TEXAS AGRICULTURAL EXPERIMENT STATION

A. B. CONNER, DIRECTOR
College Station, Texas

BULLETIN NO. 621 OCTOBER 1942

EFFECTS OF PLANTER ATTACHMENTS AND SEED TREATMENT ON STANDS OF COTTON

H. P. SMITH
M. H. BYROM

Division of Agricultural Engineering

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
T. O. WALTON, President

B20-1042-7M-L180

[Blank Page in Original Bulletin]

Getting a good stand of cotton without having to replant is one of the chief problems of the cotton grower. That the soil must be sufficiently warmed up in the spring and that ample moisture must be present in a well prepared seedbed is thoroughly understood by cotton farmers. The type of equipment and the adjustment of the various planter attachments are therefore undoubtedly important in obtaining good stands of cotton.

Reported in this bulletin are the results of studies to determine the effect on stands of cotton of several planter attachments such as different types of furrow openers, press wheels, planting at variable depths, and the treatment of undelinted seed and delinted seed with Ceresan, lime, and sulfur.

All the experiments with planter attachments were conducted at the Main Station Farm on Lufkin fine sandy loam. This soil has a tendency to pack and crust after rains, which sometimes results in poor emergence of cotton.

Better stands of cotton were obtained when the furrow for the seed was opened with a knife or runner type furrow opener than when opened with either a narrow or wide shovel opener. The average percentage of emergence for the three types of furrow openers was 72.5, 59.3, and 55.5 per cent respectively.

The knife opener gave better results probably because it left a clean furrow and a firm seedbed with little loose soil. It does not disturb the soil enough to cause it to dry out as rapidly as when the furrows are made by shovel openers. A narrow shovel 1 3/8 inch wide, with shields to hold the loose soil out of the furrow until the seed reached the bottom of the furrow, gave better results than a wide shovel four inches in width.

The regular open center press wheel used after covering the seed and in combination with a knife opener gave a slightly higher percentage of emergence than other types of press wheels. Rolling on the seed and pressing them in the bottom of the furrow before covering did not give any better stands than when the soil was pressed with an open center press wheel after covering. All types of press wheels gave slightly better stands of cotton on the Lufkin fine sandy loam than when no press wheel was used, indicating that the press-wheel attachments were beneficial.

Cottonseed planted at a constant depth gave better stands and yields on the Lufkin fine sandy loam than cottonseed planted at variable depths.

The treatment of cottonseed with Ceresan produced significant increases in the emergence of cotton seedlings. Lime, however, reduced the emergence to some extent. Sulphur apparently had no effect on germination and emergence.

CONTENTS

EFFECT OF PLANTER ATTACHMENTS AND SEED TREATMENT ON STANDS OF COTTON

H. P. Smith, Chief, and M. H. Byrom, Agricultural Engineer, Division of Agricultural Engineering

A good stand of cotton is often hard to obtain at the first planting. This may be due to many factors, such as moisture in the soil, temperature of the soil, preparation of the seedbed, planting equipment, depth of planting, treatment of the seed, and viability or germinating qualities of the seed. The cotton planting equipment now on the market shows a variety of attachments which will help the skilled farmer to overcome many of the hazards he is faced with in obtaining good stands of cotton. Rapid operating, single and multiple-row machinery is available that will certainly deposit the seed on the bottom of the furrow where the greatest amount of moisture may be found. By using good judgment in selecting the planting depth and the proper use and adjustment of the various attachments available for planters a farmer can do much toward obtaining good stands of cotton. Reported in this bulletin are the results of

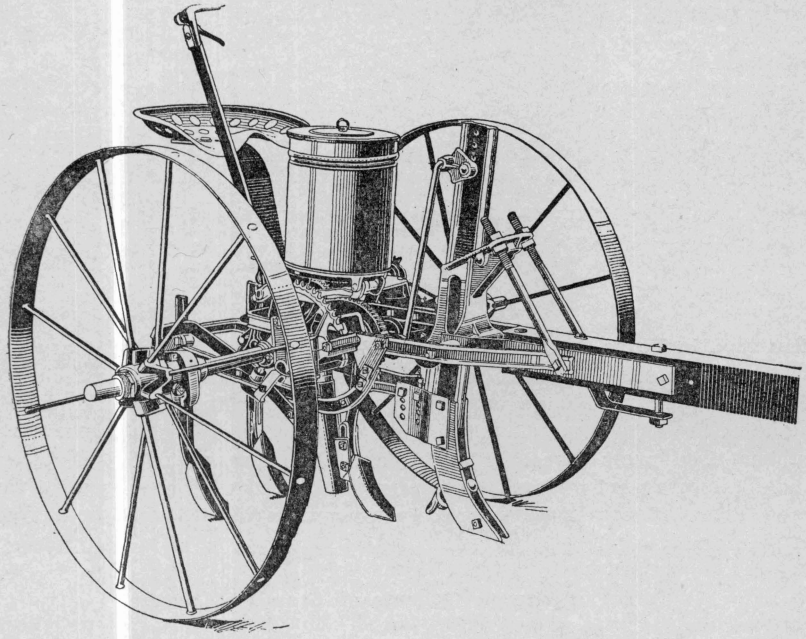

Figure 1. **Conventional type cotton and corn planter used in studying the effects of furrow openers and press wheels on stands of cotton. Note the shovel seed furrow opener and the covering shovels.**

studies to determine the effect of different types of furrow openers, press wheels, planting at variable depths, and the treatment of both undelinted and acid-delinted cottonseed with Ceresan, lime, and sulfur on the stand of cotton.

Equipment

In conducting these experiments the various planter attachments were mounted on two types of planters. The knife opener was used on an experimental planter designed and built by the Bureau of Chemistry and Engineering of the U. S. Department of Agriculture. This machine fully

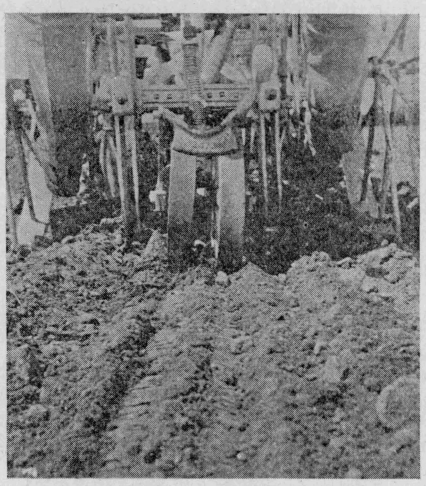

Figure 2. Rear view of planter equipped with open center press wheel. Note that the soil is pressed on each side of the seed and that the soil directly over the seed is left loose and unpressed.

described in Texas Station Bulletin 548 was too heavy for ordinary use. The narrow and wide shovel openers, and the variable-depth attachment (Fig. 5) were used on a conventional one-row riding cotton and corn planter shown in figure 1. The open center press wheel (Fig. 2), the rubber tired press wheel (Fig. 3), and the narrow wood press wheel (Fig. 4) were used on both types of planters and with each type of furrow opener. Shovel type covering equipment was used with both types of planters.

Effect of Furrow Openers on Stands of Cotton

To study methods of obtaining the best germination, cottonseed was planted on a firm, clean seedbed. In opening the furrow for the seed

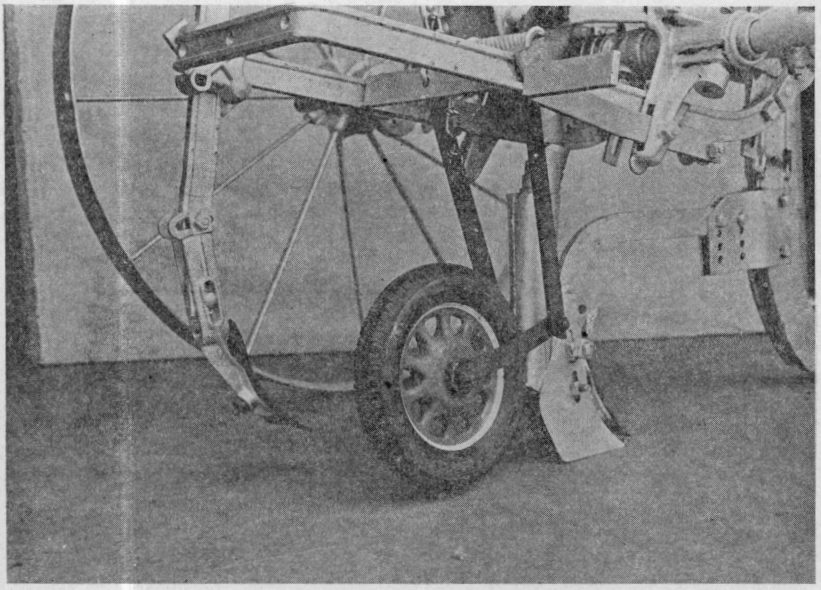

Figure 3. Rubber tired press wheel used to roll on and press cottonseed in the bottom of the furrow before covering.

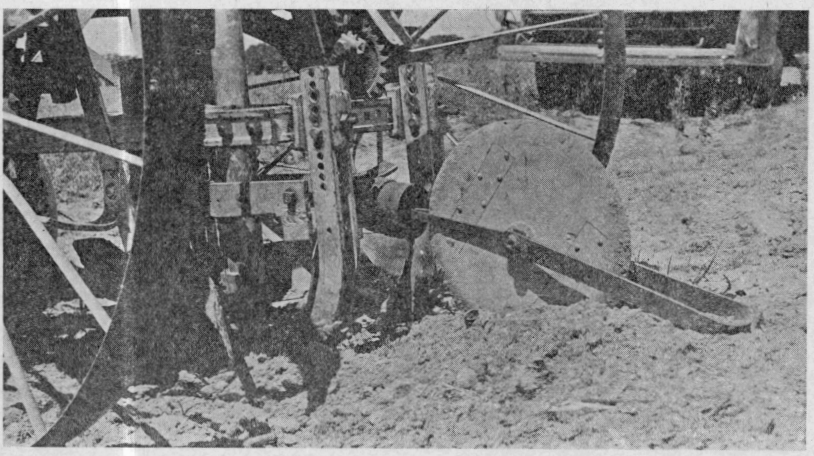

Figure 4. Side view of narrow wood press wheel used as a subsurface packer type of press wheel. The scrapers behind the wheel fill up the depression made by the wheel in cutting through the loose soil.

in some of the tests, loose soil was not permitted to fall into the furrow before the seed were deposited on the firm bottom of the furrow. The seed were thus kept more nearly in direct contact with the moist soil

and germination was aided. A well constructed knife opener having the lower end of the seed spout fitted between the wings or sides of the opener so that the seed dropped directly on the firm soil was used in one series of tests. The narrow shovel opener which was tested had shields fastened on each side of the shovel to prevent loose soil from falling into the furrow before the seed were deposited in the furrow. The wide shovel used opened a furrow in which some loose soil usually fell back into the furrow to form a thin layer of loose soil just underneath the seed.

A close search has not disclosed any references to previous investigations of the effect of furrow openers on the stands of cotton.

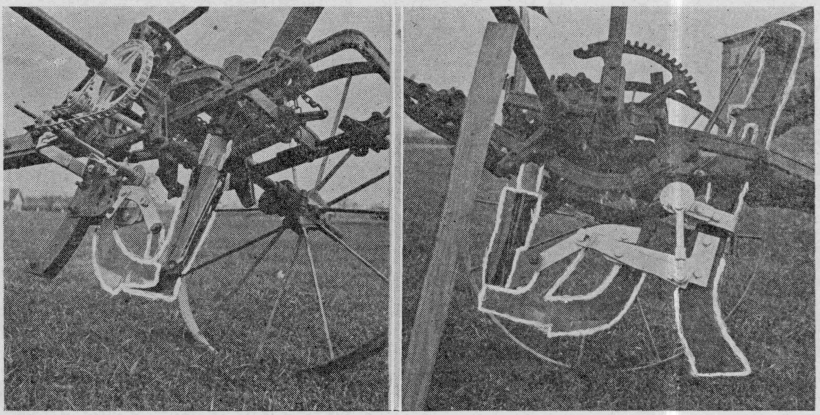

Figure 5. Views of both sides variable drop attachment mounted on a one-row riding cotton and corn planter. The view on right shows pitman wheel, pitman arm, and rocker arm for raising and lowering the knife or runner opener. The view on left shows chain drive and pitman cross shaft.

The data (Table 1) show that better stands of cotton were obtained when the furrow for the seed was opened with a knife or runner type furrow opener than when opened with either a narrow or wide shovel opener. The average percentage of emergence of cotton seedlings for the knife opener was 72.5 per cent, for the narrow shovel opener 59.3 per cent, and for the wide shovel 55.5 per cent.

The knife opener gave better results probably because it left a clean furrow and a firm seedbed. No loose soil fell into the furrow before the seed were deposited on the bottom of the furrow. The knife opener was set so that it would cut into the firm, well settled soil. About one inch of soil, when pressed down, was mounded up over the seed by covering shovels (Fig. 2). The 1 3/8-inch narrow shovel opener, made a narrow trench-like furrow of about the same width as made by the knife opener but the soil was not left in such a firm condition. Some soil perhaps worked around the shields into the furrow and the seed were probably not always dropped on a perfectly smooth, clean, firm seedbed as was the

Table 1. Effects of furrow openers on emergence of cotton, when used with different combinations of press wheels

Kind of furrow opener	Type of press wheel	Percentage of emergence						
		1937	1938	1939	1940	1941	Ave.	General Ave.
Knife	None	56.7	70.8	70.8	76.0	80.0	70.9	
"	Rubber before covering	66.0	58.7	75.6	73.6	88.2	72.4	
"	Rubber before and open center after covering	68.7	54.8	64.8	84.0	81.2	70.7	
"	Open center after covering	70.7	70.4	72.8	76.6	89.9	76.0	72.5
Narrow shovel	None	46.0	64.0	44.8	71.7	75.1	60.3	
" "	Rubber before covering	61.4	60.2	77.8	58.7	62.5	64.1	
" "	Rubber before and open center after covering		68.6	26.8	55.8	65.8	54.1	
" "	Open center after covering	60.7	54.3	52.1	60.8	66.2	58.8	59.3
Wide shovel	None	62.2	59.4	39.2	37.3	59.0	51.5	
" "	Rubber before covering	78.4	52.0	37.0	42.2	61.1	54.1	
" "	Rubber before and open center after covering		75.2	40.8	72.0	61.0	62.2	
" "	Open center after covering	57.6	43.8	60.4	63.2	45.6	54.1	55.5

Table 2. Effects of press wheels, on emergence of cotton, when used with different types of furrow openers

Type of press wheel	Kind of opener	Percentage of emergence						Gen. Ave.
		1937	1938	1939	1940	1941	Ave.	
None	Knife	56.7	70.8	70.8	76.0	80.0	70.9	
"	Narrow shovel	46.0	64.0	44.8	71.7	75.1	60.3	
"	Wide shovel	62.2	59.4	39.2	37.7	59.0	51.5	60.9
Rubber before covering	Knife	66.0	58.7	75.6	73.6	88.2	72.4	
" " "	Narrow shovel	61.4	60.2	77.8	58.7	62.5	64.1	
" " "	Wide shovel	78.4	52.0	37.0	42.2	61.1	54.1	63.5
Rubber before and open center after covering	Knife	68.7	54.8	64.8	84.0	81.2	70.7	
" " " " " " "	Narrow shovel		68.6	26.8	55.8	65.2	54.1	
" " " " " " "	Wide shovel		75.2	40.8	72.0	61.0	62.2	62.3
Open center after covering	Knife	70.7	70.4	72.8	76.6	89.9	76.0	
" " " "	Narrow shovel	60.7	54.3	52.1	60.8	66.2	58.8	
" " " "	Wide shovel	57.6	43.8	60.4	63.2	45.6	54.1	63.0
Narrow wood after covering	Knife	67.0	64.4	62.2	77.2	87.6	71.6	
Rubber before and covered shallow	Knife	49.6	57.7	62.0	72.3	85.0	65.3	

case with the knife opener. These factors probably affected the soil conditions enough to lower the germination below that of the knife opener. The 4-inch wide shovel opener, opened a wide and shallow furrow. Cottonseed dropped in the wide furrow scattered over a wider area than when dropped in the narrow furrows made by the knife and narrow shovel openers. It was necessary to set the covering shovels deeper to throw more soil to fill the wide furrow and to cover the seed adequately. The greater amount of loose soil probably dried out above the seed and affected their germination more than when narrow furrows were opened for the seed.

Even though better stands were obtained on the Lufkin fine sandy loam soil with the knife opener, the narrow shovel would be more suitable to use when planting in the hard bottom of a listed furrow and in gravelly or rocky soils.

Effect of Press Wheels on Stands of Cotton

Cotton growers use many different devices for firming the soil about the cottonseed in an effort to obtain good stands of cotton. These devices may consist of a roller made from a log, long enough to extend across three rows, some type of drag, two-wheel rollers, or by a chain or stick of wood dragged behind the covering shovels.

The average cotton and corn planter is usually equipped with a small steel press wheel which may have either a solid center or an open center. The open-center type shown in figure 2 is the most popular.

In 1897 Duggar (3)* found that by rolling a 6-inch face pulley on the soil over the seed good stands were obtained whereas poor stands were obtained where no roller was used. Camp (1) obtained good stands in Arizona by the use of a small press wheel to press the seed into the furrow directly behind the planter spout. Cumings (2) obtained some increase in yield where the seed were pressed in the furrow and covered with loose soil. Jones (4) obtained somewhat more rapid germination in the subhumid regions of Northwest Texas, when a small rubber tired press wheel was rolled on the seed to press them in the furrow before covering than when the seed were not rolled before covering.

Table 2 shows that on the Lufkin fine sandy loam at College Station the highest percentage of emergence, 76.0 per cent, was obtained when the regular open center press wheel was used after covering and in combination with a knife opener. The next highest, 72.4 per cent, was obtained when a small rubber tired press wheel was rolled on the seed which pressed them into the bottom of the furrow behind a knife opener before they were covered. It is recognized that different results may have been obtained on different soil types.

When results obtained with all three types of furrow opener are considered together, the rubber tired press wheel gave a slightly higher per-

*Numbers introduced thus throughout this bulletin refer to references on last page of this bulletin.

centage of emergence at College Station than the regular open center steel press wheel or an average of 63.5 and 63.0 per cent, respectively, which is probably not significant. All types of press wheels gave better stands than where no press wheel was used.

The narrow wood press wheel shown in figure 4 was weighted so that it cut through the loose soil and acted as a sub surface packer and pressed the soil around the seed below the surface rather than pressing the soil above the seed as is done where press wheels roll along on the surface of the soil.

Shovel coverers were used in all the experiments to throw soil over the seed. Disk coverers were tried but it was very difficult to throw a uniform amount of soil and cover the seed at a constant depth. Shovel coverers left the soil ridged-up over the seed (Fig. 2), and when rains occurred before emergence in sufficient amounts to form a hard soil crust, the soil on the sides of the ridge shrank in drying and caused a crack in the peak of the ridge over the seed and running lengthwise along the row. This permitted seedlings that otherwise could not have broken the crust to emerge through the cracks. The open-center press wheel also leaves an unpressed strip of soil directly over the seed (Fig. 2) and this condition may also aid in causing cracks in the soil crust to open up over the seed. When the soil is left flat the soil crust does not shrink and form cracks lengthwise along the row and therefore seedlings do not easily emerge. Cracks form a criss-cross pattern, when the soil is left flat.

Effect of Planting at Variable and Constant Depths on Stands of Cotton

An experiment was begun in 1932 to determine the effect of planting cottonseed at variable depths and at constant depths on the stands of cotton. The experiment was conducted for a five-year period (1932-1936) at College Station on Lufkin fine sandy loam soil.

The attachment for planting at variable depths consisted of sprockets and chains operating from the main axle of the planter to turn a crank which moved a rocker arm up and down (Fig. 5). The furrow opener was attached to the rear end of the rocker arm so that as the planter moved forward the seed opener moved up and down, planting some seed shallow and some deep, and some at intermediate depths (Fig. 6). The idea was to have at least some seed at a depth that might prove suitable for germination. If the soil is cool and wet, the shallow planted seed should germinate best, but if the soil is dry the deeper planted seed should give the best germination. If conditions are unfavorable for either the shallow or the deep planted seed, then the seed at the intermediate depths might germinate more easily (Fig. 7). By having the furrow opener set to open a furrow from ½ to 2 inches in depth within each 14-inch cycle, cottonseed are planted at all of these depths. Figures 6 and 7 show how the seed were planted and how the seedlings emerged

from the different depths. Figure 6 B shows seed planted at a constant depth.

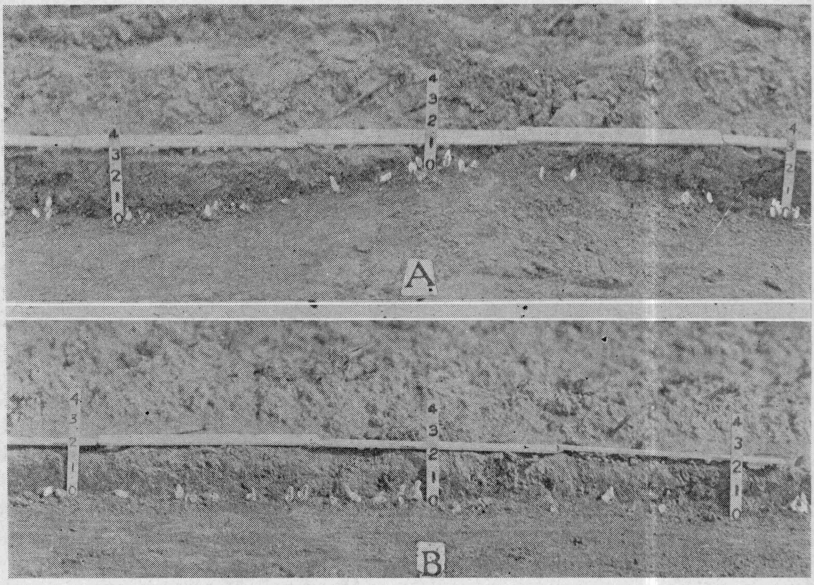

Figure 6. Cotton planted at variable and constant depths. A shows cottonseed planted at variable depths, while B shows cottonseed planted at a constant depth. A line of stakes are laying along the surface of the ground and the numbers on the small stakes show depth from surface to cottonseed.

The data in Table 3 show that cotton planted at constant depths of one to one and one-fourth inches gave better stands and yields for the period than cotton planted at variable depths. This was true whether or not press wheels were used.

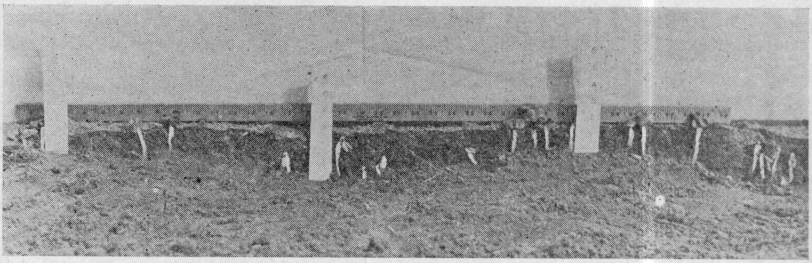

Figure 7. Showing growth of cotton seedlings resulting from variable depth planting. Note that where the seed were planted shallow the seedlings have emerged but were they were planted deep they have not emerged.

The results in these particular Texas trials fail to show that the use of a variable depth planter is advantageous.

Randolph (5) in his studies at Prattville, Alabama, obtained good stands and better yields by planting cotton at variable depths than at constant depths in the Alabama Tests. The soil was of a different type than the Lufkin fine sandy loam at College Station, and the climatic conditions were also different.

Table 3. Average stand of plants and acre yield of seed cotton, when planted at constant and variable depths, at College Station, Texas

Method of planting	Press wheels	Plants emerging in 50 feet of row					
		1932	1933	1934	1935	1936	Average
Constant depth	None	360	212	95	250	292	242
Variable depth	None	352	221	115	69	223	196
Constant depth	Regular	323	234	139	319	283	260
Variable depth	Regular	313	221	133	94	231	198
		Acre yield seed cotton (pounds)					
Constant depth	None	579	523	331	1098	346	775
Variable depth	None	473	459	276	765	258	446
Constant depth	Regular	499	569	372	913	398	550
Variable depth	Regular	541	587	282	952	241	523

Effect of Fertilizer Attachments on Stands of Cotton

It has been shown in Texas Station Bulletins 548 and 616 that better stands and yields are obtained when the fertilizer for cotton is placed some two inches to the side of the seed and approximately two inches deeper than the seed. The fertilizer can be applied in the right location by making the proper adjustments of the attachments for distributing both the fertilizer and the seed. In these tests the fertilizer was distributed at the same operation as the planting. The two operations done at the same time saved time, labor, and expense. Attachments were used to place the fertilizer in relation to the seed so that results could be compared with the well-known results when the fertilizer is applied before planting or as a side dressing. The parts of the fertilizer attachment and their operation were not permitted to interfere with the planter parts and their operation.

Treatment of Cottonseed with Ceresan, Lime, and Sulfur

Some farmers in different parts of the State have used ordinary slacked lime to treat their cottonseed before planting. This was done in the attempt to control disease organisms that injure young cotton seedlings and often hinder germination and emergence. An experiment was started in 1935 to determine the relative benefits that may be derived by treat-

ing both undelinted and delinted cottonseed with Ceresan, lime, and sulfur. The experiment was conducted at Main Station Farm at College Station and at Substation No. 11, Nacogdoches.

Several workers (6 to 12) have found that cottonseed treated with Ceresan produced better stands thaan untreated seed.

Table 4 shows that at College Station the treatment of undelinted cottonseed with Ceresan gave an average percentage of emergence of 71.0 per cent, while the untreated seed gave 59.8, lime tested, 55.0, and sulfur tested, 59.6 per cent. At Nacogdoches the average emergency for the no treatment, Ceresan, lime, and sulfur was 59.0, 83.0, 54.0 and 58.0 per cent, respectively. Ceresan produced significant increases in the emergence of cotton seedlings. Lime, however, reduced the emergence to some extent. Sulfur apparently had no effect on germination and emergence of undelinted cottonseed.

Cottonseed delinted with sulfuric acid and treated with Ceresan, lime, and sulfur, gave average percentages of emergence of 85.4, 73.6, and 79.3 per cent, respectively at College Station and 89.4, 72.5, 82.8 per cent, respectively at Nacogdoches (Table 5). The average percentage of emergence for the no treatment was 80.5 per cent for College Station, and 80.0 per cent for Nacogdoches. The Cereson treated delinted seed gave a substantially higher percentage of emergence than other treatments at both Nacogdoches and at College Station. The difference, however, was not statistically significant at College Station as compared with no treatment. At both locations the lime treatment gave substantially lower stands than the no treatment, again indicating, as was the case with undelinted seed, that the lime treatment reduced germination of delinted cottonseed. Sulfur did not appear to effect appreciably the germinating qualities of either delinted or undelinted cottonseed.

Summary and Conclusion

Different types of furrow openers and press wheels, and variable drop attachment were used to determine their effects on stand of cotton. In these studies undelinted and delinted cottonseed were treated with Ceresan, lime, and sulfur to determine the best treatment for cottonseed used for planting purposes.

A knife or runner, furrow-opener gave better percentages of emergence and stands than narrow or wide shovel openers. The narrow shovel opener gave better stands than the wide opener. The knife and narrow shovel openers cut a narrow furrow and did not disturb and loosen the soil enough to cause as much loss of moisture as when the wide opener was used.

On Lufkin fine sandy loam the regular opener-center press wheel used after covering and in combination with a knife opener gave a slightly higher percentage of emergence than other types of press wheels.

Rolling on the seed and pressing them in the bottom of the furrow be-

Table 4. Average percentage of emergence of cotton seedlings when undelinted and delinted cottonseed were treated with Ceresan lime, and sulphur

Seed treatment	College Station						Nacogdoches						Average of both locations
	1936	1937	1938	1939	1940	Average	1936	1937	1938	1939	1940	Average	
UNDELINTED													
None	66.3	65.3	69.5	36.0	61.8	59.8	52.0	58.1	62.1	80.6	42.3	59.0	59.4
Ceresan	74.8	62.2	71.4	72.4	74.2	71.0	80.1	80.9	87.0	75.5	91.3	83.0	77.0
Lime	64.7	42.7	69.4	32.3	65.7	55.0	60.6	54.0	63.8	38.6	52.9	54.0	54.5
Sulphur	72.0	49.3	74.2	33.8	68.4	59.6	71.1	58.5	70.2	28.8	61.5	58.0	58.8
Difference required between two means for significance at the 5 per cent level						11.3						16.0	11.7
DELINTED													
None	73.0	75.2	88.2	84.4	81.6	80.5	83.7	88.6	84.1	70.4	73.2	80.0	80.2
Ceresan	72.8	84.9	91.4	91.1	87.0	85.4	84.7	89.1	89.5	92.0	91.8	89.4	87.4
Lime	60.9	73.5	86.4	63.4	84.0	73.6	64.9	76.5	75.1	76.9	69.2	72.5	73.0
Sulphur	76.5	81.7	74.0	72.4	92.2	79.3	86.8	82.4	83.3	90.2	71.2	82.8	81.0
Difference required between two means for significance at the 5 per cent level						7.1						8.4	12.5

fore covering did not give any better stands than when the soil was pressed with an open center press wheel after covering.

All types of press wheels gave slightly better stands than when no press wheel was used.

Cottonseed planted at constant depths gave better stands and yields on the Lufkin fine sandy loam than did cottonseed planted at variable depths.

The treatment of both undelinted and acid delinted cottonseed with 2 per cent Ceresan gave substantial increase in stands over seed receiving treatment of lime and sulfur and no treatment.

Lime appeared to injure the germinating qualities of cottonseed while sulfur had little or no effect.

REFERENCES

Press Wheels

1. Camp, W. B. Townsend, J. S., 1926. Uniform-depth press-wheel cotton-planter attachment. U. S. Department of Agriculture. Dept. circ. 381.
2. Cumings, G. A., et al., 1933. Mechanical Application of Fertilizers to Cotton in South Carolina 1931. U. S. Department of Agriculture circ. 264, p. 29.
3. Duggar, J. F., 1897. Experiments with Cotton. Ala. Agr. Expt. Sta. Bull. 76, p. 29.
4. Jones, D. L. Unpublished data from 1936 and 1937 Annual Reports from Texas Substation No. 8, Lubbock, Texas.

Variable Depth

5. Randolph, John H., et. al., 1940. Cotton Tillage Studies on Red Bay Sandy Loam. U. S. Department of Agriculture circ. 540, p. 30.

Seed Treatment

6. Hale, E. E. and Armstrong, Geo. N. 1926. Cotton Experiments at Florence, S. C. Agr. Expt. Sta. Bull 225.
7. Hall, E. E., Delinting and Treatment of Cottonseed. 36th, 41st and 46th Annual Reports S. C. Agr. Expt. Sta.
8. Lehman, S. G., 1925. Studies on Treatment of Cottonseed. N. C. Agr. Expt. Sta. Tech. Bull. 26.
9. Perkins, W. R., Anderson, W. S. and Welborne, W. W. 1929. Organic Mercury Treatment for Cotton. Report of the South Miss. Branch Expt. Sta. Bull. 274.
10. Smith, H. P., et. al., 1936. Chemical Dust Treatment of Cottonseed for Planting Purposes. Tex. Agr. Expt. Sta. Bull. 531.
11. Wallace, H. F., and Colley, J. L., Jr., 1939. Ceresan Treatment of Cottonseed. Report of the Raymond Branch Expt. Sta. Miss. Agr. Expt. Sta. Bull. 271.
12. Walters, Phillip, 1933-1934. Ceresan Treatment of Cottonseed. 46 Annual Report of the Ga. Agr. Expt. Sta.