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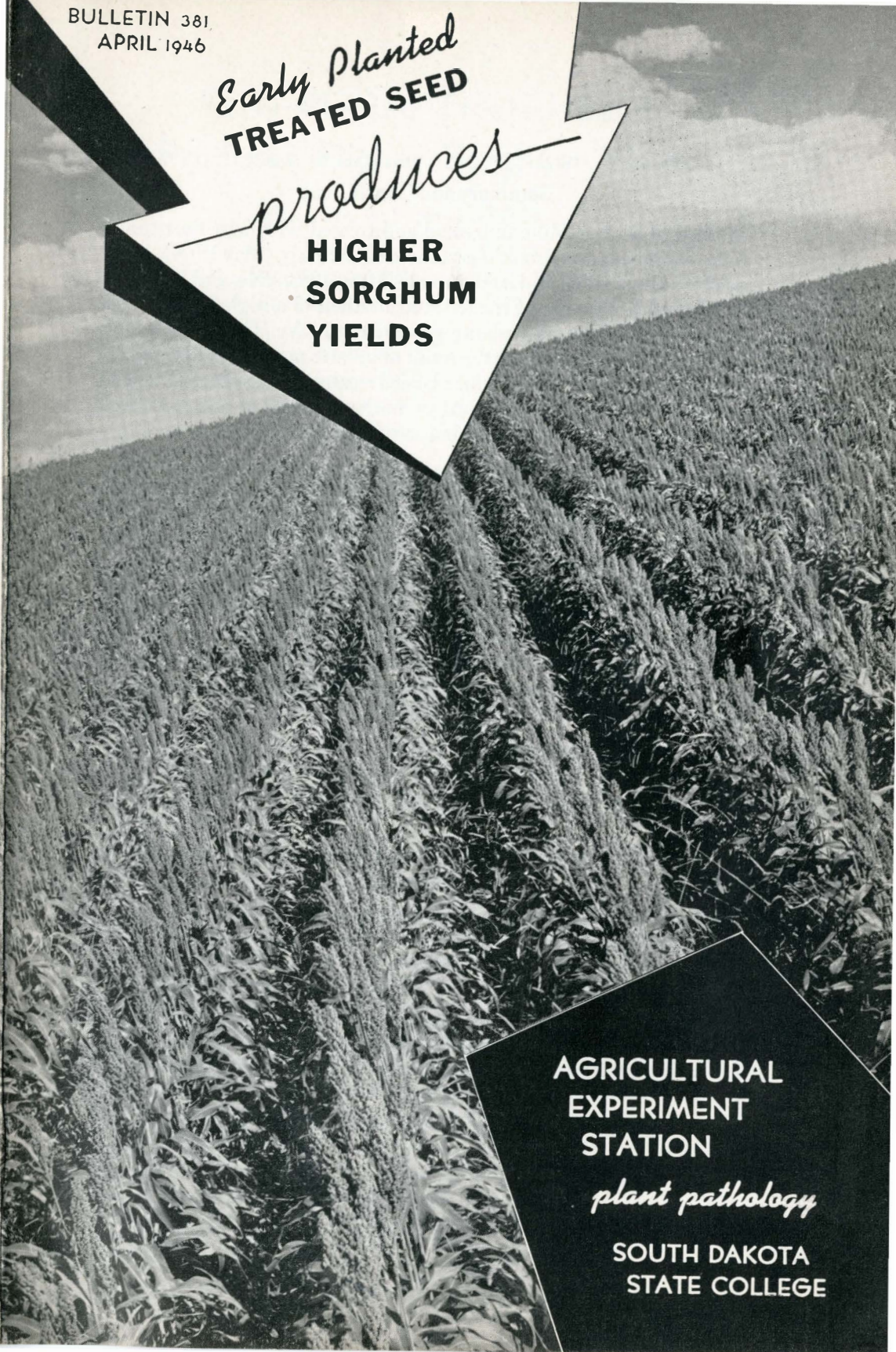

AGRICULTURAL EXPERIMENT STATION
plant pathology
SOUTH DAKOTA STATE COLLEGE

Summary and Conclusions

Seed of Sooner Milo, untreated and treated with four dust fungicides, was planted at Brookings at three dates: early (May 18-24), intermediate (June 1-11), and late (June 17-20) in 1943, 1944, and 1945.

The early planting of treated seed resulted in a higher yield, even though stands from May plantings were not heavy. The higher yields from earlier plantings were the result of greater maturity, although actually, fewer heads were produced. Seed treatment was most beneficial to stand and yield in early plantings. Early plantings of untreated seed resulted in very poor stands and unsatisfactory yields.

Copper carbonate, tetramethyl thiuramdisulfide, and tetrachloro-para-benzoquinone were satisfactory seed treatment materials. Ethyl mercuric phosphate was inconsistent and of doubtful value for improving stands and yields in early plantings.

By planting treated seed, it is possible to plant sorghum in South Dakota before June 1. It is convenient in the farm operations to plant sorghum late in May. Seed treatment helps to insure a satisfactory stand. Because earlier planting results in more satisfactory maturity, even a fair stand from such a planting is likely to outyield a much better stand from a late planting.

WARNING

Copper carbonate, ethyl mercuric phosphate, and tetramethyl thiuramdisulfide dusts in large quantities are poisonous to human beings and livestock. Seed treated with any of these materials should not be fed to livestock. If a large quantity of seed is to be treated, the person doing the treating should wear a mask or tie a dry cloth over his nose and mouth to prevent inhaling the dust. The treating operation can be so arranged as to allow the wind or a well-placed fan to move the dust-laden air away from the operator. Treat only an amount of seed sufficient to sow your present crop. Always follow the directions on the container.

Early Planted Treated Seed Produces Higher Sorghum Yields

By W. F. Buchholtz[1]

Grain sorghums are generally planted after June 1 in South Dakota. For this crop the growing season is frequently so short that freezing of the immature crop often results in low yields and poorly filled grain. Sorghum seed germinates best in relatively warm soil. Untreated sorghum seed planted early in cold soil rots and produces poor stands. Failure to secure satisfactory stands in earlier plantings has been a major cause for delaying sorghum planting until after June 1.

However, results of experiments in 1943, 1944 and 1945 indicate that treating the seed with a dust fungicide may result in satisfactory stands of sorghum from plantings made even before June 1. Such plantings produced a greater yield of more mature grain than later plantings with better stands. Untreated seed, on the other hand, produced very poor stands in early plantings, relatively much poorer than in late plantings.

The Experiments

These experiments were designed to determine which seed treatment would insure a satisfactory stand of sorghum in early plantings, and to measure the effects of sorghum seed treatment on seedling stands and on yields.

The procedure for each of the three years (1943, 1944 and 1945) was essentially the same. Seed of high viability (80 percent or more) of the variety Sooner Milo, was dusted with standard fungicides at the recommended dosages. Both treated and untreated seed were planted by hand at the recommended rate (approximately 3 lbs. per acre or 3 seeds per foot of row). Plantings were made at three different dates—the first between May 18 and 24, the second early in June, and the last between June 17 and June 20. The resulting crops were harvested after they were thoroughly dried in the field in October or early November, at least two weeks after a killing frost.

[1]Plant Pathologist. South Dakota Agricultural Experiment Station.

The treatments[2] applied were:

Coppercarb (copper carbonate), 18 percent, at 3 ounces per bushel.

New Improved Semesan Jr. (ethyl mercuric phosphate), 1 percent, at 2 ounces per bushel.

Arasan (tetramethyl thiuramdisulfide), 50 percent, at 3 ounces per bushel.

Spergon (tetrachloro-para-benzoquinone), 99 percent, at 3 ounces per bushel.

The dosages listed are standard.

Planting dates were:

May 18, June 3 and June 17, 1943.
June 1 and June 20, 1944.
May 24, June 11 and June 20, 1945.

Seedlings from all plantings were counted twice, once immediately after seed germination was completed and again a week or ten days later.

Harvest dates were: October 7 and 8, 1943; November 3, 4 and 5, 1944; October 18, 19 and 20, 1945. All the heads were clipped, counted and weighed by treatment rows. Weights of heads per row were converted to yields in bushels per acre after threshing a composite sample of heads taken from a given planting.

In all cases, treatment plots and plantings were arranged in replicated randomized blocks, and the corresponding tests for uniformity of results was made.

Improvement in Stands and Yields

In Table 1 are presented the stands and yields recorded for the three years' experiments. It is evident that stands from both treated and untreated seed improved with later planting, but that earlier planting of treated seed invariably resulted in a higher yield. Early plantings of untreated seed produced very poor stands and yields little or no better than those from untreated seed planted later. The relative increase in stand and yield from seed treatment was greater in earlier plantings. In early plantings, the average date of which was May 21, yields were approximately proportional to stands. In late plantings, with heavier stands, yield increases were not proportional to stand increases.

Copper carbonate, tetramethyl thiuramdisulfide and tetrachloro-para-benzoquinone were satisfactory seed treatment fungicides; ethyl mercuric phosphate, 1 percent, was fairly satisfactory in 1943, but of little or no value in 1944 or 1945. The lot used in 1945 was sent direct from the manufacturer, and was different from the lot used in 1943 and 1944.

[2]These fungicides may be secured at most drug stores and seed dealers.

Maturity of Crop from Early and Late Plantings

The higher yields from earlier plantings were the result of a greater degree of maturity of the crop, as indicated by the much greater weight per head (Table 2). It obviously was not due to the numbers of heads produced, since many more heads were produced in later plantings (Table 2), but they actually yielded less (Table 1).

The greater maturity from earlier plantings could not be anticipated from the appearance of the seedlings in early stages of growth. Seedlings from later plantings usually grew faster in early stages. In July there was not much difference between the plantings, in size and appearance. In 1944 and 1945 there was only 3 days' variation in the heading date. Nevertheless, at harvest time, the crop from earlier plantings was less immature and consequently higher yielding.

It should be emphasized that in all the experiments, the only planting which approached reasonable maturity was the early (May 18) planting in 1943.

Other Facts of Interest to Growers

Were the heavier stands from later plantings too heavy, and thus responsible for the low yields?

Such a suggestion was encountered after some of the 1943 results were presented.[3] In 1944 and again in 1945, stands from later plantings of copper carbonate-treated seed were thinned to correspond to stands in earlier plantings from treated (copper carbonate) and untreated seed.

The results show conclusively that thinned stands of late plantings produce fewer heads and lower yields than identical unthinned stands in earlier plantings (Table 3).

Does seed treatment benefit yield other than by increasing stand?

The results from the same experiment (Table 3) indicated that seed treatment may slightly increase the yield of individual plants. This effect was not so large and so consistent, however, as the improvement in yield due to improved stands.

Smut control by seed treatment was previously investigated and is discussed in Circular 51.[4] All the seed dust fungicides included in these experiments are satisfactory for smut control.

Is it possible in early plantings to increase stand and yield by increasing the planting rate?

Since stand increase apparently is the biggest contribution of seed treatment to increased yield, is it possible to attain the same increase in

[3]Buchholtz, W. F., "Sorghum Seed Treatment," South Dakota Agricultural Experiment Station Circular 51, 1944.
[4]Buchholtz, *op. cit.*

stand and yield by an increased planting rate? Table 4 shows the results in stand, number of heads, and weight of heads from an early planting of untreated and treated seed at the standard, double the standard, and four times the standard rate. It is evident that increased planting rates resulted in increased stands with both treated and untreated seed.

These are only one year's results, but it may be that both seed treatment and a somewhat above standard planting rate are necessary in order to achieve uniformly good stands in very early plantings.

What about weeds in early plantings?

While not within the scope of the information contained in this bulletin, the matter of weeds in early plantings is of utmost concern. Each year weeds have been a very severe problem in the early plantings of these experiments at Brookings. Two suggestions are perhaps in order: (1) It is possible to plant sorghum so early that it germinates with certain annual grass weeds, which, if abundant, may then be almost impossible to control. (2) If weeds can be controlled in a seemingly thin stand of sorghum from an early planting, it will in all probability outyield a much heavier stand from a late replanting in South Dakota.

Table 1. Stands and yields of Sooner Milo from untreated and treated seed planted at different dates during 1943, 1944, and 1945

Time of planting and treatment	1943 Percentage stand	1943 Yield, bu. per A.	1944 Percentage stand	1944 Yield, bu. per A.	1945 Percentage stand	1945 Yield, bu. per A.
Early planting (May 18, '43; May 24, '45)						
Untreated	9.2	17.2	*	*	10.7	12.1
Copper carbonate, 18%, 3 oz.	30.4	49.3			22.1	21.8
Ethyl mercuric phosphate, 1%, 2 oz.	21.0	42.2			9.3	11.5
Tetramethyl thiuramdisulfide, 50%, 3 oz.	.....	.....			18.9	17.8
Tetrachloro-para-benzoquinoine, 99%, 3 oz.	.....	.....			19.7	19.1
Intermediate planting (June 3, '43; June 1, '44; June 11, '45)						
Untreated	19.4	24.2	16.2	18.0	12.7	10.2
Copper carbonate	54.4	45.1	31.0	24.4	35.5	17.0
Ethyl mercuric phosphate	30.8	34.2	11.5	14.0	16.3	11.8
Tetramethyl thiuramdisulfide	.....	.....	29.7	24.7	35.2	16.3
Tetrachloro-para-benzoquinone	.....	.....	29.0	26.3	39.7	19.2
Late planting (June 17, '43; June 20, '44; June 20, '45)						
Untreated	66.2	20.4	40.3	8.9	39.2	7.7
Copper carbonate	79.7	22.6	53.3	10.1	58.4	8.9
Ethyl mercuric phosphate	81.0	23.8	45.8	9.2	34.9	7.2
Tetramethyl thiuramdisulfide	.....	.....	55.7	9.9	58.7	9.5
Tetrachloro-para-benzoquinone	.....	.....	56.5	9.6	63.7	9.1

*Very wet soil prevented planting.

Table 2. Heads produced,* and ounces per head† of Sooner Milo from untreated and treated seed planted at different dates during 1943, 1944, and 1945

Time of planting and treatment	1943 Av. No. heads per row	1943 Av. wt. per head (ounces)	1944 Av. No. heads per row	1944 Av. wt. per head (ounces)	1945 Av. No. heads per row	1945 Av. wt. per head (ounces)
Early:						
Untreated	39.0	1.49	‡	‡	55.5	.95
Copper carbonate	104.4	1.60			107.5	.87
Ethyl mercuric phosphate	80.6	1.66			49.9	1.01
Tetramethyl thiuramdisulfide	------	------			87.7	.86
Tetrachloro-para-benzoquinone	------	------			94.4	.85
Intermediate:						
Untreated	98.4	.96	92.5	.79	60.0	.85
Copper carbonate	180.0	.98	130.7	.76	137.6	.62
Ethyl mercuric phosphate	134.0	.99	64.0	.89	78.4	.78
Tetramethyl thiuramdisulfide	------	------	124.3	.88	133.9	.61
Tetrachloro-para-benzoquinone	------	------	132.8	.81	149.3	.64
Late:						
Untreated	148.8	.59	140.3	.33	130.1	.44
Copper carbonate	160.4	.61	168.7	.31	161.9	.40
Ethyl mercuric phosphate	163.8	.64	146.8	.33	116.3	.46
Tetramethyl thiuramdisulfide	------	------	166.3	.34	174.9	.40
Tetrachloro-para-benzoquinone	------	------	163.3	.30	161.1	.41

*Per row of 100 seeds planted.
†Weight per head is an indication of stage of maturity.
‡Very wet soil prevented planting.

Table 3. Heads produced,* and yields in bushels per acre of Sooner Milo from untreated and treated seed planted at different dates, and of similar (thinned) stands grown from treated seed planted at the same time or later, 1944 and 1945

Time of planting and treatment	1944 Av. No. heads produced per plot	1944 Yield, bu. per A.	1945 Av. No. heads produced per plot	1945 Yield, bu. per A.
Early:				
Untreated (Check)	†	†	55.5	12.1
Copper carbonate ($CuCO_3$)			107.5	21.9
$CuCO_3$, thinned to check, at random			56.8	13.4
$CuCO_3$ thinned to check, selectively			60.3	15.3
Intermediate:				
Untreated (Check)	92.5	18.0	60.0	10.3
Copper carbonate ($CuCO_3$)	130.7	24.4	137.6	16.9
$CuCO_3$, thinned to check, at random	------	------	51.7	9.8
$CuCO_3$, thinned to check, selectively	96.8	21.0	61.6	11.9
$CuCO_3$, thinned to early planted check, selectively	------	------	53.1	11.4
$CuCO_3$, thinned to early planted $CuCO_3$, selectively	------	------	98.4	14.8
Late:				
Untreated (Check)	140.3	9.0	130.1	7.7
Copper carbonate ($CuCO_3$)	168.7	10.1	161.9	8.9
$CuCO_3$, thinned to check, at random	------	------	122.4	7.8
$CuCO_3$ thinned to check, selectively	141.8	9.3	127.7	7.7
$CuCO_3$ thinned to early planted check, selectively	------	------	54.4	5.2
$CuCO_3$, thinned to early planted $CuCO_3$, selectively	------	------	89.1	7.3
$CuCO_3$ thinned to intermediate planted check, selectively	87.0	7.7	51.7	4.9
$CuCO_3$, thinned to intermediate planted $CuCO_3$, selectively	132.5	9.5	128.3	8.3

*Per row of 100 seeds planted.
†Very wet soil prevented planting.

Table 4. Number of plants, heads, and weight of heads per row of Sooner Milo from untreated and treated seed planted at the standard, twice the standard, and four times the standard rate. May 18, 1945

Treatment	Planting rate (No. seeds per row)	No. per row		Wt. of heads in ounces
		Plants	Heads	
Untreated	25*	2.4	13.0	13.1
Copper carbonate	25	5.2	23.6	19.8
Untreated	50	6.4	25.2	20.5
Copper carbonate	50	15.6	41.6	29.8
Untreated	100	12.2	33.6	23.0
Copper carbonate	100	27.4	50.4	35.8

*The standard rate was assumed to be about 3 lbs. per acre; in these experiments that was found to be 3 seeds per foot of row.