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DIVISION OF AGRONOMY

Control of Weeds in Rice Fields

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*In cooperation with the School of Veterinary Medicine, A. & M. College of Texas.
**In cooperation with the United States Department of Agriculture.

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BULLETIN NO. 239 DECEMBER, 1918

CONTROL OF WEEDS IN RICE FIELDS*

BY

H. H. LAUDE, SUPT., SUBSTATION NO. 4, BEAUMONT, TEXAS

This paper describes some field methods which have been found effective in controlling the occurrence and growth of weeds in rice fields. No attempt is made to give specific methods for particular weeds, but only such methods as have a general application to the weed problem in rice production.

THE WEED PROBLEM

When the rice industry first began in Texas, only sod land was used for the production of the crop. Weeds, as a serious pest, were not known on this new land. After a few years of continuous cropping, however, they became abundant. The common practice of moving to new land every two to four years was effective in distributing numerous noxious weeds throughout the rice belt, particularly the older producing districts. The usual farming practices were not planned to destroy or control weeds. When one field became too foul another was secured. Rice growing soon developed to such extent, however, that new land was not available in sufficient quantity to support the industry, and as a result the fields in some sections have been devoted to rice production during several periods of from one to a few years each. From the beginning of the rice industry the weed problem gradually became more serious, until it has now come to be considered one of the chief factors in rice production.

It requires but little observation and calculation to see that weeds mean an annual loss of many thousands of dollars to the rice growers. It should be realized that practically all of this loss can be eliminated by applying a few simple and inexpensive farm practices.

The competition between rice and weeds begins very soon after the rice comes up and continues for several weeks after the irrigation period is begun. By that time either the rice or the weeds will have control. The critical period begins when the rice is two or three weeks old and continues until it has been under irrigation about three weeks.

CULTIVATION OF RICE

It has been found through a series of experiments conducted on the Texas Agricultural Experiment Station, Substation No. 4, located at Beaumont, Texas, that if the weeds are killed and the field is clean when irrigation begins there will be no further trouble from weeds, and the entire productive capacity of the land will be devoted to the growth of rice. This clean condition of the field has been effectively secured by cultivating the rice when it is young.

To make cultivation most practical the rice is planted in rows far

*The Office of Cereal Investigations, U. S. Department of Agriculture, cooperated in conducting this work in 1914.

enough apart so that a mule can easily walk between them. The rows may be as much as twenty inches or possibly even twenty-four inches wide without causing a reduction in the yield.

The amount of seed sown on an acre should be the same as when the crop is planted in narrow drills or is broadcasted, the only difference being that it is sown thicker in the row.

The exact time at which cultivation should be given must be a matter for the grower to decide in each case. He should apply the same principles to the cultivation of young rice that are best for the so-called highland crops. The ground should be kept free from weeds. Where thorough preparation has been given before planting, one cultivation is usually sufficient, but if weeds start, or if irrigation is delayed, a second cultivation may be needed.

Several implements have been used in the experiments in cultivation of rice, including the spring-tooth cultivator, the ordinary cultivator with small shovels, the sweep, and the hoe. The type of implement that does best work varies somewhat with conditions, but usually the spring-tooth cultivator or weeder type of cultivator is most efficient. At present no implement is manufactured on a commercial scale for doing this work, but a weeder or spring-tooth cultivator can easily be adapted, and will serve to demonstrate the value of the method.

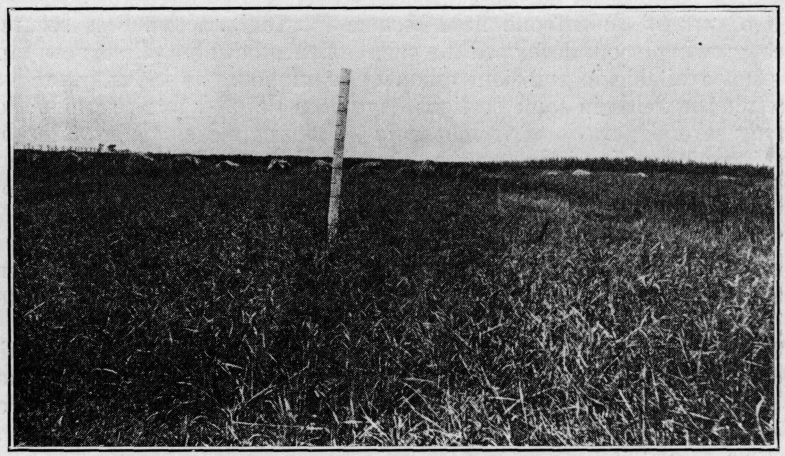

Figure 1—Rice on plat 1 in 1917. This is the third year continuous cropping by the usual method. Yield, 890 pounds per acre. Note the very short growth.

Preventing the growth of weeds by cultivation affects the development of the plant in a striking way. Very strong, vigorous plants have invariably been found on the cultivated plats, where the growth of weeds has been prevented. The root system is large and the plant stools abundantly. It is evident that this practice aids in securing more nearly optimum growing conditions for young rice, as it does for other crops.

One of the most important features connected with eliminating weeds by cultivating rice is that it makes it unnecessary to over-irrigate young rice in an attempt at control. Many fields of rice are seriously dam-

aged every year by applying water too deep or holding it too long during the early part of the season in an effort to kill weeds. This is usually done at the time when rice is as easily killed as some of the weeds, and almost as easily killed as most of them. The result is that if the weeds are reduced appreciably the rice is seriously injured.

The cultivation of rice during the early part of the season makes it possible for the crop better to withstand adverse conditions occasioned by a lack of irrigation water. Due to the better root system, the more vigorous condition of the rice plant, and to the fact that there are no weeds in the field, the rice will thrive with less water than is needed when the crop is handled in the usual way. This feature is of great importance under conditions of limited supply of irrigation water, such as may prevail in seasons of low rainfall, or when salt is present in the water. The grower who has planted his rice in rows is not helpless under such adverse conditions. He can cultivate his crop and can usually keep it in good condition until he has opportunity to irrigate.

The accumulative effect on the condition of the land where rice is cultivated each year during the early part of the season is very noticeable. Under normal conditions rice land tends to become more foul with weeds with each succeeding crop. By cultivating the rice, which keeps the field free from weeds and thus prevents the production of weed seeds, the field becomes cleaner each year. This makes it possible to produce rice continuously on the same land for a much longer period of years than when the usual method of farming is practiced.

YIELDS FROM CULTIVATED AND NON-CULTIVATED PLATS

Probably the strongest argument in favor of preventing weed growth by cultivation of rice when it is young, is the influence this has upon the yield. It might be anticipated that planting in wider rows would tend to decrease the yield. This has been the case where no cultivation was given, but when the field was kept free from weeds by cultivation much larger yields were produced than when the rice was planted in close drills or broadcasted. The increased yield is probably due to several factors, among which are absence of weeds, strong, vigorous plants, with large root systems, and no drowning of rice in the early part of the season—all of which result directly or indirectly from the cultivation.

The accompanying table shows the yields which were secured on Substation No. 4, at Beaumont, in the four years, 1914 to 1917, inclusive.

Table 1.—Yields of rice on Substation No. 4. Beaumont, for four years, 1914 to 1917, inclusive, when planted in eight-inch rows without cultivation and in sixteen-inch rows with cultivation in the early part of the season.

	Distance between drill rows inches	Inter-tillage	Yield of grain per acre							
			Field A 1914	Field B			Average of three years field B		Average of four years fields A and B	
				1915	1916	1917				
			lbs.	lbs.	lbs.	lbs.	lbs.	bbls.	lbs.	bbls.
1	8	none.....	1560	1940	2420	890	1750	10.8	1702	10.5
2	16	cultivation	1772	1622	3860	2403	2628	16.2	2414	14.9

In 1914 the test was conducted in field A, and in 1915, 1916, and 1917 the work was done in field B. During the last three years the same plats were used for particular parts of the test each year, thus giving results for three years continuous farming with each method. In plat 1 the rows were eight inches apart and no cultivation was given, which represents the usual method of producing rice. In plat 2 a different method was tested in which the rows were sixteen inches apart, and the rice was cultivated before irrigation. The land on both plats was prepared alike every year, the same amount of seed was planted, irrigation was the same; in fact, all factors were alike on both plats except the width of the rows and cultivation. One cultivation was given each of the crops on plat 2 except in 1917, when soon after irrigation was begun water became unavailable, and the ground became dry, at which time the rice was cultivated again.

The land used for plat 1 from 1915 to 1917, inclusive, had cowpeas on it in 1914, and that used for plat 2 during the same three years had Sudan grass on it in 1914. Therefore, at the beginning of this three-year period plat 1, on which the rice was not cultivated, was in better condition than plat 2, on which the rice was cultivated. In 1915, which was the first year in the period of rice production that both the plats were free or practically free from weeds and the highest yield was produced on plat 1, which followed cowpeas.

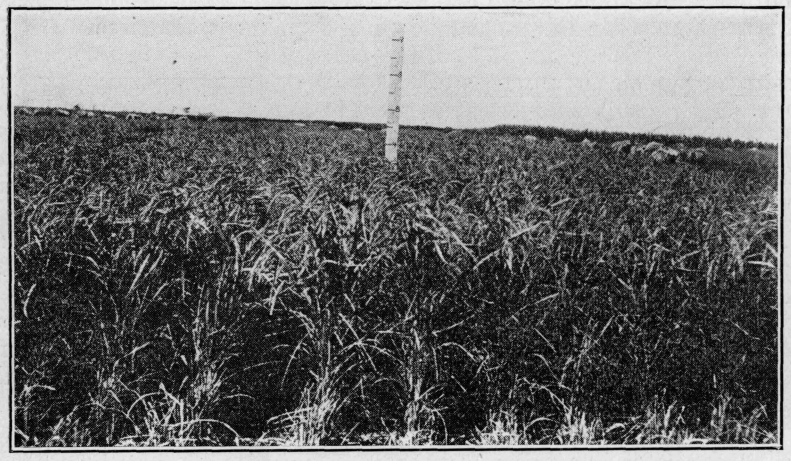

Figure 2—Rice on plat 2 in 1917. This is the third year continuous cropping by the cultivation method. Yield, 2403 pounds per acre. Note the height and vigor of the plants.

In 1916, which was the second year on the same land, plat 1 had many more weeds than it did the previous year; in fact, it was evident that the weeds were sufficiently abundant to interfere appreciably with the development of the rice. On plat 2 fewer weeds started in 1916 than in 1915, and these were destroyed by the cultivation. The rice on this plat was in excellent condition throughout the entire season. In spite of the fact that plat 1 was in better condition at the beginning of the three-year test, the results in 1916 show a much higher yield from plat 2, which was cultivated; the yield without cultivation being

2420 pounds (14.93 barrels) per acre, and with cultivation, 3860 pounds (23.82 barrels) per acre, a difference of 1440 pounds in favor of the cultivated rice.

In 1917 the third crop was produced on the same land, and the difference between the yields on the two plats was still greater than in 1916, even though the crops were not so good as in the preceding year, due apparently to less favorable weather during the middle of the season. This year the yield on plat 1 was 890 pounds per acre, and on plat 2, 2403 pounds per acre, a gain of 1513 pounds where the rice was kept free of weeds by cultivation. It was very noticeable that plat 1, which was farmed as rice land usually is, had very many weeds in 1917, while fewer weeds started to grow in plat 2 than was the case in 1916.

It should be noted that the rice crops of 1914 and 1915 were both produced on land that had grown other crops in the preceding years, and that all of the plats in these two years were practically free from weeds The crops of 1916 and 1917, however, were the second and third crops, respectively, in a period of continuous rice cropping, and the data show that it was only where the field was kept clean by cultivation that satisfactory production was maintained.

By noting the average yields given in the table, it may be seen that for the three years during which the test was conducted on the same land the average yield without cultivation was 1750 pounds or 10.8 barrels per acre, which is somewhat more than the State average for the same years. The average yield of the cultivated rice for the same period was 2628 pounds or 16.22 barrels per acre. Including the results of 1914 on field A, the four-year average on plat 1 was 1702 pounds or 10.5 barrels per acre, and on plat 2 the average was 2414 pounds or 14.9 barrels per acre. Considering the three consecutive tests on field B, the average annual gain of the cultivated rice over that produced in the usual way was 5.4 barrels per acre, and the average increase during the four years was 4.4 barrels.

While this method of growing rice has not, to the writer's knowledge, been tried on a commercial scale in recent years in Texas, the experimental evidence recommends it very strongly as a practical and profitable means of increasing the yield of rice on the used rice fields of this State, and as a means of lengthening the period of years during which rice may be grown continuously.

It is advised that growers who do not have sod land or land that is free from weeds, plant part of their crop in rows and cultivate it, and thus test on their own farms a method that appears to be exceedingly successful in solving the serious weed problem confronting the rice producers.

DISTRIBUTION OF WEED SEED

In addition to adopting a method of controlling the weeds that come up in the rice field, it is important to prevent as far as possible the transportation of weed seeds into the field. In this regard two factors—type of levee, and purity of seed—deserve very careful consideration.

Type of Levee

The narrow, steep levees, which are still much too common in rice fields, are one of the chief sources of weed seeds. Conditions on these

levees are ideal for maximum weed growth, and since farm implements cannot operate over the narrow, steep levees, an enormous crop of weeds is produced and the weed seeds are scattered profusely on both sides of the levees. It is usually not far between levees, and the result is that the entire field is supplied with a fresh lot of seed each year. The entire source of this contamination can be abolished by using broad, sloping levees instead of narrow, steep ones. Broad levees may be plowed and planted with the remainder of the field, and instead of a strip of weeds, the heaviest rice in the field will grow on the levee. With the chief source of weed seed eliminated, the problem of weed control becomes less difficult.

In addition to the elimination of weeds the broad, sloping levee has several other features to recommend its use. Plowing and other field operations may be done in straight lands and in the direction of the slope, thus aiding drainage, instead of at right angles to the slope of the land, as is necessary with narrow, steep levees. With the increased use of tractors, this factor is especially important. Also, the area of land actually producing rice is considerably increased by the use of broad levees, especially in the more sloping fields where the levees are necessarily close together.

It will be found practical to place the broad, sloping levees closer together than the narrow steep ones are usually located, and then it will not be necessary to build them so high.

It is conservative to estimate that the additional amount of rice produced in one year on a field with broad, sloping levees will be sufficient to pay the extra cost of construction over that required to build narrow, steep levees.

Pure Seed

The importance of pure seed has been emphasized in the case of many field crops. Increased yields of several bushels per acre from pure seed over impure seed have been found in numerous instances. In addition to the difference in yield, the impure seed introduces weeds which lower the value of the land for crop production as well as the value of the immediate crop.

The introduction of red rice through seed rice is the original source of infestation, and at present is probably the most important means of maintaining this pest. The use of absolutely pure seed, proper cultural methods, and rotations would in a comparatively short time free Texas of red rice.

Many of the other weeds found in rice fields are seldom carried in seed rice, but some are found frequently and these should be guarded against very carefully in the selection of seed.

SUMMARY

The problem of controlling weeds in rice fields is one of the most serious confronting the rice growers in Texas.

The weed problem is growing more and more acute as the area of new clean land is decreased by bringing it under cultivation.

Tests conducted on the Texas Agricultural Experiment Station, Substation No. 4, located at Beaumont, show that by planting rice in rows

and cultivating it in the early part of the season: (a) the weeds are controlled, (b) larger yields of rice are produced; (c) the land becomes cleaner with each succeeding crop, (d) the period of profitable production is lengthened.

It is advised that the cultivation of young rice be tried on a larger scale by rice farmers who do not have land that is free of weeds.

The distribution of weed seed is an important factor in the weed problem. Narrow, steep levees are the source of large quantities of weed seeds which can be eliminated by substituting broad, sloping levees. The use of pure seed helps to control weeds because seed rice is a common source of weed seeds, particularly red rice.