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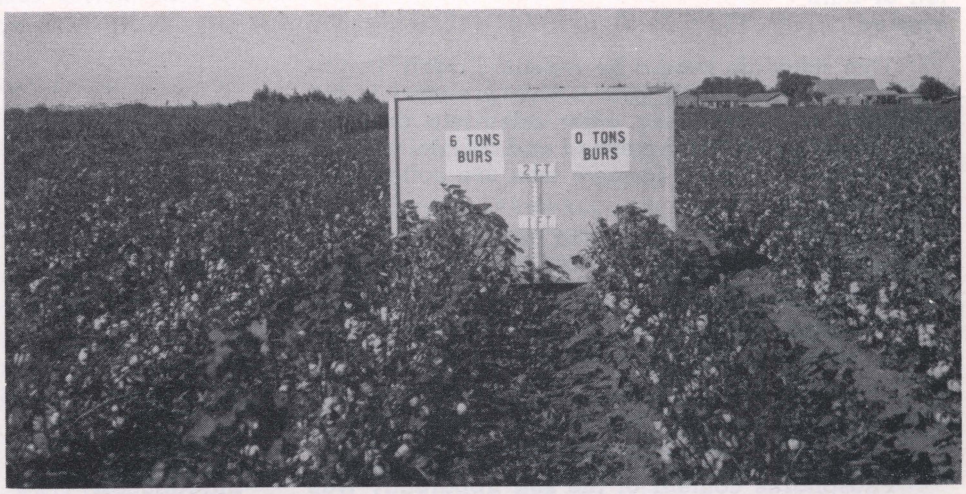
• Use of Cotton Burs
• to Improve Productivity on
• Irrigated Land



Cotton plot treated with 6 tons of cotton burs per acre (left) compared with a similar plot which did not receive the burs.

TEXAS AGRICULTURAL EXPERIMENT STATION

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SUMMARY

Cotton burs applied annually on an irrigated fine sandy loam soil at Lubbock during 1953-58 increased the lint yield 36 pounds per ton of burs applied. For the 6-year period covered by this test, the greatest lint yield increases were obtained during the last 4 years. Following three annual applications of burs on the same location, increased lint yields were obtained for 3 additional years without burs.

The addition of 12 to 15 pounds of nitrogen per ton of burs applied during the first 2 years of bur application is recommended. This amount provides sufficient nitrogen for plant growth and for the microorganisms involved in the decomposition of the burs.

Information obtained in these experiments with burs and nitrogen fertilizer show that lint yields can be increased and maintained in a farming operation according to the following schedule:

FIRST YEAR	SECOND YEAR	THIRD YEAR	FOURTH YEAR	FIFTH YEAR	SIXTH YEAR
Burs plus 12 to 15 pounds of nitrogen per ton of burs applied	Same program	Burs only	— —	No burs	— —
			No nitrogen		

This schedule should be repeated again beginning with the seventh year. This program is not intended to replace any other adequate program with which yields are increased and maintained, but is suggested for those farmers who use cotton burs on their land.

Method of land preparation after the burs were applied had little effect on the benefits obtained from the burs.

The application of cotton burs did not significantly affect the pH of the soil in this test.

Organic matter content of the soil was not increased appreciably with annual applications of 2, 4 or 6 tons of burs per acre during 1953-58.

Phosphorus content of the soil apparently was increased slightly at the 6 to 12-inch depth with bur applications.

Potassium content of the soil was high on untreated and treated land at the beginning and end of the test period.

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ACKNOWLEDGMENTS

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Soil tests were made by the Soil Testing Laboratory, Texas Agricultural Extension Service, College Station, Texas.

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CONTENTS

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Use of Cotton Burs to Improve Soil Productivity on Irrigated Land

Harvey J. Walker and John Box*

The use of cotton burs, or gin waste (Figure 1), on the farm has increased yields, increased the efficiency of water use in crop production and decreased losses from gin-yard fires.

On the South Plains of Texas, approximately 375,000 tons of burs are available from the average annual production of 1,500,000 bales of lint on 2,000,000 acres of cotton grown. This amount of burs would provide 4 tons per acre for 93,750 acres, or about one-twentieth of the total acreage.

The value of cotton burs on dry land was determined by Jones (3), (4) in 1951 and by Harper (2) in 1952. Harper reported a 24-year study which showed burs were worth $9.82 per ton. These results were obtained on continuous cotton land by plowing under 3 tons of burs every third year. Sherrill (6) reported, in 1955, on farmer usage of burs in Lubbock county. Rook (5) and Fraps (1) determined the chemical values of cotton burs and presented certain other statistics on the supply and use of cotton burs, Table 1. Rook (5) also presented the trace element content of burs.

Trucks similar to the one in Figure 2 are used to apply burs on a farm scale. These trucks have a bur capacity of 3 to 4 tons per load. Burs were released for use on land in 1951 by the Texas Department of Agriculture. This publication presents results of research with bur applications on irrigated land used for cotton production.

LOCATION, SOILS, RAINFALL AND IRRIGATION

The experiments with cotton burs were conducted on Substation No. 8 at Lubbock.

Soils at the test locations were the Portales and Mansker series which have a fine sandy loam texture. Slope varies from 0 to 1 percent. These soils tend to be shallow and range in depth from 18 to 30 inches over caliche which is high in calcium carbonate. Rates of intake, water penetration and drainage on these soils are excellent. Water erosion is not serious because of a high water intake rate and slight slope. These soils are susceptible to wind erosion, especially with improper management.

The average pH is 7.8 to 8.0. Organic matter varies from 0.7 to 1 percent and is stable in this range under continuous cropping. Phosphorus content averages 20 ppm in the 0 to 6-inch depth and 7 ppm in the 6 to 12-inch depth.

Rainfall and supplemental irrigation for the test period are shown in Table 2.

MATERIALS AND METHODS

Cotton burs were obtained from a nearby commercial gin. The burs were hauled from the gin in November and December, piled and then spread on the plots in January, as shown in Figure 3. A farm

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TABLE 1. NITROGEN, PHOSPHORUS (P_2O_5) AND POTASSIUM CONTENT OF BURS OR GIN WASTE

Element	% gin waste	Pounds per ton
Nitrogen	.730	14.6
Phosphorus (P_2O_5)	.395	7.9
Potassium	5.076	101.52

TABLE 2. RAINFALL AND IRRIGATION, 1953-58

Year	Pre-seasonal, Oct.-Mar.	Seasonal, Apr.-Sept.	Irrigation	Total
	— — — Acre-inches of water — — —			
1953	5.55	5.14	13.0	23.69
1954	3.98	9.71	13.0	26.69
1955	4.48	10.91	13.0	28.39
1956	2.70	6.80	13.0	22.50
1957	8.36	16.15	10.0	34.51
1958	6.40	13.51	13.0	32.91
Average				28.11

Figure 1. Four tons of cotton burs per acre on the land before the stalks were shredded.

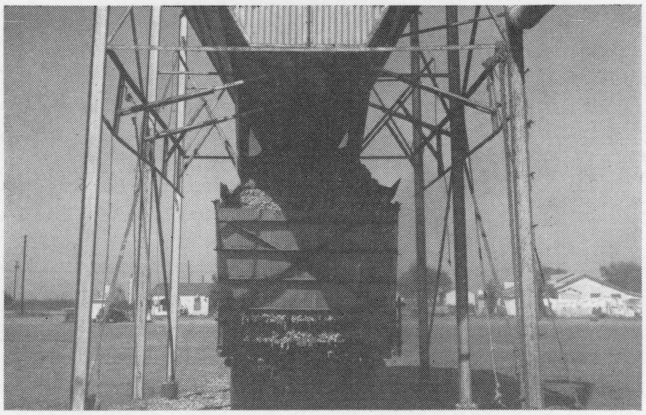

Figure 2. Cotton burs as they are loaded from gin bur hopper. Burs are spread directly on the land by the truck shown.

manure-spreader, calibrated for the desired rates, was used to apply the burs.

Four different tests were conducted with continuous and residual effect of one rate of burs with different placement and tillage and one rate of burs with nitrogen fertilizer. The following outline identifies the tests by number and treatment:

TEST NO.	TREATMENT
1	Rates of 2, 4 and 6 tons of burs per acre. Applied annually, 1953-58.
2	Rates of 2, 4 and 6 tons of burs per acre applied annually, 1953-55. No burs applied, 1956-58.
3	Annual rate of 4 tons of burs per acre applied, 1953-56, with tillage or bur-placement practices as follows:
	(a) Burs applied after cotton was up and in the four-leaf stage.
	(b) Burs applied, then the land was flat-broken with a moldboard plow before listing and the preplant irrigation.
	(c) Burs applied, then the land was listed only before the preplant irrigation.

Figure 3. Plot on right treated with 4 tons of burs per acre and untreated land on the left.

TABLE 3. EFFECT OF COTTON BURS ON LINT YIELD, 1953-58

Tons of burs per acre	Average lint yield, pounds per acre, 1953-58	Pounds of lint per acre-inch of water
0	538	19.1
2	649	23.1
4	705	25.1
6	762	27.1

4	One rate of 4 tons of burs per acre with the following treatments:
	(a) Burs only.
	(b) Burs with 30 pounds of nitrogen per acre.
	(c) Burs with 45 pounds of nitrogen per acre.

The cultural treatments after bur applications and before planting in tests 1, 2 and 4 were: listing, preplant irrigation, preplant weed control and planting. The source of nitrogen in this test was ammonium sulfate (21 percent N) which was applied in bands 20 inches apart before planting. A latin square design with four replications was used in all tests. Soil samples were taken in the third and sixth year of the test for pH, organic matter, phosphorus and potassium.

RESULTS

Test 1—Effect of Continuous Bur Application

Average production of cotton grown on untreated land in this test was 538 pounds of lint per acre. The plots receiving an annual application of 2, 4 and 6 tons of burs produced an average yield of 649, 705 and 762 pounds of lint per acre, respectively, Table 3. This represents an increase of 111, 167 and 224 pounds of lint per acre, respectively. These figures are average increases for land that had been treated annually with burs for 6 years. Lint yield increases were small at the end of the first 2 years.

Typical growth and development of cotton on untreated land and on land treated with 6 tons of burs per acre are shown on the cover. On land with 6 tons of burs per acre, the cotton plants averaged

TABLE 4. LINT YIELD FROM LAND WITH SIX ANNUAL APPLICATIONS OF BURS COMPARED WITH A 3-YEAR AVERAGE LINT YIELD FOLLOWING THREE ANNUAL BUR APPLICATIONS

Tons of burs per acre	Average lint yield 1953-58	Average lint yield 1956-58
	Continuous application	Residual
0	539	569
2	649	668
4	705	682
6	762	765

TABLE 5. AVERAGE LINT YIELD WITH DIFFERENT METHODS OF PLACEMENT AND TILLAGE FOR COTTON BURS, 1956-58

Tons of burs per acre	Date burs applied	Tillage or time of application	Lint yield, pounds per acre
0	None	Listed	535
4	6-10	Applied after planting	547
4	1-10	Flat broken then listed	674
4	1-10	Listed	656

about 6 inches taller and had slightly longer fruiting limbs than plants grown on untreated land.

The relationship between lint yield and rate of bur application is shown in Figure 4. Each ton of burs increased lint yields 36 pounds per acre for the 6-year period. An estimate of the total pounds of lint increase can be made by multiplying the number of tons of burs applied by 36.

The average amount of rainfall and irrigation (Table 2) and yield of lint (Table 3) were used to calculate the pounds of lint produced from an acre-inch of water, as shown in Figure 5. Untreated land produced 19 pounds and land that received 2, 4 and 6 tons of burs produced 23, 25 and 27 pounds of lint per acre-inch of water, respectively. These figures show a trend of increased efficiency of water use by cotton plants growing on the bur-treated land. Two explanations are considered as possible reasons: (1) improved plant-soil-water relations within the soil and a possible increase in soil surface water-intake rate and (2) additional plant nutrients supplied by the burs. The value of burs for increasing the efficiency of water use by the cotton plant is extremely important for sub-humid and supplemental irrigation areas.

Test 2—Residual Effect of Burs Following 3 Years' Application

To determine the residual effect, burs were applied annually for 3 years, followed by a 3-year period during which no burs were applied on the same plots.

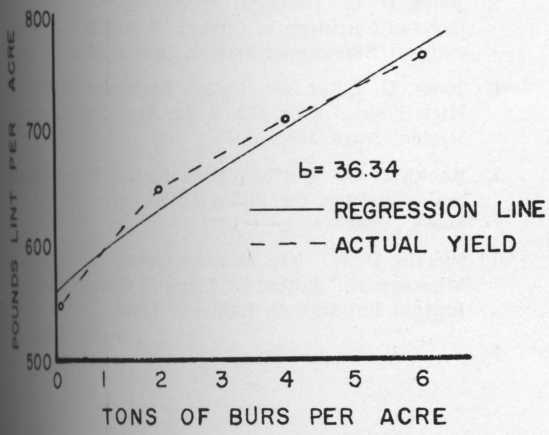

Figure 4. Relationship between lint yield and rate of bur application.

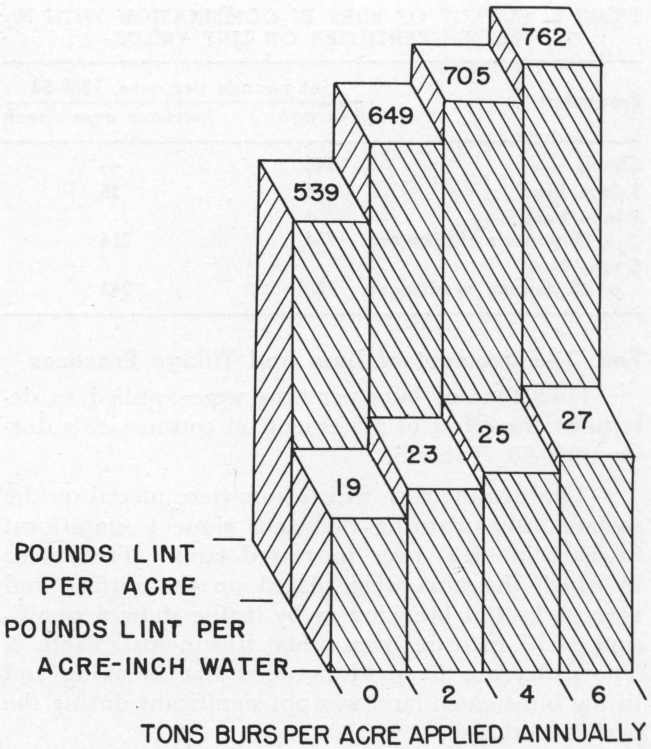

Figure 5. Effect of cotton burs on lint yield and water efficiency, 1953-58.

Results of this study are shown in Table 4.

The continuous treatments received burs annually during 1953-58 while the residual treatments received burs annually during 1953-55 and did not receive any burs during 1956-58. The 3-year average lint yields in the residual plots were close to the yields of the plots receiving continuous bur treatments. These results show that increases in yield are maintained for a period of 3 years on land that has had three consecutive annual bur applications.

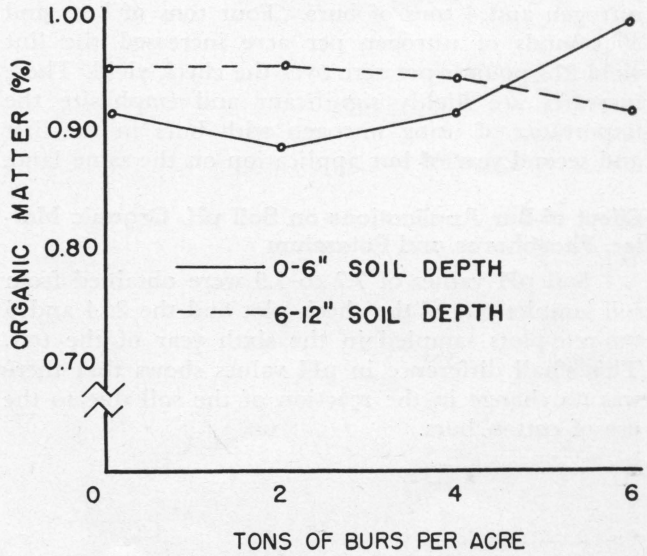

Figure 6. Effect of six annual applications of three rates of cotton burs on soil organic matter content.

TABLE 6. EFFECT OF BURS IN COMBINATION WITH NITROGEN FERTILIZER ON LINT YIELDS

Treatment	Lint pounds per acre, 1956-58	
	Average	Increase over check
Check	540	—
4 tons burs	575	35
4 tons burs + 30 pounds of nitrogen	754	214
4 tons burs + 45 pounds of nitrogen	783	243

Test 3—Placement of Burs and Tillage Practices

Four tons of burs per acre were applied to determine the effect of placement on cotton yields during 1956-58, Table 5.

The treatment in which burs were placed on the surface after planting does not show a significant increase in yield over untreated land. Treatments in which the burs were placed on the surface and covered by flat breaking or by listing show a significant yield increase over other treatments, Table 3. The difference in yield between flat breaking and listing bur-treated land was not significant during the period of this test.

This test indicates that the method of land preparation has little effect on the result obtained from the use of cotton burs on fine sandy loam soils under irrigation.

Test 4—Burs and Nitrogen Fertilizer

The results of the combination of 4 tons of burs plus 30 to 45 pounds of nitrogen, applied before planting, are shown in Table 6.

Cotton burs alone at the rate of 4 tons per acre increased lint yields by an average of 35 pounds for the 3-years period, as compared with untreated land. Lint yields were increased over check yields by 243 pounds per acre by the application of 45 pounds of nitrogen and 4 tons of burs. Four tons of burs and 30 pounds of nitrogen per acre increased the lint yield 214 pounds per acre over the check yield. These increases are highly significant and emphasize the importance of using nitrogen with burs in the first and second year of bur application on the same land.

Effect of Bur Applications on Soil pH, Organic Matter, Phosphorus and Potassium

Soil pH values of 7.7 to 7.9 were obtained from soil samples out of the check plot and the 2, 4 and 6 ton-rate-plots sampled in the sixth year of the test. This small difference in pH values shows that there was no change in the reaction of the soil due to the use of cotton burs.

TABLE 7. SOIL ORGANIC MATTER AND PHOSPHORUS AT TWO SOIL DEPTHS IN THE COTTON BUR TEST

Tons burs per acre	Soil depth, inches	Year 1956	Year 1958	Average	P_2O_5
		Percent organic matter			ppm
0	0-6	.96	.85	.91	23
	6-12	.93	.97	.95	16
2	0-6	.89	.87	.88	26
	6-12	1.01	.90	.95	13
4	0-6	.92	.89	.91	25
	6-12	.99	.89	.94	18
6	0-6	.99	1.00	.99	22
	6-12	.84	.98	.91	20

Table 7 gives the organic matter content of soils receiving different rates of burs for a 6-year period. Differences in soil organic matter due to bur treatment were not significant. The equilibrium level of organic matter for soils in the test appears to be stable between .7 and 1.0 percent under continuous cropping. The average percentage of organic matter during 1956-58 at two soil depths and under various bur treatments is shown graphically in Figure 6.

Phosphorus (P_2O_5) content of the soil in the bur test is shown in Table 7. The phosphorus content of the soil at the 0 to 6-inch depth did not show any significant change due to rate of bur treatment. There was an indication of a small increase in phosphorus at the 6 to 12-inch soil depth as the rate of burs increased.

The potassium content of the soil was above 240 ppm in untreated and treated plots.

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