RESEARCH UPDATE
1992
GRAIN CROPS

Higher Nitrogen Rates Needed for Black Belt Corn

The potential for nitrogen (N) losses from runoff and denitrification during wet weather on calcareous, clayey soils of Alabama's Black Belt region is great. Because of this, some corn producers with a high yield potential in this area routinely use higher N rates than the Auburn University Soil Testing Laboratory recommends (120 pounds N per acre for nonirrigated corn).

Results of an on-farm Alabama Agricultural Experiment Station study conducted in Hale County since 1989 seem to agree with the decision to use higher N rates. The study evaluated nitrogen rates, sources, and time of application for nonirrigated corn grain production on a calcareous, Black Belt soil (Vaiden clay).

Sources of fertilizer N used in the study included ammonium nitrate, urea, ammonium sulfate, 32 percent nitrogen solution, and a premium grade ammoniated granular blend in a 1:1:1 N-P_2O_5-K_2O ratio (13-13-13). There were no differences among fertilizer sources. Sulfur and potassium were not yield limiting factors at this site.

Excessive rainfall in the springs of 1989 and 1991 resulted in low yields due to excessive denitrification in saturated soils and some N runoff loss when sidedress N was applied. The standard N rate of 120 pounds per acre was not adequate. Highest yields of 91 and 102 bushels per acre for 1989 and 1991, respectively, were produced when at least 150 pounds N per acre were applied in split applications.

In 1990, yields were limited only by slight moisture stress during the critical silking period, see table. Nevertheless, grain yields of 132 bushels per acre were produced with 160 pounds N per acre applied either as a sidedress application at the V10 growth stage or in a split application at planting and at V10. Increasing N rates to 240 pounds did not significantly increase grain yield. There were no yield differences among sources of fertilizer N.

The results of this study suggest that at least 160 pounds N per acre may be needed for corn grain production on calcareous, Black Belt soils. As with other Alabama soils, Black Belt soils delivered best response when N was applied in split applications with at least one-third at planting and the remainder in one or more sidedress applications. Based on these tests, even on these fine-textured soils, applying all of the N at planting appears to be risky.

Corn grain yield was significantly correlated with N concentration and chlorophyll measurements in ear-leaves at silking and with leaves at V10 growth stage. Data suggest a need for additional fertilizer N if leaf chlorophyll reading is less than 44 SPAD at V10 or at silking.

C.C. Mitchell and P.L. Mask

EFFECT OF NITROGEN RATES, SOURCES, AND TIME OF APPLICATION ON CORN GRAIN YIELD ON A CALCAREOUS VAIDEN CLAY, 1990 AND 1991

N source[1]	Total N rate	Time of N application	Grain yield/acre 1990	1991
	Lb.		*Bu.*	*Bu.*
Rates of N				
—	0	—	69	56
AN	120	2-split	108	89
AN	160	2-split	132	98
AN	200	2-split	135	96
AN	240	2-split	138	102
Time of N application				
AN	160	planting	95	80
AN	160	2-split	132	98
AN	160	3-split	—	98
AN	160	sidedress	137	78
AN	160	silking	—	70
Sources of N				
AN	160	2-split	132	98
AS	160	2-split	119	91
Urea	160	2-split	130	98
UAN	160	2-split	124	85
13-13-13	160	2-split	136	93

[1]AN=ammonium nitrate; AS=ammonium sulfate; UAN=32 percent urea ammonium nitrate solution; 13-13-13 (with micronutrients) was applied at planting followed by ammonium nitrate at sidedressing.

ALABAMA AGRICULTURAL EXPERIMENT STATION AUBURN UNIVERSITY
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Alternative Practices Promising for Annual Ryegrass Control in Wheat

Wheat producers can control annual ryegrass in wheat using the herbicide Hoelon®. However, there are potential drawbacks to using this herbicide, including the possibility that restricted-use herbicides such as Hoelon are more likely to have registrations canceled by EPA. Since there are no other selective herbicides available to replace Hoelon, research is needed to develop alternative control practices that will reduce the damaging effects of ryegrass on wheat. Such alternatives are being sought in Alabama Agricultural Experiment Station research.

Cultural practices that have potential for reducing the effects of ryegrass in wheat include tillage, planting date, and row spacing. These practices have been used in integrated weed management systems of other crops and have proven to be of considerable value. Also, nonselective herbicides, such as Gramoxone® (paraquat), can substitute for tillage.

The objectives of the AAES research were:

1. Determine the effects of destroying annual ryegrass flushes either mechanically (conventional tillage) or chemically (stale seedbed) prior to planting wheat.

2. Determine the effects of row spacings and planting dates of wheat on control of annual ryegrass.

The above factors were integrated into systems (with and without Hoelon) and evaluated at Tallassee in 1990-91. Ryegrass seeds were sown at 100 pounds per acre to simulate a heavy population of annual ryegrass. These seeds were added to an area where ryegrass seeds already infested the soil. Wheat variety for both planting dates was Coker 9766. Seeding rate for wheat was 15 seeds per foot of 8-inch rows and 10 per foot of 4-inch rows. Fertilization and pest control were provided for adequate wheat yield.

Mechanical or chemical elimination of annual ryegrass prior to planting wheat in October resulted in 47 to 66 percent annual ryegrass control when rated in April. The same treatments with the addition of Hoelon resulted in 98 percent control and wheat yield that averaged 31 percent more. The 4-inch row spacing produced a slight increase in ryegrass control, but a slight decrease in grain yield at the October planting. Wheat lodging was a significant problem at this early planting with the Coker 9766 variety planted in 4-inch rows. The alternative procedures were generally unacceptable at this planting date.

Eliminating annual ryegrass chemically with Gramoxone and planting the wheat in December into a stale seedbed combined to give ryegrass control at the April rating that averaged 90 percent for the 8-inch row spacing and 93 percent for the 4-inch row. However, wheat yield averaged 23 percent higher for the 4-inch row spacing. The addition of Hoelon to these late implemented systems proved to be detrimental to wheat yield, although ryegrass control was slightly higher. Lodging was not a problem when the wheat was planted late in the 4-inch row. Chemically eliminating ryegrass flushes with Gramoxone and planting wheat late to 4-inch rows into a stale seedbed shows good potential as an alternative procedure for annual ryegrass control in wheat.

R.H. Walker

Increasing Nitrogen and Using Strip Tillage Can Boost Tropical Corn Yields

Tropical corn is a promising new crop that may fit well into some cropping systems in the Southeast. Since it is a new crop, there is limited information available to describe its response to tillage and soil fertility. A field study was initiated at the Wiregrass Substation in 1990 to evaluate tropical corn response to nitrogen (N) and starter fertilizer when grown under conventional and reduced tillage systems.

Conventional tillage consisted of chisel plowing and disking followed by in-row subsoiling at planting. Strip tillage consisted of planting corn into wheat stubble after in-row subsoiling. Nitrogen was applied at rates of 0, 50, 100, and 150 pounds per acre. Five starter treatments, consisting of various combinations of N, phosphorus (P), and sulfur (S), also were tried: (1) no starter; (2) 20 pounds N per acre; (3) 20 pounds P per acre; (4) 20 pounds N and 20 pounds P per acre; and (5) 20 pounds N, 20 pounds P, and 10 pounds S per acre.

In 1990, Pioneer X304C was grown and grain yields were not determined due to severe insect damage. Insect pressure, however, did not limit silage yields. Excellent silage yields were obtained with the conventional and strip tillage systems averaging 17.1 and 20.3 tons per acre, respectively. Silage yields were increased by the addition of N and starter fertilizer. The use of the N and P starter increased silage yields by 3.1 tons per acre.

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Tropical Corn Silage and Grain Yields (Averaged Over Starter Treatments) as Affected by Rate of Nitrogen Fertilizer Under Conventional and Strip Tillage, 1991

Nitrogen rate/acre, lb.	Silage yield/acre			Grain yield/acre		
	Conventional	Strip	Mean	Conventional	Strip	Mean
	Tons	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*
0	6.8	6.3	6.6	26	29	28
50	9.0	10.7	9.8	46	62	54
100	10.9	12.0	11.4	56	74	65
150	11.6	13.3	12.5	60	81	71

New Tropical Corn Varieties Examined for Alabama Production

In recent years there has been substantial interest in utilizing tropical corn hybrids in Alabama. In general, tropical corn is not replacing conventional corn hybrids, but is being planted instead of silage sorghums. There also is interest in tropical corn as a grain crop to follow small grains or as a grain crop that is able to utilize the nitrogen fixed by winter legume cover crops.

Little information is available regarding the potential and management of tropical hybrids for Alabama, and Pioneer X304C has been the most widely available commercial hybrid. Therefore, an Alabama Agricultural Experiment Station study was conducted to compare 10 hybrids for silage and grain production to see if other hybrids have production potential in Alabama.

The hybrids were planted on three different dates at Belle Mina, in the Tennessee Valley, on a Decatur silt loam. The earliest planting date in the study was mid-May, to fit in a silage or double-cropping system. If corn is planted before May, then hybrids adapted to temperate climates will yield more grain than tropical hybrids.

For grain production, the optimum planting date for north Alabama was mid-May to June 1. Optimum planting dates for central and south Alabama would likely be 1 to 2 weeks earlier. Early planting was especially critical for grain production. In 1990, for example, grain yield for the Pioneer 3072 was 73, 52, and 35 bushels per acre when planted May 17, June 1, and June 21, respectively.

When planting for silage, early planting is not as critical. The hybrids tested varied considerably in their suitability for silage or grain production and their yield response to planting date, see table. Pioneer X304C and 3098 and DeKalb 678C were top silage producers, yielding 22, 18, and 18 tons per acre, respectively, in the dry year of 1990.

Ranking of Tropical Corn Varieties for Silage and Grain Planted June 1 at Belle Mina, 1990

Brand and hybrid	Silage yield/acre	Rank	Grain yield/acre	Rank
	Tons		*Bu.*	
Pioneer X304C	22	1	11	6
DeKalb 678C	18	2	14	7
Pioneer 3098	18	3	15	5
Pioneer 3078	14	4	27	4
Pioneer 3214	11	5	15	6
Pioneer 3210	11	6	32	3
Pioneer 6875	8	7	33	2
Pioneer 3072	6	8	52	1

Pioneer 3072 and 3210 were the best grain producers, averaging 73 and 64 bushels per acre when planted May 17. Overall, hybrids that yielded well for grain did not yield well for silage, while hybrids that yielded well for silage did not yield well for grain.

This study indicated that Pioneer X304C and some of the hybrids that are not currently commercially available have great potential as an alternative double-crop for Alabama farmers. However, more research is needed on control of fall army worm before the full potential of this crop can be realized.

P.L. Mask and D.W. Reeves

Nitrogen and Strip Tillage, continued

The experiment was continued in 1991 using Pioneer 3072, a high grain yielding tropical corn variety. Grain yields in 1991 ranged from 26 to 81 bushels per acre. Silage and grain yields increased with N rate, with consistently higher yields and a greater response to added N occurring under strip tillage.

The best starter treatment for silage was the N and P (NP) treatment, which produced an average of 11 tons per acre, see table. For grain, N alone as a starter gave the same yield as the NP starter, with the greatest response occurring under conventional tillage (increase of 26 bushels per acre when averaged over N rates). Initial results of this test indicate that tropical corn is a promising alternative source of silage and grain for Alabama farmers.

G.L. Mullins, S.E. Alley, and D.W. Reeves

Pesticides Evaluated for Scab Epidemics on Wheat

Head scab of wheat caused by *Fusarium* species occurs sporadically in humid regions where wheat is grown. Scab is best recognized on emerged immature heads where one or more spikelets or the entire head appears prematurely bleached. Small, black structures (fungal fruiting bodies) and pink or orange mycelium may be seen at the base of diseased spikelets. Grain from scab-infected wheat may contain mycotoxins that can induce vomiting in humans and other nonruminant animals.

In Alabama, weather conditions in the winter and spring of 1990 were conducive for scab development. Sterility and poor grain fill due to scab resulted in an estimated 40 percent yield decrease in infected fields. Current Alabama Agricultural Experiment Station research is evaluating means of creating artificial *Fusarium* epidemics while simultaneously evaluating fungicides for control. One way of creating artificial epidemics is by injecting plants with the pathogen.

Field experiments were conducted at the Sand Mountain Substation and the Tennessee Valley Substation during the 1990-91 growing season. *Fusarium* occurrence on heads was increased by simulating frost damage to wheat dur-

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Tropical Corn Shows Potential for Conservation Tillage Systems

The late planting date of tropical corn allows more flexibility than temperate corn for double-cropping with winter annual legumes. Using temperate corn with a winter legume requires yearly costs of labor, machinery, seed, and chemicals to plant and kill the legume in time to plant temperate corn. A conservation tillage system with tropical corn would, however, eliminate these costs and maximize the advantages of the winter annual legume.

In the past, Pioneer X304C was the only widely available commercial tropical corn hybrid. Grain yields of this hybrid have been disappointing. Results from variety trials, however, indicate that Pioneer 3072 has a higher grain yield potential than Pioneer X304C.

Results of joint Alabama Agricultural Experiment Station and USDA-ARS field experiments at the E.V. Smith Research Center, Shorter, and the Sand Mountain Substation, Crossville, illustrate the advantages of using tropical corn and crimson clover in a conservation tillage system.

Four years ago, the plot area was either left fallow or seeded to crimson clover in the fall. Clover naturally reseeded every year thereafter. Tropical corn hybrids Pioneer X304C and 3072 were planted into the fallow area and the clover residue in June 1991. Four nitrogen (N) rates (0, 45, 90, and 180 pounds N per acre) were applied either at planting or split with one-third applied at planting and the remainder 5 weeks later.

Effect of a Winter Cover Crop on Grain Yield, Averaged Over N Rate and Application Time

Winter cover crop	1991 grain yield/acre			
	Shorter		Crossville	
	X304C	3072	X304C	3072
	Bu.	*Bu.*	*Bu.*	*Bu.*
Fallow	39	57	45	67
Crimson clover	51	85	76	105

Crimson clover, compared to fallow, increased grain yield of Pioneer X304C and 3072 an average of 53 percent, see table. Split N applications, however, had no effect on grain production and the effect on silage production was variable. When averaged over both locations, silage yields of Pioneer 3072 tended to decrease while those of Pioneer X304C tended to increase when the N rate was split.

The hybrids responded differently to N rate for both silage and grain production. At both locations, Pioneer 3072 increased silage production with each additional increment of N applied. Maximum yield was 20 and 24 tons per acre at Shorter and Crossville, respectively, with 180 pounds of N per acre. Pioneer X304C, however, reached its silage yield potential (17 and 22 tons per acre at Shorter and Crossville, respectively) at the 45-pound N rate and did not significantly increase in yield with additional N applied at either location.

The same trends existed for both hybrids in grain production. Yield potential of Pioneer 3072, however, was much greater than that of Pioneer X304C. At Crossville, yields of Pioneer 3072 peaked at 124 and 104 bushels per acre following clover and fallow, respectively, with 180 pounds N. At Shorter, yields peaked with the 90-pound N rate, averaging 87 and 72 bushels following clover and fallow, respectively. Pioneer X304C, on the other hand, did not respond as well to N applications beyond 90 pounds per acre, especially at Shorter.

The high yield potential of newer tropical corn hybrids such as Pioneer 3072, when grown in a conservation tillage reseeding clover system, indicate it may be an economical and environmentally sound alternative cropping system.

R.C. Kingery and D.W. Reeves

Pesticides Evaluated, continued

ing anthesis by applying dilute amounts of paraquat. Studies in the lab showed that tebuconazole provided better control against growth of *Fusarium*, but this fungicide was not as effective as benomyl or triadimenol for control in the field. However, plots treated with tebuconazole had highest yields and lowest levels of mycotoxin contamination.

K.L. Bowen, D.J. Collins, and P.L. Mask

Government Program, Crop Insurance, and Options Reduce Corn Producer's Income Risk

Government program participation, commodity options, and Multiple Peril Crop Insurance are management methods that can be used to reduce price and production risks. A recent Alabama Agricultural Experiment Station study estimated the riskiness of using alternative combinations of these strategies to produce and market 100 acres of corn on a representative north Alabama farm.

Returns exceeding variable costs were calculated for each combination of farm program participation, crop insurance, and commodity option possibilities on the 100 acres. Flex crops considered were corn, soybeans, and cotton. Farm financial performance was charted for 5 years with 500 different combinations of possible yields and prices per year.

The results showed that participation in the farm program provided higher returns than not participating. Also, participation at the 15 percent flex level with commodity options and crop insurance generally provided the highest returns with the least financial risk.

The alternative with the least financial risk was found to be participation in the farm program with a 15 percent

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Traffic and Tillage Systems Influence Corn Production

The need to manage soil compaction, along with new regulations for soil conservation in the 1985 and 1990 Farm Bills, has led to the need to examine tillage practices on coarse-textured Coastal Plains soils for corn production.

The interaction of tractor traffic and tillage on corn yields was studied in a joint Alabama Agricultural Experiment Station/USDA-ARS project at the E.V. Smith Research Center, Shorter. Plots with varying tillage and tractor traffic treatments were planted on 30-inch rows following a legume winter cover crop . Treatments consisted of the following :

Deep tillage. No subsoiling, annual in-row subsoiling, or a one-time complete disruption of the hardpan in 1988.

Surface tillage. Leaving winter cover crop residue on the surface or harrowing and field cultivating before planting.

Tractor traffic. Normal tractor traffic with the use of 4-row equipment or removal of all tractor traffic from plots (use of wide-frame research vehicle that spanned corn rows for necessary tillage).

Soil moisture was monitored throughout the growing season and corn yields were measured at harvest. In addition, soil compaction measurements at different depths were made with a penetrometer.

The test covered 4 years, including 2 years of drought (1988 and 1990) and 2 years of abundant rainfall (1989 and 1991). With both complete disruption and in-row subsoiling, yields in the drought year of 1988 were greatest when vetch residue was not incorporated by surface tillage; however, when deep tillage was not performed, surface tillage increased yields.

With favorable rainfall in 1989, there was no beneficial effect of surface residues as in 1988. However, yields again increased with the intensity of deep tillage, and surface tillage increased yields when no deep tillage was performed. In the extreme drought year of 1990, corn yields were severely limited, with a maximum yield of only 28 bushels per acre. In that year, yields decreased with intensity of tillage.

EFFECT OF TRACTOR TRAFFIC AND TILLAGE SYSTEMS ON CORN YIELD, 1991

Tillage	Corn yield/acre, by tractor traffic	
	Normal traffic	No traffic
	Bu.	*Bu.*
Deep tillage		
No deep tillage	132	134
Annual in-row subsoiling	138	135
Complete disruption	128	142
Surface tillage		
Harrow/field cultivation	131	140
No surface tillage	135	135

After 4 years, the effect of tractor traffic was dependent on tillage system, see table. When tractor traffic was removed, highest yields resulted from surface tillage or from the one-time complete disruption of the hardpan; however, when normal tractor traffic was used and caused recompaction, these same treatments resulted in the lowest yields. Therefore, in the absence of traffic, residual effects of tillage performed 4 years previously still improved yields. With traffic, annual subsoiling still maintained yields near the top.

Data indicate that an intensive tillage system followed by tractor traffic resulted in greater recompaction of the soil, which restricted root growth.

Results from this study suggest that the conservation tillage practice of in-row subsoiling without incorporating residues is an appropriate practice for sustaining corn yields on Coastal Plains soils, especially if traffic patterns can be maintained so that at least one row middle adjacent to each row receives no traffic during the growing season.

H.A. Torbert and D.W. Reeves

Income Risk, continued

soybean flex, and with commodity options and crop insurance. With this least-risk combination, the estimated net present value of returns for 5 years averaged $62.13 per acre.

Participation in the 15 percent and 25 percent flex programs provided higher returns than those received where there was no government program participation. In general, 15 percent flex alternatives provided higher net returns than did 25 percent flex alternatives for comparable levels of insurance and options participation.

Purchasing crop insurance provided higher minimum returns than comparable noninsured alternatives (probability of less than the minimum = 0). The minimum net present value with crop insurance ranged from -$0.63 per acre (25 percent cotton flex) to $21.49 per acre (25 percent soybean flex).

Growing cotton on the 15 percent flex acres, without insurance, provided the highest net present value of returns (probability of less than $123 per acre = 100 percent). On the average, however, a producer was better off to purchase crop insurance and options (probability of less than $66 per acre = 50 percent).

For a farmer who chooses not to participate in the farm program, purchasing crop insurance and commodity options provided higher average, minimum, and maximum values than did purchasing insurance alone or not purchasing insurance and options. The average net present value of returns per acre (probability of getting less than expected returns = 50 percent) with no government program participation ranged from $38.93 with no insurance to $41.62 with insurance and options.

The best individual strategy depends on how much of a risk the producer can stand. The most profitable high risk strategy was to plant corn with a 15 percent cotton flex crop, without crop insurance or commodity options. The best risk neutral strategy found was corn with a 25 percent cotton flex. Finally, the risk averse strategy of choice was corn with a 15 percent soybean flex crop.

J.L. Novak, R.G. Nelson, and W.R. Goodman

Insecticides May Have Use in Hessian Fly Management on Wheat

Experiments on chemical control of Hessian fly have been conducted during the past several years throughout the State. Experimental wheat plots were planted at five locations on two different dates (late September and early November). The locations were: Black Belt Substation, Marion Junction; Wiregrass Substation, Headland; Gulf Coast Substation, Fairhope; Tennessee Valley Substation, Belle Mina; and Upper Coastal Plain Substation, Winfield.

Each treatment consisted of either Saluda, Coker 9766, or Florida 302 wheat cultivars treated with either disulfoton or phorate. In previous tests, Saluda proved to be resistant to Hessian fly, Coker 9766 was moderately resistant, and Florida 302 was susceptible to this pest. Insecticides were applied in-furrow at planting at 0.75 pound active ingredient per acre. Hessian fly counts and yield determinations were made at harvest.

Severe weather conditions and heavy wheat disease incidence precluded data collection at several planting dates and locations. The table shows the combined yield data from all plots harvested. Although no statistical differences were present, the yields from insecticide treatments were usually slightly higher than those from check plots. Coker 9766 was consistently the highest yielding cultivar of the three evaluated. This difference cannot be explained by Hessian fly control because this pest was not present at all locations.

EDITOR'S NOTE

Mention of company or trade names does not indicate endorsement by the Alabama Agricultural Experiment Station or Auburn University of one brand over another. Any mention of nonlabel uses or applications in excess of labeled rates of pesticides or other chemicals does not constitute a recommendation. Such use in research is simply part of the scientific investigation necessary to fully evaluate materials and treatments.

Information contained herein is available to all persons without regard to race, color, sex, or national origin.

February 1992 7.5M

Combined Grain Yield 1989-90

Treatment	Yield, bu/acre			
	Gulf Coast Substation	Wiregrass Substation	Upper Coastal Substation	Average
Insecticide				
Check	22.33	37.40	15.33	25.02
Disulfoton	23.41	37.16	16.59	25.72
Phorate	23.29	41.88	16.38	27.19
Cultivar				
C9766	29.56	55.24	13.64	32.81
FL 302	12.46	33.41	15.57	20.48
Saluda	7.80	27.79	19.10	18.23

Low but consistent Hessian fly numbers did occur at the Gulf Coast Substation following the first planting. Hessian fly counts at harvest indicated that at least two times as many pupae were found in the check plots as in the treated plots. However, this difference was not reflected in the yields. Saluda and Coker 9766 had fewer pupae than Florida 302, although yields were not related to fly numbers. Overall, Coker 9766 proved to be a good yielding variety even under unfavorable conditions.

Past experiments have indicated that insecticides have limited use in management of Hessian fly; however, these results do suggest that this avenue should be explored further.

P.M. Estes

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