% report play at over capacity in terms of course maintenance, while 67% report the courses are underplayed. Yet, all courses reporting play at over capacity were municipal. The preponderance of privately owned public courses indicates municipalities have used their scarce resources in other sectors and allowed the private sector an opportunity to meet golfing demands. The high proportion of underplayed courses indicates demand is not as great as expected in areas where courses are located.

Public as well as private golf courses face the problem of a disproportionate demand. The course remains available for play 6 or 7 days per week, 52 weeks per year. Yet, golfers primarily desire facilities during the evening, on weekends, and during warmer weather. A course may operate 2½ days per week at 150 to 200% of capacity during the spring and summer and at less than 10% of capacity the remaining days of the week and during the winter. To the golfer the supply of facilities appears inadequate, while to the course operator the demand for golf appears low. Differential pricing, opening private clubs to public use on off days and special days, and other procedures have been used in an attempt to stabilize demand throughout the week and year.

As a recreational activity, golf ranks relatively low in percentage participation among Alabama residents. Many reasons account for this fact. The game requires specialized equipment, developed facilities, a degree of professional instruction, and generally a fee charged for participation. With increasing levels of income and increased awareness of the game, demand for golf facilities has increased.

Golf courses do not appear to represent viable profit opportunities under present conditions. Investment, operation, and maintenance costs are relatively high, while the number of rounds played is relatively low. Increases in rounds played beyond course capacity leads to correspondingly steep increases in operating costs or deterioration of course conditions. Skillful management is necessary for returns from green fees to cover operating costs. Since collective capital can overcome these difficulties, private clubs with restricted membership can cover costs by membership fees and assessments.

The combination of seasonality of demand, high initial investments and operating costs, and the relatively small portion of the population participating raises serious questions regarding the role of government in providing golf facilities. Public agencies would need to commit substantial resources to provide golfing facilities for all who wish to play during high use periods. Whether these resources should be used to expand and develop golf facilities is a public issue and should be considered with the alternative needs for scarce public funds.



A watershed protection study was made in Talladega County in an attempt to increase land use alternatives.

SHOULD Our COUNTY SPONSOR WATERSHED DEVELOPMENT?

HOWARD A. CLONTS, *Department of Agricultural Economics and Rural Sociology*

YES OR NO. The argument continues on the benefits and detriment of watershed development.

Watershed development is the process of reducing flood damage in local areas. Actual work on watershed protection under public law began in Alabama in 1955. Today there are 70 projects completed or underway in the State. Should every county sponsor these projects? What are the gains and costs?

To answer these and other questions a study was initiated of one particular watershed in Alabama. In 1962, Cheaha Creek in Talladega County was known to flood several times yearly, causing considerable damage and reducing land use alternatives. However, that same year work began on flood control under funding of the Watershed Protection and Flood Prevention Act of 1954, P.L. 566. The project was virtually completed in 1972. This area was selected for study to measure the impact of development on the economy of the county and local area.

The economy of Talladega County is based largely on textile manufacturing, although the population is nearly equally divided between urban and rural. About 15% of the county land area lies in this watershed.

Two major activities were used to measure the impact of development on the county. First, an analysis of the production and consumption of products in the county was made. Income generated by these activities before and after the project was estimated. This was followed by a review of local watershed land use and productivity change and land value changes.

In calculating the effect of watershed development expenditures on the local economy, two periods of time, 1963 and 1967, were selected for pre- and post-project estimates. Through the respending process it was found that approximately $1.32 of additional county income was generated by each dollar spent for development. This income resulted from an estimated $2.32 output value increase per federal dollar spent.

Agricultural output increased most as a result of watershed activity. This result was expected since funds were spent for protection in the rural areas. An estimated $2.33 of additional output and $1.90 of additional agricultural income was generated by each $1.00 of watershed construction funds.

Since the project was located entirely in a rural area comprising about 15% of Talladega County, the impact on local people was important. Landowners in the immediate floodplain and upland portions of the watershed were interviewed to determine changes induced by development.

A majority of these landowners were satisfied with the project. Residents of the floodplain area were content with the operation of flood retarding dams and channel improvements. The less affected upland owners were not as aware of the watershed's benefits as were floodplain owners, but they believed that an expansion of watershed activities such as land stabilization, sodding, and reforestation would enhance the attractiveness of their holdings.

There were some objections and adverse opinions about the project although over 80% of all landowners were well pleased. From an environmental viewpoint, loss of vegetation and stream bank erosion were the main objections. In general, landowners were disappointed with the depth of the channel, loose sediment in the channel bottom, and unrepaired damage to fences and other personal property by construction crews. Recommendations for future projects made by landowners were centered primarily on these points with most emphasis given to minimal stream channel alteration.

Significant differences in land use shifts were observed between floodplain and upland farms. In the floodplain, major shifts of land to crop use from pasture occurred. This was accompanied by large amounts of land shifted from forest to pasture. In other words, as the fertile bottoms became flood safe they were converted to crop production and the less fertile and erosive upland areas were shifted to pasture use. Outside the immediate flood area nearly all land use shifts were toward pasture expansion. Very small amounts of land were changed to crop uses.

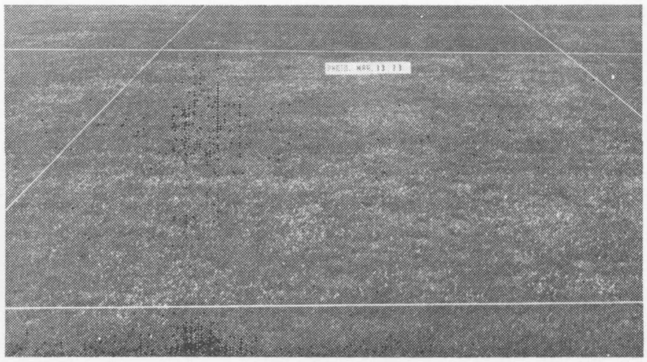
Results of these land use changes were increased farm crop yields and pasture carrying capacity and associated higher income. Net farm income for the typical floodplain general farm increased about 12% over the period studied. This change was measured in constant 1962 dollars, which removed artificial inflationary income changes.

Land values also rose, but only partially as a result of the project improvements. The average agricultural value of good bottomland was estimated to be $217 in 1962. This rose to $309 in 1973. However, a small sample of actual market values showed the 1973 value to be $415 per acre. The difference indicated that non-farm influences significantly influenced rural land values. The difference was even more significant with upland farms. Land values which could be generated from agricultural income amounted to only $107 per acre in 1973. Yet, the actual average sale price was $358 per acre. In other words, non-farm influences on value were such that paying for land with farm income would be extremely difficult.

In summary, this study showed that farm incomes, productivity, land values, and landowner satisfaction increased as a result of watershed development. However, the net effects were not large, especially with respect to the entire county. Immediate area impacts were favorable and benefits did exceed landowner costs. Total effects will not be known for several years, but continued improvements in land use and farm income are expected.

Annual Bluegrass Hard to Control in Overseeded Lawns and Golf Courses

RAY DICKENS, *Department of Agronomy and Soils*



Untreated plot in center contrasts sharply with foreground and background where the experimental herbicide NC-8438 provided good control of annual bluegrass. Light areas in untreated plot are annual bluegrass.

ANNUAL BLUEGRASS (*Poa annua*) is on the march. During the past decade this weed became a serious problem in dormant lawns and on overseeded golf greens. Contributing to its profusion are such factors as close mowing and excessive irrigation.

Where the bluegrass problem is in dormant warm season grasses, effective herbicides are available. Preemergence applications of DCPA (Dacthal), bensulide (Betasan or Presan), benefin (Balan), or pronamide (Kerb) give excellent control. Pronamide is equally effective when applied after annual bluegrass emerges. Excellent control with postemergence applications of either endothal (Endothal), simazine (Princep), or paraquat (Paraquat Cl) was established in earlier Auburn University Agricultural Experiment Station research.

The problem is different, however, with golf greens, fairways, or lawns overseeded with cool season grasses, such as ryegrass or fine fescues. All of the above herbicides severely injure seedlings of cool season grasses when applied at rates recommended for controlling annual bluegrass in dormant turf. Because of this problem, research was begun at Auburn to determine if herbicides could be used to selectively control annual bluegrass on dormant bermuda greens overseeded with cool season grasses.

Fifteen herbicides were evaluated in a greenhouse at three rates at or below amounts suggested for bluegrass control in dormant turf. Seeds of annual bluegrass and cool season turf grasses were sown in rows in greenhouse flats filled with potting soil. The herbicides were applied in spray immediately after seeding.

Seedling counts made 12-20 days after planting showed little annual ryegrass injury from DCPA, simazine, or an experimental compound NC-8438, and these materials controlled annual bluegrass, Table 1. Soon after counts were made, however, there was complete kill of all ryegrass seedlings on simazine treatments. Bensulide looked promising at low rates.

No selectivity among creeping bentgrass, roughstalk bluegrass, and annual bluegrass was noted for any of the herbicides evaluated. There was some selectivity toward red fescue.

Results of greenhouse tests were extended to field experiments to further evaluate control of bluegrass in annual ryegrass seeded on dormant bermudagrass golf greens. Herbicides were applied in water when ryegrass was seeded into the bermuda turf. Stands of ryegrass were visually estimated during the following winter, and control of annual bluegrass was determined by counting seedheads the following spring.

All herbicides gave slight to moderate reductions in ryegrass stands. The higher rates of some materials caused more serious reduction, Table 2. DCPA produced the least injury to ryegrass, but it did not satisfactorily control bluegrass. Bensulide caused severe stand reductions at the higher rate and did not control annual bluegrass at either rate.

The only material that produced consistent control of annual bluegrass was NC-8438. However, single applications made at time of seeding caused ryegrass damage that could not be tolerated. Further studies have indicated that NC-8438 will control annual bluegrass after it emerges. Perhaps postemergence applications or multiple application of lower rates will provide selective control in dormant turf overseeded with ryegrass.

TABLE 1. EFFECTS OF PREEMERGENCE APPLICATIONS OF HERBICIDES ON GERMINATION OF ANNUAL BLUEGRASS AND COOL SEASON TURFGRASSES IN THE GREENHOUSE

Grass	Stand as pct. of untreated check from herbicides, lb./acre																	
	DCPA			Benefin			Simazine*			Bensulide			Terbutol			NC-8438		
	2½	5	10	¾	1½	3	¼	½	1	2½	5	10	2½	5	10	1	2	3
Annual ryegrass	92	74	61	9	2	0	79	69	70	74	56	39	84	82	89	100	98	93
Red fescue	55	59	40	9	2	0	0	0	0	54	44	12	75	77	76	4	4	13
Creeping bentgrass	0	0	0	0	0	0	0	0	0	8	1	0	9	0	0	----	----	----
Roughstalk bluegrass	0	0	0	0	0	0	0	0	0	10	2	0	43	23	21	----	----	----
Annual bluegrass	10	0	0	1	0	0	0	0	0	28	7	3	91	70	81	14	11	0

* Ryegrass seedlings on all simazine treatments were dead soon after counts were made.

TABLE 2. EFFECTS OF PREEMERGENCE HERBICIDES ON STANDS OF ANNUAL BLUEGRASS AND RYEGRASS IN FIELD EXPERIMENTS

Herbicide rate/acre	Pct. of optimum ryegrass stand in winter following fall treatment			Annual bluegrass seedheads/sq. ft. in spring following fall treatment		
	1970	1971	1972	1970	1971	1972
	Pct.	*Pct.*	*Pct.*	*No.*	*No.*	*No.*
NC-8438						
1 lb.	54	68	55	81	2	19
2 lb.	44	64	30	57	1	8
3 lb.	42	53	25	3	0	1
Bensulide						
2½ lb.	62	45	----	175+[1]	35	----
5 lb.	18	15	----	175+[1]	19	----
DCPA						
2½ lb.	68	70	----	175+[1]	30	----
5 lb.	64	69	----	175+[1]	30	----
Untreated	79	86	75	175+[1]	63	152

[1] Too numerous to count.

Boron Toxicity A Threat to Chrysanthemum Culture

G. JAY GOGUE* and KENNETH C. SANDERSON, *Department of Horticulture*

POSSIBLE BORON TOXICITY to chrysanthemums showed up in test plantings at Auburn University Agricultural Experiment Station. Poor growth, injury, and high concentrations of boron (B) in the plants were noted with chrysanthemums growing in composted garbage media.

Further investigation of the potential problem revealed that B is widely used in many products, detergents for example, which makes it a potential environmental contaminant. Chrysanthemums are particularly susceptible to B toxicity, and there is a narrow range between deficiency and toxicity.

Risk of Overuse

Chrysanthemum flower development is influenced by B nutrition, so the risk of indiscriminate application is high. In some areas of the country, excessive amounts of B occur naturally in the soil.

Two experiments were conducted at Auburn, to (1) observe the effects of B addition on growth, and (2) establish average toxic foliar levels to serve as a guide in chrysanthemum culture. Boron ranging from 0 to 80 mg per 1.5-liter volume of a sand-peat mixture was applied to two chrysanthemum varieties.

Serious Damage Possible

In severe cases, B caused death of plant tissues. Plants receiving extremely high B levels had necrotic blotches or lesions, as shown by the photo. Young leaf tips became yellowed in early stages, followed by interveinal chlorosis. These leaf changes limited photosynthetic capabilities of the plant, causing a reduction in growth measurements, as shown here:

Boron treatment, mg/1.5 liters	*Length of stem, cm*	*Diameter of flowers, cm*
0	52.5	11.8
20	41.4	10.1
40	35.1	9.0
80	9.0	7.3

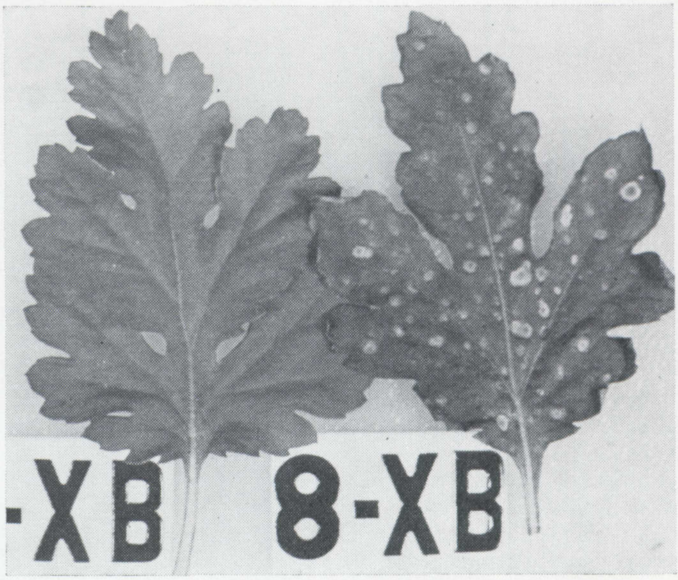
Analyses of chrysanthemum leaves indicated that B levels in excess of 125-140 p.p.m. were toxic to plants. The result was reduced growth. However, levels of about 150-175 p.p.m. were required before toxicity symptoms were noticeable. These values are approximate because the B levels vary with such factors as variety, season, method of analysis, and leaf collection procedures. Average optimum foliar elemental values for CF #2 Good News and Improved Albatross varieties are given below:

Element	*Optimum foliar standards*
Nitrogen	4.5-5.5%
Phosphorus	0.5-0.75%
Potassium	5.0-8.0%
Calcium	0.5-2.0%
Magnesium	0.2-0.5%
Manganese	200-400 p.p.m.
Iron	100-200 p.p.m.
Copper	30- 60 p.p.m.
Zinc	50-125 p.p.m.
Boron	100 p.p.m.

Other Elements Important

It is important to know the ranges of these additional elements for a valid interpretation of the B level. For example, liming causes B to become less available to the plant and, therefore, less is taken up. This is not a phenomenon resulting from a pH change, but rather is the influence that calcium has in the formation of insoluble boron compounds.

Results of these findings suggest that commercial chrysanthemum growers can reduce the chances of toxicity problems by (1) being able to recognize foliar symptoms of excess B, (2) using soil that has been tested for B levels or specifically prepared for plant growth, (3) having periodic leaf sample analysis for various element concentrations, and (4) using B fertilizers only when test results show need for it.



Necrotic blotches or lesions of chrysanthemum leaf at right resulted from boron rate of 80 mg per 1.5 liters. Normal leaf at left was from plant getting no boron.

* Former graduate student; now with National Parks Service, Bay St. Louis, Mississippi.

CONTROL of ROUNDWORMS in YOUNG CHICKENS

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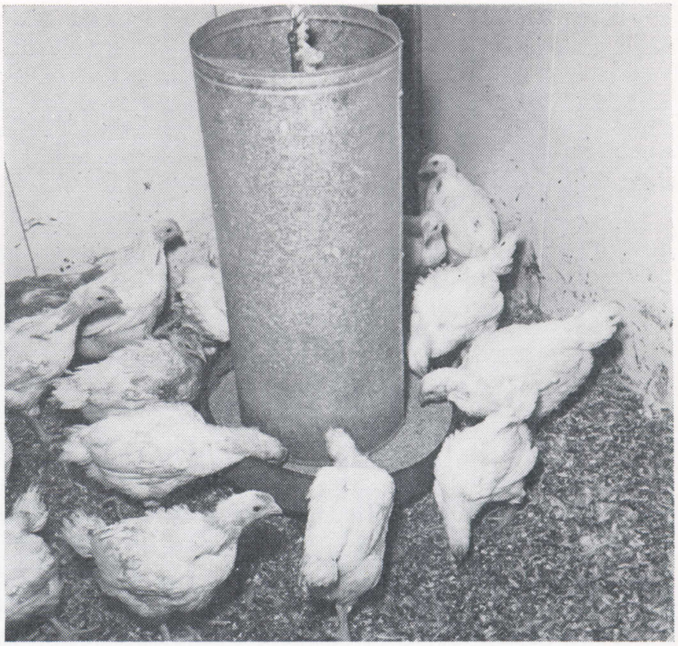
S. A. EDGAR
Department of Poultry Science



The ever-expanding poultry industry suffers significant economic losses each year from morbidity caused by parasites. Chief among these is the large intestinal roundworm, *Ascaridia galli*. This parasite inhabits the small intestine and can cause irritation of the intestinal wall and in rare cases total blockage of the intestine if large numbers are present.

The life cycle of the large intestinal roundworm includes a stage outside the chicken's body. Worm eggs are passed from the chicken in droppings and under ideal conditions of temperature and moisture will embryonate and become infective within 10-14 days. When susceptible chickens eat these eggs, a new worm develops in the small intestine, matures, and starts producing eggs in 5-6 weeks.

Effective control programs are based on breaking the life cycle by eliminating worms before they mature and begin passing eggs.

Research Methods

The efficacy of five compounds, reported to be effective in roundworm control, were tested with four consecutive batches of broilers at the Agricultural Experiment Station. Pens with concrete floor were prepared by adding 4 in. of wood shavings as litter. Chickens of an earlier trial were inoculated with embryonated worm eggs and allowed to remain in the pens until the litter was seeded with eggs. Conditions of the litter were managed to enhance embryonation and survival of the worm eggs. Two pens of 100 chickens each were assigned to the following treatment regimens: (1) unmedicated controls, (2) hygromycin B at 10 g. per ton of feed, continuously, (3) 1% nicotine sulfate (Mash-Nic) in feed, continuously, (4) 0.32% piperazine dihydrochloride in water at 5 weeks of age, (5) 0.77% piperazine phosphate in feed at 5 weeks of age, and (6) 2 lb. of Trithiadol per ton of feed continuously. The litter was not changed during the five consecutive broods.

Comparative Efficacy of Five Methods for the Control of *Ascaridia galli* in Broilers

Medication used amount/ton/or level	Average number *A. galli* per bird in each test[2]				
	52-L 9 weeks	52-N 9 weeks	52-P 9 weeks	52-R 9 weeks	52-V 9 weeks
	No.	*No.*	*No.*	*No.*	*No.*
Control	13.7	4.6	1.9	8.0	6.2
Control	12.1	3.5	2.9	7.3	6.2
Hygromycin B-10 g per ton	1.7	4.4	0.1	1.1	0.0
Hygromycin B-10 g per ton	3.9	0.8	0.6	0.1	1.2
1% Mash-Nic	0.8	9.4	0.9	2.4	1.4
1% Mash-Nic	3.6	2.7	1.7	3.3	1.5
Pip. hydrochloride H_2O SWL-.32%level	10.3	15.7	0.6	0.1	1.3
SWL-.32%level	2.6	1.2	0.5	0.1	0.1
Pip. phos.-0.77% in feed 5 weeks	1.6	0.6	0.2	0.0	0.0
Pip. phos.-0.77% in feed 5 weeks	10.5	1.1	2.3	0.0	0.3
2 lb. Trithiadol	11.7	4.1	2.4	7.9	13.1
2 lb. Trithiadol	0.9	13.6	0.6	13.0	22.1

[1] 100 day-old-chicks started per pen, Vantress-W. P. Rock crosses.
[2] Ten birds per pen were sacrificed at 9 weeks to determine worm infections.

Results

A summary of results is shown in the table. During the course of the experiments the birds in control pens maintained a moderate worm load, indicating the presence of continued exposure. Treatment compounds exhibited various degrees of efficacy, with Trithiadol being ineffective in this type of program, and the old mash nicotine treatment was only partially effective. The Hygromycin treatment was effective in lowering worm load but was more expensive than the piperazine treatments.

Both piperazine programs were effective and test chickens had reduced worm load to a negligible level by the end of the second batch of broilers.

This work clearly shows that a carefully followed program of treatment at 5 weeks of age with the proper level of piperazine in water or feed will effectively control roundworms in confined chickens.

EFFICIENT USE of farm machinery becomes increasingly important as production costs continue to rise. One method currently being used to increase machinery field operation efficiency is operation analysis.

Use Operational Analysis For Efficient Machinery Operation

ELMO RENOLL
Department of Agricultural Engineering

When the operation analysis concept is used to study machines in the field, some type of record of their operation must be obtained. This is essentially a study of the total production system – machines, fields, and management.

An operation analysis involves three basic parts. The first is to obtain accurate time records of all activities relating to a specific machine operation in a field. An example of this would be a complete field-time record of a cotton planter in operation and would include the increments of time related to each major segment of the total planting operation, as in Table 1.

The second part of the operation analysis involves dividing the time record into primary and supporting functions as in Table 2. In a planting operation, placing seed in the ground is the primary function. Supporting functions include adding seeds, chemicals, and row-end turning. The time for each component operation is expressed as a percentage of total field time.

The third part of the operation analysis involves a detailed study of the information obtained in parts one and two. This includes looking at each segment of the operation to determine if the time for any appears to be excessive with respect to the total operation time.

After the questionable segments are identified each is examined and analyzed in detail. This analysis takes into account physical conditions of the field, the machines used, and any managerial decisions that might have influenced the time record. After a detailed analysis is completed, changes in future operational procedures are recommended for those segments which show the greatest possibility for improving the efficiency of the total operation.

TABLE 1. PLANTING OPERATION TIME RECORD 4-ROW PLANTER

Operation	Total time	
	Hr.	*Min.*
Total field operation time	8	0
Actually placing seed in ground	3	12
Adjustment and down time	0	24
Adding seed	0	31
Adding fertilizer	1	36
Adding chemicals and water	1	55
Turning time	0	19

TABLE 2. PLANTER OPERATION ANALYSIS DATA 4-ROW PLANTER

Operation	Total field time
	Pct.
Primary function	
Actually placing seed in ground	41
Support function	59
Adjustments and down time	5
Adding seed	6
Adding fertilizer	20
Adding chemicals and water	24
Turning time	4

The value and use of operation analysis can be illustrated with the following examples. For the planting operation in Table 2, the support functions use 59% of the total field operating time, including 44% to add fertilizer, water, and chemical. In relatively efficient planting operations support functions use 40 to 50%. This suggests the support function time for the planting example is excessive and should be examined for the cause.

Adding fertilizer uses 2% of the total field time. This is excessive and needs to be changed to increase planting efficiency, Table 3. Chemicals and water use an additional 24%. Improved methods of handling these items are needed. The times used for turning and adjustment in the example are in the range for efficient planter operation. When turning time is excessive, the farm manager should examine field size, row arrangements, terrace layout, row length, and physical condition of the turn area to determine if changes can be made to reduce turning time and thus improve efficiency.

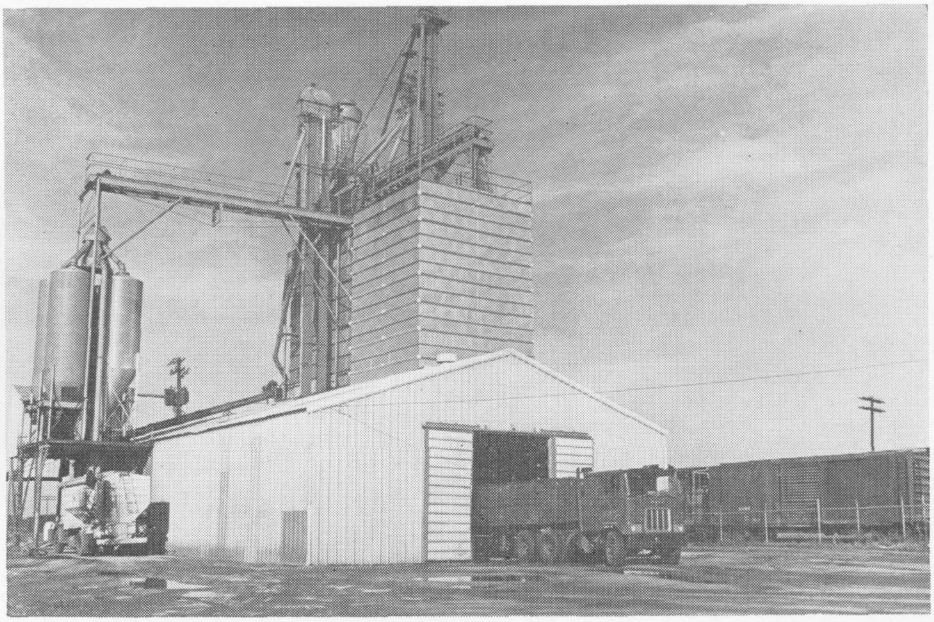
If planter adjusting time is excessive there may be several management problems. These might include poor seedbed preparation, improper planter maintenance which could cause excessive parts breakage, improper planter set-up before starting to plant, or improper operator training which could result in a trial-and-error approach to planter adjustment.

Planter maintenance, repair, calibration, and adjustment should be performed prior to the start of planting.

Operation analysis can be used to study the total machine operating system, including specific machines, fields, interaction between the machines and fields, and management of the machines. Some items can be studied in detail such as materials flow, field size and row arrangement, turn areas, and improper service or maintenance of the machine.

TABLE 3. TYPICAL SUPPORT-FUNCTION VALUES

Machine operation	Support-function value				
	Adjustments, percent	Other delays, percent	Add seed, percent	Add fertilizer, percent	Add spray chemicals percent
Plant (4-row)	3-7	3-4	3-5	10-14	7-9
Cultivate (4-row)	5-7	3-4			
Spray (12-row)	3-5	2-3			6-9
Harrow	1-3	0-1			
Harrow and apply chemicals	2-4	0-1			10-12
Plow (3-bottom)	2-5	1-3			
Plow (4-bottom)	3-6	1-3			



GRAIN MOVEMENTS between SOUTHEAST and CORN BELT

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THE SOUTHEAST is generally a deficit feed grain area with large grain-consuming livestock and poultry industries.

While certain Southeastern areas may have surpluses of feed grains temporarily at harvest time, they are net importers of feed grains throughout most of the year. Only a few areas are truly self-sufficient in feed grains. The Corn Belt, on the other hand, is a surplus producing area.

Perhaps, because of the close proximity, the available transportation network, and the existence of both customer and supplier, the Corn Belt and the Southeast are business partners in the feed grain-livestock economy. This partnership, especially the movement of all feed grains and other grains, will be reviewed in this article.

Data for identifying flow patterns of grain were obtained from surveys of grain handling and processing firms in the three Corn Belt and eight Southeastern states. Work was done under Regional Research Project SM-42 entitled Predicted Effects of Selected Policy and Technological Changes on the Grain Marketing System. Data were for the calendar year 1970.

For the eight Southeastern States studied, 519,603,000 bu. or over 92% of all interstate receipts of feed and other grains came from 11 states generally included in the Corn Belt. For corn alone, 393,657,000 bu. or over 95% were received from the Corn Belt. Indiana and Illinois were the two main sources of most of the grain moving between these areas, accounting for over 66% of the corn, almost 70% of the soybeans, nearly 57% of the wheat, and nearly 73% of the rye.

Grain sorghum, grown extensively in the drier areas of the Great Plains, came mostly from Kansas and Nebraska, although 3,656,000 bu., or over 9%, came from within Southeastern States. Kansas accounted for nearly 57% and, with Nebraska, nearly 70% of grain sorghum receipts in the Southeast.

Minnesota alone accounted for about 40% of the oats received in the Southeast, with nearly 80% being accounted for when Wisconsin, Indiana, and Illinois are included. Over 9% came from within Southeastern States.

The importance of interstate commerce to the Corn Belt can be seen by the fact that 1,081,417,000 bu. of all feed and other grain moved in interstate commerce in 1970 and over 42% of this was shipped to the Southeast, with shipments to ports for export accounting for over 36%. Smaller amounts moved within the Corn Belt (over 15%), to the Northeast (nearly 6%), and, a small amount to the West (less than 1%).

Corn was the most important grain shipped in interstate commerce from Corn Belt states accounting for 688,690,000 bu., or nearly two-thirds of all grain movements. Over 52% of the corn went to the Southeast with about 28% going to ports for export in 1970.

Soybeans were an important export crop in 1970, accounting for nearly 60% of all interstate shipments from the three Corn Belt states studied to ports for export. However, an important amount, over 26%, went to Southeastern States.

Alabama, like other Southeastern States studied, received most of its feed and other grains from the Corn Belt in 1970, 92,114,000 bu. or nearly 94%. However, unlike the Southeast in general, Illinois was by far the most important source for Alabama, accounting for over 54%. Illinois and Indiana together accounted for over 73% of all feed and other grains.

For corn, the most important grain received in Alabama, 62,930,000 bu. or over 66%, was received from Indiana and Illinois. While the pattern may have changed in recent years, 6,177,000 bu., or over 82%, of soybean receipts came from Illinois in 1970. Most grain sorghum received in Alabama came from Kansas and Missouri, over 77%. Most wheat came from Missouri, over 41%, probably from Kansas City. Other grains received in Alabama were mainly oats and over 49% came from Minnesota.

The high dependence of Alabama and other Southeastern States on interstate commerce in feed and other grains can be seen from this study. Alabama, in 1970, imported nearly 90% of its feed and other grain needs, nearly 94% from the Corn Belt. On the other hand the Corn Belt depended on the Southeast for over 42% of its interstate market for its surplus grains in 1970. Any phenomena of the economy which might disrupt the free flow of this trade relationship would be greatly to the detriment of both areas.

High density planting of young pecan trees at the Gulf Coast Substation near Fairhope.

High Density Pecan Planting

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ATTAINING PECAN YIELDS of 3,000 to 4,000 lb. or more per acre annually within 10 years after planting is a goal of horticultural researchers in the Alabama Agricultural Experiment Station. Such production appears obtainable by high density planting of 40 or more trees of adaptable varieties to the acre.

Varieties must start bearing a considerable number of nuts by the third, fourth, or fifth growing season to be adaptable. Such varieties are referred to as being precocious. The variety Cheyenne is the most precocious pecan tested to date. Trees of this variety at the Gulf Coast Substation near Fairhope have borne up to 1½ lb. (approximately 90 nuts) in the third growing season.

Adaptable varieties are characterized by a tendency to produce nut bearing lateral shoots. In contrast, as shown in the table, currently recommended varieties such as Stuart and Desirable produce few lateral shoots compared to varieties now being evaluated for high density plantings.

High density plantings by their very nature create conditions more favorable for scab development. Hence, adaptable varieties must exhibit some degree of scab resistance. Varieties Cape Fear, Cheyenne, and Chickasaw currently exhibit a sufficient degree of scab resistance in contrast to Wichita, Grabohls, and Cherokee which show none.

High density plantings of 40 to 50 trees per acre will begin to crowd by the eighth to tenth year after planting, unless tree size control pruning procedures are implemented.

Heavy radical pruning of older varieties such as Stuart, which lack precosity and a lateral branching habit, results in excessive non-branching vegetative shoot development. Such pruning eliminates nut production on these varieties for a number of years. The same degree of pruning on adaptable varieties results in vigorous developing shoots that laterally branch and bear nuts on these branches the following year. To date, pruning is the only recourse available to effectively control tree size in high density plantings.

Current research efforts are concentrated on developing training procedures for young trees to facilitate their pruning in later years, development of pruning procedures, varietal adaptation evaluations, and irrigation methods. Spacing studies are now being planned using more adaptable varieties to see just how close pecan trees can be planted and still be manageable.

LATERAL BRANCHING TENDENCY OF SELECTED VARIETIES

Variety	Number of lateral branches per foot of shoot growth
Grabohls	4.8
Cherokee	4.6
Shoshoni	4.4
Chickasaw	3.9
Wichita	2.4
Cheyenne	2.3
Cape Fear	2.2
Elliott	1.9
Farley	1.3
Desirable	1.1
Stuart	0.4

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