HIGHLIGHTS

of agricultural research

VOL. 20, NO. 4/WINTER 1973

Agricultural Experiment Station
AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

IN THE SPRING ISSUE of Highlights I asked readers of the Director's Comments to support legislation for funds to improve the Main Station field research facilities at Auburn. I know the funding of this by the Legislature and Governor Wallace was a response to the effort and encouragement of many people in Alabama who appreciate the importance of agriculture and of agricultural research to the future of this State. Therefore, on behalf of all of agriculture – THANK YOU!

R. DENNIS ROUSE

With this kind of active interest Alabama will continue to move toward the forefront agriculturally in this Nation. The future of Alabama agriculture is indeed bright!

In the last issue of Highlights I noted some implications of the change in availability of agricultural products. The change from viewing agriculture as a financial liability to the hope of the Nation, by those in leadership positions, looms greater today than could have been anticipated 3 months ago. To illustrate this point I can quote a recent statement by Dr. Phillip Handler, President of the National Academy of Science: "The future of this country is in agriculture and the future of agriculture is in research." President Nixon has said food was the foremost topic in his meetings with the leaders of China and Russia. The export of agricultural products is viewed by our government as the hope for a balance of trade. Secretary of Agriculture Butz recently said, "We dare not chance not enough agricultural production."

Last year exports of agricultural products amounted to $12.9 billion. We must meet the essential food needs of the people of the United States first, but last year the products of nearly 1 acre out of 4 went for export. With increased export demand and removal of acreage restriction, this ratio should narrow. Alabama, through the port of Mobile, has unequaled export potentials. Alabama must rapidly develop its transportation systems and port facilities for export.

With the projected increased need for overseas petroleum, our agricultural export would need to be doubled by 1985 just to balance the purchase of petroleum. This Nation with 6% of the petroleum supply is using 33% of the world production of petroleum. Although agriculture uses only about 3% of the total fuel consumption in this Nation, it will play a vital role in our present projected energy shortage. Food is the most vital thing on earth! It is in the same category with air and water as a basic requirement of human life. This means the energy required for agriculture must have a high priority, not only for the production of domestic needs but also for export.

The only approach that can be effected immediately to meet an energy shortage is conservation of use, producing agricultural products for export to the maximum of our capacity to strengthen the purchasing power of the U.S. dollar abroad, and transporting these products most economically.

The agricultural research at this Station will include as a high priority area of concern the use of available fossil fuel with maximum efficiency in agriculture.

may we introduce . . .

James L. Stallings, associate professor of Agricultural Economics and Rural Sociology. Dr. Stallings was raised on a farm in southwest Indiana. He earned B.S. and M.S. degrees from Purdue University and the Ph.D. from Michigan State University. Dr. Stalling's major fields of study include farm management, production economics, agricultural marketing, and economic development of under-developed areas.

Dr. Stallings teaches undergraduate and graduate level courses at Auburn and is currently doing research work on grain marketing, forage harvesting systems, least cost dairy rations and dairy waste disposal, the last of which is featured on page 3.

Prior to coming to Auburn on July 1, 1969, Dr. Stallings was Head of the Rural Economy Department at Morogoro Agricultural College in East Africa, which is a new college modeled after U.S. land grant universities. He also has served as a Station Statistician at West Virginia University; Chief of the Farm Products Branch, Agriculture Division, U.S. Bureau of Census in Maryland; Economist with the U.S. Department of Agriculture; and as an Assistant Professor of Agricultural Economics at New Mexico State University.

HIGHLIGHTS of Agricultural Research

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ON THE COVER: Lagoon waste disposal system proved efficient in tests. See story on page 3.

ECONOMICS of DAIRY WASTE DISPOSAL SYSTEM for ALABAMA

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Department of Agricultural Economics and Rural Sociology
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Department of Animal and Dairy Sciences

DAIRY WASTE DISPOSAL has long been a problem of the dairyman. Since 1969, scientists of the Agricultural Experiment Station have studied four systems of disposal to help solve this problem.

Two systems were studied at the Gulf Coast Substation: (I) the "conventional" system using a motorized scraper-loader and a manure spreader, and (II) a flush-irrigation system which involved flushing waste into a holding tank from which it was sprinkler irrigated onto fields. The third and fourth systems were a semi-liquid haul system at the North Auburn Dairy Unit using a holding tank and a tank spreader (III), and a two-stage, flush-lagoon system at the Black Belt Substation (IV). Systems I and II were complete confinement systems requiring removal of all the waste while III and IV were partial confinement systems and required provision for waste disposal only during milkings – approximately one-sixth of the time. Therefore, the different systems are not entirely comparable but may be possible alternatives on a particular farm.

ESTIMATED TOTAL COSTS PER COW PER YEAR FOR SYSTEMS OF DAIRY WASTE DISPOSAL AND VARYING NUMBERS OF COWS HANDLED PER YEAR, ALABAMA, 1969-72

Av. no. cows	Annual cost per cow for:			
	Complete conf.		Partial conf.	
	Conventional	Flush irr.	Flush lagoon	Semi-liquid
	Dol.	*Dol.*	*Dol.*	*Dol.*
30	40.10	63.37	21.31	34.31
60	29.42	44.01	14.60[1]	25.56
90	25.84	35.06	14.63[1]	22.66
120	24.07	30.31	13.18	21.21
150	23.01	27.42	12.59	20.32
180	22.30	25.62	12.65	19.73
210	21.78	24.56	13.81	19.32
240	----	23.76	16.56	19.02
2,000	----	18.88	----	----

[1] Does not include cost of aerator through herd size of 60 cows. Cost of aerator was included starting at 90 cows.

Initial costs in 1969 for systems I, III, and IV were roughly comparable at $6,318, $7,662 (including aerator cost of $2,407), and $5,879, respectively. System II had an initial cost of $15,482.

The conventional system was the cheaper per cow of the two confinement systems for herd sizes up to 240 cows and somewhat beyond, see table and Figure 2. No practical upper limit in cow numbers was determined for this system. However, cost per cow for the flush-irrigation system became lower and eventually cheaper than the conventional system as herd size increased beyond 240 cows.

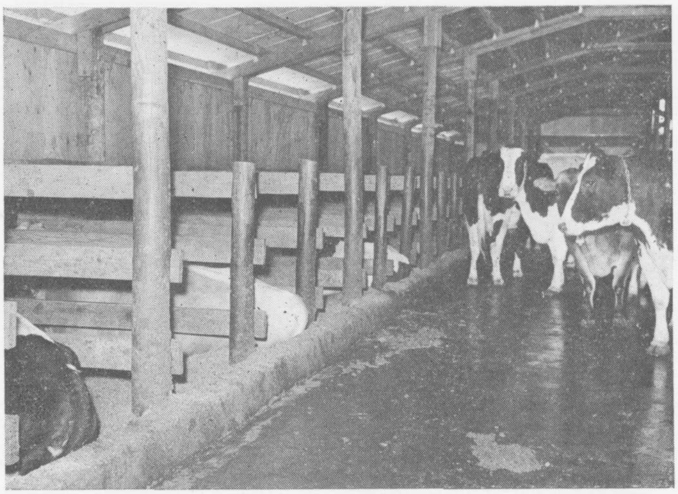


FIG. 1. Flush system of dairy waste disposal used at the Gulf Coast Substation.

All equipment for the conventional system was used only for the dairy enterprise and all costs were charged to it. This is probably not typical for this system on actual farms where equipment may be used for other purposes, or an existing tractor may be used with a scraper-loader attachment instead of the motorized scraper-loader. In such a case, cost per cow for the conventional system might mean that it was the cheapest system of dairy waste disposal for particular cases.

The flush-lagoon system was the cheaper of the partial confinement systems up to its capacity of about 240 cows.

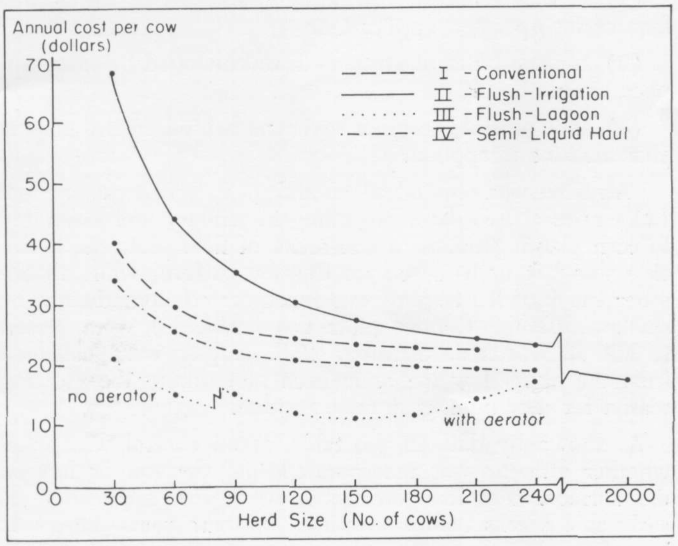


FIG. 2. Estimated total cost per cow for four systems of dairy waste management for various herd sizes, Alabama 1969-72.

However, both partial confinement systems were cheaper than the two complete confinement systems for this size operation.

If a lagoon is adopted, farmers should know that construction permits are required by regulatory agencies in most areas and recommendations of experts concerning size, suitability of the soil, and other aspects of construction should be observed. Also, the limit of 240 cows for the lagoon in this study could be increased by constructing more or larger lagoons. Whatever its size, an aerator will be necessary for an increasing percentage of time as herd size approaches the capacity for a particular lagoon, thereby causing costs to rise accordingly.

Disking in Atrazine Ahead of Corn Planting Gives Good Weed Control

GALE A. BUCHANAN and A. E. HILTBOLD
Department of Agronomy and Soils

ADVANTAGES OF PRE-PLANT herbicide application – long enjoyed by cotton farmers – are now available to corn growers. Atrazine incorporated as much as 3 weeks ahead of corn planting gave good weed control in Alabama tests.

Possible reduction of work load at planting time was responsible for the interest in preplant herbicide application to corn land, and this interest led to the Auburn project beginning in 1967. Sought in the study at the Plant Breeding Unit, Tallassee, were answers to these specific questions:

(1) Is weed control with atrazine affected by either surface or incorporated application?

(2) Is persistence of atrazine in soil changed by these application methods?

(3) Is it possible to grow soybeans behind corn the same year atrazine is applied?

Atrazine was applied at normal (1X) and twice normal (2X) rates at five dates beginning in January and extending to corn planting time. In one series of field plots the herbicide was left undisturbed on the soil surface, while in another the broadcast spray was incorporated immediately by shallow disking. Control plots (no herbicide) were disked to kill all weeds at planting. Soil samples were collected from the upper few inches in each plot during the growing season for determining atrazine residue.

As shown by data in the table, weed control was equal whether atrazine was incorporated into the soil or left on the surface. Results were good even with application as early as 3 weeks before planting. In some years there was loss of weed control with February applications.

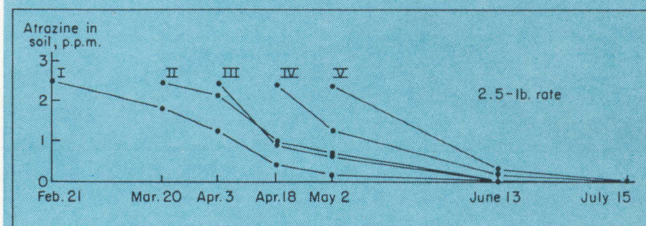
Shallow incorporation did not change persistence of atrazine in the soil from that observed with surface application. Soil content of the herbicide declined continuously after application to insignificant levels by fall. The loss rate appeared somewhat slower in early spring, as shown by the graph, probably because of lower soil temperatures. An important observation of atrazine persistence was that the 2X rate did not remain active twice as long as the normal rate – only about 20 days longer.

Atrazine carryover is a problem in such areas as the Midwest because of cooler climate and soils with less acidity and more organic matter than most Alabama soils. Thus, label restrictions stipulate that fields treated with atrazine are not to be planted with crops other than corn until the following year.

Results at the Gulf Coast Substation indicate there is no problem from carryover of atrazine when soybeans and small grains are planted the same year following corn. Atrazine was applied broadcast at normal and 2X rates preemergence to corn in March each year. After corn was harvested for silage in early July the soil was prepared and immediately planted to soybeans. Rye, wheat, and oats were planted in late October after soybean harvest.

Soybeans planted only 4 months after a 3-lb. per acre application of atrazine to silage corn showed no yield reduction. The 4-year average was 17 bu. per acre, as compared with 20 bu. for plots getting no herbicide. Increasing the atrazine rate to 6 lb. per acre cut yield to 15 bu. Small grains following the soybeans showed no effects of atrazine residue.

The experiments described illustrate that atrazine can be applied either preplant incorporated or preemergence to corn, and with no residue problem. Shallow incorporation may be advantageous in dry weather, serving to distribute the atrazine into moist soil and protect the chemical against degradation by sunlight. On the other hand, deep incorporation dilutes the atrazine and is an added expense. With favorable moisture conditions, the standard preemergence application is equally effective. Since atrazine is inactivated in soil during the growing season for corn, little if any persists into the fall in most Alabama soils.



CORN WEED CONTROL SIX WEEKS AFTER ATRAZINE APPLICATION[1] BY DIFFERENT METHODS AND AT DIFFERENT DATES, 1967-69

Date[2]	Method of application	Weeds per 80 sq. ft. of row: Grasses			Broadleaf weeds		
		1967	1968	1969	1967	1968	1969
		No.	*No.*	*No.*	*No.*	*No.*	*No.*
I	Surface	271	35	125	3	15	1
	Incorporated	86	54	106	3	3	13
	No herbicide	2,279	138	127	106	181	96
II	Surface	56	39	12	1	17	0
	Incorporated	24	19	142	3	9	9
	No herbicide	2,019	156	359	111	26	75
III	Surface	120	22	22	2	10	0
	Incorporated	56	14	39	1	3	0
	No herbicide	1,638	101	419	115	12	16
IV	Surface	128	48	13	0	2	0
	Incorporated	21	24	25	1	0	0
	No herbicide	1,604	172	345	37	2	29
V	Surface	—	14	46	—	11	0
	Incorporated	—	17	62	—	14	0
	No herbicide	—	156	339	—	26	38

[1] Rate was 2.5 lb. per acre.
[2] Application dates by years: 1967—February 27, March 31, April 14, April 28, and May 17; 1968—February 21, March 20, April 3, April 18, and May 1; 1969—February 4, February 28, March 12, March 27, and April 9.

Narrow Row Cotton Still Doubtful for Alabama

NOELL K. ROGERS and WILEY C. JOHNSON, *Department of Agronomy and Soils*

NARROW ROW COTTON shows little likelihood of revolutionizing Alabama's cotton production. Nevertheless, there are good reasons for interest in this production system.

Interest in "narrow row" or "high population" production – any row width narrower than the usual 36-42 in. with plant population of about 100,000 per acre – has multiplied in recent years. Increasing production costs and corresponding profit reduction are major reasons for the interest. The new system appears to offer some relief to soaring production costs, with five specific advantages claimed:

(1) Slight yield increases, up to 30%.

(2) Fewer bolls per plant on more plants for uniform early maturity and more uniform lint quality.

(3) Early once-over harvest.

(4) Fewer insecticide applications necessary.

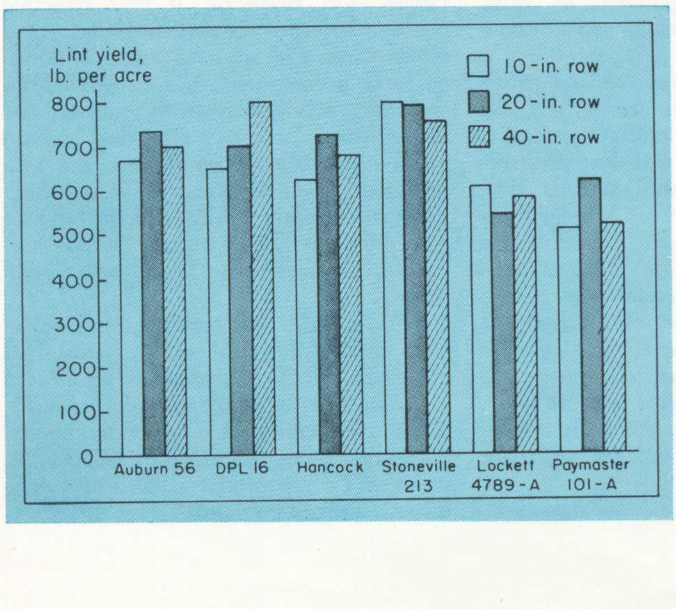
(5) Removal of food for diapausing boll weevils because of early harvest and plant destruction.

Most interest and research in narrow row systems has been in cotton growing areas of the Southwest. Plant breeders in Texas have developed determinate, early fruiting strains adapted specifically for high population in narrow rows. Preplant herbicide combinations have been devised for season-long weed control, and harvesters have been developed or adapted for narrow rows.

Conditions are different in Alabama, of course, so the narrow row method has been studied at Auburn and the Tennessee Valley Substation. Related research on harvesting is being done cooperatively with USDA and the Agricultural Engineering Research Unit, Marvyn.

No consistent or large yield advantage has resulted from narrow row plantings at Auburn or the Tennessee Valley Substation. Average total lint yields at Auburn were similar for 10-, 20-, and 40-inch rows (648, 678, and 665 lb. per acre). Varieties responded differently to the three spacings, however, as shown by the graph.

Varieties adapted for use in the area (Stoneville 213, Deltapine 16, Auburn 56, and Hancock) yielded higher at all spacings than the two western cottons, Lockett 4789-A and Paymaster 101-A. Stoneville 213 was the only variety with high yields at all three row spacings.



Yield differences between row widths and varieties were small in 1972 tests, with no response to different nitrogen rates. Comparisons were between Stoneville 213 and Coker 8304 (an experimental strain) at 21- and 42-inch row widths. As shown by data in the table, Coker 8304 made the highest yield in narrow rows, but differences were small.

EFFECT OF VARIETY, ROW WIDTH, AND NITROGEN RATE ON SEED COTTON YIELD, TENNESSEE VALLEY SUBSTATION, 1972

Row width and variety	Seed cotton, by N rate		
	80 lb.	120 lb.	160 lb.
	Lb.	*Lb.*	*Lb.*
21-inch rows			
Stoneville 213	3,458	3,267	3,422
Coker 8304	3,625	3,683	4,037
42-inch rows			
Stoneville 213	3,550	3,706	3,636
Coker 8304	3,570	3,788	3,625

Three nitrogen rates (80, 120, and 160 lb. per acre) were tried in the 1972 variety and row width tests, but no yield differences resulted. Although several years of testing are necessary to adequately evaluate crop response to nitrogen, results in 1971 and 1972 indicate that narrow row cotton needs no more N than the recommended rate for wide rows.

Problems unique to the humid Southeast complicate production of narrow row cotton in contrast to western parts of the Cotton Belt where the system is being used successfully.

Weed control is one of these complicating factors, since cultivation and lay-by herbicide treatments are difficult in narrow row cotton. Fields infested with such hard-to-control weeds as nutsedge and johnsongrass are not suited to the narrow row system.

Cotton in narrow rows shows drought stress sooner and these effects are more severe than in wide rows. Even a short drought during the short fruiting period of narrow row cotton can cause serious yield loss or even a crop failure. The same short dry period in conventional cotton would delay fruiting and perhaps only slightly reduce yields. Excessive moisture and nitrogen presents the same problem of rank growth regardless of row width.

Harvesting in narrow rows requires specialized machines. Ordinary 1- or 2-row pickers cannot be used. A spindle type cotton combine has been developed but is not yet generally available. Suitable stripper harvesters also have been developed.

At present there is not a cotton variety adapted to Alabama conditions that was developed specifically for narrow row production. Commonly used varieties have performed better than the western varieties when grown in narrow rows, even though they were not bred for this type culture. No distinct advantage from growing cotton in narrow rows has showed up in the first 2 years of research.

FIG. 2. Four weekly applications of Bacillus thuringiensis protected the right-hand plant from the damage received by the plant on the left.

Bacillus Thuringiensis: Development and Use of a Microbial Insecticide

JAMES D. HARPER, *Department of Zoology-Entomology*
ROBERT T. GUDAUSKAS, *Department of Botany and Microbiology*

ENTOMOLOGISTS HAVE CONTINUOUSLY SOUGHT efficient methods for controlling insect pests. Chlorinated hydrocarbons, organophosphates, and other products of the great chemical insecticide boom of the 1940's appeared to be the ultimate weapons for control of these pests. However, the enthusiasm generated by chemical insecticide technology soon subsided as problems of insect resistance, persistence in the environment, danger to non-target organisms, and human safety were realized. The search for safe alternatives to chemicals was continued.

One such alternative is the utilization of disease-causing micro-organisms in insects. Insects suffer from diseases just as humans and animals. Viruses, fungi, bacteria, and many other groups of organisms take their toll of insects under natural conditions. Insect pathologists, scientists who study diseases of insects, have discovered a number of micro-organisms that show promise as microbial insecticides. Among these is the bacterium, *Bacillus thuringiensis,* commonly called "B.T."

B.T. was first reported in 1901 as a pathogen causing death in silkworm larvae. It has since been isolated from a number of insects in different parts of the world. Some strains have shown greater pathogenicity or killing power than others. The more potent of these have been mass produced by several industrial firms for commercial sale and application. Some of the early products met with either limited success or complete failure. Recently, a new B.T. strain with 30 to 50 times more killing power for certain insect pests has replaced older strains on the market. This new strain is currently produced and marketed in the United States as Biotrol®XK, Dipel®, and Thuricide®, and shows remarkable ability to control many difficult-to-kill pests. The bacterium is formulated as a suspension, wettable powder, or dust, and can be applied with conventional equipment.

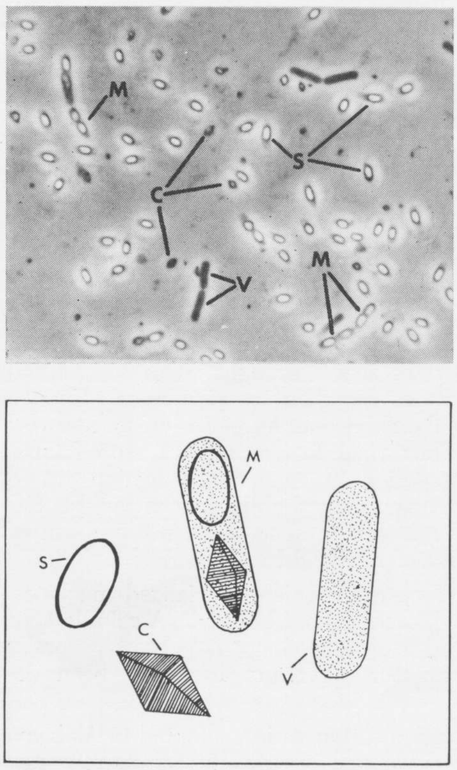


FIG. 1. (top) A microscopic view of Bacillus thuringiensis cells that have been magnified 925 times. (bottom) Diagram of cell components (v) immature vegative cell, (m) mature cell with spore and crystal, (c) protein crystal, (s) reproductive spore.

B.T. is effective against various caterpillars, many of which are serious defoliators of vegetables, cotton, soybeans, ornamentals, and trees. It has little effect on other insects and thus is very selective in its action. Most beneficial insects, such as predators and parasites, are not affected. In addition, B.T. is non-toxic to man or other vertebrates and is exempt from tolerances established by the Environmental Protection Agency. Thus, a crop can be treated, harvested, and consumed or processed with no waiting period, which is particularly desirable for the home gardener or vegetable producer.

B.T. does not infect and kill insects in the same manner as human bacteria. Instead, each bacterium produces a tiny protein crystal, Figure 1, which, upon ingestion by a susceptible insect, breaks down into a chemical that causes drastic changes in the insect's stomach. Once crystals are ingested, feeding ceases. The insect lives until it starves to death or until reproductive spores consumed with the crystals germinate and infect the other tissues of the body.

B.T. has been tested against a variety of insect pests on several crops in Alabama. It successfully controlled the complex of defoliators on collards, Figure 2, including cabbage loopers, imported cabbage worms, and diamond back moth larvae. On soybeans, it was effective against the velvet bean caterpillar, green cloverworm, and soybean looper. Loopers and hornworms were controlled on tomatoes, while fruitworm control was inadequate. Loopers attacking cotton can be controlled with B.T. in the rare instances when such control is required. Extensive testing against the forest tent caterpillar in water tupelo stands has shown this pest to be highly susceptible to B.T.

B.T. is safe, non-residual, and selective, having little effect on non-target organisms. It thus overcomes drawbacks associated with many chemical insecticides. New and even more potent strains currently being produced promise to make B.T. even more useful in future insect control programs.

Development of Structural Sandwich Panels With Sawdust Bark and Southern Pine Veneer

EVANGELOS BIBLIS and GEORGE E. COLEMAN, *Department of Forestry*

More than a year ago the authors reported the development of a structural sandwich wood panel made of a particleboard core (commercial underlayment southern pine particleboard) and southern pine veneer faces. It was stated that such panels were tested and found to be stronger and stiffer in flexure than conventional floor systems. It also was stated that conservative estimates indicated manufacturing costs of such sandwich floor panels could be 30% less than corresponding costs of commonly used floor systems.

Now, we would like to report the development of an even more challenging structural sandwich panel, which consists of a pressboard core made either entirely or largely of southern pine sawdust or bark and faced with southern pine veneer.

It is known that the amount of sawdust derived from manufacturing southern pine timber represents between 8 and 25% of the sawlog's volume. It also is known that the amount of southern pine bark of pulpwood size trees represents between 12 and 24% of a tree's volume.

Although bark and sawdust have been used for several agricultural products, the majority of bark and sawdust either has been burned or accumulated in large piles. However, burning bark and sawdust are prohibited by State and Federal anti-pollution laws.

Other studies concerned with utilization of bark and sawdust in board panels indicated a severe reduction of strength properties with an increase in bark percentage. Inclusion of 20-25% bark in wood particleboard reduced the board's properties below commercial standards. What was not realized was the potential of using board containing large percentages of bark or sawdust as cores of sandwich panels with softwood veneer faces.

Preliminary Experimental Results

A limited number of experimental sandwich panels was fabricated, and specimens were tested in flexure to obtain preliminary experimental results. Two series of pressboard mixes were prepared, one with various portions of southern pine sawdust and the other with various portions of southern pine bark. Each batch was mixed with urea formaldehyde resin (9% solids) and pressed into ⅝-in. boards. One-half of each board of every mixture was machined into 3 or 4 flexure specimens, 3 in. wide and 19 in. long. The other one-half was laminated into a sandwich with ⅛-in. southern pine veneer faces, then cut into 3 or 4 flexure specimens.

All specimens were tested to failure in flexure. The table presents properties of the two sandwich specimens with various percentages of sawdust or bark in the core. It also shows properties of the ordinary two-layer floor and of ⅝-in. southern pine plywood, which is used as a single-layer floor over 16-in. spans.

Summary and Conclusions

Limited experimental evidence suggests the following:

(1) Southern pine sawdust and southern pine bark can be utilized successfully to produce pressboards to form the cores of structural sandwich panels with southern pine veneer faces.

(2) Such structural sandwich wood panels appear to be structurally superior to the two-layer conventional system and undoubtedly could be manufactured at a fractional cost of the two-layer floor. Results indicate that such sandwich panels, even with cores containing 100% pine sawdust, are 185% stiffer and 140% stronger than the two-layer floors.

(3) Development, manufacture, and utilization of such structural sandwich panels would provide the following benefits to the forest owners, forest products manufacturers, consumers, and the public:

(a) It would provide the opportunity to make full and efficient utilization of all wood material and thereby contribute to the conservation of our natural resources.

(b) It would produce a structural wood panel at considerably lower cost and with higher performance than the two-layer conventional floor.

(c) It would contribute directly to the improvement of the environment since it would eliminate burning and disposal of these residues on the land.

Flexural Properties of Sandwich Specimen[1]

Specimen[2]	Density, lb./cu. ft.	Maximum load, lb.	Load causing 0.1-in. mid span deflection	Internal bond PSI
Sawdust sandwich				
s-o	47.1	1,196	323	240
s-15	48.8	1,024	306	238
s-30	43.8	982	282	154
s-45	47.2	1,050	277	237
s-60	47.6	973	260	203
s-75	47.4	919	258	194
s-90	47.1	971	293	228
s-100	47.0	911	259	----
Bark sandwich				
b-15	47.8	893	252	188
b-30	47.7	966	244	118
b-45	48.2	917	253	120
b-60	47.9	781	228	76
b-75	47.9	709	263	71
b-90	47.8	587	252	63
b-100	47.8	553	237	----
Two-layer floor	----	377	90	----
⅝ in. S.P. plywood	----	445	82	----

[1] Each value is the average of 3 or 4 specimens, which were 3 in. wide and tested over a 16-in. span along the veneer grain. For comparison (a) properties of the conventional two-layer floor and (b) properties of ⅝-in. plywood are listed.

[2] Numbers after letters s and b designate percentages of sawdust and bark by weight, respectively, in the core of sandwiches; s-o is a sandwich with all wood particleboard core.

BIGGER FARM INVESTMENTS and HIGHER COSTS

J. H. YEAGER, *Department of Agricultural Economics and Rural Sociology*

TECHNOLOGY FEEDS ON CAPITAL. This is one of the most significant features of modern day agriculture.

Tremendous scientific advances have been made in the production of crops, livestock, and livestock products in the past quarter century. A majority of these advances can be adopted by producers only through additional outlays of funds in the form of capital investments or operating expenses. This does not imply that it is not profitable for producers to adopt and use developments of this scientific age. To the contrary, where sound management has been used the adoption of science and technology has paid dividends to producers. It has also greatly benefited consumers and society in general. In no other industry during the past quarter century have gains in efficiency of production been as great as in agriculture.

Increased Size and Capital

Alabama farms have grown in size from an average of about 100 acres in 1950 to more than 200 acres at present. This trend in increased size will continue. With mechanization of almost all operations, farmers can and must handle more acres. If machinery and equipment investments are increased without an increase in volume of production or efficiency, the farmer will find that his unit costs of production have increased and he is less competitive.

The addition of acreage to existing farm units and the consolidation of farms have given rise to an increased demand for farm land. Along with other pressures to acquire land for many nonagricultural uses, such as recreational purposes, urban expansion, country estates, airports, and pipelines, the average value of Alabama farm real estate per acre has more than doubled in the past 8 years, as shown below:

Year	*Average value per acre*[1]	*Year*	*Average value per acre*[1]
1950	49	1966	142
1955	60	1967	159
1960	91	1968	170
1961	95	1969	187
1962	99	1970	200
1963	106	1971	229
1964	118	1972	239
1965	130	1973	274

[1] "Farm Real Estate Market Developments," ERS, USDA.

This higher value of farm real estate may be pleasing to the farmer who is ready to retire or sell his farm for other reasons. To the one who wishes to go into agricultural production, however, acquisition of the real estate resource presents a major problem. Also, upon transfer of a high value estate at death of the owner, tax liability and other problems may be encountered. Because of the tremendous real estate capital investment required, leasing or other arrangements for obtaining the use of farm real estate have and will continue to be more prevalent.

Besides real estate, which represents land, buildings, and other permanent improvements, a farmer's capital investment includes machinery, equipment, livestock, and inventories of feed, seed, and supplies. USDA reported the average total capital investment per farm in the United States as $102,100 in 1972. Three-fourths of this total was in real estate.

The 1973 machinery and equipment investment will be greater than in 1972 because of increased purchases of farm tractors and other machinery and equipment items. Sales of tractors in the 100 horsepower and larger increased more in 1972 than sales for smaller sizes, according to USDA. Safety and antipollution regulations also affect farmers' investments in machinery and equipment. As an example, a complete safety tractor cab adds about $1,200 to the cost of a tractor and a roll bar about $400.

Livestock numbers, in particular beef cattle on farms, have also increased. Higher prices for cattle together with greater numbers point to a greater total investment in livestock. For the U.S. average, livestock prices in 1972 were about 18% above the 1971 level. Livestock prices continued into 1973 at relatively high levels.

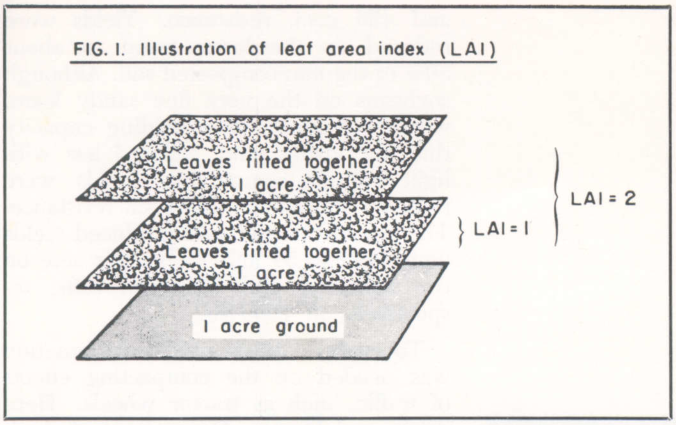
Greater Expenditures

Not only does it take more capital investment today than previously, but also considerably more capital in the form of operating expenses to farm. In 1972, Alabama farmers spent more than three times as many dollars for production items as they did in 1950. This increase resulted from higher costs and greater quantities purchased. Purchases of feed and livestock and interest on the farm mortgage debt were items with the greatest expenditure increases from 1950 to 1972, as shown here:

Item	*Farm production expenses, $ millions*		*Per cent increase*
	1950	*1972*	
Feed	29.5	238.0	707
Livestock	4.4	45.3	930
Seed, plants, and trees	8.3	17.7	113
Fertilizer and lime	51.9	61.6	19
Repairs and operation of capital items	34.0	86.2	154
Hired labor	32.1	42.2	31
Depreciation	34.9	122.9	252
Taxes on farm property	6.0	10.0	67
Interest on mortgage debt	4.2	28.3	574

A measure or index of prices paid by Alabama farmers is not available. However, for the United States, prices paid for items used in production, interest, taxes, and wage rates increased 72% from 1950 to 1972. Farm machinery, motor vehicles, interest, and building and fencing materials were individual items showing major increases in prices during this period. The outlook is for continued cost increases for most production items, including fertilizer which had a relatively small cost increase from 1950 to 1972.

In 1950, Alabama farmers spent 66¢ out of each $1 in cash receipts from farm marketings for production items. In 1972, production items took 81¢ out of each $1.



How Much Leaf Area for a Good Corn Crop?

C. E. SCARSBROOK, *Department of Agronomy and Soils*
B. D. DOSS, *Coop. USDA, ARS*

LEAVES ARE THE MOST IMPORTANT parts of corn plants in food manufacture. Although they make up only 10-15% of the weight of above-ground plant parts, the leaf blades manufacture most food produced by the plant. Only a small portion is produced in husks, stalks, leaf sheaths, and tassels.

The problem in efficient production of corn grain is to have enough leaf area for maximum yield yet not enough to make the plant excessively vegetative at the expense of grain. Insufficient leaf area results in poor use of light since much of the sunlight reaches the ground and is lost to the plant's food making process. With too many leaves, however, there is excessive shading of lower leaves to reduce their efficiency in food manufacture or cause them to die.

Relationship between optimum leaf area and grain yield was established in 1969-72 research with three hybrids (irrigated) at Thorsby. Leaf length and width were measured on live leaves in mid-July and the leaf area index (LAI) calculated by multiplying length x width x 0.75.

An LAI = 1 means there are enough leaf blades on 1 acre of corn that if placed flat on the ground and exactly pieced together would just cover the acre of ground, Figure 1. Likewise, a crop with an index of 3 would exactly cover an acre with three layers of leaves.

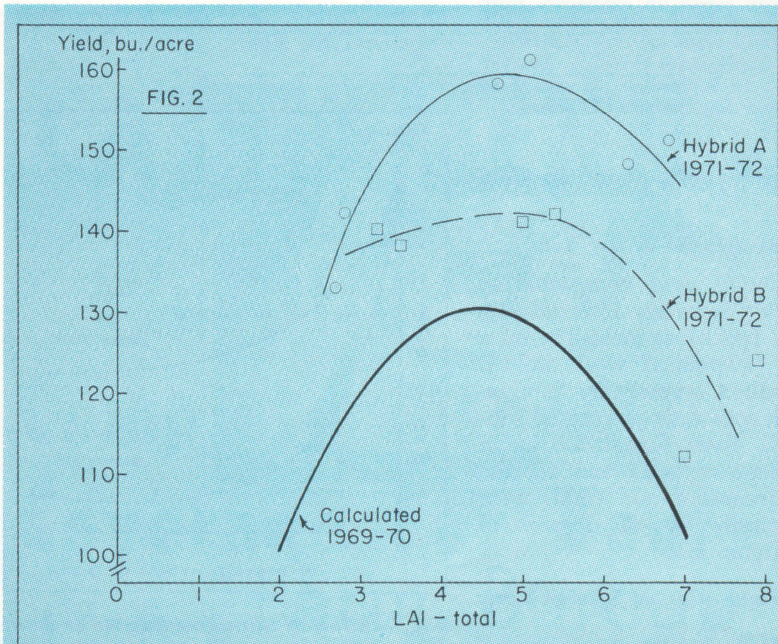
LAI's by 2-ft. vertical sections, beginning at the ground, were measured to determine which leaves on the plant were most closely related to grain yield. A range of leaf areas was obtained by varying plant populations and row widths. Amounts of N, P, and K fertilizers considered adequate for maximum yields were used.

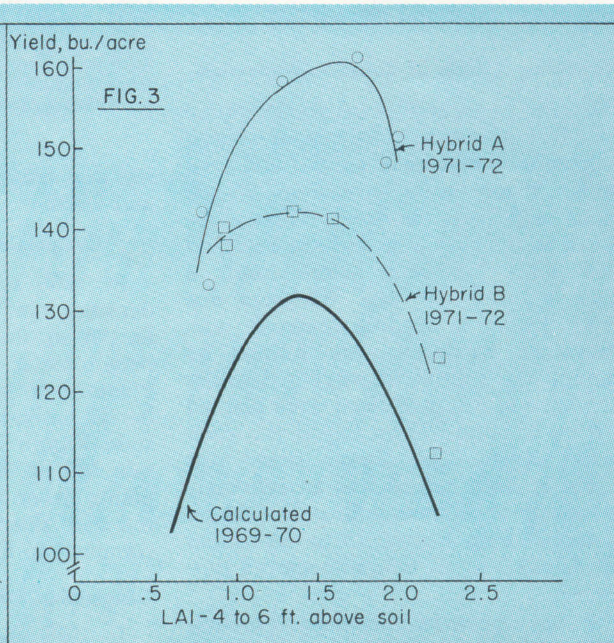
Data for 1969-70 were used to calculate average relationships between total LAI and grain yield for two hybrids. The graph of this relationship, Figure 2, predicted that yields would be highest when the total LAI was about 4.0 to 5.0. Sharp reductions in yield could be expected with higher or lower index values.

Yields from a medium height, mid-season hybrid and a tall, full-season hybrid were both much higher in 1971-72 than with hybrids used in the previous 2 years. However, maximum yields as well as lowered yields were found at about the same LAI values as previously observed.

Leaves located 4 to 6 ft. above the soil were more accurate than other plant segments in predicting grain yield in 1969-70. In fact, an index based on these leaves predicted ultimate grain yield as accurately as total LAI. This calculated relationship predicted maximum yields when the leaves of the 4- to 6-ft. segment had an LAI of 1.25 to 1.75, Figure 3. Yield curves for the two hybrids showed a similar relationship in 1971-72 and 1969-70, although grain yields were higher the latter year.

Accuracy of index values in yield predictions is shown by the Thorsby results. Both total LAI and LAI of the 4- to 6-ft. segment predicted about two-thirds of the variation in grain yields where moisture was always adequate. The excess leaf area found associated with a reduction in grain yield presents a challenge for research. Knowing how to utilize the food-making potential of this excess leaf area in the production of grain would be valuable information.





SOYBEANS RESTRICTED by SOIL COMPACTION[1]

HOWARD T. ROGERS and D. L. THURLOW
Department of Agronomy and Soils

WAYS TO OBTAIN more efficient use of soil moisture by soybean plants during the critical pod-filling period when rainfall is usually poorly distributed for top yields in Alabama and much of the Southeastern United States have concerned scientists for years.

For some 30 years, crop and soil scientists, engineers, farm equipment manufacturers, and some farmers have observed and studied soil compaction, including "traffic" pans, "hard" pans, or "plow" pans. These pans are known to prevent root penetration and proliferation in the subsoil, and to cause root strangulation in many soils with low moisture. Suggestions have been made on how to avoid development of these pans. Either the proposals have not proved practical or most farmers have not been convinced that soil compaction is a major problem.

The trend to heavier tractors, along with more "times over" for fertilizer application, seedbed preparation, planting, pesticide applications, and cultivation have led to more soil compaction.

Measuring Effects of Subsoil Compaction

Research was conducted to determine the effect of varying degrees of subsoil compaction on soybean growth and seed yields. Plants were grown in 55-gal. drums with ends removed. These were placed in trenches in a soybean field and filled with Lakeland loamy sand, a coarse-textured soil, and Wickham fine sandy loam, a medium-textured soil. Subsurface hardpans were formed by tamping the subsoil to varying densities from loose to compact. Seed were planted in 8 in. of loose soil on top of the compacted layer. The 3-year study was started in 1968, which was an extremely dry season at Auburn with only 0.44 in. of rainfall from August 15 to September 15. About 3 in. of rainfall occurred during this critical fruiting period in 1969 and 1970.

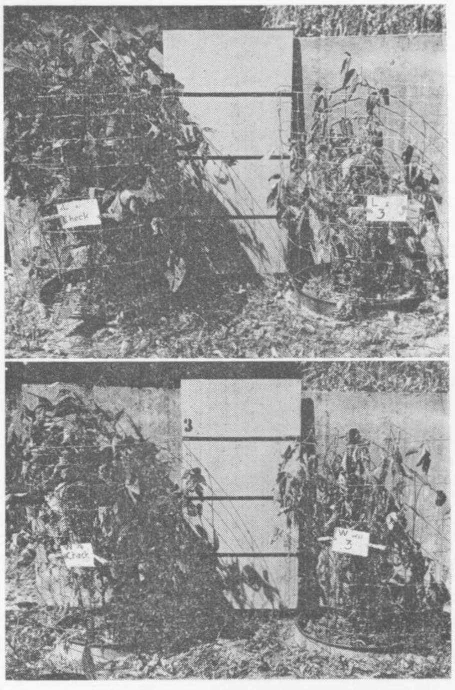


FIG. 1. Moisture stress on soybeans, right side, caused by subsoil compaction (300 p.s.i.) on Lakeland sand (above) and Wickham very fine sandy loam (below). Rainfall from August 15 to September 15 was 0.44 in. (Photographed September 12, 1968).

Compaction Effects—A Dry Year

In 1968 subsoils were compacted to densities ranging between 150 and 900 lb. per sq. in. (p.s.i.) as measured by a penetrometer (a pointed steel probe). Plants were wilted severely by September 12 on both soils with compacted subsoils, Figure 1. Even though 1.6 in. of rain fell on September 17 and 18, the plants never recovered and yields were reduced drastically by all degrees of compaction, Figure 2.

Compaction Effects—Normal Rainfall Years

In 1969 and 1970 subsoil compaction was reduced, and ranged between 75 and 450 p.s.i. resistance. Yields were reduced on the loamy sand to about 50% of the non-compacted soil. Although soybeans on the very fine sandy loam, which has more water-holding capacity than the loamy sand, suffered less with light subsoil compaction, yields were reduced 60% at the 450 p.s.i. resistance. The non-compacted soils produced yields equivalent to 57 and 76 bu. per acre on the Lakeland and Wickham soils, respectively, in 1969-70.

To evaluate these results, information was needed on the compacting effects of traffic, such as tractor wheels. Hendricks and Dumas, Department of Agricultural Engineering, reported in Highlights of Agricultural Research, Vol. 16, No. 1, Spring 1969, that sandy loam turned 12-14 in. deep each year was quickly recompacted in a traffic furrow in a cotton field to a penetrometer resistance of over 600 p.s.i. at 2½ in. deep. The same soil, when turned deep the first year and then harrowed each year before planting, was recompacted to more than 400 p.s.i. strength at 8-10 in. deep in 3 years.

This research shows the serious effects of soil compaction on soybeans. If the soybean plant is to produce top yields, the most *practical* known tillage methods to reduce soil compaction by heavy equipment must be followed. Until better and more practical tillage methods and systems are developed, the soybean grower should consider: (1) deeper plowing, (2) operating tractor with wheels on unplowed land, rather than in furrow, when turning the soil, (3) limiting wheel traffic to certain middles after planting, and (4) making fewer trips over the field.

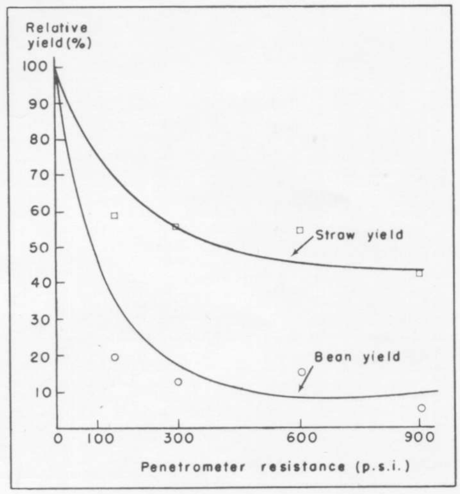


FIG. 2. Effect of subsoil compaction as shown by penetrometer resistance on bean and straw yields (average of 2 soils), 1968.

[1] Partial support for initiation of this study was provided by the American Soybean Association Research Foundation.

Evaluation of Commercial Nematicides For Control of Parasitic Nematodes in Peanuts

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THE PEANUT PLANT is subject to attack by a number of plant parasitic nematodes which directly, or indirectly through association with other soil-borne pathogens, cause significant yield losses every year. Root-knot, sting, and leison nematodes are among those parasitic to peanuts. Although various species of these nematodes are present in Alabama, root-knot nematode is the most prevalent in the peanut growing counties; it is probably responsible for the largest share of peanut yield losses to nematodes. Because knowledge was lacking on the value of commercial nematicides for controlling peanut root-knot nematode under Alabama conditions, research was initiated in 1971 at the Wiregrass Substation in Headland, Alabama, and vicinity to gain the necessary information.

Research efforts have been directed to screen different materials and formulations for effectiveness against root-knot nematode, to determine optimal application time for nematicides, and to assess the importance of root-knot nematode interactions with soil-borne fungal pathogens. Results presented here will illustrate the type of information obtained in these studies.

Application of Nematicides

Peanut fields in rotation with corn contain low numbers of root-knot nematode larvae at planting time; large proportions of the nematodes are probably in the egg stage. Application of a nematicide at that time may result in less control than at blooming time, Table 1, when a larger proportion of the nematode population is composed of the more susceptible larvae. Because of the relatively shallow root system of the peanut plant, it is possible to apply granular nematicides that have some solubility in water. Application at blooming time in a moist year provides better control than planting-time applications. Such practice would be valueless under dry conditions when the material remains on the surface of the soil and is lost through volatilization.

TABLE 1. EFFECT OF PLANTING AND BLOOMING TIME APPLICATIONS OF A GRANULAR NEMATICIDE ON ROOT-KNOT INCIDENCE AND YIELD IN FLORUNNER PEANUTS IN 1971

Treatment	Rate active mat./acre	Time of application	Root-knot* larvae/pint soil	Yield* per acre
	Lb.		*No.*	*Lb.*
Mocap 10G	3	Planting	70	3,781
Mocap 10G	3	Blooming	3	3,889
Control			226	3,092

*Averages from four 4-row x 50-ft. plots; larvae counts are midseason values.

Comparison of Nematicides

Comparisons between granular and liquid formulations of the nematicides Nemacur and Dasanit, Table 2, indicate generally that broadcast treatments result in higher peanut yields than banded treatments at equivalent per area rates. Results also show that use of liquid formulations resulted in yield responses comparable to those obtained with granular formulations. This suggests the possibility of applying compatible formulations of nematicides and herbicides prior to planting and avoiding the need for additional operations.

TABLE 2. YIELD RESPONSE OF FLORIGIANT PEANUTS TO APPLICATIONS OF GRANULAR (G) AND LIQUID (L) FORMULATIONS OF TWO NEMATICIDES IN A 1972 TEST

Treatment	Rate active mat./acre	Type of application	Yield* per acre
	Lb.		*Lb.*
Nemacur 15G	4	Broadcast	2,018
Nemacur 15G	2	18-in. band	1,689
Nemacur 3L	2	18-in. band	1,666
Dasanit 15G	3	18-in. band	1,779
Dasanit 6L	3	18-in. band	1,622
Control			1,340

* Average of four 2-row x 600-ft. plots.

Addition of Fungicides

Adequate control of root-knot nematodes does not always result in proportional yield increases, probably because of the presence of other pathogens. Table 3 illustrates the need for including a fungicide (PCNB) to control "white mold" (*Sclerotium rolfsii*) in fields where it is endemic with root-knot nematode. The involvement of white mold or other soil-borne pathogens with root-knot or other nematodes is probably a general rule in peanut fields. Because of the importance of these complexes, our present research involves a greater effort to determine the economic value of these interactions and the means to reduce corresponding losses in quality and quantity.

TABLE 3. EFFECTS OF TWO NEMATICIDES AND A NEMATICIDE-FUNGICIDE COMBINATION ON YIELDS AND ON INCIDENCE OF ROOT-KNOT NEMATODE AND WHITE MOLD IN FLORUNNER PEANUTS IN 1972

Treatment	Nematicide rate (active mat. acre)	Root-knot* larvae/pint soil	White* mold	Yield* per acre
	Lb.	*No.*		*Lb.*
Mocap 10G**	3	97	8.13	3,015
Mocap 10G** + PCNB	3	51	2.63	3,264
Fumazone	¾ gal.	17	6.38	3,095
Control		171	5.38	2,720

* Averages from eight 4-row x 30-ft. plots, root-knot counts are midseason levels and white mold figures are the number of peanut crowns killed per plot.

** Applied at blooming time.

SAFETY CABS SAVE LIVES in TRACTOR OVERTURNS

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FIG. 2. Operator protection is available as standard equipment on most current tractors as a safety cab (left) or a protective frame (right) and can be purchased as separate items for mounting on older tractors.

FARMING is a dangerous occupation. Nearly 2,300 persons are killed annually and every 50 seconds a farm resident or worker in this country is injured in farm-work accidents. About one-third of these accidents or more than two per day involves a farm tractor.

The following table lists tractor accidents by the percentage that each type occurs.

Types of tractor accidents	*Per cent*
Tractor upset	55
Fall from tractor	15
Crushed	10
Run over	8
Motor-vehicle collision	6
Power take-off	3
Other	3

At least two things can be done to help reduce tractor accidents and the resulting fatal injuries. One way to reduce all type accidents is to give each tractor operator safety training. Hopefully this will enable him to operate the tractor in a safe manner and help him recognize potentially dangerous situations before they become serious problems.

From the table it is evident that tractor upset or overturning is the most frequent type of accident. A protective cab or frame and safety belts could be used to lower the rate of occurrence of this type accident.

The cabs and frames provide a protective zone around the operator in the event of a tractor upset. They also tend to prevent the tractor from turning completely upside down by limiting the overturn to 90 degrees. See Figures 1 and 2.

The importance of the frame or cab in reducing deaths from tractor upsets is evident from several recent research studies. One such study was conducted for 6 years in Nebraska. A stunning 40% of these tractor upsets resulted in death. In addition, 53% produced serious injury. All of the injuries and deaths were on "open" tractors, with no cabs or frames.

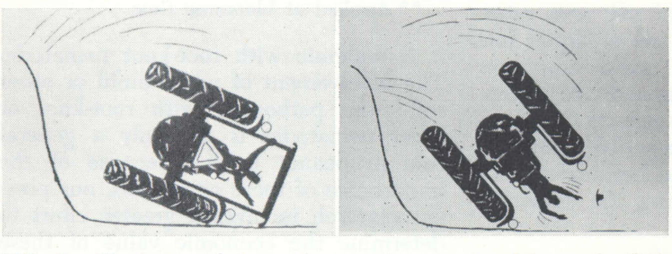


FIG. 1. Illustrates what can happen to a tractor driver, who fails to have a safety frame on his vehicle. The frame helps to prevent a complete tractor overturn and reduces the chance of injury to the driver.

In this same study about 5% of the accidents involved tractors equipped with overturn protection. Although they made up only a small part of the study, these accidents produced no fatalities, and no injuries in half of them.

Some European countries have a long history of tractor cab and frame use. Sweden, for example, has more than 50% of the farm tractors equipped with protective cabs or frames. For several years they studied every tractor-upset accident in detail. During this time 35 upset accidents with frame or cab-equipped tractors were investigated. Only one operator was killed – he tried to jump and was fatally injured outside the tractor cab. Not one person was killed who remained inside the protective frame or cab.

Information from the Nebraska and Sweden reports suggests that protective cabs or frames and safety belts will greatly reduce the chances of being killed if you should become involved in a tractor upset. Without cab or frame protection, your chances of being killed if your tractor overturns are as high as 40%.

Not all cabs are safety or protective cabs; some are comfort cabs. Protective cabs are specifically designed for that purpose. The American Society of Agricultural Engineers and the Society of Automotive Engineers have suggested standards for protective cabs.

Safety cabs and frames cost money and as such are sometimes thought of as pay-extra items. They are really payoff items – a payoff in reduced risks of a fatal tractor accident.

Weed Seed Germinate, Even in Dry Soil

C. S. HOVELAND and G. A. BUCHANAN
Department of Agronomy and Soils

IT NEVER GETS TOO DRY for weeds. At least it seems that way.

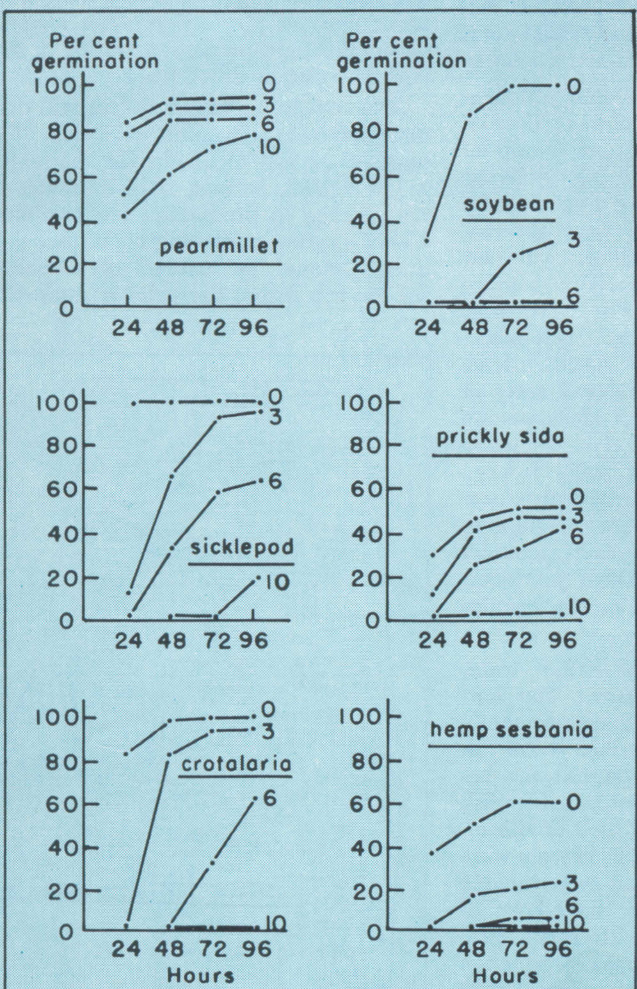
This observation leads to the assumption that weed seed will germinate when soil is dry enough to prevent crop seed germination. If this is true, drought at planting time favors germination of certain weeds giving them a competitive advantage over crops.

To provide a range of soil moisture values needed for seed germination experiments, Auburn laboratory experiments were begun. Drought was simulated by germinating seed on filter paper moistened with non-toxic polyethylene glycol solution. The simulated drought values ranged from 0-bar osmotic pressure (wet) to 10-bar osmotic pressure (soil feels dry to touch).

Seed of 5 crop and 17 weed species were germinated at drought values of 0, 3, 6, and 10 bars. Warm season plants were germinated at 84° and cool-season ones at 70°F.

Both crop and weed species varied widely in germination under drought conditions, as illustrated by the graphs. Ratings of germination under simulated drought is listed below for crop and weeds species in the test:

Very good – pearlmillet and sorghum-sudangrass.



Effect of simulated drought on seed germination of six plant species is illustrated by the graphs. Numbers at ends of lines identify drought treatments, from 0 (wet) to 10 (dry) bars of osmotic pressure.

Good – morningglory, prickly sida, sicklepod, and ryegrass.

Medium – showy crotalaria, crowfootgrass, and wheat.

Poor – curly dock, dandelion, bitter sneezeweed, and jimsonweed.

Very poor – soybeans and hemp sesbania.

Pearlmillet seed were more tolerant of simulated drought than other species, with 40% of seed germinating after 24 hours at the driest treatment (10 bars). Sorghum-sudan germinated slower under drought than pearlmillet, but both species germinate well where soil moisture is limited.

Soybean seed provided a strong contrast, being very sensitive to drought. After 4 days, germination was only 31% at 3 bars and nil at 6 or 10 bars osmotic pressure, while those at 0-bar moisture germinated 100%. This confirms that soybean seed require good soil moisture for germination.

Prickly sida, sicklepod, and morningglory were the most tolerant weed species to poor moisture conditions. Their capacity to germinate rapidly under low soil moisture gives them a competitive advantage over many other species. Crotalaria and crowfootgrass were somewhat less tolerant of simulated drought, and jimsonweed germination was reduced even more.

Hemp sesbania was the least tolerant of drought treatments, similar to soybeans. Germination of this weed was sharply reduced at 3 bars, while only 2% germinated at 6 bars and none at 10 bars pressure. Curly dock, dandelion, and bitter sneezeweed germination were reduced at 3 bars, even less at 6 bars, and none occurred at the drier (10-bar) treatment.

Wheat germinated slowly at the 3-bar drought measure, whereas Italian ryegrass showed little effect. At the drier 6-bar measure, however, ryegrass seed showed delayed germination and wheat was drastically reduced. Some seed of both wheat and ryegrass germinated at the 10-bar condition. The relatively rapid germination of ryegrass with limited moisture can be valuable in rapid establishment and competition with other species.

Weeds that germinate soon after planting give major competition with crops, and this initial competitive advantage is difficult to overcome. Results show this to be particularly troublesome in the Southeast. Sandy soils of this region dry rapidly on the surface during early spring when temperatures are high and winds brisk. Seed of such crops as corn, soybeans, and peanuts are planted deep enough to ensure germination even though soil is dry at the surface. Weed seed near the surface germinate despite the dry conditions and start growth along with the crop. The result is stiff competition and hard-to-control weed populations.

MARKETING ALABAMA CATFISH

E. W. McCOY, *Department of Agricultural Economics and Rural Sociology*

CATFISH PRODUCTION in ponds represents a relatively new farm enterprise for Alabama.

In 1968, about 500 acres of water were stocked for intensive catfish production. By 1970, 362 producers had about 3,500 acres of surface water in intensive catfish production. An additional number of producers had waters stocked with catfish for fishout or personal use. In total, over 700 Alabama producers were raising catfish under intensive culture. The map indicates the location and acreage of commercial production in Alabama in 1970.

With the rapid growth of the catfish industry, production and marketing difficulties were unearthed. Research was developed to assist producers with problems of nutrition, disease, water quality, and other production problems. Less attention was given to problems of marketing the finished product.

Catfish production typically follows a pattern. Fingerling catfish are stocked in a pond and fed until an appropriate harvest weight is reached. The fish are then removed from the pond and sold. At the time of harvest the fish vary in weight from 4 oz. to 2 lb. The diversity in the size of fish represents a problem in marketing.

Catfish buyers include processors, individuals, grocery stores, restaurants, fish markets, and others. Individuals may purchase fish for consumption or for restocking in recreational pay lakes. Each buyer may desire to purchase a specific size of fish. A restaurant, for instance, may desire fish with a dressed weight between 4 and 6 oz. Since catfish have a dressing percentage of 60%, sales to the restaurant require a uniform batch of fish with a live weight from 6 oz. to 10 oz. Fish not meeting the weight specifications would not be acceptable. Direct producer sales to institutional buyers require farm grading and processing of the fish. No Alabama producer has sufficient production to undertake these functions. For producer marketing the individual farmer has two alternatives. The scale of production must be large: i.e. production in excess of 1 million lb. a year, or the scale must be very small, no more than 9 or 10 1-acre ponds. With large-scale production the producers can contract weekly or monthly sales, guarantee year round delivery, process his own and other fish, accumulate quantities of desirable sizes, and establish sales for varying sizes of fish. The small producer can supply local fish markets, individuals, and local restaurants when fish are available.

An alternative to individual producer sales is cooperative arrangements for sales and/or processing of fish. A group of small producers can pool fish to amass sufficient supply for processing or sales to markets which the lone producer cannot reach. Processors seldom will harvest ponds beyond a certain distance radius from the plant. Also, processors will not pick up less than a full truckload beyond some greater distance from a plant. Producers with 1 or 2 acres of fish are faced with the cost of harvesting and hauling equipment if the production unit is located over 100 miles from a processing plant. The equipment is necessary even though sales are not made to processors. The costs for each producer can be minimized if several producers in an area jointly purchase the equipment for mutual use.

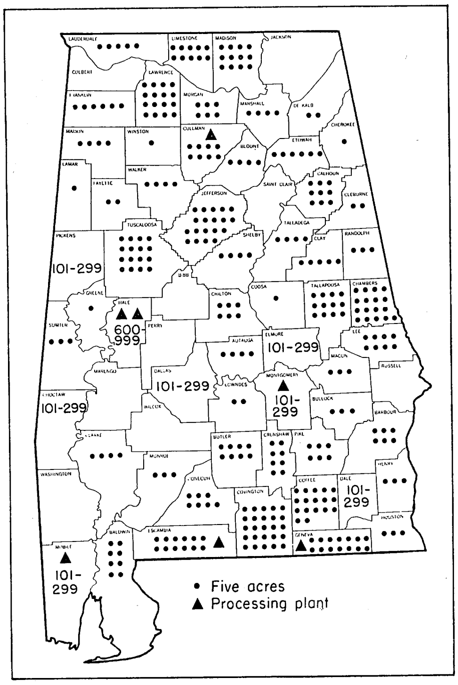
In 1970, 1,880 acres of surface water were harvested in Alabama. The harvested acreage represented approximately 55% of the acreage of surface water devoted to catfish production. At the beginning of 1971 an inventory of catfish was on hand in ponds. Much of the inventory was involuntary. Producers were willing to sell the fish but were unable to find buyers. A severe shakedown of the industry followed with many producers switching to fishout production or using catfish ponds for personal fishing. Producers with established markets expanded acreage. The 1,880 harvested acres produced 2,335,000 lb. of catfish or approximately 1,242 lb. per acre. On the basis of fish harvested, the average weight per fish was about 0.9 lb. The fish were directly marketed by producers to four types of buyers, as shown below:

Type buyer	*Thousand lb. sold*
Processor	2,008
Pay-lake	79
Individual	222
Restaurant	26
Total	2,335

Included in sales to individuals were direct sales to grocery stores and fish markets. The sales to pay-lake operators occurred primarily during the summer months, while the remaining sales occurred during fall, winter, and spring with the highest sales occurring after water temperatures dropped below 70° and the catfish ceased to gain weight.

Lack of buyers was the most prevalent problem for catfish producers. The large inventory of catfish on hand in ponds was a symptom of the problem. A second problem was price levels too low to cover costs of production. The increase in supplies and marketing during a limited time period drove the price down.

The catfish marketing system still does not operate at maximum efficiency. The number of fish available for marketing is not known, in fact, only estimates of the acreage in production are available. Under existing marketing conditions producers should be assured of a market for the fish before the pond is stocked.



Estimated acreage of commercial catfish production and location of processing plants, 1970.

The Process of Choice in Family Food Buying

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MILDRED VAN de MARK[1], *Department of Home Economics Research*

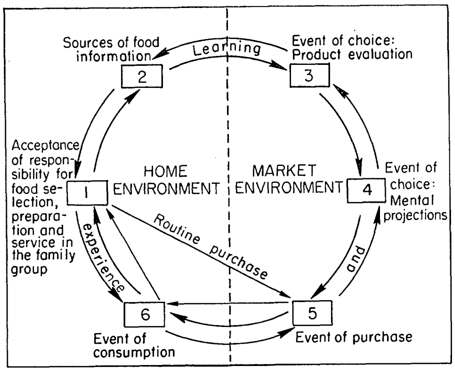
FOOD BUYING is a complex procedure that is repeated many times in the lifetime of a homemaker. The assortment of items purchased and the pressure of selections are seldom the same. Each shopping trip forces a series of decisions of varying degrees on the homemaker. Low income and stability in family size are related to routine purchases, while changes in income, type meal, health, or residence may require extensive decision making.

A model, based on the steps in problem solving that are related to homemaker environment, information sources, evaluations of product acceptability and purchase, and use of food in the home, was developed to organize findings from 18 years of consumer behavior research.

When food buying is regarded as a "process" in which there are innumerable variations, it becomes possible to organize data in an orderly manner. "Process" may be defined as a sequence of interrelated actions directed toward some goal, purpose, or end. In problem-solving decisions, the process of choice becomes part of a continuing series of events rather than an isolated instance.

Decision making is possible only when a situation requiring action is present and a selection must be made among alternative solutions. The commonly accepted stages in decision making are: identifying the problem, obtaining the necessary information upon which to base a decision, weighing the alternatives, selecting a strategy for the course of action, and reaching a positive, negative, or delayed decision. In a problem-solving situation, responsibility must be taken for the consequences of the decision.

Steps or stages in decision making are modified to fit the path taken by the homemaker. After preparation is made for the food buying trip, items are selected and purchased, and then food is stored in the home for later preparation and service to family members. Addition of the learning or experience role to the steps in decision making transformed a seemingly complex operation into a relatively simple circular form.



The Model

The dynamics of the process of choice used in food buying decisions by homemakers are shown in the figure. Steps 1 and 6 occur largely in the home. Step 2 may be inventory control, interaction with family members, or forecasting of meal service, but it also includes outside sources of information that may result in improved food management, more healthful foods, or use of new products through personal communication or the mass media. Steps 3, 4, and 5 occur in the market environment, usually the local food store, where much of the research in consumer behavior has been concentrated. The arrows in the margin symbolize the collection and use of experience at every stage in the process of food purchase and consumption.

1. Role Acceptance and Home Environment. Pertinent information about the respondent includes attitudes toward the homemaker role and food shopping, nutritional and marketing knowledge and their implementation, food selection and preparation skills, availability of storage and kitchen equipment, and access to food information sources such as newspapers. Family activities, preferences and needs, and family members' attitudes toward the homemaker's performance also are important factors in food buying decisions.

2. Sources of Food Information. Step 2 of the process of choice is of great importance to all phases of the food industry and to agencies concerned with the health of human populations. What information to present and how it should be implemented are exceedingly complex, but immensely important problems, if our national resources are to be used wisely.

3. Event of Choice – Product Evaluation. Aspects of consumer attitudes and practices would include store selection, price reduction appeals, merchandising techniques, quality standards or grade, knowledge and use of consumer aids, new foods or forms, convenience items, packaging, and purchase of nonfoods in food stores. Attributes of product appearance, quality, and price also are considered at this point.

4. Event of Choice – Mental Projections. Limitations, such as family tastes, meal type, items on hand, equipment or culinary skills, and usual food expenditures, must be considered by the homemaker in estimating the probable success of one product over another in providing the desired family satisfaction.

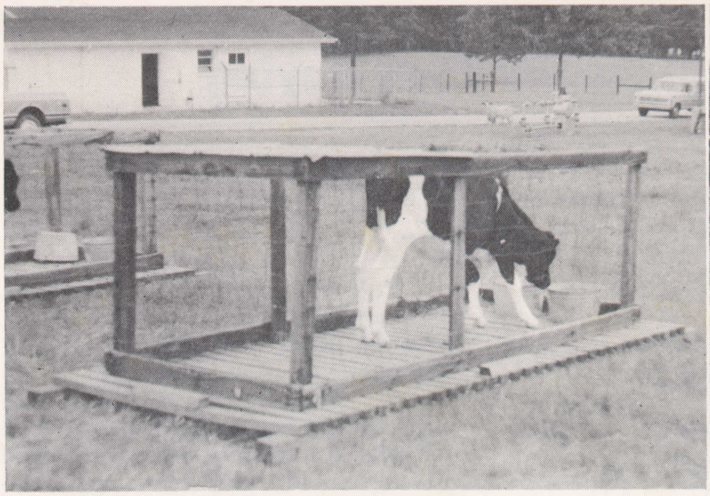
5. Event of Purchase. In a recent study, per capita income accounted for slightly over half the explained variation in amount spent for food, while family size and stage in the family life cycle were responsible for most of the remainder.

6. Event of Consumption. Experience with the product in the home leads to future inclusion as a habitual purchase or permanent rejection for products failing to meet expectations, with numerous variations on frequency of purchase or intermittent selections.

Use of the Model in Future Research

The model also would apply to the individual who purchases some meals, the consumer with a home garden, the dieter, the person living alone, and groups such as communes or college students in an apartment, as well as to the nuclear family.

[1] Retired.



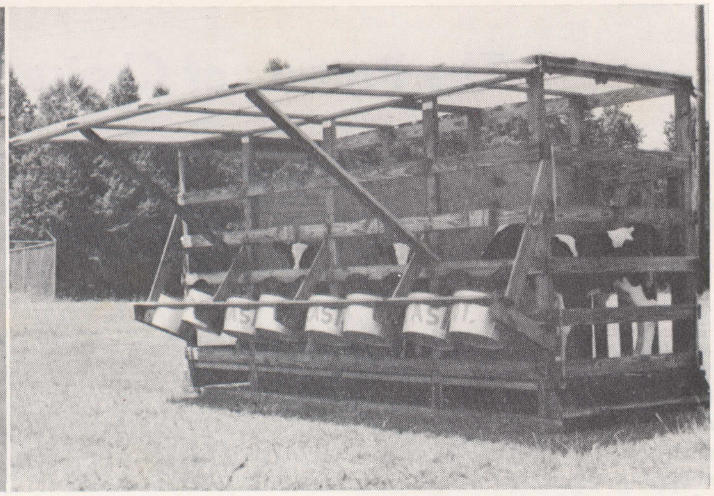


FIG. 1 (left). Slatted floors make portable pens even more effective. FIG. 2 (right). Pens that provide space for several calves showed advantages in Auburn research.

Grow Healthy Calves in Portable Pens

G. W. BENZ, *Dept. of Animal Health Research*

THE PORTABLE-PEN system for raising dairy calves got its start in Auburn more than 20 years ago. Dr. L. R. Davis, of the USDA Regional Parasite Research Laboratory, first used the management method that isolated calves to control various diseases.

Individual pens were made of lightweight frames with wire fencing to confine the calves. The pens were moved to fresh ground every few days. Weather protection was provided by covering one end of the pen with a roof and enclosing one end during winter months.

Later research revealed that the pens were more suitable for disease control when used with slatted floors to keep calves off the ground. The original pens can be mounted on a platform of wooden slats nailed to skids, Figure 1. Slats can be made with 2- x 6-in. boards treated with pentachlorophenol and cut lengthwise down the center at a 60° angle. These slats are nailed to skids, leaving openings of about 1 in. between them. Droppings fall through the openings.

Another modification of the system has been made that offers still further advantage. Pen units are built to accommodate more than one calf, Figure 2, and still provide the necessary isolation for disease control. Much greater weather protection is offered by the units shown, while providing adequate space for young calves. Buckets for water and a calf starter ration are in a more secure position and a door is available for each calf on the opposite side. Calves started in these units are moved to the larger individual pens after a few weeks.

Large numbers of calves can be raised in a limited area by using the multiple-calf pens. Calves are effectively separated and the spread of diseases such as colibacillosis by direct contact is avoided. Calves are kept off the ground and well protected against bad weather. The stalls can be hosed down for cleaning, giving sanitary pens with a minimum of labor.

Slatted-floor pens have been used in the Department of Animal Health Research for several years for raising calves free of internal parasites. Results have been good. Occasional nematode ova have been observed during fecal examinations, but this was probably the result of calves being exposed to infective larvae before purchase.

Only a few problems have been encountered in using the pens. The slats when first used had sharp edges that caused some minor leg disorders. A few calves had fluid accumulations over knee joints in the front legs at 12-15 weeks of age. The joint capsules were not found to be involved at post-mortem examination when an experiment was terminated.

Care in using the pens is needed to avoid grass growing up through the slatted floors. Growth into the pen could result in contamination with various pathogens, including nematode larvae.

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