UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 564

Contribution from the Bureau of Entomology
L. O. HOWARD, Chief

Washington, D. C. ▼ October 4, 1917

# COLLECTION OF WEEVILS AND INFESTED SQUARES AS A MEANS OF CONTROL OF THE COTTON BOLL WEEVIL IN THE MISSISSIPPI DELTA

By

B. R. COAD and T. F. McGEHEE, Entomological Assistants
Southern Field Crop Insect Investigations

## CONTENTS



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# COLLECTION OF WEEVILS AND INFESTED SQUARES AS A MEANS OF CONTROL OF THE COTTON-BOLL WEEVIL IN THE MISSISSIPPI DELTA.

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CONTENTS.



## GENERAL STATEMENT OF EXPERIMENTS CONDUCTED.

During the cotton-growing seasons of 1915 and 1916 the writers conducted a series of studies to ascertain the value of various methods of collecting boll weevils and infested cotton forms as a means of control for the cotton-boll weevil. The experimental work was conducted in the vicinity of Tallulah, La., while more or less extensive observations were made at various points throughout Louisiana and Mississippi. The following studies apply most directly to the conditions existing in what is termed the "Delta" of Louisiana and Mississippi, but are also undoubtedly applicable to other portions of the cotton belt where a severe weevil infestation prevails.

In July, 1916, the senior writer published a preliminary report on the results of the 1915 studies [1] in order to place the information secured in a form available for use by the planters.

Note.—This bulletin will be of interest to entomologists and to cotton growers in the Delta region of Louisiana.

[1] Coad, B. R. Cotton-boll Weevil Control in the Mississippi Delta, with Special Reference to Square Picking and Weevil Picking. U. S. Dept. Agr. Bul. 382, July 8, 1916.

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The investigations of 1916 were conducted under seasonal and climatic conditions differing considerably from those of 1915 and were more extensive, so that it seems that the combined results of the two seasons' investigations may be considered as more or less conclusive. The following report presents a rather brief summary of these experiments, together with the conclusions which seem warranted by the observations.

The various field experiments were conducted by the junior writer and Messrs. W. B. Williams and T. P. Cassidy, under the direction of the senior writer.

## BRIEF REVIEW OF 1915 EXPERIMENTS.

Before proceeding with a consideration of the investigations of 1916 it is probably well to review briefly the results of the 1915 studies, since the program of work for the second year was based upon these results. In 1915, plat tests of the collection of fallen forms in the cotton field gave an increased yield of 23 per cent over the untreated cotton. Similar tests of weevil collection were started and the study of weevil infestation and other observations made during the season indicated that a similar degree of control was being secured. Unfortunately, the weevil-picking test plats of that year were ruined by hail in the latter part of June, so most of the conclusions on weevil picking were based on observations made prior to the hail storm and upon comparative efficiency studies of the various means of collecting adult weevils made later in the season.

The seasonal conditions of 1915 in the neighborhood where these experiments were conducted were very peculiar. Owing to the rather severe winter of 1914–15 the emergence from hibernation in the spring of 1915 was very light and late, resulting in only a slight initial infestation. Following this, the exceedingly dry weather of July produced a very high climatic control of the weevil stages in the fallen forms. This naturally resulted in a comparatively light degree of weevil injury regardless of whether or not control measures were practiced. In view of this very unusually light degree of injury it was considered probable that different seasonal conditions would produce different results from these control measures.

One interesting feature of the investigation of 1915 was the study of different methods of collection of the weevils and infested forms. Consideration of two factors—(1) the labor supply available and (2) the labor required for the hand picking of either the weevils or the infested forms—showed these measures of repression to be impracticable under the average Delta plantation conditions, hence an effort was made to find some way of reducing the labor requirements of the picking operation. The most promising method considered in this connection was the use of the bag-and-hoop as a weevil collector. This semimechanical method, which has been explained in detail in the earlier bulletin, proved to collect more weevils in less time than did hand picking, and as an additional advantage gathered a considerable number of infested squares and bolls during the course of the shaking operation. As it was so well adapted to the type of labor available and as it considerably reduced the amount of labor required, this method appeared to give the greatest promise of success. Consequently the investigations of 1916, which largely employed the bag-and-hoop method of collection, were aimed at securing information on the exact degree of control exerted by its use in the field under varying conditions.

## LINES OF INVESTIGATION IN 1916.

The experiments of 1916 may be divided into three more or less distinct lines of investigation. These were: (1) Plat tests under field conditions to determine the degree of weevil control produced by the operation of the bag-and-hoop for different periods at various time intervals between pickings; (2) intensive studies on the relation of the time interval between the pickings to the proportion of the infested forms collected in the bag; and (3) studies on the efficiency of certain mechanical collectors.

## TIME INTERVAL BETWEEN BAG-AND-HOOP COLLECTIONS IN RELATION TO PROPORTION OF INFESTED FORMS SECURED.

As has been stated, one of the favorable features attending the use of the bag-and-hoop as a means of collecting weevils was the collection of the infested squares and bolls while shaking the plants for the weevils. Thus this operation to some extent combined the results secured from two operations—(1) hand picking of weevils and (2) hand picking of infested forms. However, in attempting to outline some scheme for the practical use of the bag-and-hoop in the field it was necessary to know just what proportion of the forms falling to the ground because of weevil injury would be collected at different time intervals between pickings. In other words, it seemed desirable to find just what time interval would be necessary to secure the largest proportion of the infested squares and still be feasible for use. Indirect information on this score was of course secured from the general field tests of the use of this method of control; but, in addition to these, an intensive study was conducted by Mr. Williams on Eureka plantation, near Tallulah, La. The idea of this study was not so much to secure information on the actual degree of weevil control exerted by this operation in the plats under observation, but to secure information on the forms collected in the bags and the forms reaching the ground in the different plats. As one of the larger field tests of the bag-and-hoop method was also located on this same plantation, this intensive study was termed "Eureka Experiment No. 2."

### DESCRIPTION OF PLATS.

For conducting this study a small block of cotton was selected in the center of the cut. This cotton was a part of the general planting of the cut and was farmed exactly the same as the surrounding cotton throughout the season. The experimental area considered was 32 rows in width and 150 feet long. This was divided into eight plats of four rows each. The two outside plats were left untreated as checks, while plat 1 was shaken with the bag-and-hoop six times a week; plat 2, five times; plat 3, four times; plat 4, three times; plat 5, twice; and plat 6 once a week during the experimental period. These pickings were distributed through the week as well as possible. In addition to picking these plats a strip 30 feet in length beyond the end of each plat was gone over each time that the adjoining plat was picked. This was done simply to provide a buffer system which would protect the plats from an immigration of weevils from unpicked cotton.

The cotton variety used in these plats was the Simpkin's Ideal, and a good stand prevailed at the beginning of the experiment.

### METHOD OF OPERATION.

The method of collection used in these plats was the ordinary system of bag-and-hoop shaking, the plants being shaken into a sack held open by a hoop sewn in the mouth.

Negro laborers were used for the work, but they were under the constant supervision of an entomologist, and care was taken to make the work very thorough. Unnecessary injury to the plants was avoided as much as possible. At the beginning of the season bags about 20 inches in diameter were used for the small plants, but these were later replaced by considerably larger ones which allowed a reasonably thorough treatment as long as the pickings were continued.

The pickings were started on June 12. The plats had been watched carefully for some weeks before that time in order to start the picking as soon as the weevils became sufficiently abundant to make the records of any value. The initial spring infestation in this particular cut of cotton was rather light, and it was not until about this date that any weevils could be located in the plats. Following this first picking the schedule mentioned was continued for nine weeks, thus making the total pickings of the different plats range from 9 in plat 6 to 54 in plat 1.

### WEEVILS COLLECTED.

Throughout the experimental period a record was kept of the number of weevils gathered from each row of each plat at each picking. These records are only of incidental interest, as the extreme smallness of the plats, of course, allowed more or less of an interplat movement of weevils every day, and the records secured bear no relation to the conditions which would exist if larger tracts were picked at the different time intervals. However, the row and plat totals and plat averages for the season are of some interest and are given in Table 1.

TABLE 1.—*Total number of weevils collected, by rows and plats, Eureka plantation, Talluluh, La., 1916.*

| Plat No. | Total number of pickings. | Row No. 1. | Row No. 2. | Row No. 3. | Row No. 4. | Plat total. | Average per picking for plat. |
|---|---|---|---|---|---|---|---|
| 1 | 54 | 275 | 257 | 130 | 210 | 872 | 16.1 |
| 2 | 45 | 229 | 203 | 184 | 176 | 792 | 17.5 |
| 3 | 36 | 169 | 167 | 243 | 176 | 755 | 20.9 |
| 4 | 27 | 127 | 174 | 100 | 136 | 537 | 19.8 |
| 5 | 18 | 92 | 114 | 108 | 110 | 424 | 23.5 |
| 6 | 9 | 81 | 60 | 84 | 62 | 287 | 31.8 |

From this table it is seen that, generally speaking, the weevils per picking increased about in proportion to the increase in the time interval between pickings. However, the average number of weevils per picking in plat 6 was only twice that of plat 1, whereas plat 1 was picked six times as often as plat 6. The fact that there was an increase in the number of weevils secured per picking with the decrease in the number of pickings shows that the weevil movement within even these small plats was at least not sufficient to equalize the distribution completely throughout the plats between the pickings. This point is of principal interest in connection with the consideration of the important question of the extent and effect of the interplat movement of weevils in the larger field tests, which will be discussed later in the present report.

### FORMS COLLECTED IN BAGS.

In the same way that the weevil collections were recorded the forms gathered in the sacks from each row at each picking were noted. These forms were examined each time and divided into squares and bolls; then these were redivided into those uninjured (termed "clean"), those weevil punctured, and those showing other injury, such as rot, worm injury, etc. The plat totals secured during the different pickings are shown in Table 2, and are rearranged in Table 3 to show the averages per picking for each plat.

TABLE 2.—*Total number of forms collected in bags and percentage injured, Eureka plantation, Tallulah, La., 1916.*

| Plat No. | Bolls. | | | | | | | Squares. | | | | | | | Total bolls and squares collected. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Clean. | | Weevil punctured. | | Other injury. | | Total number collected. | Clean. | | Weevil punctured. | | Other injury. | | Total collected. | |
| | Total. | Per cent. | Total. | Per cent. | Total. | Per cent. | | Total. | Per cent. | Total. | Per cent. | Total. | Per cent. | | |
| 1 | 1,224 | 44.5 | 770 | 28.0 | 755 | 27.5 | 2,749 | 1,435 | 33.7 | 2,740 | 64.2 | 91 | 2.1 | 4,266 | 7,015 |
| 2 | 800 | 42.9 | 577 | 31.0 | 486 | 26.1 | 1,863 | 1,362 | 30.2 | 3,073 | 68.0 | 82 | 1.8 | 4,517 | 6,380 |
| 3 | 610 | 37.9 | 481 | 29.8 | 520 | 32.3 | 1,611 | 1,424 | 32.0 | 2,969 | 66.6 | 64 | 1.4 | 4,457 | 6,068 |
| 4 | 633 | 44.4 | 422 | 29.7 | 368 | 25.9 | 1,423 | 726 | 25.8 | 2,027 | 72.0 | 63 | 2.2 | 2,816 | 4,239 |
| 5 | 171 | 28.1 | 246 | 40.2 | 195 | 31.7 | 612 | 686 | 26.4 | 1,813 | 71.4 | 55 | 2.2 | 2,554 | 3,166 |
| 6 | 121 | 35.7 | 118 | 34.8 | 100 | 29.5 | 339 | 562 | 30.7 | 1,240 | 67.6 | 32 | 1.7 | 1,834 | 2,173 |
| Total | 3,559 | | 2,614 | | 2,424 | | 8,597 | 6,195 | | 13,862 | | 387 | | 20,444 | 29,041 |
| Weighted average | | 41.4 | | 30.4 | | 28.2 | | | 30.3 | | 67.8 | | 1.9 | | |

From Table 2 it is seen that the total forms collected ranged from 2,173 for plat 6 to 7,015 for plat 1. In other words, three times as many forms were gathered in the bags in plat 1 as in plat 6. These figures show the number of forms collected per plat to increase quite rapidly with the increase in the number of pickings. In fact, the average bolls per picking increased somewhat with the increase in the number of pickings per plat. The figures on the percentage infested and clean show this increase to be largely due to the fact that more clean bolls were shaken off as the number of pickings per week was increased. This was quite probably due to the weight of the bolls breaking the stems during the frequently repeated shakings.

The square collections show different results from the boll records just noted. With the squares the increase per collection as the shakings decreased in frequency is marked, ranging from 79 for plat 1 to 204 for plat 6. This difference in results between bolls and squares is probably due to the fact that the clean squares are not broken off in such large numbers by the excessive shakings as are the bolls. In fact, the percentage of clean squares collected in the different plats ranged only from 25.8 per cent to 33.7 per cent, while the clean bolls ranged from 28.1 per cent to 44.5 per cent. Incidentally, these results seem to indicate a rather undesirable amount of loss of clean forms due to the shaking process.

The high percentage of bolls recorded as "other injury" was due to the fact that practically daily rains prevailed in the experimental area during the month of July, and consequently there was a great shedding of young, infertile or rotting bolls. This rain may have increased the natural shedding of clean forms also, and thus raised this percentage above normal. In the total of all the pickings in all plats, one-third (weighted average 33.9 per cent) of the forms collected in the bags were clean. Of course, some of these forms may have belonged to the class which shed normally for physiological causes, but this proportion seems to be very undesirably high.

The fact that the squares collected in plat 1 numbered only two and one-half times as many as in plat 6, in spite of the fact that the former was picked six times as often as the latter, is of interest. This shows that a picking at a weekly interval secures more than that day's pro rata of the squares due to fall.

## FALLEN FORMS COLLECTED.

As a check on the relative number of forms collected in the bags, the number of forms falling to the ground in each row was also determined. To accomplish this all forms were picked from the ground once a week, beginning June 29. These were examined and sorted into bolls and squares, clean and injured. This sorting was continued until July 31, when it was found that so nearly all fallen forms were injured that they were divided only into bolls and squares. Unfortunately, the forms were not collected from the ground in the checks for the first four weeks. On July 25, however, all forms were cleared from the ground in the checks, and these two plats were included in the last three pickings. This makes it necessary to consider only these three pickings when comparing the picked plats with the checks.

TABLE 3.—*Forms collected in bags averaged by pickings, Eureka plantation, Tallulah, La., 1916.*

| Plat No. | Times picked. | Bolls collected. | | Squares collected. | | Total forms collected. | |
|---|---|---|---|---|---|---|---|
| | | Total. | Average per picking. | Total. | Average per picking. | Total. | Average per picking. |
| 1 | 54 | 2,749 | 51 | 4,266 | 79 | 7,015 | 130 |
| 2 | 45 | 1,863 | 41 | 4,517 | 100 | 6,380 | 141 |
| 3 | 36 | 1,611 | 45 | 4,457 | 123 | 6,068 | 168 |
| 4 | 27 | 1,423 | 52 | 2,816 | 104 | 4,239 | 156 |
| 5 | 18 | 612 | 34 | 2,554 | 142 | 3,166 | 176 |
| 6 | 9 | 339 | 37 | 1,834 | 204 | 2,173 | 241 |

TABLE 4.—*Fallen forms collected. Plat totals at each collection, Eureka plantation Tallulah, La., 1916.*

| Date picked. | Plat 1. | | | | | | Plat 2. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bolls. | | | Squares. | | | Bolls. | | | Squares. | | |
| | Number. | Clean. | Injured. | Number. | Clean. | Injured. | Number. | Clean. | Injured. | Number. | Clean. | Injured. |
| June 29 | ...... | ...... | ...... | 34 | 13 | 21 | ...... | ...... | ...... | 42 | 18 | 24 |
| July 3 | 13 | ...... | ...... | 40 | 14 | 26 | 9 | ...... | ...... | 16 | 8 | 8 |
| July 10 | 394 | 108 | 286 | 248 | 58 | 190 | 482 | 152 | 330 | 375 | 181 | 194 |
| July 17 | 497 | 17 | 480 | 227 | 40 | 187 | 205 | 16 | 189 | 200 | 74 | 126 |
| July 25 | 900 | 219 | 681 | 465 | 64 | 401 | 889 | 364 | 525 | 431 | 86 | 345 |
| July 31 | 701 | ...... | 701 | 692 | ...... | 692 | 836 | ...... | 836 | 1,504 | ...... | 1,504 |
| Aug. 7 | 834 | ...... | 834 | 1,085 | ...... | 1,085 | 942 | ...... | 942 | 1,566 | ...... | 1,566 |
| Aug. 14 | 204 | ...... | 204 | 442 | ...... | 442 | 431 | ...... | 431 | 750 | ...... | 750 |
| Total | 3,543 | 344 | 3,186 | 3,233 | 189 | 3,044 | 3,794 | 532 | 3,253 | 4,884 | 367 | 4,517 |

| Date picked. | Plat 3. | | | | | | Plat 4. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bolls. | | | Squares. | | | Bolls. | | | Squares. | | |
| | Number. | Clean. | Injured. | Number. | Clean. | Injured. | Number. | Clean. | Injured. | Number. | Clean. | Injured. |
| June 29 | ...... | ...... | ...... | 23 | 8 | 15 | ...... | ...... | ...... | 48 | 12 | 36 |
| July 3 | 9 | ...... | ...... | 19 | 10 | 9 | 14 | ...... | ...... | 26 | 11 | 15 |
| July 10 | 379 | 81 | 298 | 241 | 91 | 150 | 365 | 90 | 275 | 183 | 84 | 99 |
| July 17 | 170 | 17 | 153 | 196 | 63 | 133 | 338 | 43 | 295 | 299 | 31 | 268 |
| July 25 | 1,112 | 194 | 918 | 468 | 44 | 424 | 1,974 | 93 | 1,875 | 851 | 54 | 797 |
| July 31 | 1,203 | ...... | 1,203 | 957 | ...... | 957 | 1,360 | ...... | 1,360 | 1,403 | ...... | 1,403 |
| Aug. 7 | 816 | ...... | 816 | 1,007 | ...... | 1,007 | 885 | ...... | 885 | 1,044 | ...... | 1,044 |
| Aug. 14 | 645 | ...... | 645 | 1,224 | ...... | 1,224 | 647 | ...... | 647 | 843 | ...... | 843 |
| Total | 4,334 | 292 | 4,033 | 4,135 | 216 | 3,919 | 5,583 | 232 | 5,337 | 4,697 | 192 | 4,505 |

| Date picked. | Plat 5. | | | | | | Plat 6. | | | | | | Average of both checks. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bolls. | | | Squares. | | | Bolls. | | | Squares. | | | | |
| | Number. | Clean. | Injured. | Number. | Clean. | Injured. | Number. | Clean. | Injured. | Number. | Clean. | Injured. | Bolls, total. | Squares, total. |
| June 29 | ...... | ...... | ...... | 21 | 5 | 16 | ...... | ...... | ...... | 65 | 16 | 49 | ...... | ...... |
| July 3 | 4 | ...... | ...... | 20 | 3 | 17 | 32 | ...... | ...... | 64 | 20 | 44 | ...... | ...... |
| July 10 | 330 | 70 | 260 | 341 | 121 | 220 | 821 | 514 | 307 | 739 | 438 | 301 | ...... | ...... |
| July 17 | 219 | 10 | 209 | 287 | 24 | 263 | 543 | 86 | 457 | 655 | 61 | 594 | ...... | ...... |
| July 25 | 1,570 | 66 | 1,504 | 1,087 | 121 | 966 | 1,997 | 109 | 1,888 | 1,253 | 87 | 1,166 | ...... | ...... |
| July 31 | 986 | ...... | 986 | 1,561 | ...... | 1,561 | 2,090 | ...... | 2,090 | 3,536 | ...... | 3,536 | 1,861 | 3,081 |
| Aug. 7 | 769 | ...... | 769 | 1,732 | ...... | 1,732 | 1,177 | ...... | 1,177 | 2,645 | ...... | 2,645 | 1,233 | 2,248 |
| Aug. 14 | 492 | ...... | 492 | 1,383 | ...... | 1,383 | 913 | ...... | 913 | 2,874 | ...... | 2,874 | 1,032 | 2,218 |
| Total | 4,370 | 146 | 4,220 | 6,432 | 274 | 6,158 | 7,563 | 709 | 6,832 | 11,831 | 622 | 11,209 | 4,126 | 7,547 |

TABLE 5.—*Summary of fallen forms collected from picked plats, showing percentage injured and clean, Eureka plantation, Tallulah, La., 1916.*

| Plat No. | Bolls. | | | | | Squares. | | | | | Squares and bolls. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number bolls. | Clean. | | Injured. | | Number squares. | Clean. | | Injured. | | Total. | Clean. | | Injured. | |
| | | Number. | Per cent. | Number. | Per cent. | | Number. | Per cent. | Number. | Per cent. | | Number. | Per cent. | Number. | Per cent. |
| 1 | 3,543 | 357 | 10.0 | 3,186 | 89.9 | 3,233 | 189 | 5.9 | 3,044 | 94.1 | 6,776 | 546 | 7.6 | 6,230 | 92.4 |
| 2 | 3,794 | 541 | 14.3 | 3,253 | 85.7 | 4,884 | 367 | 7.5 | 4,517 | 92.5 | 8,678 | 908 | 10.5 | 7,770 | 89.5 |
| 3 | 4,334 | 301 | 7.0 | 4,033 | 93.0 | 4,135 | 216 | 5.2 | 3,919 | 94.8 | 8,469 | 517 | 6.1 | 7,952 | 93.9 |
| 4 | 5,583 | 246 | 4.1 | 5,337 | 95.9 | 4,697 | 192 | 4.1 | 4,505 | 95.9 | 10,280 | 438 | 4.3 | 9,842 | 95.7 |
| 5 | 4,370 | 150 | 3.4 | 4,220 | 96.6 | 6,432 | 274 | 4.3 | 6,158 | 95.7 | 10,802 | 424 | 4.0 | 10,378 | 96.0 |
| 6 | 7,563 | 731 | 9.7 | 6,832 | 90.3 | 11,831 | 622 | 5.3 | 11,209 | 94.7 | 19,397 | 1,353 | 7.0 | 18,041 | 93.0 |
| Total | 29,187 | 2,326 | .... | 26,861 | .... | 35,212 | 1,860 | .... | 33,352 | .... | 64,399 | 4,186 | .... | 60,213 | .... |
| Weighted average | ..... | ..... | 7.9 | ..... | 92.1 | ..... | ..... | 5.2 | ..... | 94.8 | ..... | ..... | 6.5 | ..... | 93.5 |

TABLE 6.—*Fallen forms collected at last three collections, Eureka plantation, Tallulah, La., 1916.*

| Date. | Plat 1. | | | Plat 2. | | | Plat 3. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Bolls. | Squares. | Total. | Bolls. | Squares. | Total. | Bolls. | Squares. | Total. |
| July 31 | 701 | 692 | 1,393 | 836 | 1,504 | 2,340 | 1,203 | 957 | 2,160 |
| Aug. 7 | 834 | 1,085 | 1,919 | 942 | 1,566 | 2,508 | 816 | 1,007 | 1,823 |
| Aug. 14 | 204 | 442 | 646 | 431 | 750 | 1,181 | 645 | 1,224 | 1,869 |
| Total | 1,739 | 2,219 | 3,958 | 2,209 | 3,820 | 6,029 | 2,664 | 3,188 | 5,852 |

| Date. | Plat 4. | | | Plat 5. | | | Plat 6. | | | Average check. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bolls. | Squares. | Total. | Bolls. | Squares. | Total. | Bolls. | Squares. | Total. | Bolls. | Squares. | Total. |
| July 31 | 1,360 | 1,403 | 2,763 | 986 | 1,561 | 2,547 | 2,090 | 3,536 | 5,626 | 1,861 | 3,081 | 4,942 |
| Aug. 7 | 885 | 1,044 | 1,929 | 769 | 1,732 | 2,501 | 1,177 | 2,645 | 3,822 | 1,233 | 2,248 | 3,481 |
| Aug. 14 | 647 | 843 | 1,490 | 492 | 1,383 | 1,875 | 913 | 2,874 | 3,787 | 1,032 | 2,218 | 3,250 |
| Total | 2,892 | 3,290 | 6,182 | 2,247 | 4,676 | 6,923 | 4,180 | 9,055 | 13,235 | 4,126 | 7,547 | 11,673 |

Table 4 shows the plat totals of fallen forms at each of the pickings, while Table 5 shows the total collections from each of the picked plats throughout the season and indicates the percentages of clean and injured forms in each lot. In order to facilitate comparison with the checks, the last three collections of fallen forms have been isolated and summarized in Table 6, together with the check records.

From these tables it is seen that the total fallen forms collected in the picked plats throughout the season ranged from 6,776 for plat 1 to 19,397 for plat 6. Thus it is seen that about three times as many forms reached the ground in the plat picked once a week as in the plat picked six times a week.

Turning to Table 6, which includes only the last three pickings, and thus affords a comparison with the checks, it is interesting to note that the checks yielded not quite three times as many fallen forms as plat 1. In other words, bag-and-hoop pickings six times a week secured only two-thirds of the squares due to fall and allowed one-third to reach the ground. It will be noted that plat 6 yielded more fallen forms than the checks. However, this is due to the fact that the check record is an average of both checks and there was a slight grading in the soil from east to west which caused the growth and fruiting of check 1 to be more determinate than that of check 2. This resulted in a much smaller number of squares forming in check 1 this late in the season and as a result this plat lowered the check average. For this reason it is more accurate to compare plat 6 with check 2 in these last three pickings, as these two plats adjoin. Comparing in this manner it is seen that plat 6 yielded a total of 13,235 fallen forms at the last three pickings while check 2 yielded 14,342. This is a total reduction of only 1,107 fallen forms due to the once a week shaking, or an average reduction of 369 per week. In this connection it is interesting to note that the forms collected in the bags from plat 6 during those same three weeks averaged 481 per week. Totaling these figures it is seen that 14,677 forms were collected in the bags and from the ground in plat 6 during these three weeks. This is 335 more than those found on the ground in check 2. This difference in totals is practically accounted for by the fact that 290 clean forms were gathered in the bags on plat 6 during these three pickings.

In connection with these studies it is of interest to compare the total forms gathered both in the bags and from the ground in each of these plats. Table 7 shows these data for the picked plats, while Table 8 shows only the final three weeks in order to afford a comparison with the checks.

TABLE 7.—*Total forms collected in picked plats throughout season, Eureka plantation, Tallulah, La., 1916.*

| Mode of collection. | Forms collected. | | | | | |
|---|---|---|---|---|---|---|
| | Plat 1. | Plat 2. | Plat 3. | Plat 4. | Plat 5. | Plat 6. |
| In bags | 7,015 | 6,380 | 6,068 | 4,239 | 3,166 | 2,173 |
| From ground | 6,776 | 8,678 | 8,469 | 10,280 | 10,802 | 19,397 |
| Total | 13,791 | 15,058 | 14,537 | 14,519 | 13,968 | 21,570 |

TABLE 8.—*Total forms collected from picked plats and checks during final 3 weeks, Eureka plantation, Tallulah, La., 1916.*

| Mode of collection. | Forms collected. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Plat 1. | Plat 2. | Plat 3. | Plat 4. | Plat 5. | Plat 6. | Average, both checks. |
| In bags | 3,935 | 4,369 | 4,027 | 2,847 | 2,146 | 1,442 | .......... |
| On ground | 3,958 | 6,029 | 5,852 | 6,182 | 6,923 | 13,235 | 11,673 |
| Total | 7,893 | 10,398 | 9,879 | 9,029 | 9,069 | 14,677 | 11,673 |

In Table 7 it is seen that the total for the picked plats ranged from 13,791 for plat 1 to 21,570 for plat 6. However, if plat 6 is excluded, the totals are more or less approximate.

In Table 8 it is seen that for the last three weeks the totals ranged from 7,893 for plat 1 to 14,677 for plat 6. All plats totaled less than the average check except plat 6, which was 3,004 above check. Here again the soil gradation probably distorts the results somewhat, and in considering all late season results it should be remembered that the soil graded lighter from east to west and the fruiting became more determinate, so that the figures for the various plats can not be accepted absolutely at their face value. Another factor operating at this time was the effect of the shakings on plant development. This will be dealt with in detail later in the present report.

## WEEVIL INVESTATION.

Although the plats were so small that they could not represent, or even approximate, an actual test of weevil control under field conditions, the progress of the infestation was still followed very carefully throughout the season. This record was determined for each plat by examining 100 squares at each end and the middle of the two inside rows of the plat. This made a total of 300 squares for each plat and the percentage of these which had been weevil injured was noted. These records were made about once a week during the season. The detailed results secured are shown in Table 9.

TABLE 9.—*Weevil infestation, Eureka plantation, Tallulah, La., 1916.*

| Date. | Plat 1. | Plat 2. | Plat 3. | Plat 4. | Plat 5. | Plat 6. | Check 1. | Check 2. |
|---|---|---|---|---|---|---|---|---|
| June 16 | 8.0 | 15.0 | 6.3 | 4.6 | 0.6 | 2.6 | 9.6 | 4.3 |
| June 20 | 3.3 | 5.6 | 4.6 | 6.6 | 4.0 | 5.3 | 3.3 | 5.0 |
| June 27 | 6.6 | 4.6 | 6.6 | 5.3 | 5.3 | 7.0 | 14.0 | 10.6 |
| July 4 | 12.7 | 11.7 | 11.3 | 5.3 | 6.7 | 11.3 | 16.0 | 13.3 |
| July 11 | 7.6 | 6.6 | 4.6 | 12.6 | 19.0 | 25.0 | 28.6 | 24.6 |
| July 19 | 21.0 | 22.0 | 20.3 | 23.0 | 50.3 | 47.3 | 57.0 | 42.6 |
| July 26 | 71.3 | 64.7 | 64.7 | 68.7 | 71.3 | 76.7 | 92.0 | 84.3 |
| Aug. 2 | 90.0 | 83.0 | 91.0 | 94.0 | 93.3 | 90.3 | 95.7 | 94.0 |
| Aug. 9 | 85.3 | 85.7 | 86.7 | 89.7 | 91.3 | 88.3 | 97.3 | 94.3 |
| Aug. 15 | 93.3 | 94.3 | 94.7 | 97.7 | 97.0 | 97.0 | 97.7 | 97.0 |
| Average of each plat | 39.9 | 39.5 | 38.9 | 40.7 | 43.9 | 45.1 | 51.1 | 47.0 |

From Table 9 it is seen that a uniformly low infestation prevailed in these plats during the entire month of June, and it was not until the record of July 11 that any significant difference in the infestation of the various plats appeared. Even then the difference was rather irregular, though it showed that plats 5 and 6 and the two checks were becoming more rapidly infested than the remainder. This same condition prevailed at the examination made July 19, but by July 26 the difference had been more or less neutralized, and from that time onward the only consistent difference was the slightly higher record of the checks above the picked plats. Taking the seasonal average of the various plats, it is seen that plats 1 and 4 were practically equal, while plats 5 and 6 showed a slight increase of about 3 per cent and 5 per cent, respectively, while the two checks were slightly higher still. These figures would seem to indicate that, even in the exceedingly small plats under consideration, the pickings of three times a week or more tended to reduce the degree of weevil infestation.

### EFFECT OF SHAKINGS ON PLANT DEVELOPMENT.

Rather early in the season it was observed that the shakings were apparently having a decidedly pronounced effect upon the growth of the plants in the various plats. It was noted that the plants in the most frequently shaken plats were apparently standing still as far as growth in height was concerned and that the more frequent the shaking the more pronounced this effect.

One method of measuring this effect was a series of studies on the average height of the plants, which was determined by measuring 20 plants in each row and taking the average. The first measurement was made on June 13, when it was found that the plants were more or less uniform in height, the range being only from 14.7 inches to 20.2 inches. At this time it was noted that the 15th to 18th rows (plats 4 and 5) were lower than the remainder. This was due to a slight dip in the land extending over these four rows, which had a tendency to retain standing water and thus somewhat retarded plant growth. This tended to reduce the average of these two plats, as will be noted in Table 10, which gives average heights of the plats and rows. Other than this slight difference the growth was very uniform over the series of plats.

FIG. 1.—TYPICAL PLANT IN PLAT 1, WITH LEAVES REMOVED, EUREKA PLANTATION, TALLULAH, LA., JULY 25, 1915. (ORIGINAL.)

FIG. 2.—TYPICAL PLANT IN CHECK 2, WITH LEAVES REMOVED, EUREKA PLANTATION, TALLULAH, LA., JULY 25, 1915. (ORIGINAL.)

COMPARISON OF SHAKEN AND UNSHAKEN COTTON PLANTS IN BOLL WEEVIL CONTROL.

FIG. 1.—LOOKING ACROSS END OF BUFFER OF PLAT 1, UNSHAKEN PLANTS ON LEFT, EUREKA PLANTATION, TALLULAH, LA., JULY 25, 1916. (ORIGINAL.)

FIG. 2.—DIVIDING LINE BETWEEN PLATS 1 AND 2, THE SHAKEN COTTON ON THE RIGHT, EUREKA PLANTATION, TALLULAH, LA., AUGUST 4, 1916. (ORIGINAL.)

COMPARISON OF SHAKEN AND UNSHAKEN COTTON PLANTS IN BOLL WEEVIL CONTROL.

TABLE 10.—*Average height of plants in each row and plat on June 13, Eureka plantation, Tallulah, La., 1916.*

| Plat number. | Row No. 1. | Row No. 2. | Row No. 3. | Row No. 4. | Plat average. |
|---|---|---|---|---|---|
| | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* |
| 1 | 18.3 | 14.7 | 16.1 | 15.7 | 16.2 |
| 2 | 15.0 | 17.1 | 18.6 | 16.2 | 16.7 |
| 3 | 15.7 | 16.5 | 16.6 | 19.5 | 17.0 |
| 4 | 17.2 | 15.1 | 12.8 | 13.8 | 14.7 |
| 5 | 12.7 | 14.2 | 15.6 | 19.5 | 15.5 |
| 6 | 19.0 | 16.2 | 17.2 | 15.6 | 17.0 |
| Check 1 | 19.8 | 21.4 | 20.2 | 19.5 | 20.2 |
| Check 2 | 18.1 | 19.2 | 20.0 | 19.7 | 19.2 |

On July 15, just about one month later, similar measurements were made in these same plats and it will be seen from Table 11 that very different results were secured.

TABLE 11.—*Average height of plants in each plat, Eureka plantation, Tallulah, La., 1916.*

| Date measured. | Plat 1. | Plat 2. | Plat 4. | Plat 4. | Plat 5. | Plat 6. | Check 1. | Check 2. |
|---|---|---|---|---|---|---|---|---|
| | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* |
| June 13 | 16.2 | 16.7 | 17.0 | 14.7 | 15.5 | 17.0 | 20.2 | 19.2 |
| July 15 | 19.8 | 23.1 | 25.4 | 25.5 | 29.2 | 34.7 | 37.4 | 44.3 |

Plat 1 was far the lowest in height, and there was a regular increase in height with the lessening in the number of shakings, the two checks being highest of all. Of course, at this time the factor of the determinate growth due to soil had become somewhat effective, and it will be noted that check 2 averaged 7 inches taller than check 1. This would tend to make the plants grade gradually in height from plat 1 to plat 6 regardless of their treatment, but the grading was far more extreme than this soil difference could explain. In fact, it will be noted that plat 6 averaged 10 inches less than check 2, which adjoined it. In the same way, plat 1 averaged 18 inches less than its adjoining check 1.

A number of photographs were taken to illustrate these differences in height of plants on July 15. Plate I, figure 1, shows a typical plant in plat 1 with the leaves removed, while figure 2 of the same plate shows a typical plant in check plat 2, thus affording a comparison of unshaken plants with those shaken six times a week. To illustrate this difference further, photographs were made showing the dividing lines between shaken and unshaken cotton. These are given in Plate II. These figures show very well the tremendous effect of the shaking operation on the height and form of the plants.

In addition to reducing the height, it was found that the shakings had considerable influence on the branching and general make-up of the plant. The most frequently shaken plants presented a bushy, compact form with exceedingly short internodes and badly deformed stalks and branches. In addition, these frequently shaken plants were much darker in color than the others, plat 1 appearing almost blackish, in fact. This color graded off as the shakings decreased until it reached the checks, which were at that time a light-yellowish green.

At the time this plant injury was noted, examinations were made in all other tests with the use of the bag-and-hoop being conducted by the writers. These were large field plats, each some acres in extent, but it was found that wherever the bags had been used the plants presented this same deformed, dwarfed appearance, and the more frequent the use of the bags the more pronounced the injury.

The exact causes of this injurious effect of the shaking operations on the cotton plant are not positively known, but it seems probable that they are produced by several different factors. In the first place, it was noted that a very large number of terminal buds were found in the bags at all shakings, and it is probable that this loss of terminal buds was very effective in producing the bushy growth noted. The loss of the terminal bud, of course, forced the formation of adventitious buds and aided in developing the very irregular branching. In addition to this, considerable injury to the stalk itself was observed, due to the bending during the shaking operation. In shaking the plants with the bag-and-hoop, it is customary to bend the stalk near the ground at a rather sharp angle in order to insert the plant into the bag before shaking it. This apparently resulted in some crushing of the tissues at the point of bending. In extreme cases noted in the most frequently shaken plats the stalk was badly scarified at the point of bending, and in some cases was actually split for a distance of several inches.

Still another effect was probably the disturbance of the root system. Whenever the plants are shaken the movement pushes the soil away from the stalk for a distance of from 1 to 2 or 3 inches below the surface of the ground. This forms a small hole all around the stalk, and it is probable that during the formation of this hole the important lateral roots, which branch out near the surface of the ground, are either very seriously injured or actually broken off. In fact, a number of plants examined showed a decidedly distorted development at the surface of the ground.

### SQUARE COUNTS.

Another effect of the shaking operation on the plants is shown by the square counts which were made twice during the season. For securing these records 50 plants were examined in each plat and the total and average number of squares per plant determined. The first count was made June 13, while the second was made on August 11. The results secured are shown in Table 12.

TABLE 12.—*Square counts, Eureka plantation, Tallulah, La., 1916.*

| Plat No. | June 13. | | | Aug. 11. | | |
|---|---|---|---|---|---|---|
| | Number of plants examined. | Number of squares found. | Number of squares per plant. | Number of plants examined. | Number of squares found. | Number of squares per plant. |
| 1 | 50 | 689 | 13.8 | 50 | 167 | 3.3 |
| 2 | 50 | 615 | 12.3 | 50 | 672 | 13.4 |
| 3 | 50 | 679 | 13.6 | 50 | 709 | 14.2 |
| 4 | 50 | 518 | 10.4 | 50 | 504 | 10.1 |
| 5 | 50 | 568 | 11.4 | 50 | 827 | 16.5 |
| 6 | 50 | 705 | 14.1 | 50 | 894 | 17.9 |
| Check 1 | 50 | 896 | 17.9 | 50 | 367 | 7.3 |
| Check 2 | 50 | 688 | 13.7 | 50 | 1,107 | 22.1 |

In the count of June 13 it was found that the plats were more or less uniform, ranging from 10.4 to 17.9 squares per plant. At this time check 1 averaged 17.9 squares per plant while check 2 averaged 13.7. Very different results were secured on August 11, when the determinate growth factor had become operative and check 1, which averaged above check 2 at the June 13 examination, averaged only 7.3 squares per plant, while check 2 averaged 22.1. In other words, the plants in check 1 had practically matured as far as their square formation was concerned, and were devoting themselves to ripening their crop of fruit. However, although check 1 averaged only 7.3 squares, plat 1 fell far lower still, averaging 3.3 squares per plant. Going to the other side of the experimental area, it is found that plat 6 averaged 17.9 squares per plant in comparison with 22.1 squares per plant in check 2. This shows the difference due to the once-a-week shakings. Owing to the soil variation it is difficult to compare the middle plats with either of the checks, but considering these outside records, which are strictly comparable, it seems obvious that the shaking operation greatly reduced the number of squares per plant, and on the whole the figures seem to warrant the conclusion that this reduction of square formation was more or less directly proportionate to the number of shakings which the plants received.

## SPACING OF PLANTS.

In order to determine if the shaking operation had had any definite effect on the stand remaining, the total number of plants in each plat was counted on July 14. The figures secured are given in Table 13.

TABLE 13.—*Average spacing on July 14—600 feet of rows in each plat, Eureka plantation, Tallulah, La., 1916.*

| Plat Number. | Number of plants in plat. | Average spacing. |
|---|---|---|
| | | *Inches.* |
| 1 | 349 | 20.6 |
| 2 | 336 | 21.4 |
| 3 | 342 | 21.0 |
| 4 | 363 | 19.8 |
| 5 | 332 | 21.6 |
| 6 | 423 | 17.0 |
| Check 1 | 398 | 18.0 |
| Check 2 | 427 | 16.8 |

From Table 13 it is seen that the checks averaged the closest spaced of all, while the average spacing increased somewhat as the number of shakings increased. This, of course, is undoubtedly due to the plants actually killed by the shaking operations and further illustrates the injurious effect of the bags.

## SEED-COTTON PRODUCTION.

Owing to the small size of the plats and the soil variations existing, it was not to be expected that there would be much significance in the seed-cotton production of each, but the figures were secured for whatever value they might possess. Table 14 shows the comparison of the different pickings by plats while the row results are shown in Table 15.

TABLE 14.—*Seed-cotton production; comparison of different pickings by plats, Eureka plantation, Tallulah, La., 1916.*

| Plat Number. | Seed-cotton production. | | |
|---|---|---|---|
| | First picking, Aug. 17. | Second picking, Sept. 8. | Third picking, Nov. 21. |
| | *Ounces.* | *Ounces.* | *Ounces.* |
| Check 1 | 478 | 437 | 42 |
| Plat 1 | 189 | 247 | 54 |
| Plat 2 | 96 | 439 | 145 |
| Plat 3 | 285 | 650 | 194 |
| Plat 4 | 126 | 511 | 108 |
| Plat 5 | 166 | 586 | 216 |
| Plat 6 | 132 | 834 | 217 |
| Check 2 | 74 | 697 | 391 |

TABLE 15.—*Seed-cotton production by rows and plats, Eureka plantation, Tallulah, La., 1916.*

| Plat No. | Row No. | Seed-cotton production. | | | | |
|---|---|---|---|---|---|---|
| | | First picking, Aug. 17. | Second picking, Sept. 8. | Third picking, Nov. 21. | Total by rows. | Total by plats. |
| | | *Ounces.* | *Ounces.* | *Ounces.* | *Ounces.* | *Ounces.* |
| 1 | 1 | 68 | 78 | 13 | 159 | 490 |
| | 2 | 55 | 75 | 13 | 143 | |
| | 3 | 33 | 36 | 16 | 85 | |
| | 4 | 33 | 58 | 12 | 103 | |
| 2 | 5 | 20 | 112 | 30 | 162 | 680 |
| | 6 | 15 | 111 | 36 | 162 | |
| | 7 | 25 | 99 | 44 | 168 | |
| | 8 | 36 | 117 | 35 | 188 | |
| 3 | 9 | 71 | 160 | 50 | 281 | 1,129 |
| | 10 | 104 | 144 | 50 | 298 | |
| | 11 | 23 | 188 | 56 | 267 | |
| | 12 | 87 | 158 | 38 | 283 | |
| 4 | 13 | 16 | 195 | 33 | 244 | 745 |
| | 14 | 37 | 158 | 26 | 221 | |
| | 15 | 29 | 68 | 13 | 110 | |
| | 16 | 44 | 90 | 36 | 170 | |
| 5 | 17 | 42 | 77 | 28 | 147 | 968 |
| | 18 | 42 | 115 | 32 | 189 | |
| | 19 | 44 | 179 | 63 | 286 | |
| | 20 | 38 | 215 | 93 | 346 | |
| 6 | 21 | 32 | 222 | 67 | 321 | 1,183 |
| | 22 | 28 | 182 | 51 | 261 | |
| | 23 | 34 | 204 | 49 | 287 | |
| | 24 | 38 | 226 | 50 | 314 | |
| Check No. 1 | 1 | 130 | 94 | 7 | 231 | 966 |
| | 2 | 106 | 133 | 14 | 253 | |
| | 3 | 129 | 101 | 7 | 237 | |
| | 4 | 122 | 109 | 14 | 245 | |
| Check No. 2 | 1 | 20 | 206 | 65 | 291 | 1,162 |
| | 2 | 18 | 151 | 95 | 264 | |
| | 3 | 19 | 164 | 112 | 295 | |
| | 4 | 17 | 176 | 119 | 312 | |

A number of rather interesting points are brought out by these figures. It is seen that the picked plats generally increased in production from west to east—that is, with the decrease in pickings. Of course the increase in soil fertility is in the same direction, but it is far from sufficient to account for the differences between the plats. One break in this gradation is the comparatively low records of plats 4 and 5. This was due to the poor cotton in rows 15, 16, 17, and 18, which has already been mentioned. From Table 15 it is seen that these four rows yielded about the same as the other four rows of these two plats at the first picking, but at the second and third pickings there was a great loss in these four rows of poor cotton.

Another interesting feature of the production records is the late maturity of check 2. In this plat the vegetative growth was not restrained as in the shaken plats, and as a result the exceedingly wet weather of July produced a very rank plant which shaded the bolls so completely that they did not open. From Table 14 it is seen that this plat yielded far the lowest of all at the first picking, and it was not until the leaves were killed by the frost that a good portion of the crop in this plat finally opened. In fact, a considerable proportion

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of the bolls in check 2 never opened, as they rotted while covered with the dense foliar growth. Thus it is seen that the detrimental effect of the shaking on the fruiting of plat 6 was offset by the reduced vegetative growth (due to this same shaking), allowing a greater proportion of the bolls to open safely, and thus actually yielding more cotton than check 2, although check 2 set more bolls than plat 6. However, in a normal season this rank growth and the accompanying boll rot would not be encountered, and consequently somewhat different results would undoubtedly be secured.

In order to avoid repetition the summary of this series of studies is included in the general discussion at the end of the present report.

## PLAT TESTS OF THE VALUE OF THE BAG-AND-HOOP AS A MEANS OF WEEVIL CONTROL UNDER FIELD CONDITIONS.

During the season of 1916 two series of tests were conducted to determine the value of the bag-and-hoop as a means of weevil control on the plantation. One of these tests was conducted on Hecla plantation at Mound, La., and consisted of a study of five pickings at weekly intervals on Express cotton. The principal idea of this test was to secure data on this variety of cotton, as all of the earlier work had been with the Simpkins variety and no records had been secured on the result of using the bag-and-hoop on a long-staple cotton. It was expected that there would be some difference in results between the long and short staple cottons, especially in the number of forms collected during the pickings. The long-staple cottons generally tend to retain the infested forms longer than do the short varieties, and, consequently, it seemed probable that a different proportion of the infested forms would be gathered while shaking the staple cotton.

The second test was conducted on Eureka plantation and consisted of a study of varying numbers of pickings at different time intervals on Simpkins cotton. This test is referred to as Eureka test No. 1 in order to distinguish it from the studies just described.

### EXPERIMENT ON HECLA PLANTATION.

For conducting this test on Hecla plantation a small cut of cotton some 4 acres in extent was selected. This cut was comparatively new land, which had been in corn for several years and immediately adjoined heavy timber. The cotton immediately adjoining the woods consisted of a number of irregular short rows, and these were omitted from the plat, the first row of the plat proper being the third row, which extended completely through the cut. However, in order to protect the picked plat from an influx of weevils, these short rows of cotton between this plat and the timber were picked over every time the plat was picked, and in the same manner the ends of the rows extending beyond the plat lines of the picked plat were shaken each time for further protection. A buffer system was also instituted between the two plats to reduce as far as possible the influence that either plat might have on the other. This system consisted of dropping four rows from each plat immediately adjoining the dividing line when considering the plat production. As treated throughout the season the plats consisted of 22 rows each, or an area of 1.44 acres. With the four-row buffer dropped from each plat, however, the plats proper each consisted of 18 rows with an area of 1.18 acres.

The soil was of a rather heavy "buckshot" type. The drainage was fair over most of the plats, but a low area which extended across the center of both plats was rather poorly drained. The outer two rows of the check plat immediately adjoining the roadside ditch were also lower than the remainder of the plat, especially at the eastern end. In an ordinary season this difference in drainage would have made little difference in the plats, but the summer of 1916 was so exceedingly wet that the slightest difference in drainage was greatly accentuated. As a result a narrow strip across the middle of the picked plat and a wider strip through the check, as well as a considerable area in the southeast corner of the check plat, suffered from an excess of water. This tended to throw the plats "off balance," as a much greater area in the check was injured than in the picked plat. This fact of course should be borne in mind in considering the results secured.

### PICKINGS.

The idea of this test was to start the pickings as soon as the weevils became sufficiently abundant to make the operation worth while. In order to determine this time, regular examinations were made at different points throughout the plats, beginning with May 8. On this date 2,100 plants were examined, and no weevils were found. On May 13, one thousand plants yielded eight weevils, but on the 19th the same number yielded four weevils. On May 24, twelve weevils were found on 1,000 plants. These records were made in belts extending along the plats parallel to the timber line. After this time, however, separate records were secured for the two plats. The observations were made at both ends and the middle of each plat. In the examination of June 1 it was found that plat 1 averaged one weevil to 55 plants, while plat 2 averaged one weevil to 33 plants. On June 5 both plats averaged one weevil to 75 plants. From these observations it is seen that a fairly heavy infestation was being developed rather gradually in this field, and it was not until the middle of June that a considerable increase in the number of weevils was noted. Consequently, the plat was first picked over on June 16, at which time 129 weevils per acre were collected. This was a rather large number and is apparently due to a sudden emergence of a great number of weevils at about this time. This plat was picked five times in all on the following dates, June 16, 22, 29, July 10 and 17. This made the pickings extend over a total period of 32 days, the average time interval being eight days.

At the time of the first picking the stage of plant development was determined by a series of square counts and plant-height measurements distributed over the two plats. From these it was found that there was an average of 3.1 squares per plant and the average height of the plants was 11.4 inches at this time.

The time required to make the various pickings is shown in Table 16.

TABLE 16.—*Labor involved in weevil picking; Hecla plantation experiment, Mound, La., 1916.*

| Date. | Area. | Per plat. | | Per acre. | |
|---|---|---|---|---|---|
| | | Hours, labor. | Cost of labor at 7½ cents per hour. | Hours, labor. | Cost of labor at 7½ cents per hour. |
| | *Acres.* | | | | |
| June 16 | 1.44 | 7.5 | $0.56 | 5.2 | $0.39 |
| June 22 | 1.44 | 4.5 | .34 | 3.1 | .24 |
| June 29 | 1.44 | 8.0 | .60 | 5.6 | .42 |
| July 10 | 1.44 | 7.0 | .53 | 4.9 | .37 |
| July 17 | 1.44 | 9.0 | .68 | 6.2 | .47 |
| Total | | 36.0 | 2.71 | 25.0 | 1.89 |
| Average | | | | 5.0 | .38 |

Both men and women were used for this purpose, and as the work was about equally divided between the two the value of the labor is figured at the rate of 7½ cents an hour, which represents a fair average. From this table it is seen that an average of five hours per acre was required for each picking. Figuring on the basis of a 10-hour day this would mean 2 acres per day per hand on the average. This is a slightly higher average than has been secured from most of the figures on area covered per hand per day and is probably due to the fact that with the number of hands used and the small size of the plats only a few hours were required for the picking. It is quite probable that the laborers would not have maintained this same rate of speed if they had been working all day. The cost figures show an average of 38 cents per acre per picking, or a total of $1.89 per acre for the five pickings.

In connection with these same labor observations, a comparison was made of the relative efficiency of different individuals. Three men were selected, two of whom were fast workers and the third a very slow hand. Separate records were kept of these individuals while the fast hands were covering eight rows each and the slow man picked six. It was found that while the fast men took much less time for a row than the slow one, they averaged 8.1 and 10.9 weevils to the row, whereas the slow one averaged only 4. Thus it is seen that the efficiency of the individual largely determines not only the speed of the operation, but also its thoroughness. This same observation has been made a number of times and it was found that the individuals varied even more widely than the figures just given would indicate.

The weevils collected at the various pickings are shown in Table 17.

TABLE 17.—*Weevils collected with bag-and-hoop, Hecla plantation experiment, Mound, La., 1916.*

| Picking. | Date. | Number weevils collected. | Weevils per acre. |
|---|---|---|---|
| First | June 16 | 185 | 129 |
| Second | June 22 | 178 | 124 |
| Third | June 29 | 160 | 111 |
| Fourth | July 10 | 159 | 110 |
| Fifth | July 17 | 163 | 113 |
| Total | ........ | 847 | 587 |

From this it is seen that the pickings ranged from 110 to 129 weevils per acre, with a total of 587 weevils per acre for the five pickings. It is interesting to note that the highest number was collected at the first picking. The range, however, was comparatively small.

The forms collected in the bag-and-hoop are shown in Table 18.

TABLE 18.—*Forms collected per acre with bag-and-hoop, Hecla plantation experiment, Mound, La., 1916.*

| Date. | Forms collected per acre. | | | Clean. | Punctured. |
|---|---|---|---|---|---|
| | Total. | Clean. | Punctured. | | |
| | | | | *Per cent.* | *Per cent.* |
| June 16 | 285 | 17 | 268 | 5.8 | 94.2 |
| June 22 | 346 | 45 | 301 | 13.1 | 86.9 |
| June 29 | 414 | 59 | 355 | 14.3 | 85.7 |
| July 10 | 894 | 355 | 539 | 39.8 | 60.2 |
| July 17 | 506 | 139 | 367 | 27.6 | 72.4 |
| Total | 2,445 | 615 | 1,830 | ........ | ........ |
| Weighted average | ........ | ........ | ........ | 25.2 | 74.8 |

At the first three pickings only squares were secured, but at the fourth and fifth both squares and bolls were collected. A total of 2,445 forms were collected at the five pickings, of which 1,830 were punctured and 615 were clean. Thus it is seen that practically one-fourth of the forms collected in the bag-and-hoop were clean. While making these collections it was noted also that a considerable number of terminal buds were broken off and gathered in the sacks.

In order to see if these injured forms collected in the bags were reducing the number reaching the ground to any extent, one collection of fallen forms was made in both plats on July 14. For this purpose a strip 20 feet long and three rows wide was laid off in the middle and each end of each plat, and all fallen forms were gathered from these strips. As the rows averaged four and a half feet in width, the total area examined in each plat was 820 square feet. The strips were selected so that no skips in stand were included, and the cotton as nearly as possible represented the average growth of that portion of the plat. As the preceding bag-and-hoop collection had been made on July 10, this fallen form collection was four days after a picking. The results secured are shown in Table 19.

TABLE 19.—*Fallen forms collected in Hecla plantation experiment, Mound, La., July 14, 1916.*

| Plat. | Forms gathered. | | |
|---|---|---|---|
| | Squares. | Bolls. | Total. |
| Check | 447 | 23 | 470 |
| Picked | 234 | 21 | 255 |

From Table 19 it is seen that while the boll collection differed very little, there were 213 more squares collected from the check than from the picked plat. If these figures are taken as a criterion, they show that the bag-and-hoop pickings reduced the forms reaching the ground by 47 per cent. This is a considerably greater reduction than has been found in most of the tests with the 7-day interval, but this difference may well be due to the varietal differences in the cotton. As has already been mentioned, this test was conducted with a long-staple variety which tended to retain a considerable proportion of the infested squares. Even the squares which were going to fall were probably sufficiently attached to the plant to remain somewhat longer than would be the case on a short-staple variety, and consequently their chance of being collected in the bags was increased.

One important question in connection with this type of plat work concerns the influence of one plat upon another and also the influence of any near-by untreated cotton on the treated plat. This point, of course, is of primary importance in determining just how nearly such plat tests represent the conditions which would prevail if an entire field was treated in the same manner as the plat in question. In an effort to secure some information on this point the records of the bag-and-hoop collections of weevils and forms were made by rows as well as by plats. The rows in the picked plat were numbered from 1 to 22, beginning with the row adjoining the check, and the record for each row was kept separate throughout the five pickings.

TABLE 20.—*Row records of weevils collected with bag-and-hoop, Hecla plantation experiment, Mound, La., 1916.*

| Row No. | Weevils collected. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | June 16. | June 22. | June 29. | July 10. | July 17. | Row total. | Average per row in 5-row blocks.[1] | Average per row of outside and inside blocks. |
| 1 | 8 | 7 | 4 | 8 | 17 | 44 | 43.3 (rows 1–6) | 43.3 (rows 1–6) |
| 2 | 5 | 7 | 4 | 5 | 7 | 28 | | |
| 3 | 8 | 12 | 2 | 14 | 11 | 47 | | |
| 4 | 9 | 14 | 18 | 8 | 8 | 57 | | |
| 5 | 9 | 16 | 5 | 5 | 6 | 41 | | |
| 6 | 10 | 6 | 14 | 5 | 8 | 43 | | |
| 7 | 6 | 1 | 7 | 6 | 13 | 33 | 42.0 (rows 7–11) | 39.0 (rows 7–16) |
| 8 | 8 | 8 | 6 | 13 | 10 | 45 | | |
| 9 | 6 | 2 | 10 | 7 | 8 | 33 | | |
| 10 | 25 | 11 | 8 | 11 | 8 | 63 | | |
| 11 | 8 | 14 | 5 | 5 | 4 | 36 | | |
| 12 | 6 | 5 | 5 | 12 | 8 | 36 | 36.0 (rows 12–16) | |
| 13 | 14 | 6 | 3 | 7 | 4 | 34 | | |
| 14 | 3 | 14 | 14 | 5 | 6 | 42 | | |
| 15 | 4 | 2 | 8 | 8 | 7 | 29 | | |
| 16 | 9 | 5 | 12 | 6 | 7 | 39 | | |
| 17 | 8 | 10 | 0 | 3 | 9 | 30 | 32.5 (rows 17–22) | 32.5 (rows 17–22) |
| 18 | 2 | 9 | 2 | 5 | 3 | 21 | | |
| 19 | 13 | 11 | 9 | 7 | 9 | 49 | | |
| 20 | 4 | 6 | 4 | 6 | 3 | 23 | | |
| 21 | 11 | 7 | 9 | 3 | 5 | 35 | | |
| 22 | 9 | 5 | 11 | 10 | 2 | 37 | | |

[1] Outside blocks each consist of 6 rows.

The weevil collection records are shown in Table 20. Owing to the variations produced by the individual efficiency of the pickers, it does not seem advisable to compare the various rows at a single picking, but this factor should be more or less averaged out in the five pickings, and to reduce this error further the rows have been averaged together in blocks. It will be noted that the first average of this type divides the plat into four blocks, the outside blocks consisting of six rows each and the two inside blocks consisting of five rows each. From this grouping it is seen that rows 1 to 6 averaged 43.3 weevils per row, while rows 7 to 11 averaged 42; rows 12 to 16 averaged 36 and rows 17 to 22 averaged 32.5. Thus it is seen that there is a more or less regular decrease in the infestation of the picked plat as the distance from the check plat is increased. However, the highest record for any single row was row 10, which was very nearly in the center of the plat. These figures would seem to indicate that picking cotton beyond the ends of the picked plat and to the north of it prevented the plat from receiving an infestation of weevils from those sides. It is also seen that there was apparently some migration of weevils from the check plat into the south side of the picked plat. However, this was not of grave importance and is probably largely counteracted by the later omission of rows 1 to 4 as buffers.

TABLE 21.—*Row records of infested squares collected with bag-and-hoop, Hecla plantation experiment, Mound, La., 1916.*

| Row No. | Infested squares collected. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | June 16. | June 22. | June 29. | July 10. | July 17. | Row total. | Average per row in 5-row blocks.[1] | Average per row of outside and inside blocks. |
| 1 | 22 | 23 | 19 | 47 | 71 | 182 | | |
| 2 | 8 | 14 | 19 | 33 | 40 | 114 | | |
| 3 | 13 | 28 | 6 | 5 | 43 | 95 | | |
| 4 | 32 | 29 | 36 | 70 | 29 | 196 | 144.0 | 144.0 |
| 5 | 13 | 12 | 23 | 36 | 38 | 122 | | |
| 6 | 18 | 11 | 28 | 64 | 33 | 154 | | |
| 7 | 19 | 19 | 27 | 31 | 18 | 114 | | |
| 8 | 28 | 26 | 15 | 48 | 30 | 147 | | |
| 9 | 13 | 8 | 28 | 19 | 14 | 82 | 127.0 | |
| 10 | 25 | 33 | 24 | 48 | 24 | 154 | | |
| 11 | 44 | 28 | 35 | 26 | 4 | 137 | | |
| 12 | 8 | 18 | 14 | 28 | 23 | 91 | | 118.8 |
| 13 | 24 | 23 | 22 | 44 | 11 | 124 | | |
| 14 | 15 | 18 | 29 | 29 | 18 | 109 | 110.6 | |
| 15 | 10 | 23 | 21 | 26 | 16 | 96 | | |
| 16 | 24 | 23 | 51 | 26 | 9 | 133 | | |
| 17 | 9 | 18 | 19 | 11 | 20 | 77 | | |
| 18 | 9 | 23 | 11 | 30 | 13 | 86 | | |
| 19 | 18 | 22 | 20 | 22 | 14 | 96 | 83.1 | 83.1 |
| 20 | 14 | 16 | 19 | 44 | 2 | 95 | | |
| 21 | 9 | 20 | 30 | 7 | 12 | 78 | | |
| 22 | 12 | 12 | 15 | 23 | 5 | 67 | | |

[1] Outside blocks each consist of 6 rows.

Table 21 shows the row collections of the infested squares in the same manner. An analysis of this table by blocks shows the square collections to correlate very well with the weevil collections, the number of infested squares decreasing with the increase in distance from the check plat. In this connection it is interesting to note that the highest record was in row 4, while the second highest was in row 1, so it is seen that the most highly infested rows were included in the 4-row buffer which was dropped.

Considering these row records on the whole it is seen that the only outside influence affecting the infestation of the picked plat was apparently the migration of the weevils from the check plat. This was sufficient in extent to increase slightly the infestation of the side immediately adjoining the check and would undoubtedly have some influence on the results secured. However, this migration appears to have been comparatively unimportant, and consequently its only effect on the results would be in the degree. That is, it would not offset any beneficial effect from the bag-and-hoop collections, but probably would lessen the gain somewhat.

## INFESTATION.

The infestation of these various plats was followed throughout the season in the usual manner. As has been mentioned, the weevil abundance was determined from May 8 to June 5 by plant examinations, the figures secured expressing the ratio of the weevils to the plants. After June 5, however, the squares became sufficiently abundant to allow square-infestation records. This type of record was begun on June 15 and continued at weekly intervals until August 9. At the first three examinations 100 squares were examined in each corner and the center of each plat, making a total of 500 squares to the plat. Beginning with July 4, however, the records were made in the center of each end and the middle of each plat, 200 squares being examined at each point, making a total of 600 squares to the plat.

Table 22 shows the figures secured at these examinations.

TABLE 22.—*Weevil infestation, Hecla plantation experiment, Mound, La., 1916.*

| Date of examination. | Infestation. | |
|---|---|---|
| | Picked plat. | Check plat. |
| | *Per cent.* | *Per cent.* |
| June 15 | 65.6 | 49.0 |
| June 20 | 43.8 | 47.8 |
| June 27 | 34.0 | 38.6 |
| July 4 | 39.0 | 25.5 |
| July 10 | 25.7 | 24.7 |
| July 17 | 47.0 | 50.2 |
| July 26 | 48.2 | 53.2 |
| Aug. 1 | 71.0 | 67.8 |
| Aug. 9 | 87.8 | 89.8 |
| Weighted averages | 51.5 | 49.9 |

From Table 22 it is seen that there was no significant regularity in the comparative infestation of the two plats. In fact, in the weighted average for the season there was a difference of only 1.6 per cent in the infestation of the two plats. These infestation records failed to show any effect whatever from the pickings, as there was no apparent reduction in the infestation of the picked plat at any time.

Averages of the infestation records at each of the points of observation throughout the season give the following:

| | Per cent. |
|---|---|
| Picked plat: | |
| West end | 54.4 |
| Center | 47.4 |
| East end | 52.1 |
| Check plat: | |
| West end | 49.4 |
| Center | 50.8 |
| East end | 49.2 |

From these averages it is seen that the infestation was very evenly distributed over the two plats, as the extreme range was only from 47.4 per cent to 54.4 per cent. It is interesting to note that both of these extremes were located in the picked plat. The averages at the points where the infestation was determined are further evidence of the failure of the picking operation to reduce the weevil infestation in the picked plat.

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### EFFECT ON PLANTS.

After the first few shakings it was noticed that this operation was having a decided effect on the growth of the plants. The shaken plants were becoming much shorter than the check plants and were more bushy and compact in growth. This became so pronounced that on August 1 the height of 200 plants in each end and the center of each plat was measured. These 600 plants in the picked plat averaged 48.6 inches in height, while those in the check plat averaged 58.6 inches in height. Thus the plants in the check plat averaged 10.3 inches higher than those in the picked.

### BOLL COUNTS.

In order to secure some index to the fruit being set in these two plats, 100 plants were examined in each end of each plat on July 17 and the bolls counted. At this time it was found that the picked plat averaged 3.9 bolls to the plant, while the check plat averaged 5.4 bolls to the plant. These observations were checked very carefully by a thorough examination of both plats, and it seemed obvious that the check plat, generally speaking, was fruiting better than the picked plat. However, the factor of drainage had become operative at this time, and it was seen that portions of the check plat were injured seriously by the drowning of the plants in poorly drained areas.

### PRODUCTION.

The seed cotton matured in these plats was picked on October 30. The amounts secured are shown in Table 23.

TABLE 23.—*Seed-cotton production in Hecla plantation test, Mound, La., 1916.*

| Plat and treatment. | Area. | Seed-cotton production. | |
|---|---|---|---|
| | | Per plat. | Per acre. |
| | *Acres.* | *Pounds.* | *Pounds.* |
| 1. Picked | 1.18 | 591 | 501 |
| 2. Check | 1.18 | 541 | 458 |

From Table 23 it is seen that the picked plat exceeded the check in production by 43 pounds of seed cotton per acre. This was a gain of 9 per cent over the check. At first glance this result seems rather surprising in view of the result of the boll counts and other observations made on the relative fruiting of the two plats, which showed the check plat to be leading the picked plat by a considerable margin. In fact, the boll count showed the check plat to have a 38 per cent margin over the picked plat. Of course, such boll counts are not absolutely accurate, but they usually prove fairly representative. However, other factors than the weevil picking itself were operating to influence the production of these two plats. The factor of drainage has been mentioned as seriously injuring a portion of the check plat. In fact, this injury probably was sufficient practically to account for the results secured. In addition to this, the factor of boll rot must be considered. The exceedingly wet weather of July caused an excessively rank plant growth on all highly nitrogenous land, such as that on which these plats were located, and this resulted in the rotting of many of the lower bolls which could not be reached by the sunlight. It has been shown that, while the shaking operations were reducing the fruiting of the plants, they also tended to prevent a rank plant development. As a result, there was little or no boll rot in the picked plat, while the check was injured seriously by this factor. Consequently it is seen that, while the shaking operation actually reduced the fruit set in the picked plat, the reduction in foliar development served to offset this by preventing boll rot.

Taking these two factors of boll rot and poor drainage of the check plat into consideration, it is possible to understand why the check matured less cotton than the picked plat in spite of the fact that it actually set more bolls per plant on the poorly drained portions of the plat. To check the production record a bur count was made in both plats by examining 500 plants in each on October 31. At this time it was found that the check plat averaged 7.4 burs per plant, while the picked plat averaged 8.7 per plant. Thus it is seen that the bur count corresponded fairly well with the production record of the two plats. This tends to place further emphasis on the probable accuracy of the boll count.

At any rate, regardless of the explanation of the weights secured, the fact remains that the difference in favor of the picked plat was so small as to constitute an economic loss, and the utter absence of evidence of a reduction of the infestation of the picked plat due to the pickings makes this test decidedly unfavorable to weevil picking as a means of control.

## EUREKA PLANTATION EXPERIMENT NO. 1.

The more extensive Eureka test was located in a cut of cotton extending along Walnut Bayou. The series consisted of five plats, each plat extending at right angles to the bayou. The soil on which these plats were located was a rather light sandy loam on the bayou front, grading off heavier toward the back of the cut. As practically all soil gradation in this cut was from north to south, and as it was fairly uniform from east to west, the plats should have been reasonably comparable as regards the soil, since each extended through the extreme variation. To safeguard further against soil variations two check plats were selected, one on the east side of the series and the other on the west. In most cases in the following report the average of the records made on these two check plats is given instead of the individual records of the two, as this average should compare best with the conditions existing between the two checks. Three treated plats were arranged between these two check plats. The first of these, plat 2, was picked once a week for six weeks; plat 3 was picked twice a week for six pickings, while plat 4 was picked once a week for four weeks.

As considered during the period of treatment, each plat was 22 rows in width and 380 feet long. This made the area of each plat exactly 1 acre. However, it was recognized that there would probably be some interplat effect at the dividing lines, so a buffer system was arranged between each two plats at the time of picking in order to absorb as much as possible of this interplat effect. This system consisted of omitting four rows on each side of each dividing line. As the checks adjoined plats on only one side, this resulted in four rows being dropped from each check, while eight rows were dropped from each picked plat. Thus the checks finally considered consisted of 0.82 of an acre each, while the picked plats each consisted of 0.64 of an acre. However, all figures given in the present report, with the exception of those of production, are based on plats of 1 acre each, and, of course, the production was reduced to an acreage basis. In order to protect the plats further from outside influence a buffer system across the ends of the picked plats was maintained throughout the picking period. For this purpose the pickings were extended about 30 feet beyond the plat lines at each end each time a plat was picked.

This cut was planted in corn and peas during 1915, and a very heavy growth was turned under. This resulted in the land being in excellent condition with the exception of a rather spotted infestation of nut-grass extending along the back of the cut. However, the back end of the plats was moved forward sufficiently to avoid this grassy area almost entirely. The drainage throughout all plats was very good, and there was no apparent water injury at any time, in spite of the excessive rains during July. The cotton was the Simpkins Ideal variety, which had been planted on April 5. A very good stand was secured over all the plats.

### PICKINGS.

As in the case of the Hecla experiment, the idea was to begin the pickings as soon as the weevils became sufficiently abundant to make the operation worth while. Plant-infestation studies were made in the same manner as those already described for Hecla plantation. On May 10, 1,000 plants were examined and no weevils found; on May 17 three weevils were found on 1,000 plants, while on May 23 one weevil was found, and on May 30, two weevils were found to 1,000 plants. On June 6 the plant examinations were separated by plats and 50 plants were examined in each end and the center of each plat, making a total of 150 plants to the plat. At this time only two weevils were found, one in plat 1 and one in plat 3. From these figures it is seen that the emergence of weevils into these plats was exceedingly light and late. However, by about June 12 a rather heavy general emergence of weevils was taking place over the parish, and it was considered advisable to begin picking these plats, in spite of the fact that only a small number of weevils had been found in this cut. Consequently, the first picking of all of the plats was made on June 13. At this time plat 2 yielded 10 weevils to the acre, plat 3 yielded 13, and plat 4 yielded 6. This is quite different from the first picking made three days later on Hecla plantation, when 129 weevils per acre were collected, and shows the light initial infestation of this series of plats.

In order to determine the exact stage of the cotton plants at the time of this first picking the squares were counted on 20 plants at 10 different points in the series of plats. These 200 plants averaged 7.5 squares per plant. A similar study of the plant heights showed them to average 13.1 inches at this time.

The labor involved in these pickings is shown in Table 24, figured on the same basis as in the Hecla test.

TABLE 24.—*Labor required for picking weevils, Eureka plantation, Tallulah, La., 1916, experiment No. 1.*

| Plat No. | Picking. | Date. | Labor per acre. | Cost of labor per acre, at 7½ cents per hour. |
|---|---|---|---|---|
| | | | *Hours.* | |
| 2 | First | June 13 | 6.4 | $0.48 |
| | Second | June 20 | 5.5 | .41 |
| | Third | June 27 | 6.0 | .45 |
| | Fourth | July 5 | 9.0 | .68 |
| | Fifth | July 11 | 15.0 | 1.13 |
| | Sixth | July 22 | 10.0 | .75 |
| | Total | | 51.9 | 3.90 |
| | Average | | 8.6 | .65 |
| 3 | First | June 13 | 6.4 | .48 |
| | Second | June 17 | 4.5 | .34 |
| | Third | June 20 | 5.5 | .41 |
| | Fourth | June 23 | 6.5 | .49 |
| | Fifth | June 27 | 6.0 | .45 |
| | Sixth | June 30 | 8.0 | .60 |
| | Total | | 36.9 | 2.77 |
| | Average | | 6.1 | .46 |
| 4 | First | June 13 | 6.4 | .48 |
| | Second | June 20 | 5.5 | .41 |
| | Third | June 27 | 6.0 | .45 |
| | Fourth | July 5 | 9.0 | .68 |
| | Total | | 26.9 | 2.02 |
| | Average | | 6.7 | .51 |

From this it is seen that the cost per acre ranged from 46 to 65 cents for picking in the different plats. Of course, the average per picking increases as the season progresses, and consequently the greater number of pickings cost more per picking. The hours of labor per acre ranged from 6.1 to 8.6. From the total cost figures it is seen that the four pickings at an interval of one week cost $2.02, while 6 pickings at the same time interval cost $3.90. The six pickings given twice a week cost $2.77. These records show a uniformly higher cost for the pickings on Eureka than on Hecla, and, judging from the general observations which have been made, it is probable that the Eureka figures more nearly represent average conditions.

The weevils collected from these plats at the various pickings are shown in Table 25.

TABLE 25.—*Weevils collected per acre with bag-and-hoop, Eureka plantation, Tallulah, La., 1916, experiment No. 1.*

| Plat No. | Picking. | Date. | Number of weevils collected. |
|---|---|---|---|
| 2 | First | June 13 | 10 |
| | Second | June 20 | 11 |
| | Third | June 27 | 25 |
| | Fourth | July 5 | 63 |
| | Fifth | July 11 | 82 |
| | Sixth | July 22 | 470 |
| | Total | | 661 |
| 3 | First | June 13 | 13 |
| | Second | June 17 | 11 |
| | Third | June 20 | 6 |
| | Fourth | June 23 | 13 |
| | Fifth | June 27 | 27 |
| | Sixth | June 30 | 20 |
| | Total | | 90 |
| 4 | First | June 13 | 6 |
| | Second | June 20 | 9 |
| | Third | June 27 | 27 |
| | Fourth | July 5 | 43 |
| | Total | | 85 |

From Table 25 it is seen that if the sixth picking in plat 2 is excluded, the highest number of weevils collected per acre at any picking was 82. However, there was a tremendous increase at the sixth picking of plat 2, and 470 weevils per acre were collected at this time. This increase was due to the effect of climatic conditions on the multiplication of the weevils. As has been mentioned, the month of July was exceedingly rainy, the plats being subjected to a shower almost every day in the month. This, of course, produced a great reduction in the climatic control of the weevils in the fallen forms and, as a result, although the initial infestation of these plats was very light, the July-bred weevils multiplied so rapidly that this was quickly changed to an excessively heavy infestation. Considering the totals collected from the various plats, it is seen that only 85 weevils were secured from plat 4, while 90 were picked from plat 3. The high number secured at the sixth picking brought the total for plat 2 up to 661.

The forms collected in the bags from the different plats at the various pickings are shown in Table 26.

TABLE 26.—*Forms collected per acre with bag-and-hoop, Eureka plantation, Tallulah, La., 1916, experiment No. 1.*

| Plat No. | Date. | Forms collected. | | | Clean. | Punctured. |
|---|---|---|---|---|---|---|
| | | Total. | Clean. | Punctured. | | |
| | | | | | *Per cent.* | *Per cent.* |
| 2 | June 13 | 123 | 48 | 75 | 39.0 | 61.0 |
| | June 20 | 116 | 43 | 73 | 37.1 | 62.9 |
| | June 27 | 338 | 159 | 179 | 47.0 | 53.0 |
| | July 5 | 472 | 271 | 201 | 57.4 | 42.6 |
| | July 11 | 1,309 | 990 | 319 | 75.6 | 24.4 |
| | July 22 | 2,196 | 419 | 1,777 | 19.1 | 80.9 |
| | Total | 4,554 | 1,930 | 2,624 | | |
| | Weighted average | | | | 42.4 | 57.6 |
| 3 | June 13 | 108 | 33 | 75 | 30.6 | 69.4 |
| | June 17 | 156 | 68 | 88 | 43.6 | 56.4 |
| | June 20 | 127 | 43. | 84 | 33.9 | 66.1 |
| | June 23 | 83 | 42 | 41 | 50.6 | 49.4 |
| | June 27 | 231 | 105 | 126 | 45.5 | 54.5 |
| | June 30 | 223 | 109 | 114 | 48.9 | 51.1 |
| | Total | 928 | 400 | 528 | | |
| | Weighted average | | | | 43.1 | 56.9 |
| 4 | June 13 | 76 | 28 | 48 | 36.8 | 63.2 |
| | June 20 | 98 | 25 | 73 | 25.5 | 74.5 |
| | June 27 | 223 | 99 | 124 | 44.4 | 55.6 |
| | July 5 | 330 | 224 | 106 | 67.9 | 32.1 |
| | Total | 727 | 376 | 351 | | |
| | Weighted average | | | | 51.7 | 48.3 |

One interesting feature of the figures shown in Table 26 is the extremely rapid increase in the number of forms collected at the later pickings. For example, in plat 2, 2,196 forms were collected at the sixth picking, while a total of only 2,358 were collected at the other five pickings from this plat. Another important feature is the high percentage of clean forms collected in the bags. This varied from 42.4 to 51.7 in the different plats and averaged 45.7 over the entire series. From this it is seen that almost one-half of the total forms collected in the bag-and-hoop during this series of tests were perfectly clean. In addition to this destruction of clean squares the same loss of terminal buds which was noted in the other tests was observed in this experiment.

It is interesting to compare the form collections of plat 2 with those made on the Hecla test about the same time. This comparison is shown in Table 27.

TABLE 27.—*Comparison of Hecla and Eureka, Madison Parish, La., tests in forms collected in bags.*

| Date. | Forms collected per acre. | |
|---|---|---|
| | Eureka plat 2. | Hecla. |
| June 13 | 123 | |
| June 16 | | 285 |
| June 20 | 116 | |
| June 22 | | 346 |
| June 27 | 338 | |
| June 29 | | 414 |
| July 5 | 472 | |
| July 10 | | 894 |
| July 11 | 1,309 | |
| July 17 | | 506 |
| Total | 2,358 | 2,445 |

In the Hecla test it is seen that during a total of five pickings extending from June 16 to July 17, 2,445 forms per acre were collected, while on plat 2 of the Eureka test the five pickings extending from June 13 to July 11 yielded a total of 2,358 forms per acre. Thus through this period the total forms collected in the two tests were approximately the same. However, a study of the individual pickings shows these totals to have been reached by quite different records. There was a comparatively slight increase on the Hecla test from the first to the fourth picking, and then the fifth picking decreased somewhat. In the Eureka test the first four pickings yielded less than the same number of the Hecla test, but the fifth picking increased several hundred per cent. Two factors undoubtedly influenced this difference of results in the two tests. These were the degree of weevil infestation and the cotton variety. The higher initial infestation of the Hecla test resulted in a greater number of squares being collected on that plat in the early pickings, but the comparative lack of prolificacy and the determinate fruiting of this long-staple variety of cotton was becoming effective by the picking of July 17, and consequently there was an actual reduction in the number of forms collected. On the other hand, the light initial infestation of the Eureka test resulted in low records at the first few pickings, but the rapid increase in this infestation and the enormous abundance of squares caused the later pickings to yield large numbers.

Unfortunately no collections of fallen forms were made in the Eureka plats, so it is impossible to compare the two tests on this point.

TABLE 28.—*Row records of weevil collection in bags, Eureka plantation, Tallulah, La., 1916, test No. 1.*

| Plat. | Row | Weevils collected in bags. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | June 13 | June 17 | June 20 | June 23 | June 27 | June 30 | July 5 | July 11 | July 22 | Row total. | Row average in blocks. |
| | 1 | ...... | ...... | ...... | ...... | ...... | ...... | 1 | 5 | 19 | 25 | |
| | 2 | 1 | ...... | 2 | ...... | ...... | ...... | 1 | 3 | 23 | 30 | |
| | 3 | 1 | ...... | 1 | ...... | 1 | ...... | 3 | 5 | 28 | 39 | |
| | 4 | ...... | ...... | ...... | ...... | 3 | ...... | 4 | 5 | 15 | 27 | 31.1 |
| | 5 | ...... | ...... | ...... | ...... | 3 | ...... | 3 | ...... | 23 | 29 | |
| | 6 | ...... | ...... | ...... | ...... | 2 | ...... | 9 | 6 | 20 | 37 | |
| | 7 | ...... | ...... | ...... | ...... | 1 | ...... | 2 | 6 | 36 | 45 | |
| | 8 | ...... | ...... | ...... | ...... | 2 | ...... | 4 | 3 | 14 | 23 | |
| | 9 | ...... | ...... | 1 | ...... | ...... | ...... | 2 | 3 | 25 | 31 | |
| | 10 | 1 | ...... | ...... | ...... | 2 | ...... | 2 | 4 | 29 | 38 | |
| 2 | 11 | ...... | ...... | ...... | ...... | ...... | ...... | 1 | 4 | 30 | 35 | |
| | 12 | 1 | ...... | 2 | ...... | 2 | ...... | 9 | 9 | 30 | 53 | 33.9 |
| | 13 | 1 | ...... | ...... | ...... | 1 | ...... | 2 | 7 | 10 | 21 | |
| | 14 | 1 | ...... | ...... | ...... | 1 | ...... | 3 | 5 | 25 | 35 | |
| | 15 | ...... | ...... | 1 | ...... | 3 | ...... | ...... | 7 | 26 | 37 | |
| | 16 | ...... | ...... | 2 | ...... | 1 | ...... | 3 | 3 | 12 | 21 | |
| | 17 | 1 | ...... | ...... | ...... | ...... | ...... | 1 | 3 | 9 | 14 | |
| | 18 | 1 | ...... | ...... | ...... | 1 | ...... | 5 | 2 | 17 | 26 | |
| | 19 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 22 | 22 | |
| | 20 | 1 | ...... | ...... | ...... | 1 | ...... | 2 | ...... | 27 | 31 | 22.5 |
| | 21 | ...... | ...... | ...... | ...... | ...... | ...... | 2 | ...... | 13 | 15 | |
| | 22 | 1 | ...... | 2 | ...... | 1 | ...... | 4 | 2 | 17 | 27 | |
| | 1 | ...... | 1 | ...... | ...... | 1 | 2 | ...... | ...... | ...... | 4 | |
| | 2 | 1 | 2 | 1 | 1 | ...... | ...... | ...... | ...... | ...... | 5 | |
| | 3 | ...... | ...... | ...... | ...... | 2 | ...... | ...... | ...... | ...... | 2 | |
| | 4 | 1 | 1 | ...... | ...... | ...... | 1 | ...... | ...... | ...... | 3 | 3.1 |
| | 5 | ...... | ...... | ...... | ...... | ...... | 1 | ...... | ...... | ...... | 1 | |
| | 6 | 1 | ...... | ...... | 1 | 1 | 1 | ...... | ...... | ...... | 4 | |
| | 7 | ...... | 2 | ...... | ...... | 1 | 1 | ...... | ...... | ...... | 4 | |
| | 8 | 1 | ...... | ...... | 1 | 2 | ...... | ...... | ...... | ...... | 4 | |
| | 9 | ...... | ...... | ...... | 1 | 6 | 2 | ...... | ...... | ...... | 9 | |
| | 10 | 2 | ...... | ...... | 1 | 3 | 2 | ...... | ...... | ...... | 8 | |
| 3 | 11 | 1 | ...... | 1 | 2 | ...... | ...... | ...... | ...... | ...... | 4 | |
| | 12 | 2 | 3 | 1 | ...... | 2 | 4 | ...... | ...... | ...... | 12 | 5.8 |
| | 13 | ...... | ...... | ...... | ...... | 1 | ...... | ...... | ...... | ...... | 1 | |
| | 14 | ...... | ...... | ...... | ...... | 2 | 2 | ...... | ...... | ...... | 4 | |
| | 15 | ...... | ...... | ...... | 1 | ...... | ...... | ...... | ...... | ...... | 1 | |
| | 16 | ...... | 2 | 2 | 4 | 1 | 2 | ...... | ...... | ...... | 11 | |
| | 17 | ...... | ...... | ...... | ...... | 1 | ...... | ...... | ...... | ...... | 1 | |
| | 18 | 1 | ...... | ...... | 1 | ...... | 1 | ...... | ...... | ...... | 3 | |
| | 19 | 1 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1 | |
| | 20 | 1 | ...... | 1 | ...... | 1 | ...... | ...... | ...... | ...... | 3 | 2.1 |
| | 21 | ...... | ...... | ...... | ...... | 1 | 1 | ...... | ...... | ...... | 2 | |
| | 22 | 1 | ...... | ...... | ...... | 2 | ...... | ...... | ...... | ...... | 3 | |
| | 1 | ...... | ...... | 2 | ...... | 3 | ...... | 1 | ...... | ...... | 6 | |
| | 2 | ...... | ...... | 1 | ...... | ...... | ...... | 10 | ...... | ...... | 11 | |
| | 3 | ...... | ...... | ...... | ...... | ...... | ...... | 1 | ...... | ...... | 1 | |
| | 4 | ...... | ...... | ...... | ...... | 1 | ...... | 1 | ...... | ...... | 2 | 3.6 |
| | 5 | ...... | ...... | ...... | ...... | ...... | ...... | 1 | ...... | ...... | 1 | |
| | 6 | ...... | ...... | ...... | ...... | 1 | ...... | ...... | ...... | ...... | 1 | |
| | 7 | ...... | ...... | 2 | ...... | 1 | ...... | 1 | ...... | ...... | 4 | |
| | 8 | ...... | ...... | ...... | ...... | 3 | ...... | 1 | ...... | ...... | 4 | |
| | 9 | ...... | ...... | 2 | ...... | 2 | ...... | 5 | ...... | ...... | 9 | |
| | 10 | 1 | ...... | ...... | ...... | ...... | ...... | 3 | ...... | ...... | 4 | |
| 4 | 11 | 1 | ...... | ...... | ...... | ...... | ...... | 4 | ...... | ...... | 5 | |
| | 12 | 1 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 1 | 3.6 |
| | 13 | ...... | ...... | ...... | ...... | 2 | ...... | 1 | ...... | ...... | 3 | |
| | 14 | ...... | ...... | 1 | ...... | 1 | ...... | ...... | ...... | ...... | 2 | |
| | 15 | ...... | ...... | ...... | ...... | 2 | ...... | ...... | ...... | ...... | 2 | |
| | 16 | ...... | ...... | 1 | ...... | 1 | ...... | ...... | ...... | ...... | 2 | |
| | 17 | ...... | ...... | ...... | ...... | 1 | ...... | 1 | ...... | ...... | 2 | |
| | 18 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | |
| | 19 | 1 | ...... | ...... | ...... | 3 | ...... | 2 | ...... | ...... | 6 | |
| | 20 | 1 | ...... | ...... | ...... | 1 | ...... | 3 | ...... | ...... | 5 | 4.5 |
| | 21 | 1 | ...... | ...... | ...... | 1 | ...... | 5 | ...... | ...... | 7 | |
| | 22 | ...... | ...... | ...... | ...... | 4 | ...... | 3 | ...... | ...... | 7 | |

TABLE 29.—*Row records of square collection in bags, Eureka plantation, Tallulah, La., 1916, test No. 1.*

| Plat. | Row. | Squares collected in bags. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | June 13. | June 17. | June 20. | June 23. | June 27. | June 30. | July 5. | July 11. | July 22. | Row total. | Row average by blocks. |
| | 1 | 1 | ...... | 1 | ...... | 7 | ...... | 5 | 12 | 87 | 113 | |
| | 2 | 2 | ...... | 3 | ...... | 8 | ...... | 7 | 25 | 97 | 142 | |
| | 3 | 2 | ...... | 5 | ...... | 4 | ...... | 17 | 15 | 81 | 124 | |
| | 4 | 3 | ...... | 2 | ...... | 7 | ...... | 10 | 10 | 109 | 141 | 145.6 |
| | 5 | 9 | ...... | 3 | ...... | 5 | ...... | 13 | 19 | 134 | 183 | |
| | 6 | 5 | ...... | 1 | ...... | 4 | ...... | 12 | 16 | 133 | 171 | |
| | 7 | 4 | ...... | 4 | ...... | 5 | ...... | 12 | 30 | 67 | 122 | |
| | 8 | 1 | ...... | 8 | ...... | 7 | ...... | 7 | 13 | 83 | 119 | |
| | 9 | 6 | ...... | 13 | ...... | 10 | ...... | 16 | 24 | 89 | 158 | |
| | 10 | 5 | ...... | 2 | ...... | 9 | ...... | 8 | 15 | 138 | 177 | |
| | 11 | 6 | ...... | 4 | ...... | 21 | ...... | 5 | 5 | 83 | 124 | |
| 2 | 12 | 2 | ...... | 4 | ...... | 13 | ...... | 13 | 15 | 71 | 118 | 122.9 |
| | 13 | 3 | ...... | 6 | ...... | 12 | ...... | 5 | 13 | 44 | 83 | |
| | 14 | 2 | ...... | 1 | ...... | 16 | ...... | 11 | 12 | 98 | 140 | |
| | 15 | 8 | ...... | 2 | ...... | 4 | ...... | 8 | 12 | 74 | 108 | |
| | 16 | 2 | ...... | 2 | ...... | 20 | ...... | 9 | 9 | 38 | 80 | |
| | 17 | 1 | ...... | 3 | ...... | 5 | ...... | 5 | 7 | 69 | 90 | |
| | 18 | 3 | ...... | 1 | ...... | 6 | ...... | 17 | 7 | 50 | 84 | |
| | 19 | ...... | ...... | 2 | ...... | 6 | ...... | 5 | 2 | 93 | 108 | |
| | 20 | 3 | ...... | 2 | ...... | ...... | ...... | 5 | 1 | 72 | 83 | 78.8 |
| | 21 | 3 | ...... | 2 | ...... | ...... | ...... | 2 | 3 | 27 | 37 | |
| | 22 | 4 | ...... | 2 | ...... | 10 | ...... | 9 | 6 | 40 | 71 | |
| | 1 | 1 | 5 | 4 | 2 | 3 | 6 | ...... | ...... | ...... | 21 | |
| | 2 | 6 | 4 | 10 | 4 | 2 | 3 | ...... | ...... | ...... | 29 | |
| | 3 | ...... | 2 | 3 | 1 | 5 | 4 | ...... | ...... | ...... | 15 | 20.1 |
| | 4 | 1 | 2 | 1 | 5 | 4 | 5 | ...... | ...... | ...... | 18 | |
| | 5 | ...... | 3 | ...... | 1 | 2 | 4 | ...... | ...... | ...... | 10 | |
| | 6 | 1 | 5 | 4 | ...... | 6 | 12 | ...... | ...... | ...... | 28 | |
| | 7 | 2 | 3 | 8 | 3 | 3 | 4 | ...... | ...... | ...... | 23 | |
| | 8 | 3 | 5 | 3 | 4 | 4 | 9 | ...... | ...... | ...... | 28 | |
| | 9 | 3 | 6 | 7 | ...... | 8 | 5 | ...... | ...... | ...... | 29 | |
| | 10 | 6 | 10 | 10 | 4 | 9 | 11 | ...... | ...... | ...... | 50 | |
| | 11 | 7 | 9 | 5 | 2 | 5 | 8 | ...... | ...... | ...... | 36 | |
| 3 | 12 | 16 | 5 | 4 | ...... | 9 | 7 | ...... | ...... | ...... | 41 | 29.0 |
| | 13 | ...... | 1 | 4 | 1 | 5 | 6 | ...... | ...... | ...... | 17 | |
| | 14 | 7 | 8 | ...... | 1 | 12 | 2 | ...... | ...... | ...... | 30 | |
| | 15 | 6 | 4 | 1 | 1 | 4 | 1 | ...... | ...... | ...... | 17 | |
| | 16 | ...... | 3 | 2 | 7 | 5 | 2 | ...... | ...... | ...... | 19 | |
| | 17 | 4 | 1 | 2 | ...... | 12 | 1 | ...... | ...... | ...... | 20 | |
| | 18 | 5 | 4 | 1 | 1 | 3 | 5 | ...... | ...... | ...... | 19 | |
| | 19 | 4 | 3 | ...... | ...... | 5 | 5 | ...... | ...... | ...... | 17 | |
| | 20 | 1 | 2 | 4 | 2 | 7 | 7 | ...... | ...... | ...... | 23 | 19.5 |
| | 21 | 2 | ...... | 3 | 2 | 8 | 3 | ...... | ...... | ...... | 18 | |
| | 22 | ...... | 3 | 8 | ...... | 5 | 4 | ...... | ...... | ...... | 20 | |
| | 1 | 2 | ...... | 7 | ...... | 9 | ...... | 6 | ...... | ...... | 24 | |
| | 2 | 11 | ...... | 6 | ...... | 12 | ...... | 7 | ...... | ...... | 36 | |
| | 3 | 4 | ...... | 2 | ...... | 4 | ...... | 3 | ...... | ...... | 13 | |
| | 4 | ...... | ...... | 4 | ...... | 6 | ...... | 6 | ...... | ...... | 16 | 22.0 |
| | 5 | 3 | ...... | 1 | ...... | 2 | ...... | 4 | ...... | ...... | 10 | |
| | 6 | 8 | ...... | 3 | ...... | 13 | ...... | 9 | ...... | ...... | 33 | |
| | 7 | 2 | ...... | 6 | ...... | 4 | ...... | 1 | ...... | ...... | 13 | |
| | 8 | 1 | ...... | 8 | ...... | 6 | ...... | 2 | ...... | ...... | 17 | |
| | 9 | ...... | ...... | ...... | ...... | 4 | ...... | 7 | ...... | ...... | 11 | |
| | 10 | 1 | ...... | 2 | ...... | 4 | ...... | 10 | ...... | ...... | 17 | |
| | 11 | ...... | ...... | 2 | ...... | ...... | ...... | 10 | ...... | ...... | 12 | |
| 4 | 12 | 3 | ...... | 4 | ...... | 6 | ...... | 5 | ...... | ...... | 18 | 12.8 |
| | 13 | 2 | ...... | 5 | ...... | 3 | ...... | 3 | ...... | ...... | 13 | |
| | 14 | 1 | ...... | ...... | ...... | 7 | ...... | 1 | ...... | ...... | 9 | |
| | 15 | 1 | ...... | 2 | ...... | 1 | ...... | 8 | ...... | ...... | 12 | |
| | 16 | 1 | ...... | 2 | ...... | 3 | ...... | ...... | ...... | ...... | 6 | |
| | 17 | 2 | ...... | 4 | ...... | 3 | ...... | 3 | ...... | ...... | 12 | |
| | 18 | 2 | ...... | ...... | ...... | 7 | ...... | 7 | ...... | ...... | 16 | |
| | 19 | 2 | ...... | ...... | ...... | 5 | ...... | 3 | ...... | ...... | 10 | |
| | 20 | ...... | ...... | 7 | ...... | 10 | ...... | 5 | ...... | ...... | 22 | 15.1 |
| | 21 | 1 | ...... | 1 | ...... | 5 | ...... | 5 | ...... | ...... | 12 | |
| | 22 | 1 | ...... | 7 | ...... | 10 | ...... | 1 | ...... | ...... | 19 | |

Row records of the weevil and square collections were made in this test in the same manner as that already described for the Hecla experiment. These are tabulated in Tables 28 and 29. The row totals are averaged by blocks in much the same manner as in the Hecla test. Of course, in this case unpicked cotton adjoined only two of the blocks. These were the outside blocks of plats 2 and 4. From Table 28 it is seen that the outside block of plat 4 averaged slightly higher in weevils collected than the remainder of the plat, but that the outside block of plat 2 averaged less than the middle block of the same plat. From Table 29 it is seen that the square collections presented exactly reversed conditions. From these square collections it would seem that the outside block of plat 2 was more highly infested than the inside, while the rows 1 to 6 of plat 4 yielded a higher average than any of the remainder of the plat. These results are rather contradictory, but at any rate they seem to indicate that if the unpicked cotton had any effect on the picked plats it was comparatively slight and should have been largely eliminated by the buffer system employed.

WEEVIL INFESTATION.

The infestation of the various plats of this series was followed throughout the season in the same manner as in the Hecla test. The general rule for determining this record was an examination of 100 squares in each end and the middle of each plat. The records secured are shown in Table 30.

TABLE 30.—*Weevil infestation, Eureka plantation, Tallulah, La., 1916, Test No. 1.*

| Date of examination. | Infestation. | | | |
|---|---|---|---|---|
| | Plat 2. | Plat 3. | Plat 4. | Plats 1 and 5; average of both checks. |
| | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| June 12 | 7.3 | 10.7 | 6.7 | 8.0 |
| June 19 | 5.3 | 13.3 | 8.0 | 11.2 |
| June 26 | 8.7 | 7.3 | 7.0 | 10.7 |
| July 3 | 9.2 | 5.7 | 4.3 | 9.0 |
| July 10 | 12.3 | 12.7 | 9.8 | 12.2 |
| July 17 | 42.2 | 35.0 | 40.7 | 44.8 |
| July 24 | 81.8 | 46.5 | 57.8 | 67.7 |
| Aug. 1 | 76.3 | 78.2 | 81.7 | 81.8 |
| Aug. 8 | 91.0 | 92.8 | 80.5 | 85.2 |
| Aug. 14 | 96.2 | 96.3 | 97.0 | 96.2 |
| Weighted average | 50.6 | 46.1 | 46.2 | 49.7 |

From these figures it is seen that starting with a practically equal infestation these three treated plats and the two checks varied back and forth somewhat, but never showed any significant regularity in the difference between the various individual plats. In fact, the range in the seasonal averages of the five plats was only 4.5 per cent and the seasonal average infestation of the three picked plats was 47.6 per cent while that of the two checks was 47.9 per cent.

### EFFECT ON PLANTS.

The same effect of the picking operation on the plants was observed in this test as in all other bag-and-hoop experiments. It was observed that the shakings were reducing the size of the plants and were causing the typical bushy growth. One thousand plants were measured in each of the plats to determine the average height on July 19, 200 plants being examined at five different points in each plat. The results secured are shown in Table 31.

TABLE 31.—*Average height of plants on July 11, Eureka plantation, Tallulah, La., 1916, Test No. 1.*

| Plat No. | Treatment. | Average height. |
|---|---|---|
| | | *Inches.* |
| 1 | Check | 42.7 |
| 2 | Shaken | 35.4 |
| 3 | do | 37.9 |
| 4 | do | 37.5 |
| 5 | Check | 40.6 |

From this it is seen that the two checks averaged 40.6 and 42.7 inches in height, while the next highest plat was 3, which averaged 37.9 inches; plat 4 was practically the same height, averaging 37.5 inches, while plat 2 showed the greatest effect of all, averaging 35.4 inches. These differences had been more pronounced earlier in the season, but, following the cessation of shaking, the picked plats had recovered a portion of the lost height by a rapid terminal growth.

The difference in height between plats 1 and 2 is illustrated photographically in figure 2 of plate 2, which shows the dividing line between these two plats.

From these figures showing the effect of the shaking of the plants it is seen that plat 2 was the most seriously injured of the series, while plats 3 and 4 were affected practically the same. This would seem to indicate that it is the duration of the pickings rather than the number which determined the effect on the plants. For example, plats 2 and 3 received the same number of shakings, but the interval was twice as long in plat 2 as in plat 3, so they extended much later into the season and the result was that in the fall plat 2 showed a much greater injury. Plat 3 received two more pickings than plat 4 but the time intervals differed so that the pickings extended over about the same period in the two plats and the resultant effect on the plants was much the same.

### SEED-COTTON PRODUCTION.

The cotton produced on these plats was gathered in three pickings, August 24, September 14, and November 21. The amount secured is shown in Table 32.

TABLE 32.—*Seed-cotton production, Eureka plantation, Tallulah, La., 1916, test No. 1.*

| Plat. | Seed cotton produced per acre. | | | |
|---|---|---|---|---|
| | Aug. 24. | Sept. 14. | Nov. 21. | Total. |
| | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* |
| 2 | 286 | 478 | 123 | 887 |
| 3 | 172 | 458 | 175 | 805 |
| 4 | 167 | 562 | 212 | 941 |
| Average of 1 and 5 | 297 | 449 | 119 | 865 |

From Table 32 it is seen that the total range of the plats was from 805 to 941 pounds of seed cotton per acre, or a range of 136 pounds of seed cotton per acre. In this series the checks ranked about midway between the extremes. Plat 4 ranked highest of all, while plat 3 ranked lowest. In view of these rankings and the results of the various studies conducted on these plats during the season it seems impossible to attach any significance to the differences of the yields of the various plats. The total range constituted only 18 per cent of the production of the lowest plat and the plat giving the highest yield logically should have shown less benefit than at least one other plat, if the picking operations had been effective. In fact, one of the check plats yielded 849, while the other yielded 881, showing a difference of 32 pounds between the checks themselves. Consequently, it seems probable that the yield differences were of no significance whatever. At any rate, they fail to show any important beneficial effect from the picking operation. The boll-rot factor which was discussed in connection with the Hecla test was likewise operative in this test, as the checks produced an enormously rank growth, but the reduction in fruiting due to the shaking operation balanced this, so that the yield from the checks was practically equal to that from the picked plats.

## STUDIES ON THE VALUE OF A MECHANICAL COLLECTOR OF BOLL WEEVILS.

Among the many methods of weevil control advocated and advertised by various individuals throughout the cotton belt are several mechanical collectors of the weevils. These machines vary widely in form and manner of construction, but most of them are similar in the principle involved. Usually they consist of some type of pan arrangement passing along beneath the plants while at the same time the plants are agitated more or less violently, the idea being to shake the weevils into the pan. A number of different types of these machines have been examined by the writers, and several of the most promising were tested at Tallulah during the season of 1915. The one of these which gave the best results during that season was selected for more intensive studies during 1916. These studies were of two types, (1) plat tests of the machine under field conditions, and (2) comparative efficiency studies to determine the relative weevil-collecting ability of this machine when compared with the bag-and-hoop.

### PLAT TEST.

The plat test was arranged in somewhat the same manner as the Hecla test which has been described. The experimental principles involved were much the same, and the same methods of arranging the plats and buffers were followed. A very uniform strip of light sandy soil was selected, and the plant growth over the entire experimental area was rather unusually uniform. The light soil was selected in order to secure plants of comparatively small size, since the machine had shown a tendency to break larger plants rather severely. Two plats were arranged, each 20 rows wide and 740 feet in length. One of these was picked with the machine, while the other was left unpicked as a check.

#### PICKINGS.

The first picking was made on these plats on July 1. Originally it was intended to start this picking somewhat earlier, but delay in securing the machine postponed it until this date. However, as has been mentioned, cotton of small size was secured, and the light and late weevil emergence into this cut was such that only a slight infestation was present on the 1st of July. Consequently, the conditions more or less approximated those which would usually prevail about two weeks earlier in a more severely infested cut of richer soil.

Table 33 shows the detailed results of the various pickings conducted.

TABLE 33.—*Pickings with mechanical collector, Tallulah, La., 1916.*

| Date. | Weevils collected. | Bolls collected. | | Squares collected. | | Time required. | |
|---|---|---|---|---|---|---|---|
| | | Clean. | Infested. | Clean. | Infested. | Hour. | Minutes. |
| July 1 | 40 | | | 103 | 112 | 1 | |
| July 11 | 156 | 15 | 115 | 364 | 665 | | |
| July 24 | 450 | 7 | 362 | 21 | 1,700 | 1 | |
| July 31 | 1,117 | | 296 | | 2,281 | 1 | 10 |
| Aug. 7 | 1,299 | | 397 | | 2,238 | | 45 |
| Aug. 15 | 2,445 | | 301 | | 1,363 | | 45 |
| Aug. 21 | 2,037 | | 457 | | 2,037 | | 45 |
| Aug. 27 | 1,064 | | 231 | | 1,079 | | 45 |
| Total | 8,608 | 22 | 2,274 | 488 | 11,475 | | |

From this it is seen that a total of eight pickings was distributed over the period from July 1 to August 27. The weevils per picking ranged from 40 to 2,445, and a total of 8,608 were collected during the experimental period. As the plat consisted of 1.53 acres, the weevils collected per acre thus ranged from 26 to 1,600 at the different pickings, with a total per acre of 5,626. During this same time 2,274 infested bolls and 11,475 infested squares were collected in the pans with the weevils. During the first three pickings a record was kept of the number of uninjured forms knocked off by the machine, and this was found to total 22 bolls and 488 squares. After that time the forms collected were so highly infested that they were considered as all injured. The time required for covering the plat ranged from 45 minutes to 1 hour and 10 minutes. This would make the average time in the neighborhood of 40 minutes to the acre. However, this did not include the time spent in emptying the pans. Studies on the operation of this machine over larger areas have shown that it may be expected to cover an average of 10 to 12 acres per day when operated on a plantation basis.

### BROKEN PLANTS.

The greatest difficulty which was found in the operation of this machine was the breakage of plants. It was found that if the machine was adjusted so that the plants were not broken it failed to catch an appreciable number of weevils, while if it was adjusted so that it collected a considerable number of weevils the plant breakage was very high. Consequently, in adjusting the machine, an attempt was made to strike a happy medium between these two extremes.

Following each picking, the plat was gone over and the number of broken plants counted. It was found that the number per picking ranged from 37 plants to 704 plants. The number decreased rapidly as the season progressed, owing to the fact that nearly all of the larger plants had already been broken down. During the course of the eight pickings a total of 1,827 plants were broken in the plat.

### FALLEN FORM COLLECTIONS.

In order to determine whether or not the forms collected in the picking machine decreased the number reaching the ground to any appreciable extent two collections of fallen forms were made. For this purpose an area 3 rows wide and 20 feet long was selected at each end and the middle of each plat. This made a total of about 750 square feet for each plat. Care was taken to locate these points where the stand was as nearly perfect as possible and where the plant growth represented about the average of that portion of the plat. The results of these collections are shown in Table 34.

TABLE 34.—*Fallen form collections in machine-picked test, Tallulah, La., 1916.*

| Date. | Picked plat. | | | Check plat. | | |
|---|---|---|---|---|---|---|
| | Squares. | Bolls. | Total forms. | Squares. | Bolls. | Total forms. |
| July 27 | 1,385 | 516 | 1,901 | 1,371 | 805 | 2,176 |
| Aug. 5 | 1,436 | 372 | 1,808 | 2,581 | 984 | 3,565 |
| Total | 2,821 | 888 | 3,709 | 3,952 | 1,789 | 5,741 |

From this table it is seen that on both occasions considerably more forms were gathered from the ground in the check plat than in the picked plat. In the two pickings a total of 3,709 fallen forms were gathered from the picked plat and 5,741 from the check, thus giving a reduction of 2,032 in favor of the picked plat.

## INFESTATION.

The degree of weevil infestation in the two plats was followed through the season in the usual manner in order to determine the effect of the picking operations. Table 35 gives the results of these observations.

TABLE 35.—*Square infestation, Tallulah, La., 1916.*

| Date. | Picked plat. | Check plat. |
|---|---|---|
| | *Per cent.* | *Per cent.* |
| July 1 | 14.3 | 14.3 |
| July 7 | 21.4 | 17.2 |
| July 13 | 47.7 | 38.0 |
| July 21 | 60.3 | 57.2 |
| July 27 | 66.8 | 75.0 |
| Aug. 2 | 85.3 | 85.3 |
| Aug. 8 | 88.8 | 90.3 |

From this it is seen that at the beginning of the experiment the two plats averaged exactly the same infestation. At the next examination, however, the picked plat increased slightly above the check plat and retained this position until July 27. The seasonal average of the check plat was 53.9 per cent, while that of the picked plat was 54.9 per cent. Thus these records fail to show any decrease in the infestation due to the weevil collections. In fact, the averages are remarkably nearly equal. Studies on the seasonal average infestation of the various points of observation show this infestation to have been evenly distributed in the various plats.

## EFFECT ON PLANTS.

The plant breakage due to the operation of the machine has been mentioned. By the latter part of the season it was quite obvious that this was going to have a very detrimental effect on the picked plat. The picked cotton looked as if it had been topped, and it was easy to distinguish the last picked row at a glance, as this row was a foot or more shorter in height than the adjoining unpicked row.

### PRODUCTION.

The seed cotton produced in these two plats was picked on August 24 and October 26. The amounts secured are shown in Table 36.

TABLE 36.—*Seed-cotton production, mechanical picker test, Tallulah, La., 1916.*

| Date picked. | Seed cotton per acre. | |
|---|---|---|
| | Check plat. | Picked plat. |
| | *Pounds.* | *Pounds.* |
| Aug. 24 | 216 | 182 |
| Oct. 26 | 190 | 109 |
| Total | 406 | 291 |

From this it is seen that the check yielded considerably more than the picked plat each time and in the total of the two pickings there was a loss of 115 pounds of seed cotton per acre in the picked plat. This amounts to a loss of 28 per cent below check and shows quite well the injurious effect of the picking operations with this machine.

### COMPARATIVE EFFICIENCY STUDIES.

As a further check on the efficiency of the machine it was tested in comparison with the bag-and-hoop simply on the basis of efficiency in operation.

The first test was conducted on July 13. A uniform strip of cotton 14 rows wide and 645 feet in length was selected. The method followed was to pick two of these rows with the mechanical picker, then two with the bag-and-hoop, then two with the mechanical picker and so on until eight rows had been picked with the mechanical picker and six with the bag-and-hoop. Records were kept of the number of weevils and forms collected by each of these methods, and the time required was likewise noted. This test was repeated in an identical manner on the same cotton August 3. The results of these two tests are shown in Table 37.

TABLE 37.—*Comparative efficiency tests, mechanical pickers, Tallulah, La., 1916.*

| Date. | Mechanical picker (per row). | | | | | | Bag-and-hoop (per row). | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Weevils collected. | Squares. | | Bolls. | | Time required | Weevils collected. | Squares. | | Bolls. | | Time required |
| | | Punctured. | Clean. | Punctured. | Clean. | | | Punctured. | Clean. | Punctured. | Clean. | |
| | | | | | | *Min.* | | | | | | *Min.* |
| July 13 | 2.6 | 9.6 | 5.9 | 1.0 | 0.25 | 2 | 9.9 | 37.0 | 15.3 | 16.0 | 3.8 | 20 |
| Aug. 3 | 48.4 | 163.1 | ........ | 14.7 | ........ | 3 | 77.5 | 280.6 | ........ | 25.0 | ........ | 20 |

From Table 37 it is seen that at the first test the mechanical picker averaged 2.6 weevils per row while the bag-and-hoop averaged 9.9. At the second test the averages were 48.4 and 77.5, respectively. This shows definitely that the mechanical picker does not even approach the bag-and-hoop in the number of weevils collected from any given area and, since the bag-and-hoop certainly does not collect all present, the mechanical picker must leave a very high percentage. The observations on the infested forms collected likewise show the bag-and-hoop to be very much superior to the mechanical picker. It is only in the time required that the mechanical picker shows an advantage over the bag-and-hoop. These figures show the bag-and-hoop to require about 20 minutes per row, while the mechanical picker required only from two to three minutes per row.

One interesting observation was made on the comparative efficiency of different individuals when using the bag-and-hoop. While conducting the test on July 13, it was noted that one of the negroes operating the bag-and-hoop was very fast, while the other one was very slow. Consequently, separate records were kept for these two women. It was found that the faster woman took just one-half the time to the row that the slower one did, and the faster woman averaged 14 weevils per row while the slower one averaged 4. This is an excellent example of the variation in the efficiency of the individual pickers.

## GENERAL CONSIDERATIONS AND SUMMARY.

The studies described in the preceding pages, together with those of the season of 1915,[1] seem to warrant some conclusions on the subjects dealt with and a general consideration of their relation to the planter.

Two points stand out preeminently in the results of the studies of 1916. These are (1) the complete failure of the picking operations to exert any appreciable beneficial effect on the weevil infestation, and (2) the injurious effect of the use of the bag-and-hoop upon the plants themselves. All points considered in connection with these studies, such as the degree of weevil infestation, plant fruitage, and actual yield, have shown consistently that the bag-and-hoop treatments were not reducing the weevil infestation within the treated plats to any extent. The control exerted by the collections of the weevils seems to have been completely overcome by the number of weevils escaping capture. In this connection it is interesting to compare the results of 1915 with those of 1916. It will be recalled that studies on the collection of fallen forms conducted in the face of the light weevil infestation prevailing during 1915 resulted in a definite

[1] U. S. Dept. Agr. Bull. 382.

weevil-control reaction, though this control was by no means complete. In 1916, however, with a rapid multiplication of weevils and a heavy infestation, no evidence of control was secured from the weevil collection. The question of the relation of the degree of infestation to the effect secured from practicing these control measures has been raised frequently, and apparently it has a very definite bearing on the difference in the results secured during the two years. It might appear that if a certain amount of benefit is to be derived from the control measures during a year of light infestation, this benefit will be increased proportionately in a year of heavy infestation. The results secured do not support this idea, however, and it seems to the writers that a year of light infestation, such as prevailed during 1915, presents the optimum conditions for securing the maximum degree of control from the picking operation. It must be conceded that the most thorough picking operation will not secure all the weevils present; say, for the sake of discussion, that 75 per cent are secured. If 100 weevils per acre are present in the field at the time of the picking (as would be the case during a light infestation), 25 would be left, and this number would be below that required to produce serious injury to the crop. On the other hand, assuming that there were 1,000 weevils per acre in the field and 75 per cent of these were collected, 250 would still remain, which would be sufficient to produce great injury to the crop, if not the maximum injury. It must be recognized that the degree of weevil injury in the field is not always directly proportionate to the number of weevils present; that is, the amount of injury per weevil decreases considerably with the increase of the number of weevils per acre, owing to the lessened chances of each individual for injury and what might be called the "duplication of effort" in the repeated puncturing of the same form. With the average degree of infestation reached in the Delta during midsummer, there is a great excess of weevils for producing the maximum injury to the crop, and a considerable number of these can be removed from the field without increasing the crop secured to any appreciable extent.

In addition to this consideration, the actual effect of this collection of over-wintered weevils in relation to their propagation is of interest. Under normal conditions, the percentage of squares punctured during the period when the weevil pickings are practiced is comparatively low. The normal shedding of forms in upland cotton is so high that the squares punctured by these hibernated individuals simply serve to take the place of a portion of those which would be shed normally. Consequently, these over-wintered weevils do not injure the cotton crop directly; their only effect on the crop itself in such a case lies in the progeny they produce and the activity of these progeny. Therefore, the only beneficial effect secured from collecting these hibernated weevils would be the reduction of their progeny. In practice it is found that two factors serve to prevent the complete elimination of these progeny. These are the eggs deposited by the weevils before capture and the percentage of hibernated individuals actually escaping capture. As has been stated, if undisturbed, the weevils in the Delta usually will produce more than sufficient progeny to cause a maximum crop injury by midsummer. In view of the results of the control experiments under heavy infestation conditions, it seems that enough weevils were missed and sufficient eggs were deposited before collection by those actually captured to develop sufficient progeny for a maximum infestation of the crop.

In view of these considerations, it seems to the writers that in a year of light infestation a slight degree of benefit may be secured from the picking operations, but that in a year of average or heavy infestation this benefit is completely lost. This conclusion is borne out by the experiences of various planters which have come under the observation of the writers, and is especially discouraging in view of the fact that in a year of heavy infestation the control measure is most needed.

Another point of primary importance in connection with the plantation use of these control measures is the labor problem. This requires a consideration of the labor supply available on the average Delta plantation, the labor requirements of the ordinary plantation operations, and the labor requirements of the weevil-picking operation. In the first place, it is advisable to consider the organization of the labor by which these picking operations are to be conducted. These measures are practiced only on a tenant basis, where a "family" takes care of a certain quantity of land. This land usually is divided between cotton and corn, the greater portion being in cotton. In addition to the labor involved in caring for this land it is necessary for the plantation to levy upon the male members of these families for a certain amount of wage labor to be used in the care of the oat and hay crops, which are handled only on a wage basis.

### RELATION BETWEEN LABOR SUPPLY AND MALARIA.

The Bureau of Entomology is conducting an investigation on the Hecla plantation, the estate where one of the writers' tests was conducted, on malaria mosquitoes and their control. In determining the exact relation of malaria to crop production, Dr. D. L. Van Dine made a detailed analysis of the available and required labor on this plantation. In his published account[1] of this work, Dr. Van Dine gives a chart showing the duration of each of the operations involved

[1] Van Dine, D. L., "The relation of malaria to crop production." *In* The Scientific Monthly, November 1916, p. 431–439.

Van Dine, D. L., "The losses to rural industries through mosquitoes that convey malaria." *In* Southern Medical Journal, Vol. VIII, No. 3, p. 184–194. March, 1915.

in the production of cotton, corn, and oats and a table showing the labor requirements of each operation for each crop. From these the writers have prepared figure 1. This diagram shows not only the period of each operation for each crop but also, by the block system, the labor requirements of each crop.

In this chart the writers have added a block showing the labor requirements for weevil picking in the same manner. This was figured on a basis of four pickings with the bag-and-hoop, extending

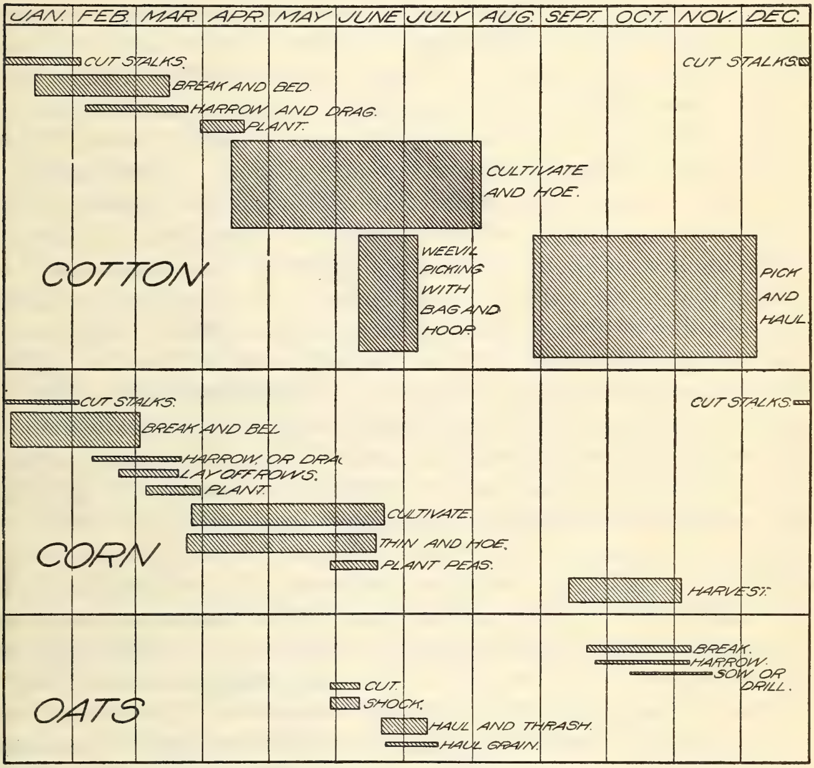


FIG. 1.—Seasonal distribution of field labor in northern Louisiana. Based on 823 acres of cotton, 657 acres of corn, and 200 acres of oats. (Original.)

over the period from June 10 to July 8, making the time interval between pickings about one week. The total acreage in cotton was 823 acres. Of course, all of this would not be picked over under normal conditions; particularly since the work would be more or less concentrated on the more heavily infested portions. Consequently, it was assumed for the sake of conservatism that only two-thirds of this acreage would be treated, or 548 acres. Extensive observations on the time required for the operation of the bag-and-hoop have shown that about the best which can be expected is an average of one and one-fourth acres per hand per day. However, these calculations were made on a basis of one and one-half acres per hand per day. At this rate, each picking of the 548 acres would require 365 labor days, making the four pickings require a total of 1,460 labor days.

In his paper Dr. Van Dine shows that the labor requirements of the ordinary plantation operations (excluding boll-weevil control) on this plantation during the month of June were 1,814 days. He also showed that the available labor days during this same month were 1,719. In other words, there was an actual shortage of 95 labor days during this month. Considering that three of the weevil pickings would fall during the month of June, a total of 1,095 June labor days would be required for conducting this operation, and as there is already a deficit of 95 labor days, this would make a total of 1,190 days of labor shortage during the month of June. Consequently, if the weevil control is practiced it must be at the expense of the neglect of some of the ordinary plantation operations. In fact, it would amount to about two-thirds neglect of these operations. In figuring the cost of malaria to the plantation Dr. Van Dine has shown that each day of crop neglect produced a loss of $5.11. Since every labor day put in at weevil picking would mean a labor-day neglect of the other operations, it is seen that, while no direct outlay for wages might be involved, the 1,460 days required would really amount to an expenditure of $7,300 at the rate of $5 per day loss for neglect. While this may be reduced by reducing the number of pickings, that would still not relieve the labor crisis which is shown in Diagram I, as the amount of labor required for each picking would still be the same unless they were conducted at longer time intervals. It is interesting to note that this same Hecla plantation attempted a thorough and systematic control of the weevils by the bag-and-hoop collection of the weevils in 1914, and this resulted in such a complete derangement of the ordinary operations without any benefit with regard to weevil infestation being shown, that the attempt has never been repeated. Although these figures of available labor are based on this plantation only, this plantation certainly is as well supplied with labor and as well organized as any in the district in which it is located.

The writers have had the opportunity of examining the original data upon which Dr. Van Dine's figures are based. Table 38 is a summary of the figures obtained on Hecla plantation in 1914 on the age, sex, and numbers of the 74 tenant families, giving the total number available for field work, the theoretical equivalent in man days, and the actual man days available for field work.

TABLE 38.—*Available labor by sex and age groups on Hecla plantation during 1914.*

| | Male. | | | | Female. | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|
| Age groups | 0 to 7 | 8 to 12 | 13 to 18 | 19 up. | 0 to 7 | 8 to 12 | 13 to 18 | 19 up. | |
| Number individuals present | 19.0 | 14.0 | 29.0 | 82.0 | 24.0 | 18.0 | 26.0 | 87.0 | 299.00 |
| Reduced to theoretical man-days labor | ........ | 4.5 | 14.5 | 82.0 | ........ | 2.25 | 6.5 | 43.5 | 153.25 |
| Actual man-days labor | ........ | 2.38 | 7.68 | 43.4 | ........ | 1.19 | 3.44 | 23.03 | 81.12 |

It will be observed from Table 38 that after determining the actual individuals of the various sex and age groups present on Hecla plantation this was reduced to a basis of the theoretical number of man days of labor in each of these groups. However, it is quite obvious that this theoretical figure does not represent the available labor actually present. Certain factors operate on all plantations to reduce this theoretical labor. Again referring to the study made by this bureau on the relation of malaria to crop production, the following estimate has been made of the reduction in the available labor supply:

In 1914, 138 persons in the tenant families out of a total of 299 suffered from malaria. Dr. L. O. Howard is the authority for the statement that the efficiency of a person suffering from malaria is reduced 25 per cent. Not taking account of the cases in children under 8 years of age and reducing the ages of those above 8 years to an equivalent of adult time, an equivalent of the time of 18.5 adult men was lost during the season of 1914 through inefficiency due to malaria.

It is a fact that the negro is incapable of maximum continuous effort during an entire day when at work, and aside from illness or other demands on his time will not under the tenant system work in the field every day when field work is possible. It is necessary to figure not a man day but a negro-man day, and this falls far short of what may be expected when continuous effort is made during the entire day and full advantage taken of working in the field on all days when field work is possible. Thirty days can not be counted on in every month for field work, since account must be taken of Sundays, holidays, and the weather conditions. The error would be as great to figure as available all labor not necessarily detained at home. Account must be taken of the class of labor upon which dependence is placed. It is considered that 25 per cent must be deducted from the total adult time available for this reason. Of the labor available on Hecla in 1914, this would be equivalent to the time of 38.31 adults.

OTHER CONSIDERATIONS CONNECTED WITH LABOR.

It is estimated that a further reduction of 10 per cent in the available labor must be made, to allow for the "pensioners" on the plantation, for those suffering from diseases other than malaria, for the care of infants and the cooking on the part of the women, and for absences from the field on account of funerals and other interruptions. This is equivalent to the time of 15.32 adults. The actual total adult time available, then, is only 81.12 instead of 153.25 adults. In Table 38 this available time has been reduced to adult time in the various groups arranged by age and sex.

Based on averages of 50 plantations in northern Louisiana, the Office of Farm Management of this department estimates that there are 19.1 days in June when field work is possible on a plantation. Taking this as a basis the various age groups shown in Table 38 have been reduced to available labor for the entire month of June. This is shown in Table 39.

TABLE 39.—*Total man days available of different types of labor on Hecla plantation during June, 1914.*

| Age groups | Male. | | | Female. | | | Total. |
|---|---|---|---|---|---|---|---|
| | 8 to 12 | 13 to 18 | 19 up. | 8 to 12 | 13 to 18 | 19 up. | |
| Theoretical labor days available | 85.95 | 276.95 | 1,566.2 | 42.97 | 124.15 | 830.85 | 2,927.07 |
| Actual labor days available | 45.45 | 146.68 | 828.94 | 22.72 | 65.70 | 439.87 | 1,549.36 |

Taking the figures shown in Table 39, it is possible to determine just what classes of labor could be used in this weevil-picking work on the basis of three pickings requiring 1,095 labor days during June. Taking the actual labor days available in the different classes, it is seen that there are 22.72 in the group of females from 8 to 12 years of age, 65.7 females from 13 to 18, and 439.87 females of 19 or older. Consequently, the total man days of labor available of the female sex on Hecla plantation during June is 528.29. It is obvious that it would be necessary to take some male labor as well for the picking operation. There are 45.45 labor days of boys from 8 to 12 years of age. Adding this to the female labor makes only 573.74 labor days. There are 146.68 labor days of males from 13 to 18. Adding this to the preceding total gives 720.42 labor days, which is still 374 days short of the number required for the weevil-picking work. In other words, if all the female labor and all of the male labor under 19 years of age were devoted to weevil picking there would still be a shortage of 374 labor days for the picking operation. As the only labor left available is the males of 19 years or older, some of these must be utilized on the picking work. There are approximately 829 labor days of this group available. Consequently, if we subtract the labor required for the picking operation from that available during June there are only 455 labor days remaining. However, it was found in the malaria investigations that 199 labor days were lost directly because of malaria during June, and subtracting this number from the 455, the reare only 256 labor days left for conducting all ordinary plantation operations during the month of June, and it has been shown that these ordinary operations require a total of 1,814 labor days.

Going back to Table 39, it is of interest to calculate just what proportion of the theoretical labor would be required. If the three groups of female labor and the males from 8 to 12 are totaled, it is found that 1,093.92 days result. In other words, even on the basis of the theoretical labor, which is far from the actual labor available, it would require all of the females and all of the males up to 13 years of age to conduct the picking operations.

These observations on labor requirements and available labor seem to show definitely the impracticability of the systematic use of the bag-and-hoop on the plantation. Since comparative efficiency observations have shown that the bag-and-hoop requires only one-fourth as long as the hand picking of weevils and collects twice as many to the acre, the outlook for hand picking is very discouraging to say the least. As the labor available is not sufficient to conduct the bag-and-hoop collections, it certainly is not sufficient for the hand pickings, which would require four times as much labor. In addition, if the proportion of weevils collected with the bag-and-hoop is not high enough to benefit materially an average or heavy infestation, there seems to be little chance of securing a benefit from hand picking one-half this number of weevils. Still another method of control is the hand collection of fallen squares. Observations on the labor requirements of this have shown that the best which can be expected is one acre per day per hand. Thus this operation would require one-third more labor than the operation of the bag-and-hoop and is eliminated in the same manner.

The type of labor available for this weevil picking and the type required are also of interest. In view of the general labor shortage prevailing in the Delta, it is necessary for the women to assume the responsibility of all operations possible. This naturally results in their use as hoe hands in restraining the grass growth in both cotton and corn, particularly cotton. In case of a rain delaying operations and causing an excess of grass growth, it falls to their lot to save the cotton crop by hoeing, while the men are attempting to catch up with the strictly masculine operations. This condition is met at some time practically every season in the Delta and shows the importance of the women in the labor complex of ordinary operations. Under such conditions (and these are normal conditions in the Delta) the only labor left available for weevil and square picking operations without taking hands from some other operations is that of the children who are too small to hoe.

In this connection it is necessary to consider the type of labor required for the control operation. It would seem that the children and such women as might happen to be available should be able to reduce the weevil infestation somewhat by picking, but this is not the case. As a general rule negro children working alone will accomplish nothing. Their only incentive for effective work lies in the continued presence of older people who will force them to work properly and continuously. This would of course involve the presence of at least a few women with each group of children, and when the family is the unit the mother would be forced to neglect the hoeing and work with the children. Even this would be practicable under some conditions if it were not for the attitude of the women. It is generally recognized that negro women are very unsatisfactory workers at many plantation operations without the presence of men to keep them at work. This is particularly true of the weevil-picking operation, as this work is very distasteful to them and they wish to slight it. Of course this is due to the fact that the incentive for performing arduous and distasteful labor is not as great with the women as with the men because, generally speaking, the women are not as much concerned as the men in securing a successful crop. As a result it is generally found that to secure a picking which in any way approaches thoroughness it is necessary to have a certain number of men with each force of laborers. At any rate, regardless of the necessity of the presence of men, a small amount of child labor is in reality the only surplus labor available, and this is certainly far from sufficient to produce any effect upon the weevil infestation. Any addition to this labor only depletes the ranks of those employed in the ordinary plantation operations, and must result in some neglect.

The discovery of the injurious effect of the use of the bag-and-hoop on the plant is of great importance. Owing to the seriousness of the labor problem concerned in these operations, the first studies of the use of the bag-and-hoop looked very encouraging, as it was certainly a great advance over hand picking in both speed and efficiency of operation. However, the studies of the past season have shown definitely that the use of this semimechanical picker can not be recommended.

The studies on the infested forms collected by the bag-and-hoop are considerably reduced in practical importance by the discovery of the injurious effect of this collector on the plants. However, the general tendency of these studies is to emphasize this injurious effect, as from 25 to 50 per cent of the forms which were collected in the bags proved to be uninfested. Of course, a certain percentage of these were uninjured forms which would shed normally, but a considerable number undoubtedly were good forms which were broken off by the shaking process.

The comparison of the two varieties of cotton was not sufficiently complete to allow any general conclusions, but the most important point seems to be that the bag-and-hoop collects a higher proportion of the infested squares on the long-staple variety than on the short.

The failure of the mechanical picker to give satisfactory results is very discouraging, as such a picker seems the only solution of the labor problem involved in the collection of weevils and squares. As has been mentioned, the picker tested was the most promising which had come under the observation of the writers, but proved to miss a sufficient number of weevils practically to prevent any reduction in the infestation. In addition, this picker was so injurious to the plants that it actually reduced the crop considerably.

The information secured on the interplat movement of the weevils in the various field experiments is of considerable importance in the interpretation of the results of such tests. It is seen that in each case there was a more or less increased infestation in the picked rows immediately adjoining the unpicked cotton. However, this was usually slight and extended only a short distance, so it was certainly not sufficient to prevent the control measures from producing a beneficial effect in the treated plats, if they would do so under field conditions. This conclusion is borne out by the fact that identical tests where the control measure tested proved effective have shown a quite definite control reaction within these comparatively small plats. It is probable that the small size of the plats would somewhat reduce the extent of the gain in production from any beneficial treatment owing to the immigration of the weevils from unpicked cotton late in the season, but it seems fair to assume that when applying these results to field conditions this factor would be at the very least counterbalanced by the greater thoroughness of the picking operations in these plat tests. It should be remembered that a limited number of pickers were used in all of these plat tests and that they were under the constant supervision of one or more of the entomologists. As a result, the operations were conducted far more thoroughly than would be possible under field conditions.

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