Corn Grown With Bermudagrass In Eastern Oklahoma

O. H. Brensing &
J. Q. Lynd

November 1965
Bulletin B-643

CONTENT

Corn Grown with Bermudagrass in Eastern Oklahoma

O. H. Brensing and J. Q. Lynd
Department of Agronomy

Many acres of formerly cultivated productive cropland are being planted to bermudagrass in Oklahoma each year. There is much interest in the possibility of returning these bermudagrass pastures to cultivated grain crop production should the need arise for another change of land use in future years. This publication reports a study to determine soil fertility treatments combined with tillage and soil management practices for production of corn with bermudagrass on problem soils of eastern Oklahoma.

Procedure

Dryland field experiments were established for these studies in the years 1955 through 1960. Three locations were used; the Tommy Rains farm on Bowie fine sandy loam, at Bently, Atoka County; the Kelly McIntire ranch with Dougherty sandy loam, at Cottonwood, Coal County; and the Paradise Experiment Station on Norge fine sandy loam, Payne County.

The experimental plans were essentially the same at all sites: split plot, randomized block designs with three and six replications. Two rates of nitrogen 0 and 20 pounds per acre, three rates of phosphorus 0, 17.5 and 33 pounds P per acre and two rates of potassium 0 and 33 pounds K per acre were used in various combination as starter fertilizers applied at planting. Four rates of nitrogen 0, 20, 40 and 80 pounds N per acre were applied as side-dressing with all starter fertilizer treatments. The fertilizer materials used were ammonium nitrate 33.5% N, treble superphosphate, 46% P_2O_5 (20%P) and muriate of potash, 60% K_2O (49.8% K).

Fertilizer applied at planting was placed below and to one side of the seed. Nitrogen fertilizer was applied as a sidedressing when the corn plants were 12 to 18 inches high.

Tillage operations for corn grown on bermudagrass pasture land included a thorough, deep disking of the bermudagrass sod in early

Research reported herein was done under Oklahoma Station Project 898.

An excellent stand of mature corn grown on bermudagrass land. To obtain good yields, tillage practices must be timed right and adequate fertilizers, especially nitrogen, must be applied.

February or March, then plowed. The land was listed leaving the sod in lister ridges and corn planted with starter fertilizer in the clean furrows. When the corn was 6 to 8 inches high, the lister ridges were harrowed to further retard the bermudagrass. The second, and normally last cultivation, was made with a combination disc and shovel type cultivator which split the lister ridges turning the soil to the corn. Nitrogen fertilizer was applied as sidedressing with this cultivation.

Results and Discussion

Bowie fine sandy loam, Bently, Atoka County: These experiments were established in common bermudagrass pasture land on gently sloping upland. This soil type has a fine sandy loam surface texture underlain with sandy clay loam below a 20 inch depth. It is normally low in organic matter and is moderately acid in reaction with low fertility levels. Earlier experiments* at this location indicated good corn production was possible on bermudagrass land if timely tillage operations and proper fertilization were used. Results from the 1955 experiments, Table 1, indicated the most favorable response was obtained

*Oklahoma Agri. Expt. Sta. Bul. B-549, "Soil Fertility Treatments for Improved Corn Production in Eastern Oklahoma," O. H. Brensing and J. Q. Lynd, Feb. 1960.

Table I—Corn yields grown on bermudagrass land in relation to various soil fertility treatments, Atoka County, 1955.

Starter Fertilizer Pounds Per Acre N— P— K	Nitrogen Sidedressed Pounds Per Acre 0	20	40	80	Average
	Bu. corn/acre				
Site 1					
38—21— 0	38.9	33.5	50.9	47.3	42.7
14—25—48	39.2	58.6	45.3	63.2	51.6
14—25— 0	43.7	48.6	59.9	62.2	53.6
25—21— 0	42.8	56.5	66.5	60.3	54.0
28—12—23	50.3	53.5	62.3	---	55.4
0—48— 0	47.2	58.2	67.9	65.5	59.7
31—41— 0	50.8	51.9	68.3	80.3	62.8
24—21—20	57.9	61.3	82.8	78.1	70.0
20—18—33	58.2	69.4	92.9	61.5	70.5
Average	47.7	53.5	66.4	63.3	
Site 2					
0—28— 0	38.1	39.5	60.0	53.7	47.9
18—24— 0	39.9	52.9	51.5	56.8	50.2
14—12—23	41.8	47.3	51.7	64.2	51.2
8—15—28	44.3	55.6	48.0	58.8	51.7
17— 8—14	47.2	42.1	60.0	60.2	52.8
8—15— 0	44.9	53.7	63.6	58.9	55.2
22—12— 0	44.6	60.9	70.2	53.3	57.3
17—15—14	49.1	66.7	69.5	62.3	61.9
14—12— 0	53.3	68.3	60.6	69.1	62.8
Average	45.4	57.9	59.3	60.5	

Yields are the mean of two replications at each site.

Site 1 Treatment F = 3.80**
Site 2 Treatment F = 4.03**

with 20 pounds N, 18 pounds P and 33 pounds K at planting plus 40 pounds N as sidedressing.

Available phosphorus was indicated as the first limiting plant nutrient in the 1957 experiments, Table 11. The average check (no treatment) yield was 15.3 bu. per acre. The highest average yield of 42.9 bu. was obtained with the 20 pounds N and 35 pounds P applied at planting with 80 pounds N applied as sidedressing.

Yields obtained in the 1958 experiments, Table III, indicated that rates of phosphorus, applied with 33 pounds potassium, determined the magnitude of response to nitrogen rates applied as sidedressing. These yield responses are shown in Figure 1 with highest average yields of 78.4 bu. obtained at the 17.5 pounds P level and 111 bu. at the 35 pound P level both receiving 33 pounds K at planting and 80 pounds N as sidedressing.

Table II—Corn yields grown on bermudagrass land in relation to various soil fertility treatments, Bently, Oklahoma, 1957.

Starter Fertilizer Pounds Per Acre N— P— K	Nitrogen Sidedressed Pounds Per Acre 0	20	40	80	Average
	Bu. corn/acre				
0— 0— 0	15.3	24.5	20.7	28.2	22.2
0—17.5—0	25.2	38.3	38.5	36.2	34.5
0—17.5—33	24.8	27.4	17.9	32.7	25.7
0—35—33	23.7	30.1	41.8	34.7	32.6
20—17.5—0	21.3	26.3	28.2	29.5	26.3
20—35—0	21.7	29.5	20.0	42.9	28.5
20—17.5—33	20.4	37.2	20.5	37.3	28.8
20—36—33	20.7	21.8	34.9	39.8	29.3
Average	21.6	29.4	27.8	35.2	28.5

Yields are the mean of two replications. Treatment F = 1.63*

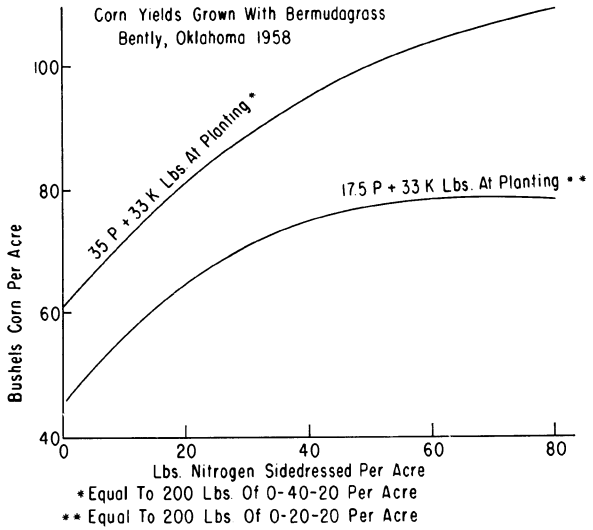

Figure 1 Crop yields increased with high levels of phosphorus fertilization on this field of Bowie fine sand. Organic matter from bermudagrass growth greatly improved soil moisture and plant nutrient relations for the corn crop.

Figure II shows that nitrogen in the starter fertilizer at planting improved corn yield response to nitrogen applied as sidedressing. An average increase of about 17 bushels was obtained from the 20 pounds N applied with 17.5 pounds P and 33 pounds K at planting with the various rates of N sidedressed.

Dougherty fine sandy loam, Cottonwood, Coal County: These experiments were established on a common bermudagrass pasture that had not been plowed or cultivated for over thirty years. The soil is characterized by very sandy surface texture grading to reddish-brown sandy clay or clay loam at 15 to 18 inches. Located on gently sloping topography with moderate slopes, this soil is subject to serious erosion when culti-

Table III—Corn yield grown on bermudagrass land in relation to various soil fertility treatment, Bently, Oklahoma, 1958.

Starter Fertilizer Pounds Per Acre N— P— K	Nitrogen Sidedressed Pounds Per Acre 0	20	40	80	Average
	Bu. corn/acre				
0— 0— 0	45.2	74.4	74.3	67.3	65.3
0—17.5— 0	48.2	75.9	77.9	105.2	76.8
0—17.5—33	44.7	65.1	74.8	78.4	65.8
0—35—33	60.2	84.0	88.9	111.0	86.1
20—17.5— 0	65.7	97.2	82.9	89.2	83.7
20—35— 0	59.6	53.5	74.9	96.1	71.0
20—17.5—33	65.6	78.4	87.2	100.2	82.9
20—35—33	55.8	82.5	91.8	102.2	83.1
Average	55.6	76.4	81.6	93.7	

Yields are the mean of three replications. Treatment F = 3.31**

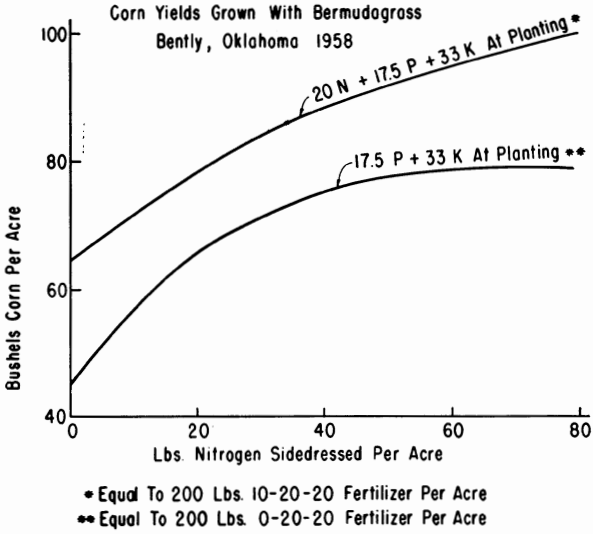

Figure 2 Increased corn yields were obtained with addition of 20 lbs. N per acre in the starter fertilizer on Bowie fine sand. Vigorous early growth was greatly improved with nitrogen included in fertilizer treatments applied at planting and resulted in better utilization of available moisture and plant nutrients through the growing season.

vated without conservation practices. Soil and subsoil are medium or slightly acid, low in available phosphorus, nitrogen and organic matter.

Results of the field experiments at this location in 1959, Table IV, indicated that both phosphorus and nitrogen were essential for satisfactory yield increases. Highest average yield of 121.9 bushels was obtained with 20 pounds N, 35 pounds P and 33 pounds K applied at planting and 80 pounds N sidedressed. This quadratic type yield increase with increased N rates when 17.5 pounds P was applied at planting is illustrated in Figure III.

Increased yields from addition of 33 pounds K in fertilizer used at planting with N and P were apparent in this experiment. The average for all N rates was 70.4 bushels for the 20-17.5-0 treatment compared to 79.9 bushels for the 20-17.5-33 treatment. Pooled mean yield for the 20-35-0 treatment at planting was 71.4 bushels compared to 82.8 bushels for the 20-35-33 treatment.

Left, corn at about five weeks growing with bermudagrass. The corn was planted in lister furrows. The lister ridge was split, turning the soil back to the corn and nitrogen was applied as a sidedressing. Right, corn growing with bermudagrass at four weeks after the last cultivation. Shading by the corn at this stage reduces bermudagrass competition for moisture and plant nutrients.

Table IV—Corn yields grown on bermudagrass land in relation to various soil fertility treatments, Cottonwood, Oklahoma, 1959.

Starter Fertilizer Pounds Per Acre N— P— K	Nitrogen Sidedressed Pounds Per Acre 0	20	40	80	Average
	Bu. corn/acre				
0— 0— 0	43.4	95.1	63.1	56 2	64.5
0—17.5— 0	43.9	70.3	81.7	102.6	74.6
0—17.5—33	60.5	79.1	75.1	81.1	74.0
0—35—33	69.3	81.0	80.1	86 6	79.3
20—17.5— 0	80.4	50.3	69.9	81.1	70.4
20—35— 0	83.3	70.0	74 5	57.8	71.4
20—17.5—33	69.9	75.5	86.6	87 6	79 9
20—35—33	50.3	81.0	77.8	121.9	82.8
Average	62.7	75.3	76.1	84.4	

Yields are the mean of two replications. Treatment F = 1.27*

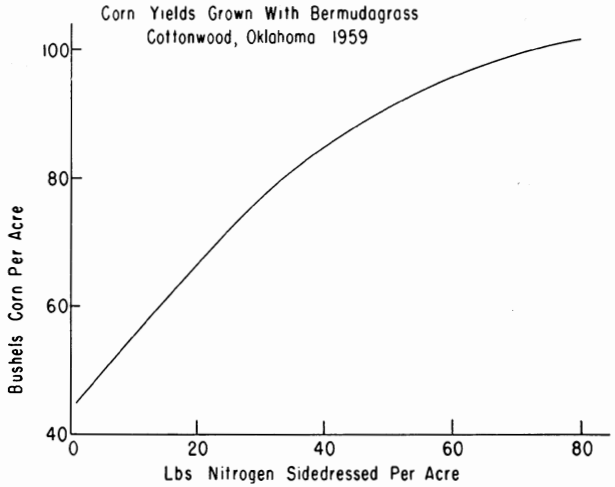

Figure 3 Consistent and profitable increases in corn yield were obtained with increased rates of nitrogen fertilization when available soil phosphorus was not limiting on Dougherty sandy loam. Increased growth of the bermudagrass at the higher N levels following the corn crop was also very apparent. The bermudagrass greatly reduced erosion on the sloping land and provided much fall and winter grazing.

Results from the 1960 experiments are presented in Table V. Yield results from fertilizer treatments were similar to those of the previous year. Marked responses to increased N rates applied as sidedressing, were obtained particularly when phosphorus was included in the starter fertilizer applied at planting. Highest average yield of 119.9 bushels per acre were obtained with the fertilizer treatment of 20-17.5-33 at planting and 80 pounds N sidedressed.

Mature corn is usually harvested in early September. After harvest, cattle can be turned on to a good, vigorous bermudagrass pasture for the fall and winter.

Table V—Corn yields grown on bermudagrass land in relation to various soil fertility treatments, Cottonwood, Oklahoma, 1960.

Starter Fertilizer Pounds Per Acre N— P— K	Nitrogen Sidedressed Pounds Per Acre 0	20	40	80	Average
	Bu. corn/acre				
0— 0— 0	48.6	59.5	87.4	46.5	60.5
0—17 5— 0	57.2	77.5	83.0	99.4	79.3
0—17.5—33	47.4	78.1	70.7	78.5	68.7
0—35—33	65.2	74.2	73.8	86.9	75.0
20—17.5— 0	79.6	86.7	98.4	98.4	90.8
2^—35— 0	81.7	88.1	102.1	75.3	86.8
20—17.5—33	59.7	98.6	67.4	119.9	86.4
20—35—33	59.0	99.9	60.0	86.9	76.5
Average	62.3	82.8	80.4	86.5	

Yield figures are the mean of three replications. Treatment F = 2.41.**

Norge fine sandy loam, Paradise Station, Payne County: These experiments were conducted on a gently sloping cultivated field essentially free of bermudagrass. Attempts to establish Midland bermudagrass in the corn crop were not successful due to the shading and competition for moisture and plant nutrients by the corn plants.

The soil has a very sandy surface texture underlain at 10 to 18 inches with sandy clay loam grading to sandy clay at 18 to 42 inches.

It is slight to moderately strong in acid reaction with low fertility levels for cultivated crops. Organic matter is easily lost with cultivation and erosion. The site had been cultivated intensively to row crops prior to the establishment of the experiment.

There was less response at this site to phosphorus and potassium in the starter fertilizer at planting. Increased yields with increased rates of nitrogen applied as sidedressing were very marked. Table VI shows the average check yield (no treatment) was 28.6 bushels per acre. Pooled mean yields of 50.2, 67.8 and 77.0 bushels per acre were obtained with 20, 40, and 80 pounds N acre sidedressed with all starter fertilizer treatments. Highest average yield of 82.6 bu. per acre was obtained with the 20-17.5-33 treatment plus 80 pounds N sidedressed.

Table VI—Corn yields grown on bermudagrass land in relation to various soil fertility treatments, Payne County, Oklahoma, 1960.

Starter Fertilizer Pounds Per Acre N— P— K	Nitrogen Sidedressed Pounds Per Acre 0	20	40	80	Average
	Bu. corn/acre				
0— 0— 0	28.6	54.4	67.2	69.0	54 8
0—17.5— 0	33.0	48.4	65.9	76.0	55.8
0—17.5—33	25.3	44.9	65.8	82.0	54.5
0—35—33	23.1	47.6	62.7	77.6	52.8
20—17.5— 0	29.5	50.4	71.2	81.6	58.2
20—35— 0	28.0	53.2	72.9	72.5	56.7
20—17.5—33	34.8	51.9	67 3	82.6	59.2
20—35—33	31.7	50.8	69.0	74.3	56.4
Average	28.8	50.2	67.8	77.0	

Yield figures are the mean of six replications. Treatment F = 1.85*

Summary

High yields of corn grown with bermudagrass were obtained on problem soils in eastern Oklahoma 1955-1960. Success has depended upon timely sequence of operations. These include preliminary cross disking to cut the sod; plowing six inches deep or more with a moldboard plow; planting in lister furrows with adequate fertilization; harrowing to lower lister ridges; and splitting the ridges with the second and normally last cultivation plus applying nitrogen fertilizer as sidedressing with that operation.

High rates of fertilization, particularly with nitrogen have been dominant factors determining success of this cropping combination.

Bermudagrass production following corn maturity in mid-August has provided abundant pasture for fall and winter forage.