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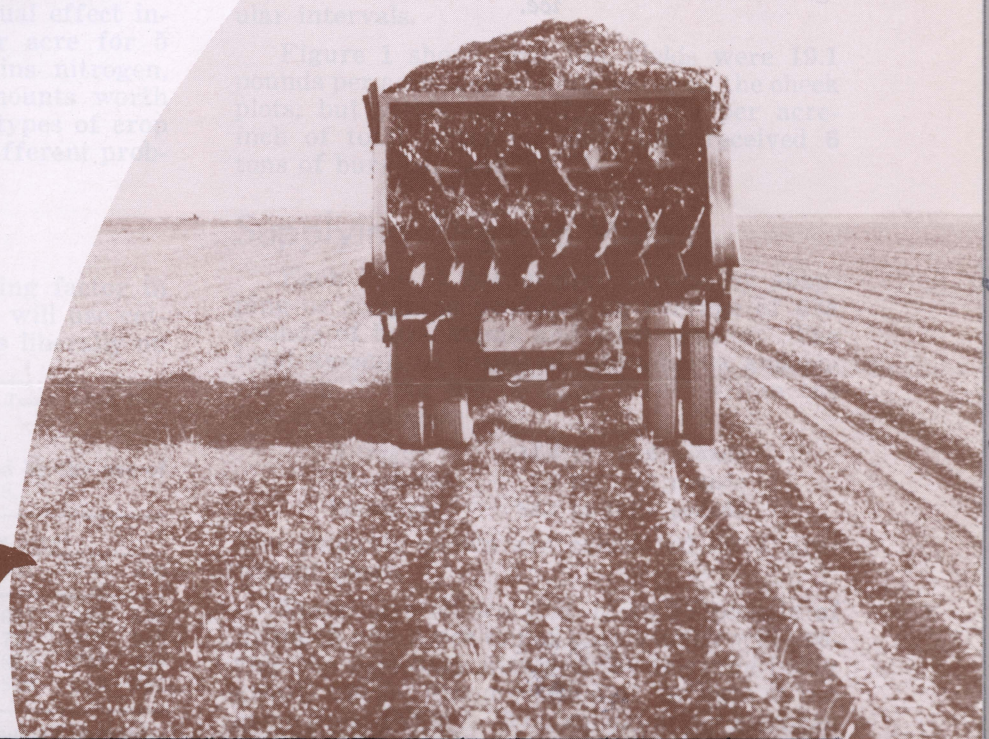
Cotton Burs

FOR SOIL IMPROVEMENT



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Cotton Burs for Soil Improvement

JOHN BOX and HARVEY J. WALKER*

YOU NEED GOOD, PRODUCTIVE SOIL if you are to farm soundly and prosperously. One way to maintain productive soil is to apply cotton burs and then turn them under.

Every year more and more Texas cotton is machine harvested, which results in a larger supply of cotton burs at the gin. To dispose of these burs, most ginners burn them, thereby increasing the fire hazard.

Research at Substation No. 8, Lubbock, shows that gin waste will increase cotton yields, Table 1. Lint yields are highest when you apply the burs at the 6-ton rate per acre. Often, however, your supply of burs will be limited; in that case, the 2-ton rate per acre will return the greatest profit per ton of burs applied. Burs are effective under irrigated and dryland conditions.

In a 4-year study by the Lubbock Station, the use of cotton burs under nonirrigated conditions increased lint yields by an average of 27 pounds per acre and the residual effect increased yields by 28 pounds per acre for 5 years. Each ton of burs contains nitrogen, phosphorus and potassium in amounts worth about $7.65. You can use other types of crop residues, but each will present a different problem in its use.

Maintaining Good Soil

Water most often is the limiting factor in crop production in Texas. If you will use cotton burs or other organic residues liberally on your soil, the soil-water relationship will improve and your crops will be able to use the available moisture more effectively. Soils to which cotton burs have been added also are more resistant to wind and water erosion and they may have a better infiltration rate. The cotton plant makes better use of water where organic residues are returned to the soil at regular intervals.

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Table 1. Lint cotton yields as influenced by the use of different amounts of cotton burs, 1953-58.

Cotton burs, tons per acre	Lint, pounds per acre[1]						
	1953	1954	1955	1956	1957	1958	Av.
0	379	449	645	532	637	588	538
2	422	537	821	670	717	727	649
4	421	490	1017	683	829	793	705
6	453	555	1142	758	810	853	762

[1]Plots received an average of 12.5 inches of supplemental irrigation annually in addition to 5.25 inches of preseasonal and 10.40 inches seasonal rainfall.

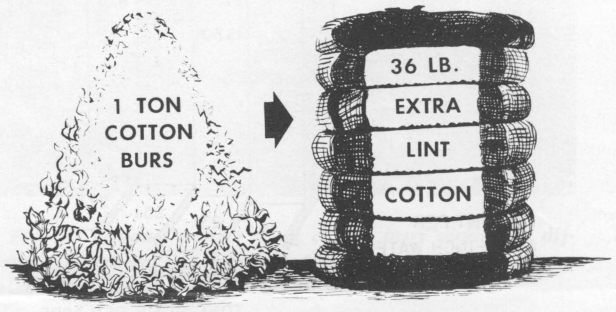

Fig. 1. Lint yields are increased by an average of 36 pounds of lint per ton of burs applied.

Figure 1 shows that lint yields were 19.1 pounds per acre-inch of total water on the check plots, but yields were 27.1 pounds per acre-inch of total water on plots that received 6 tons of burs per acre.

Supplying Organic Matter

Each bale of cotton you harvest by snapping or stripping produces an average of 675 pounds of burs, stems and other wastes. The total amount of nitrogen, phosphorus and potassium in one ton of burs varies within the following ranges:

Nitrogen	**14.6 to 21.6 pounds**
Phosphorus	**7.9 to 9.5 pounds**
Potassium	**53.4 to 101.4 pounds**

The amounts shown are calculated on a dry-weight basis.

Tests have shown that 12 to 15 pounds of nitrogen added per ton of burs usually will provide the necessary nitrogen for the crop being grown and for decomposition of the burs at the same time, Table 2. You should apply nitrogen to supplement cotton burs at or near the time the burs are turned under.

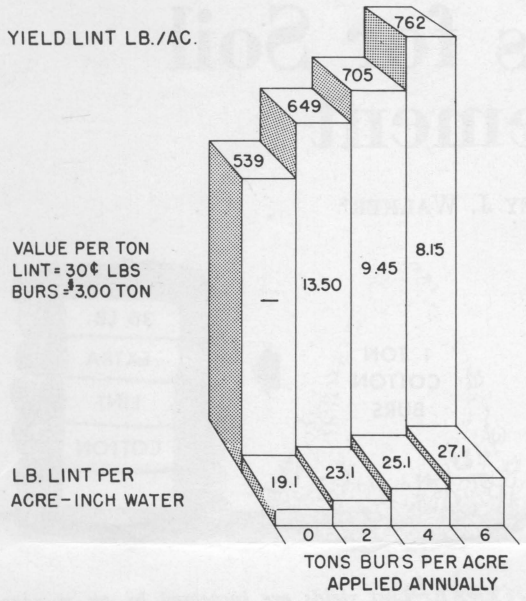

Fig. 2. Effect of cotton burs on lint yield and water efficiency, 1953-58.

Table 2. Yield of lint cotton as a result of burs and nitrogen application.

Burs and nitrogen	Lint, pounds per acre	
	3-year av.	Increase
No burs	540	—
4 tons	575	35
4 tons plus 30 lb. N	754	214
4 tons plus 45 lb. N	783	243

To produce 1 pound of stable organic matter or humus, the soil organisms must decompose 20 or more pounds of gin waste. Organic matter helps your soil the most when it is in the process of decomposition. Residues that decompose slowly remain active longer and produce effects that last longer than residues that break down rapidly.

Handling and Spreading Cotton Burs

Cotton burs are dry and bulky. They weigh about 5 pounds per cubic foot, loosely packed. This means there must be a steady flow away from the gin during the peak ginning season. The most successful method of handling burs has been for the ginner to spread the burs on his customer's land with gin-owned equipment, charging each purchaser a fixed fee.

If you plan to use burs, select your area well in advance so that the burs can be spread on the land as they come from the gin. For field crops, no economic advantage has been found in composting the burs before application.

There are many arrangements for catching cotton burs at the gin. You can obtain plans for Serial No. 424, gin trash hopper, and Serial No. 411, gin trash distributor, from the Agricultural Information Office, College Station. See Figures 3 and 4. Several companies also are fabricating and installing similar hoppers and spreaders because of the increased demand for gin wastes. Ginners should install a bur hopper to reduce the danger of fire to a minimum. A cyclone condenser and water spray nozzles also help reduce this hazard at the gin.

You can place burs more uniformly on the soil if you use an end gate spreader or similar equipment. After spreading, you can proceed with your normal seedbed preparation. Turn under the burs by disking, chiseling, listing or flatbreaking. Table 3 gives results obtained in tests using the different methods of placement. The tests show no real difference between listing and flatbreaking. Surface application after the crop is up to a stand is not recommended.

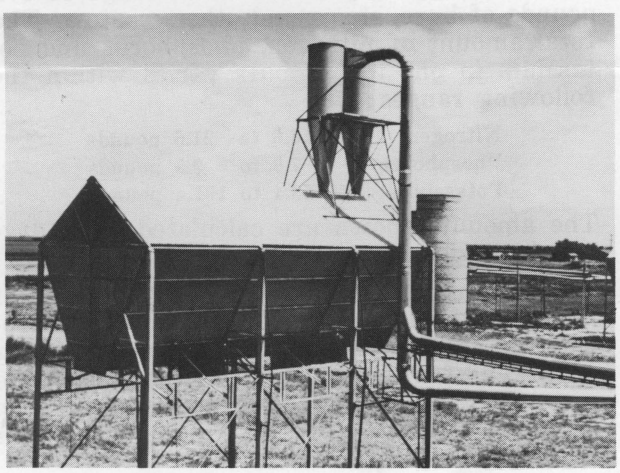

Fig. 3. A gin trash hopper.

Fig. 4. A gin trash distributor.

Table 3. Yield of lint cotton as a result of method of placement of 4 tons of cotton burs.

Burs	Lint, pounds per acre	
	3-year av.	Increase
No burs	535	—
4 tons, on surface[1]	548	13
4 tons, flatbroken[2]	674	139
4 tons, listed[3]	656	121

[1] 4 tons on surface in June, left on surface
[2] 4 tons on surface and flatbroken in January
[3] 4 tons on surface and listed in January

For best results, apply burs in the same location for at least 3 years. You will not see a maximum increase in yields often until your land has had two or more applications of cotton burs. This is shown in Table 1 for the 1955 season. Residual effects from such treatment will give you improved yields for 3 to 5 years.

Table 4 shows the results of the residual effect of cotton burs for a 3-year period following annual application of burs at varying rates. Yields on the residual plots remained at about the same level as the yields from plots receiving burs each year. Based on these findings, you can set up a system of rotation for fields to be treated with burs.

Table 4. Yield of lint cotton as a result of six annual applications compared with three annual applications.

Burs	Average yield lint, pounds per acre	
	1953-58 Continuous	1956-58 Residual
No burs	539	569
2 tons per acre	649	668
4 tons per acre	705	682
6 tons per acre	762	765

Disease Problems

Angular leaf spot, verticillium wilt or cotton seedling diseases have not shown any increase on land receiving six annual applications of cotton burs at the Lubbock Experiment Station. The degree of angular leaf spot infestation on cotton seems to vary by years. In years favorable to angular leaf spot infection, it was more serious where *no burs* or fertilizer was applied. Verticillium wilt did not infect cotton plants in the bur test plots during the 6 years of bur application. In areas known to be infected with verticillium wilt, some infection might occur from small pieces of limb or plant stem of the infected plants that are in the gin waste.

Fig. 5. Organic matter from cotton burs made the difference. Plant on left received 4 tons per acre. Plant on right received none.

Seedling diseases are no more serious on land receiving burs since there is no significant difference in plants per foot of row in the treated and untreated areas.

Insect Problems

Cotton insects which reduce yields and lower the grades have not built up to a point in the bur-treated soil that they nullify the advantage of using burs. More springtails (order Collembola) were noticed during one season in the test in plots where burs had been applied. During the short time these insects were found, the damage was not serious. In 1951, cotton burs were released by the State Department of Agriculture and the Department of Plant Quarantine for use on the land, provided certain standards in method of handling were met by ginners, to destroy any pink bollworms present. You can get copies of these regulations from either of the above mentioned agencies.

Weed Seed Problems

The number of weed seed coming with burs likely will never equal the number from other sources, such as tillage implements, combines and wind-water movement. The method of harvest and ginning operations tend to reduce weed seed carried by burs even from fields where weeds were not controlled. Over the 6-year test period, no differences in weed infestation showed up in the bur-treated and untreated areas. Bindweed, a serious weed pest, did not appear in the test area during this period.

Summary

Use gin wastes where possible for more efficient production of field crops. Over a 6-year period, cotton burs increased yield by an average of about 36 pounds of lint cotton for each ton of burs applied. Water utilization efficiency was improved by about a third at the 6-ton per acre rate of application. This value has been proved in widely separate locations and on many soil types throughout Texas.

Cotton burs exert their main influence as organic material in the soil. Research tests show that after applying cotton burs for 6 years at various rates, only slight changes occurred in the organic content of the soil. There was a slight increase in phosphoric acid content in the surface and a slight decrease at lower levels.

The main value obtained from applying burs to the soil appears to be an increased supply of energy which was used by the soil microorganisms in breaking down the material and the later release of plant food nutrients contained in the burs.

The low content of organic matter in Texas soils need not be a cause for alarm, if you make liberal additions of organic residues at regular intervals. Under Texas conditions, it is doubtful that you can obtain economic benefits by trying to raise the organic matter content of any cultivated soil above that of a virgin soil of the same type or classification. Soils which show a low organic matter content in the virgin state point out the need for a sound maintenance program that will return good increases in yields from regular applications of organic matter. The amount of organic matter needed is not great, but it should be added continuously, if you are to enjoy maximum yields for a long period of time.

What Is Organic Matter?

Organic matter is the storehouse of plant nutrients in your soil. It is literally the "fat of the land." Organic matter results from the decomposition of plant and animal materials by soil organisms. On the average it contains about 56 percent carbon and 5 percent nitrogen.

You may ask, "Of what value is organic matter in the soil?" Organic matter improves soil structure with a corresponding increase in the rate of infiltration and water storage capacity. Organic matter improves soil aeration, loosens dense, compact soils, at the same time granulating loose, open, sandy soils to give them a friable, crumb structure. Organic matter exerts a strong influence on the exchange capacity of the soil, and also acts as a buffer to prevent rapid changes or fluctuations in soil acidity or alkalinity. During the decomposition of organic matter, a continuous supply of carbon dioxide, nitrogen in various forms, phosphorus and other nutrients so essention to plant growth are liberated. Organic matter serves as a storage facility for mineral nutrients such as calcium, magnesium, nitrogen, and many others making them less likely to be lost in drainage or water seepage. Organic matter makes the soil more favorable for vigorous, rapidly developing root systems of young plants.

Continuous cultivation without attention to regular additions of residues gradually lowers the organic matter of your soils. This level may become so low that maximum production cannot be obtained. Regular addition of cotton burs to your land will offset this condition. Cotton, a clean-tilled crop, does not produce much residue; for this reason, you need to restore regularly organic matter which is lost during cultivation of the crop.

Soil organic matter decomposes relatively fast when Ph, moisture, temperature and aeration conditions are favorable. In may of the areas of Texas these conditions are favorable for rapid decomposition over long periods. Soils in these areas, therefore are not able to accumulate a high content of organic matter. For maximum production, regular additions of residues should be made to such soils to maintain a favorable balance.

Cotton burs and other crop residues are relatively high in carbon and low in nitrogen. Their decomposition process temporarily uses up much of the available nitrogen in the soil. To avoid this situation, apply burs well in advance of the crop season or supplement them with additional nitrogen from a chemical source.

Nitrogen plowed down with cotton burs is beneficial in the following ways:

1. It hastens the transformation of cotton burs into active organic matter.

2. It results in a larger amount of active organic matter from a given quantity of crude cotton burs.

3. It provides an additional supply of available nitrogen for the crop that follows.

4. It prevents any depression in yield which may result from plowing down heavy applications of cotton burs which are high in woody materials and low in nitrogen.

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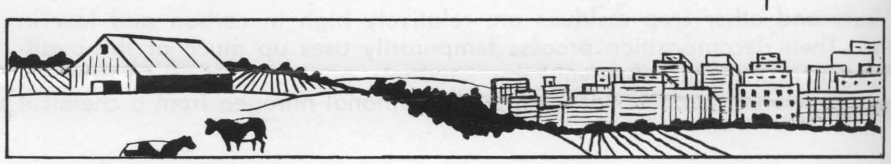

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