Methods Used and Results Secured from Pelleting of Sugar Beet, Vegetable, Flower, Tree and Other Field Crop Seeds

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The pelleted seed program of the Farmers and Manufacturers Beet Sugar Association was initiated in the late summer of 1943 in cooperation with the Dow Chemical Company, Midland, Mich. In August 1944 the entire project was taken over by the Association but we continued to use Dow facilities at Midland and Dow personnel loaned for this purpose.

The first objective of the pelleting program was to perfect a process for making a round, smooth pellet of uniform weight from the irregular segmented seed with the hope of facilitating precision planting. One condition was that these pellets were to be made of materials which would readily break down when placed in contact with soil moisture and should not interfere with normal germination of the seed.

This first objective was accomplished by the use of a rotating pan similar to those used by the pill and candy manufacturers for coating their products. The segmented seed was placed in the rotating pan and by alternate wetting with an adhesive material and dusting with an inert material was gradually built up to the desired spherical smooth pellet. We have found that methyl cellulose, a water-soluble plasticide, is the best binder. The best inert base found to date is a combination of 65 percent feldspar and 35 percent flyash. The feldspar used initially is screened through a 40-mesh screen; for the finish coat it is screened through a 200-mesh screen. The flyash, which is the ash obtained from the burning of powdered coal in large boiler installations, is screened to a similar size. It has been found that a light finish coat of fine amorphous graphite reduces the friction in a. planter and greatly reduces the amount of breakage in the planter.

The possibility of adding fungicides, fertilizers, insecticides, repellents, starting agents, hormones, etc., to the coating material for the control of seedling diseases and soil-borne insect pests, as well as to improve the vigor and growth of the seedling, was next explored. A large number of fungicides were tried in varying quantities and varying combinations. In table 1 are listed those fungicides and the optimum amounts of each which have proved best under our conditions. In figure 1 are shown the result of toxic runs on fungicide amounts and the maximum amount which may be used without injury to germination under normal conditions. The addition of superphos-

Table 1

	Date made	Pan size	Old feldspar from	New feldspar	Flyash		Semesan	Semesan Bel	Yellow Cuprocide	Red Cuprocide	Ceresan	Chlornil	Super-phosphate	Fertilizer mix
363- 1-D	8-24-45	Large		65	35							10	3	
364- 1-D	8-24-45	Large		65	35				10				3	
365- 1-D	9-27-45	Large		65	35	5							3	
366- 1-D	8-27-45	Large		65	25	10							3	
399- A	6-13-43	Small	65		35				5				10	
399- 1-D	8-27-45	Large		65	35				5				10	
418- 1-D	9- 4-45	Large		65	35	10							10	
420- 1-D	9- 4-43	Large		65	35		1						3	
421- 1-D	8-25-45	Large		65	35		5						3	
421- 3-D	9- 5-45	Large	65		35		5						3	
478- 1-D	9- 6-45	Large		65	35		1						10	
503- 1-D	9- 5-45	Large		65	35				5					10
541- 1-D	8-24-45	Large		65	35	5			5				10	
543- A	8-24-44	Small	100			10							10	
543- 3-D	9- 6-45	Large	100			10							10	
546- 1-D	8-25-45	Large		100					2				3	
563- 1-D	8-25-45	Large		100					10			20	10	
574- 1-D	8-27-45	Large		100				2					10	
603- 1-D	8-27-45	Large		100							½	10	5	
610- A	9-29-44	Small	100							3		10	5	
610-42-D	8-25-45	Large	(Clay base)							3		10	5	
610-43-D	9-13-45	Large	(Graphite base)							3		10	5	
670- 1-D	8-30-45	Large		100				2			(a)	5	5	
702- 1-D	9- 4-45	Large		100		1		2					10	
723- 1-D	8-30-45	Large		100				2			(b)		5	

(a) Also 400 p.p.M. phenolbarbitol
(b) Also 10 percent brewers yeast

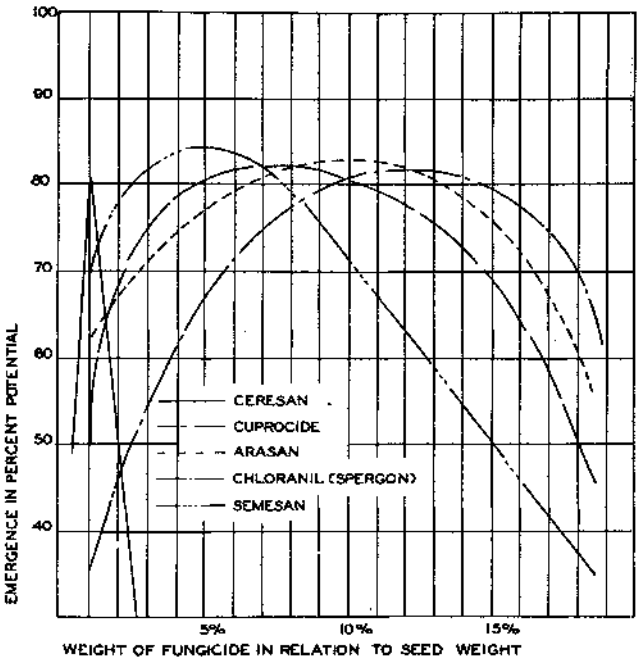

Figure 1.—Optimum range for various fungicides. The addition of fertilizer to the pellet generally reduces the amount of fungicide which can be added.

phate at the rate of 10 percent of the weight of the seed has given the best results as far as fertilizers or a combination of fertilizers are concerned. Plant stimulants and hormones have proved beneficial under certain conditions. As far as insecticides and repellents are concerned, we have determined the toxic maximum but have very few actual field results.

Table 2 shows the effect of various factors upon the resulting pellet.

Table 2.—The effects of various factors upon the resulting pellets.

	Index of emergence with best net emergence as 100
A. Results of test comparing feldspar base with a flyash-feldspar base in large and small pan	
Treatment	
1. Flyash-feldspar base made in large pan	100
2. Flyash-feldspar base made in small pan	100
3. Feldspar base made in small pan	90
4. Feldspar base made in large pan	87
B. Results of test comparing pellets made with a feldspar and feldspar-flyash base in combination with superphosphate and fertilizer mix (2-5-5)	
Treatment	
1. Flyash-feldspar base with superphosphate	100
2. Flyash-feldspar base with fertilizer mix	94
3. Feldspar base with fertilizer mix	91
4. Feldspar base with superphosphate	89
C. Results of test comparing pellets containing superphosphate and fertilizer mix (2-5-5)	
Treatment	
1. 10 percent superphosphate	100
2. 10 percent fertilizer mix	92
3. 5 percent fertilizer mix	92
4. 5 percent superphosphate	87
D. Results of tests to determine effects of location of fertilizer in pellet	
Treatment	
1. Fertilizer mixed in 1/3 of base, applied first	100
2. Fertilizer mixed in all of base	90
3. Fertilizer mixed in 1/12 of base, applied first	88

Pellets of each batch are stored for two years. A pellet that has proved satisfactory when first made is further tested every 3 months to determine the effect of pelleting on the storage of the seed.

Each pellet is tested under the following conditions:

a. In flats in a cool room.

b. In flats in a greenhouse (controlled temperature).

c. In a root cellar under damp humid cool and poor light conditions.

d. Outdoors, hand planted.

e. Outdoors, machine planted.

Tests are made both in good sugar beet soil and in soil taken from an area where black-root continually occurs. Each report is the average of several replications. A daily record is kept of all tests in order to determine the rate of emergence and extent of post-emergence damping off. Every fourth row is a row of check seed. All data are calculated on the following basis:

a. Net Emergence Index. The net emergence of the pellet after deducting for post-emergence damping off divided by net emergence of the check seed after deducting for post-emergence damping off.

b. Rate of Emergence Index. The net emergence of the seed or pellet on the seventh day divided by the net emergence on the fourteenth day is calculated as the "rate of emergence." The rate of emergence of the pellet divided by the rate of emergence of the check seed is called the "rate of emergence index."

In explanation of the above, following arc some results from good and poor pellets tested in the late summer of 1945 :

Pellet No.	399-A	610-43-D	570-1-D
Date made	6/13/43	5/13/45	8/25/45
Net emergence index	194	219	71
Rate of emergence index	115	72	61

No. 399-A, pelleted 2 years before the test, produced almost twice as many seedlings as did the check and emerged at a faster rate than the check. No. 610-43-D produced more than twice as many seedlings as did the check ; the rate of emergence was slower on the seventh day, but by the tenth day the net emergence of the pellet had exceeded the net emergence of the seed. No. 570-1-D was poor both as to emergence and rate of emergence. Table 3 shows results of some of the better pellets.

Various vegetable, flower, field crop, and tree seeds have been pelleted. Although the amount of time devoted to these crops has been limited, remarkable results have been obtained with, certain crops. In tomatoes, a test of pelleted seed vs. 8-inch transplants showed as great a production from the seed as from the transplants.

Our pelleting experience to date indicates that:

1. Most irregular seeds can be pelleted to a uniform size and weight, and when the proper binder and base are used that the pelleting does not hinder germination under normal conditions.
2. Net emergence and livability can be increased by the incorporation of proper amounts of fungicides, fertilizers, and starting agents.
3. Because of more uniform size and increased weight, the pellet can be more accurately planted than the uncoated seed.

Table 3.—Selected results from outdoor field test 1940 counts on rows of 100 feet, four replications.

	Net emergence index						Net emergence in percentage potential	
	First count		Second count		Third count		Third count	
	Hand planted	Machine planted	Hand planted	Machine planted	Hand planted	Machine planted	Hand planted	Machine planted
363— 1-D	112	113	144	131	177	172	60.02	52.20
364— 1-D	148	147	184	158	206	194	77.28	69.77
365— 1-D	65	70	114	148	171	151	57.86	45.86
366— 1-D	80	113	125	130	162	173	62.18	56.06
399— A	190	211	174	191	186	213	77.64	75.05
399— 1-D	97	79	131	120	161	164	61.78	53.16
418— 1-D	91	73	230	128	257	152	84.74	51.23
420— 1-D	23	33	123	90	137	144	60.02	47.54
421— 1-D	8	48	105	112	115	169	49.20	55.71
422— 1-D	24	37	119	98	184	133	58.45	44.02
478— 1-D	72	87	130	117	154	160	61.50	55.45
503— 1-D	110	62	131	104	151	130	60.61	42.71
541— 1-D	155	122	161	131	172	155	57.97	50.49
543— A	189	110	184	121	191	148	69.82	61.73
542— 1-D	143	80	131	106	164	120	55.51	47.71
540— 1-D	151	148	134	162	163	155	54.02	61.52
563— 1-D	111	80	127	123	159	140	53.75	55.51
574— 1-D	45	62	170	114	169	116	51.78	56.59
603— 1-D	38	66	161	107	165	111	50.41	51.76
610— A	....	65	141	144	155	157	53.05	44.75
610—42-D	81	92	214	146	231	108	54.33	59.75
610—43-D	107	144	270	161	264	283	66.09	62.39
676— 1-D	188	100	120	163	120	174	56.30	63.54
702— 1-D	12	32	73	131	95	142	41.00	52.29
723— 1-D	7	38	143	136	150	148	55.51	52.02
Average							60.89	54.71
Average of checks							36.36	35.00

Note: In the above index the net emergence of each pellet is compared to the net emergence of its adjacent check, not ro the average emergence of all checks.

4. Pelleting does not add materially to the cost when done on a production basis. If pelleting increases the net emergence to the point where the in dividual seed spacing can he increased, pelleted seed will cost less per acre than uncoated seed.

5. The incorporation of fungicides in amounts greatly in excess of the amount recommended by the fungicide manufacturer is necessary for the control of pre-emergence and post-emergence damping off.

6. Pelleted sugar beet seed will germinate in dry soil as readily as its corresponding uncoated check.

7. Under normal germinating conditions, the rate of emergence of pelleted and unpelleted seed is the same; under cool conditions,

the emergence of the pellets may be retarded several days.

8. The incorporation of growth-promoting substances may prove very beneficial.

9. Repellents and insecticides such as DD and DDT up to given amounts do not interfere with normal germination of the seed or cause injury to the seedling.

10. The incorporation of 10 percent superphosphate in the pellet gives better results than other fertilizers or combinations of fertilizers.

11. A combination of fungicides may prove better than any one specific fungicide.

12. A light coating of graphite on the pellet as a final coating improves planter performance and does not interfere with normal germination.

13. There is a possibility of controlling diseases which appear after the seedling stage. Incorporating Arasan on onion seed in an amount equal to its weight prevents onion smut.

14. Minor elements that are lacking in soils can be added in the pellets.

15. The pH of the pellet can be varied to give the proper pH for optimum germination of any given seed.

16. Much work still remains to be clone in the pelleting of field crops seeds. Pelleting may be another source of combating new seedling diseases which might attack our field crops in the future.

Patent applications on the process are held by the Farmers and Manufacturers Beet Sugar Association.