# Cotton Burs And Cotton Bur Ashes

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# Fertilizer for Cotton On A Claypan Soil

By
HORACE J. HARPER

OKLAHOMA AGRICULTURAL EXPERIMENT STATION
Oklahoma A. & M. College, Stillwater

W. L. Blizzard, Director — Louis E. Hawkins, Vice Director
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# Cotton Burs and Cotton Bur Ashes As Fertilizer for Cotton On A Claypan Soil

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This bulletin reports a 24-year comparison of cotton burs and cotton bur ashes as a fertilizer. The comparison was made on a claypan soil with cotton grown every year as the test crop. This soil was low in available phosphorus but fairly high in organic matter. The exchangeable potassium was high enough so that crop response from potash fertilization was not profitable on adjacent plots where cotton was grown for a similar period.

THE RESULTS SHOW THAT:

Three tons of burs plowed under every third year increased the average annual production of seed cotton 149 pounds per acre, or more than one-fifth.

Average value of the increased production was $9.82 per acre per year. In other words, **a ton of burs plowed under was worth nearly $10 on this soil.** (The dollar value ranged from a low of 64 cents per ton in 1937 to a high of $39.88 in 1948.)

The ashes from three tons of burs applied every third year increased cotton yields 58 pounds per acre. This was less than half the increase given by using the burs.

Six tons of burs per acre gave no better results than three tons.

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* Formerly Soils Scientist, now Assistant Director of the Okla. Agri. Exp. Sta. and Agricultural Director, Samuel Roberts Noble Foundation, Ardmore, Okla.

## HOW THE COMPARISON WAS MADE

The experiment was started in the spring of 1926, using one- and three-ton rates per acre which were to be applied every year. Cotton made a poor growth that season, and the burs did not decay because the weather was very dry. It was decided to apply the burs at the rate of 3 and 6 tons per acre every three years, since the cost of making an annual application of cotton burs at a low rate per acre would be much higher than a heavier rate at less frequent intervals.

In 1927, ten plots of 1/20th acre each were set up prior to the spring planting season. All plots were planted in cotton every year thereafter. Four were left unfertilized. The other six were fertilized every three years with either cotton burs on an equivalent amount of cotton bur ashes, as follows:

Three tons of **burs** plowed under.
Three tons of **burs** applied after plowing.
**Ashes** from three tons of burs, disked into the soil after the land was plowed.
Six tons of **burs** plowed under.
Six tons of **burs** applied after plowing.
**Ashes** from six tons of burs, disked into the soil after plowing.

## WHAT THE COMPARISONS SHOWED

### Yields

Effects of the various treatments are shown in Table 1. The yields are averages for the 24 years, 1927 to 1950 inclusive.

Largest yield increase was on the plot where three tons of burs were plowed under every third year. The increase was slightly less on the plots receiving six tons of burs every three years.

Where six tons of burs were put on after plowing and disked

**Table 1.—Yields of Cotton; Unfertilized, and Fertilized with Cotton Burs and Cotton Bur Ashes.***
(Pounds of seed cotton per acre)

| | Yield | Increase over unfertilized plots |
|---|---|---|
| No fertilization | 693 | --- |
| 3 tons burs plowed under | 842 | 149 |
| 6 tons burs after plowing | 828 | 135 |
| 6 tons burs plowed under | 813 | 120 |
| 3 tons burs after plowing | 807 | 114 |
| Ashes from 6 tons burs | 759 | 66 |
| Ashes from 3 tons burs | 751 | 58 |

* Average of 24 years, 1927 to 1950, inclusive. For annual figures, see Appendix Table I.

into the surface soil, there was some difficulty in getting a stand of cotton the year the burs were applied. This would not be a problem where cotton is planted using a disc furrow opener or a lister. In this experiment, the cotton was planted on the level.

During the drier seasons, yields were nearly as high on the unfertilized plot as on those receiving burs or ashes. But when climatic conditions were most favorable for cotton production, the bur-treated plots usually produced considerably more than the unfertilized ones. These annual differences are shown in Figure 1.

Appendix Table I gives complete yield data, by years, for all plots (see page 10).

### Money Value of Burs as Fertilizer

The money value of the additional cotton produced by plowing under three tons of cotton burs every three years is shown in Table 2. It averages $9.86 per year. In other words, a ton of burs was worth nearly $10, as an average of the 24-year period, on this soil which contains more organic matter than many soils on which cotton is planted.

### Plant Nutrients in Cotton Burs

Table 3 summarizes information obtained by chemical analysis of 32 samples of cotton burs obtained from 22 Oklahoma counties in the fall of 1937. The burs averaged about one percent of total nitrogen. Those used in the experiment reported in Table 1 also averaged about one percent nitrogen.

All of the nitrogen and organic matter are destroyed when burs are burned. Consequently, the percentage of minerals in the ashes is about 9 to 11 times what it is in the burs themselves, although the total amount of minerals added in the ashes was the same as in the burs.

Potassium is the most abundant plant nutrient in cotton burs and the ash; but there was wide variation in the potassium content of burs from different areas. This variation is partly due to the difference in the quantity of available potassium in the soil where the cotton grew. Burs from cotton grown on bottomland or in western Oklahoma normally contain more potassium than burs from cotton grown on upland soils in eastern Oklahoma. The latter soils are often lower in available potassium.

## THE USE OF BURS AND BUR ASHES AS FERTILIZER

When cotton is harvested by snapping and the burs are removed from the land, the loss of plant nutrients from the soil is much greater

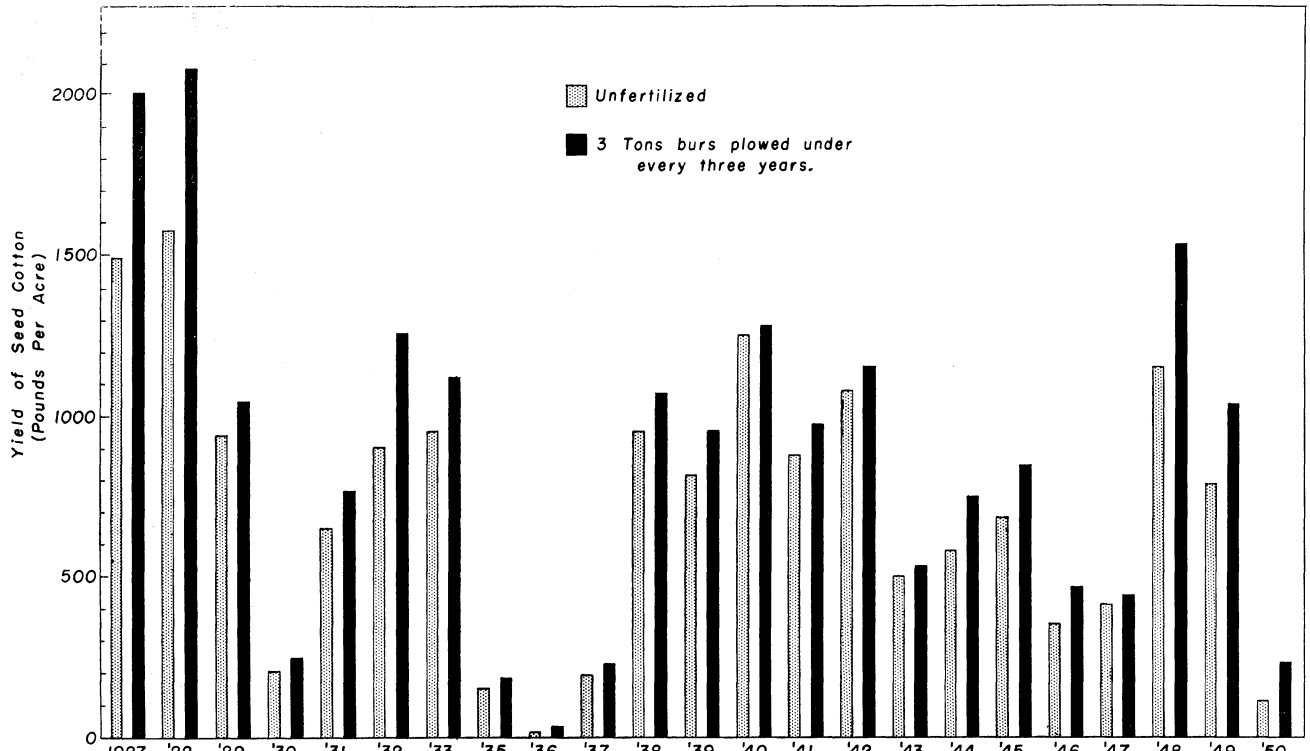


**Fig. 1.—Fertilization with cotton burs was most effective in seasons of adequate rainfall. Every year, however, the fertilized plots outyielded those which received no fertilization. Cotton crop was a failure in 1934 due to severe drought.**

**Table 2.—Calculated Dollar Value of Cotton Burs as Fertilizer.**

| Year | Price of cotton lint per pound* | Increased yield of seed cotton due to fertilizing with cotton burs** | Value of increased yield† |
|---|---|---|---|
| | **cents** | **lbs./A.** | **dollars** |
| 1927 | 20.46 | 505 | 38.23 |
| 1928 | 17.46 | 497 | 32.11 |
| 1929 | 16.09 | 100 | 5.95 |
| 1930 | 8.71 | 50 | 1.64 |
| 1931 | 5.06 | 130 | 2.43 |
| 1932 | 6.07 | 367 | 8.24 |
| 1933 | 9.65 | 162 | 5.78 |
| 1934 | 11.77 | --- | ----- |
| 1935 | 10.56 | 40 | 1.56 |
| 1936 | 11.02 | 16 | .65 |
| 1937 | 7.22 | 24 | .64 |
| 1938 | 7.95 | 131 | 3.85 |
| 1939 | 8.39 | 150 | 4.66 |
| 1940 | 9.12 | 39 | 1.32 |
| 1941 | 15.51 | 94 | 5.39 |
| 1942 | 17.33 | 68 | 4.36 |
| 1943 | 18.17 | 24 | 1.62 |
| 1944 | 18.71 | 163 | 11.28 |
| 1945 | 20.06 | 142 | 10.54 |
| 1946 | 30.07 | 124 | 13.80 |
| 1947 | 30.30 | 24 | 2.67 |
| 1948 | 28.59 | 377 | 39.88 |
| 1949 | 27.80 | 242 | 24.89 |
| 1950 | 38.00 | 108 | 15.18 |
| Average | 16.41 | 149 | 9.86†† |

* Season average price, Oklahoma.
** Calculated from data in Appendix Table I. Increase based on plot where three tons of burs were plowed under every third year.
† Value of seed cotton taken as 37 percent of the value of cotton lint. The actual relationship varied between 33 and 40 percent during the period covered by these data.
†† Weighted for annual relationships between price and increased yield.

**Table 3.—Composition of Cotton Burs, and Cotton Bur Ashes.***
(Percent elemental minerals)

| | Burs | | | Bur Ashes† | | |
|---|---|---|---|---|---|---|
| | Average | Highest | Lowest | Average | Highest | Lowest |
| Nitrogen | 1.04 | 1.40 | .72 | ** | ** | ** |
| Phosphorus | .10 | .21 | .07 | 1.17 | 2.24 | .60 |
| Calcium | .65 | 1.02 | .44 | 7.44 | 9.84 | 4.90 |
| Potassium | 3.39 | 6.25 | 1.42 | 37.48 | 52.08 | 16.00 |
| Magnesium | .25 | .34 | .19 | 2.87 | 4.31 | 1.82 |

* Based on analyses of 32 samples of burs collected in the fall of 1937 from 22 Oklahoma counties. Complete data are given in *Journal of the American Society of Agronomy*, 30:827-832 (1938).
** Nitrogen is released into the air when burs are burned.
† Percentage of ash averaged 8.73 for all samples, with a range from 5.93 to 13.09.

than that which occurs when cotton is picked. Cotton burs returned to a soil will help to replace some of the mineral matter and organic matter which gradually disappears from the soil as a result of tillage and crop removal.

### Effect on Physical Condition of the Soil

Adding cotton burs or other organic matter to soils which are medium to high in clay content improves the physical condition of the soil. This aids in the absorption of rainfall, permits an increase in the circulation of air needed by plant roots and useful soil bacteria, and provides a more favorable environment for root growth.

The beneficial effect of an improved physical soil condition on crop yields due to organic matter may be seen in Table 1, by comparing the production of seed cotton obtained on a plot where three tons of burs were plowed under with the production on a plot which received the ashes from the same amount of burs. The additional increase of 91 pounds of seed cotton on the plot where burs were used is due principally to a physical influence, because this soil had enough nitrogen for maximum cotton production under the climatic conditions which prevail in this area.

### Effect on Soil Nitrogen

Nitrogen in cotton burs is not available to crops until the burs start to decay. Cotton burs mixed with the soil early in the spring usually will decay enough so that some of the nitrogen will be released for use by the cotton crop that year.

The amount of nitrogen added by a ton of cotton burs would be about the same as that added by 60 pounds of ammonium nitrate, although much of it remains in the soil in a form unavailable to plants.

### Effect on Soil Phosphorus

In this particular experiment, the yield increases obtained by applying burs and bur ashes were in large part due to the added phosphorus, because the soil is low in available inorganic phosphorus. Cotton, which grows during the warmest part of the year, obtains a considerable quantity of phosphorus from the decay of soil organic matter. (About a third of the total phosphorus in the surface soil is contained in the soil organic matter.) Therefore the application of organic matter to a soil low in organic matter content will increase the yield of cotton, provided the organic matter does not contain too much carbon in proportion to its nitrogen content. If the carbon-

nitrogen ratio is too high, the process by which the nitrogen is made available for use of plants is retarded. Cotton yields may be decreased the first season when crop residues with a large amount of carbon and a low nitrogen content are plowed under or disked into a soil low in total organic matter.

On the plots treated with bur ashes, most of the yield increase probably was due to the phosphorus present in the ashes. In other fertility experiments on the same type of land, an application of superphosphate has increased cotton yields. The cotton bur ash contained no nitrogen, and because of the relatively small volume applied as compared with the burs it would have little effect on the physical condition of the soil. In some instances, large amounts of cotton bur ashes applied to the soil have been toxic to plant growth because of the alkalinity produced from the potassium carbonate in the ashes.

### Effect on Soil Potassium

When soils are low in exchangeable potassium, the return of cotton burs or bur ashes to the soil would be an important method of increasing the available potassium content. Many eastern Oklahoma farmers could afford to purchase cotton bur ashes and apply them to their soil to increase the available potassium supply.*

Cotton bur ashes lose potassium rapidly when exposed to rain before they are put on the land, because the potassium salts are soluble in water. If rain leaches through a pile of ashes, much of the potassium would be lost in the drainage water.

In western Oklahoma, most of the soils are high in exchangeable potassium. However, they are often low in organic matter. Therefore cotton would respond to an application of cotton burs because of the organic matter and nitrogen the burs contain.

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* Areas of Oklahoma likely to have soils low in potassium are indicated in Okla. Agri. Exp. Sta. Bul. No. B-346, *Potassium in Oklahoma Soils; and Crop Response to Potash Fertilizer (March, 1950).*

**APPENDIX TABLE I.—Effect of Cotton Burs and Cotton Bur Ashes on Yield of Cotton; Agronomy Farm, Stillwater, Okla., 1927-1950, inclusive.***

(Pounds of seed cotton per acre)

| Year | No treatment** | Ashes from 3 T. burs | 3 T. burs applied after plowing | 3 T. burs plowed under | Ashes from 6 T. burs | 6 T. burs applied after plowing | 6 T. burs plowed under |
|---|---|---|---|---|---|---|---|
| 1927 | 1495 | 1820 | 1950 | 2000 | 1670 | 1925 | 1860 |
| 28 | 1583 | 1730 | 2180 | 2080 | 1700 | 2300 | 1620 |
| 29 | 940 | 1100 | 1050 | 1040 | 1180 | 1070 | 1115 |
| 30 | 200 | 180 | 240 | 250 | 200 | 260 | 260 |
| 31 | 650 | 660 | 660 | 780 | 800 | 740 | 800 |
| 32 | 903 | 1080 | 1320 | 1270 | 880 | 1160 | 1220 |
| 33 | 948 | 780 | 1000 | 1110 | 920 | 1080 | 1110 |
| 34† | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 35 | 146 | 174 | 196 | 186 | 200 | 200 | 250 |
| 36 | 15 | 30 | 28 | 31 | 32 | 46 | 44 |
| 37 | 195 | 207 | 178 | 219 | 196 | 200 | 283 |
| 38 | 949 | 960 | 990 | 1080 | 1005 | 1065 | 1065 |
| 39 | 812 | 812 | 964 | 962 | 764 | 1016 | 892 |
| 40 | 1249 | 1264 | 1300 | 1288 | 1280 | 1420 | 1264 |
| 41 | 886 | 928 | 922 | 980 | 872 | 950 | 928 |
| 42 | 1086 | 1082 | 1084 | 1154 | 1088 | 726 | 1062 |
| 43 | 500 | 539 | 526 | 524 | 521 | 577 | 543 |
| 44 | 587 | 727 | 720 | 750 | 730 | 652 | 663 |
| 45 | 698 | 705 | 660 | 840 | 750 | 680 | 857 |
| 46 | 343 | 394 | 440 | 467 | 432 | 405 | 496 |
| 47 | 408 | 435 | 432 | 432 | 468 | 493 | 428 |
| 48 | 1143 | 1340 | 1350 | 1520 | 1320 | 1500 | 1640 |
| 49 | 790 | 906 | 1000 | 1032 | 988 | 1125 | 991 |
| 50 | 109 | 174 | 174 | 217 | 223 | 291 | 229 |
| Average | 693 | 751 | 807 | 842 | 759 | 828 | 813 |

* Claypan soil low in available inorganic phosphorus, fairly high in organic matter, and containing adequate exchangeable potassium for cotton production.

** Average of 4 plots. Treated plots were not replicated.

† Cotton crop was a failure in 1934 due to severe drought.