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In Louisiana, reasonably good stands of rice have usually been secured in years when the growing conditions have been satisfactory. However, in years when the temperatures have been unseasonably low the stands in the early plantings have sometimes been poor, and in some cases it has been necessary to plow up some fields and replant. A seed treatment that would be useful in securing better stands is needed.

Tests have been made in the past with various seed treatments, but the increases in stands from the treatments which have been reported have not been sufficient to warrant general recommendations. Recently, however, several new fungicides have come on the market, and some of these seem to have possibilities with rice. In order to test these new materials, studies were initiated in 1943 and were continued until 1946. The results show that rather substantial increases in stand can be obtained with certain of these fungicides. The purpose of this bulletin is to bring together the results of these tests and to make recommendations on the use of the seed treatment which gave the best results.

Materials and Methods

With the exception of five outfield experiments, all tests were made at the Rice Experiment Station at Crowley, Louisiana. The tests at the Station consisted of planting single rod rows at the rate of 100 pounds of seed per acre. The seed were treated by shaking with an excess of the dust used and then screened to remove the excess. This was at the rate of approximately $1\frac{1}{2}$ ounces per bushel. Each treatment was replicated four times, with the exception of a few tests made in 1946, when only two were used. In each year, plots were planted in March, April and May as close as possible to the middle of the month, and stand counts were secured about one month after planting. The plots were harvested when ripe, air dried, threshed and yields computed in barrels per acre.

In the five outfield tests, the seed were treated and planted with the drill that the grower was using. Stand counts were made of five rows ten feet long of treated and untreated seed in four places. Care was taken that the five rows were planted with treated and untreated seed that came from the same drill spouts.

Experimental Results

Effect on Stand. Three dusts, Arasan, Spergon and New Improved Semesan Jr., were tested the first two years. The results of stand counts on four varieties, Blue Rose 41, Fortuna, Early Prolific and Rexoro, are shown in Table I. It may be seen that Arasan gave the best results, with stand increases of about 25 per cent in the March and April plantings. There was only a 12 per cent increase in the May plantings. Spergon gave a much smaller increase in the April and May plantings, while the

TABLE 1. COMPARATIVE STANDS IN PER CENT IN PLOTS PLANTED WITH UNTREATED RICE SEED AND SEED TREATED WITH THREE FUNGICIDES, 1943 AND 1944.

No. Years	March				April				May			
	Check	Arasan	Spergon	N.Improved Semesan Jr.	Check	Arasan	Spergon	N.Improved Semesan Jr.	Check	Arasan	Spergon	N.Improved Semesan Jr.
BLUE ROSE 41												
2	28	46	41	37	39	50	40	42	70	72	72	70
FORTUNA												
2	26	39	36	36	30	35	31	35	69	72	67	67
EARLY PROLIFIC												
2	43	48	52	37	50	59	54	44	52	62	51	49
REXORO												
1	43	43	46	36	26	39	33	36	43	56	51	45
Average.....	35	44	44	37	36	46	40	39	59	66	60	58
Per cent increase...		+26	+26	+ 6		+28	+11	+ 8		+12	+ 2	— 2

New Improved Semesan Jr. was of relatively little value in any of the tests.

In subsequent tests Arasan was the fungicide principally used. The results with fifteen varieties where Arasan was used as a seed treatment are given in Table 2. These varieties include most of the present com-

TABLE 2. COMPARATIVE STANDS IN PER CENT IN PLOTS PLANTED WITH UNTREATED RICE SEED AND SEED TREATED WITH ARASAN.

Year	Variety	No.Yrs. tests	March		April		May	
			Check	Arasan	Check	Arasan	Check	Arasan
1943-46.....	Blue Rose 41	4	37	53	46	57	63	72
1943-46.....	Fortuna	4	32	40	35	42	63	65
1944-46.....	Early Prolific	3	43	49	40	49	52	62
1944-46.....	Rexoro	3	43	43	42	53	49	54
1945.....	Nira	1	43	54	66	73	49	54
1946.....	Bluebonnet	1	43	51	44	48		
1946.....	Zenith	1			34	45		
1946.....	Magnolia	1			36	43		
1946.....	Cody	1			32	43		
1946.....	Colusa	1			33	47		
1946.....	Kamrose	1			40	42		
1946.....	Arkrose	1			31	39		
1946.....	Hill Long Grain	1			24	36		
1946.....	Texas Patna	1			30	37		
1946.....	Delrex	1			39	51		
	Average.....		38	47	39	48	58	64
	Per cent increase.			+24		+23		+10

mercial varieties. While the data show difference in varietal response, this is not considered to be of significant value. However, the fact that Arasan did not appear to be toxic to any of the varieties is of considerable importance. The average increase in stand was 24 per cent in the March plantings, 23 per cent in April plantings and 10 per cent in the May plantings.

In 1944 and 1946, tests were made with Arasan on five farms. The increase (Table 3) averaged 27 per cent and ranged from 11 to 61

TABLE 3. RESULTS OF STAND COUNTS IN FIELDS PLANTED WITH UNTREATED AND ARASAN TREATED SEED AT 5 FARMS DURING TWO YEARS. NO. OF PLANTS PER 200 FT. OF DRILL ROW.

Variety	Farmer	Year	Check, No. Plants	Arasan, No. Plants	Per Cent Increase
Zenith	Lozen Leger	1944	2,392	3,236	35.3
Early Prolific	S. Higginbotham	1944	1,432	1,636	14.2
Rexoro	B. Hoyt	1944	3,233	3,603	11.4
Fortuna	J. Heinen	1946	763	1,229	61.1
Rexoro	J. Zaunbrecher	1946	811	1,216	49.9
		Average...	1,726	2,184	27.0

per cent on the different farms. The increases were greater in 1946 than in 1944. This was probably due to the fact that the 1946 season was somewhat unfavorable for the early development of rice, since many growers experienced difficulty in obtaining stands.

It was also observed that in the case of Arasan treated seed emergence was about a day sooner than in untreated seed. Also, the seedlings emerged with somewhat more vigor.

Effect on Yield. The data obtained over a period of four years on the yields from treated and untreated seed are given in Table 4. The increases averaged 0.4 barrel per acre with Arasan treated seed in the March plantings, 0.4 barrel in April plantings and 0.2 barrel in the May plantings. Spergon gave a 0.5 barrel increase in March but a decrease in April and May. New Improved Semesan Jr. gave no increase in March, 0.4 barrel in April, and a decrease in May plantings.

While the increases in yield in these tests with Arasan treated seed were rather small, this would be expected since normal stands were obtained in most instances from untreated seed. Larger yields from treated seed would be expected where the stand was below the critical point for a normal yield; for example, in the test on the farm of J. Heinen in 1946, yield data were secured and an increase of 1.4 barrels per acre occurred where the seed were treated. The stand in this field was poorer than usual and the increase was probably due to the fact that the seed treatment increased the stand more nearly to that considered a normal one.

Effect of Arasan on Storage. There is always the possibility that any material which will kill microorganisms may be toxic to seed and reduce germination if the seed are treated and kept too long in storage.

TABLE 4. YIELD OF RICE IN BARRELS PER ACRE IN PLOTS PLANTED WITH TREATED AND UNTREATED SEED.

Treatment	Average	Difference
MARCH		
Check	13.8	
Arasan	14.2	+ .4
Spergon	14.3	+ .5
New Improved Semesan Jr.	13.8	.0
APRIL		
Check	12.2	
Arasan	12.6	+ .4
Spergon	11.2	—1.0
New Improved Semesan Jr.	12.6	+ .4
MAY		
Check	11.0	
Arasan	11.2	+ .2
Spergon	10.2	—0.8
New Improved Semesan Jr.	10.6	— .4

Arasan: average of 4 years tests in March and April, 3 years in May.
Spergon: average of 3 years tests in March and May, and 4 years in April.
New Improved Semesan Jr.: average of 3 years tests in March and 2 years in April and May.

In order to determine if seed could be treated with Arasan and kept indefinitely, comparative germination tests of Arasan treated and untreated seed of two varieties (Blue Rose 41 and Bluebonnet) were made over a period of eight months. The results (Table 5) showed that the

TABLE 5. PER CENT GERMINATION OF UNTREATED AND ARASAN TREATED SEED FOLLOWING VARIOUS PERIODS OF STORAGE.

Variety		Period after treating, in months						
		0	1	2	3	5	8	Av.
Blue Rose 41	Untreated	88	90	72	70	86	78	81
	Treated	93	93	95	93	91	93	93
Bluebonnet	Untreated	91	85	81	85	82	80	84
	Treated	95	85	89	86	79	83	86

treated seed germinated consistently better than untreated seed in each of the seven tests made. Another interesting observation showed that at the end of the eight months only 4 per cent of the treated seed had been destroyed by the angumois moth while 12 per cent of the untreated seed had been damaged (Fig. 1).

Discussion. The results given above indicate that Arasan treated seed gave considerably better stands in March and April plantings and some increase in May plantings. While yield increases were relatively small they were large in proportion to the cost of treatment, which would

FIG. 1.—The effect of Arasan treatment on abundance of angumois moth. *1A,* Blue Rose 41, treated; *1B,* Blue Rose 41, untreated; *2A,* Bluebonnet, treated; *2B,* Bluebonnet, untreated. Top row, grains infested with moth out of 300; lower row, grains not infested.

probably not exceed 25 to 30 cents per acre. Seed treatment should also be considered as stand insurance, since the extra 25 per cent of plants obtained by treating the seed might well give sufficient plants under certain conditions to make replanting unnecessary. The fact that treated seed emerge with a little more vigor than untreated seed might well be a factor in weed control.

While very little information is available on the effect of seed treatment on seed-borne fungi, such as *Helminthosporium oryzae,* and the development of disease epidemics caused by these fungi, it is possible that it would have a helpful effect in reducing such diseases if practiced over a period of several years.

Recommendations. The Arasan dust must be mixed thoroughly with the seed. It will take about $1\frac{1}{2}$ ounces to the bushel, or 5.4 ounces to a 162-pound barrel. If used at a higher rate, the dust is wasted since larger amounts will not remain on the seed, and with much less than this rate it is difficult to cover each seed with the dust.

The seed can be treated by a number of means. It can be done by adding the dust to the seed on the floor and shoveling it thoroughly, or

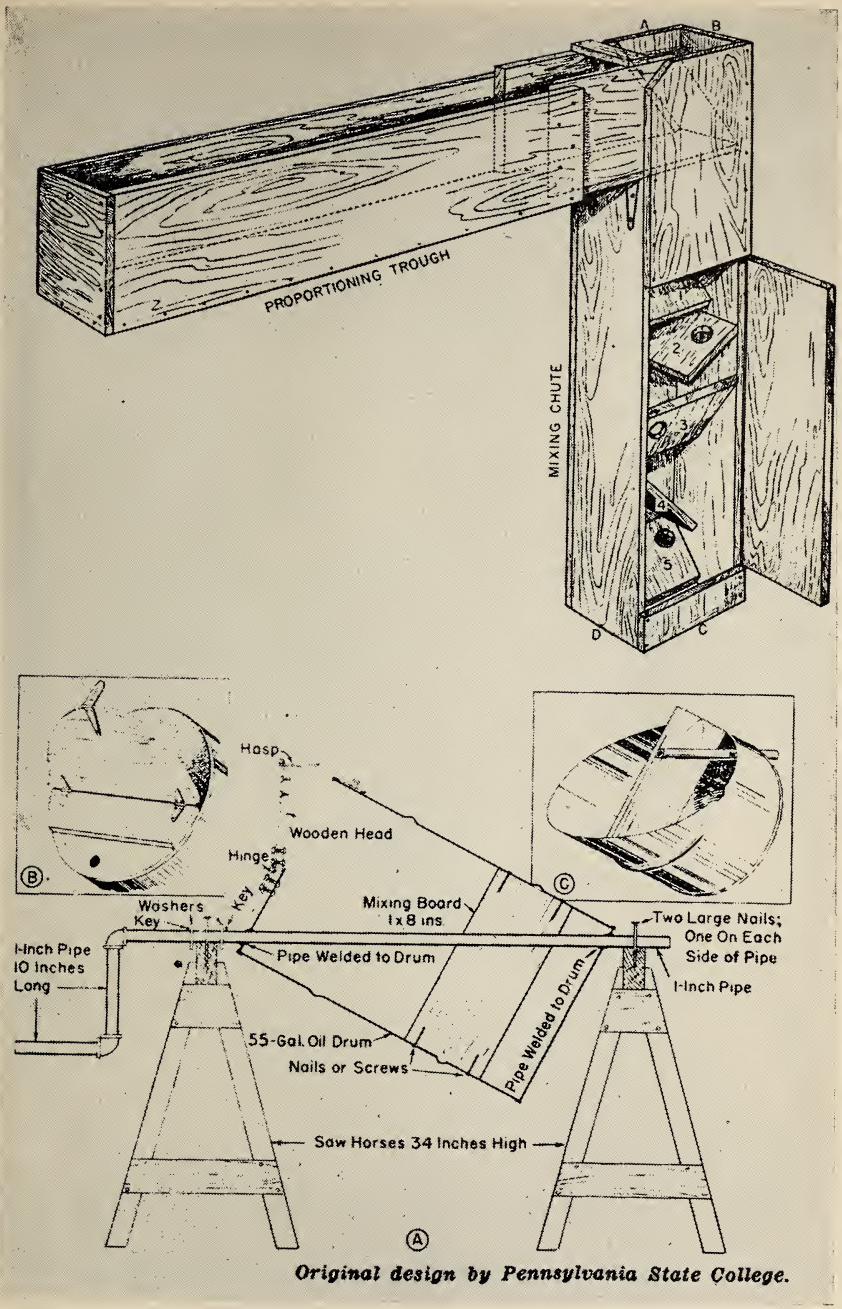

FIG. 2.—Two types of homemade seed treaters. Top: The Minnesota seed treater. Bottom: The barrel type.

by using a seed treater. There are several types of seed treaters that can be made at home. Two of these are shown in Fig. 2 (the barrel and the Minnesota). There are also several power seed treaters on the market that will treat as much as 30 barrels per hour, and cost from $200 to $600. These are the Gustafson seed grain treater, Fargo, N. D., and Calkins All-purpose treater, Spokane, Washington. It is probable that machines of the latter type will be available for 1947 to do custom treating. They can be operated in connection with cleaning machinery and necessitate no additional handling.

Certain care should be taken when treating seed with Arasan. First, it is somewhat toxic to human beings when breathed in, and often causes headaches and sometimes bleeding from the nose. A respirator should be used if the seed is treated in the open. Second, treated seed should not be fed to live stock, since the Arasan is poisonous. A new Arasan material in the form of a slurry has recently been developed. When the machinery for this is available, the danger to the handlers will be eliminated.

Summary

Rice seed treatment tests have been made during four years. Arasan, Spergon and New Improved Semesan Jr. were used.

Arasan gave the best results, increasing stands nearly 25 per cent in March and April plantings and 10 per cent in May plantings. Small but consistent increases in yield occurred where the seed were treated.

Recommendations on the use of Arasan are given.