

COOPERATIVE SEED TREATMENT TRIALS - 1969¹H. A. H. Wallace²

Abstract

Sixty-eight seed treatment chemicals were tested for their efficacy in controlling bunt of wheat (*Tilletia foetida*), covered smut of oats (*Ustilago kolleri*), covered smut of barley (*U. hordei*), seedling blight of barley (*Cochliobolus sativus*), and seed rot of flax caused by a complex of seed- and soil-borne microorganisms. Oat smut was difficult to control and the best chemical for control of seedling blight was only partially effective. As expected, the systemic fungicides usually controlled smut diseases. The value of maneb, and to a lesser extent thiram, as broad-spectrum fungicides, is indicated.

Introduction

In 1969 sixty-eight seed treatment chemicals were tested for their efficacy in controlling common bunt of wheat caused by *Tilletia foetida* (Wallr.) Liro, covered smut of oats caused by *Ustilago kolleri* Wille, covered smut of barley caused by *U. hordei* (Pers.) Lagerh., seedling blight of barley caused by *Cochliobolus sativus* (Ito & Kurib.) Drechs. ex Dastur, and seed rots of flax caused by a complex of soil- and seed-borne microorganisms.

Materials and methods

Clean seed of 'Red Bobs' wheat (*Triticum aestivum* L.), naturally smutted seed of 'Vanguard' oats (*Avena sativa* L.), and naturally smutted seed of 'Plush' barley (*Hordeum vulgare* L.) were used. One gram of the appropriate smut spores was added to each 200 g of seed to ensure heavy infection. 'Herta' barley, 100% naturally infected with *C. sativus*, was used for the seedling blight test; and 'Linott' flax (*Linum usitatissimum* L.) was used for the seed rot test.

The experiment was divided into two sections for convenience (Series A and B). The source, product name, and chemical name, where available, of the treatment materials are listed in Tables 1 and 2. Res-Q and Panogen 15B (Series A) and Agrox NM and Mer gamma NM (Series B) were included as standards. Each chemical was applied to 100 g of seed, or to 200 g of seed if the rate (Tables 3 and 4) was less than 1 oz per bushel, by shaking the seed in a glass jar until the seed was uniformly covered. Seed was removed from the jar after not more than 3 days, and samples of 200 seeds in paper envelopes were stored in polyethylene bags at 15°C for not more than 4 weeks before seeding.

Both series of tests were carried out at Brandon and Morden, Manitoba. Each plot replicate consisted of 200 seeds planted in a row 12 ft long; all rows were planted 9 inches apart, and plots were arranged in a randomized block design. Emergence of barley infected with *C. sativus* and of flax was recorded 6-8 weeks after seeding. Disease ratings of the emerged barley plants were made at the same time by examining 100 plants from each row and rating them on a 0-5 scale:

$$\text{Disease rating percentage} = \frac{\text{average of numerical ratings of individual plants} \times 100}{5}$$

The percentage of smutty heads, based on counts of 200 heads per row, was recorded after the crop had headed (when infection was very heavy, assessments were based on 100 heads). The results are given as means of eight replicates, four from each planting site. The "LSD-05" is based on an analysis of the means of the treatments for each station.

Results and discussion

Smut infection of untreated seed varied from 21% to 31% for wheat, 13% to 18% for oats, and 7% to 12% for barley. Some chemicals gave complete control of all smut diseases (Tables 3 and 4); many others controlled bunt and barley smut but failed to give good control of oat smut. BEI 16 was an exception since it gave poor control of bunt but controlled smuts of oats and barley well. Emergence of untreated flax ranged from 56% to 64%. Less than half of the seed treatment chemicals increased emergence. Emergence from the untreated diseased barley seed ranged from 57% to 60%, and generally seed treatment, except when phytotoxic, increased emergence.

Generally, treatments of the TN-702 series were phytotoxic to wheat, barley, and flax when applied at 802 per bushel. BEJ 15 and BEJ 16 were phytotoxic to flax.

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Table 1. Seed treatment materials used in the cooperative test (Series A)

Treatment no.	Source*	Product name	Chemical name
1		Untreated check	
2	Green Cross	Res-Q	hexachlorobenzene (20%) t captan (20%) t maneb (15%)
3	Nor-Am	Panogen 15B	methylmercuric dicyandiamide
4 - 6	Green Cross	"TD-"	identity not available
7	Green Cross	Ascurit	identity not available
8 - 13	Green Cross	"SWF-"	identity not available
14 - 23	Nor-Am	"EP-"	identity not available
24 - 33	Niagara	"BE-"	identity not available
34 - 39	Interprovincial	TCMTOB	2-(thiocyanomethylsulfinyl)benzothiazole
40 - 43	Interprovincial	TCMTB	2-(thiocyanomethylthio) benzothiazole
44 - 53	Hoechst	"28--"	identity not available
54	Hopkins	WOM-DB	identity not available
55 - 58	Aagrulon	"11--"	identity not available
59	Dupont	Manzate D	maneb (80%) t zinc
60		Untreated check	

* Green Cross Products, Montreal, Quebec; Nor-Am Agricultural Products Ltd., Woodstock, Illinois; Niagara Brand Chemicals, Burlington, Ontario; Interprovincial Cooperatives Ltd., Winnipeg, Manitoba; Canadian Hoechst Ltd., Montreal, Quebec; Hopkins Agricultural Chemical Co., Madison, Wisconsin; Aagrulon Chemical Works, Groningen, Holland; E. I. Dupont de Nemours and Co., Inc., Wilmington, Delaware.

Table 2. Seed treatment materials used in the cooperative test (Series B)

Treatment no.	Source*	Product name	Chemical name
61		Untreated check	
62-68	Chipman	"TF-"	identity not available
69	Dupont	Benlate	benomyl (methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate (50%)
70 [†]	Dupont Dupont	Benlate Arasan 70-S	benomyl (50%) thiram (70%) t methoxychlor (2%)
71 [†]	Dupont Chipman	Benlate Agrox NM	benomyl (50%) maneb (37.5%)
72	Dupont	Arasan 70-S	thiram (70%) t methoxychlor (2%)
73	Chipman	Agrox NM	maneb (37.5%)
74-83	Merck	"TN-702-"	identity not available
84	Uniroyal	Vitavax 40S	5,6-dihydro-2-methyl-1,4-oxathiin-3-carboxanilide

Table 2 (Continued)

Treatment no.	Source*	Product name	Chemical name
85-87	Uniroyal	Vitavax 100,101	Vitavax t maneb
88-90	Uniroyal	Vitavax 200,201	Vitavax t zineb
91	Uniroyal	Vitavax 300	Vitavax t maneb t aineb
92-93	Chemagro	Bay 78175	N, N ¹ -dipropyl-N ₂ N ¹ -(dichlorofluoromethyl thio) sulfamide
94-95	Chemagro	Chemagro 5506	2-((1,2,2-trichloroethyl) dithio) propionamide
96	Uniroyal	Vitavax 75W	Vitavax
97	Green Cross	Res-Q Dual	hexachlorobenzene (16%), maneb (12%), captan (16%), lindane (30%)
98	Rohm & Haas	Dithane M45	zinc coordinated maneb (80%)
99	Chipman	Mergamma NM	maneb (37.5%) t lindane (18.75%)
100		Untreated check	

* Chipman Chemicals Ltd., Hamilton, Ontario; E. I. Dupont de Nemours & Co., Inc., Wilmington, Delaware; Merck & Co., Inc., Rathway, New Jersey; Uniroyal (1966) Ltd., Elmira, Ontario; Chemagro Corporation, Kansas City, Missouri; Green Cross Products, Montreal Quebec; Rohm & Haas Co. of Canada Ltd., West Hill, Ontario.

† In treatments 70 and 71, the seed was treated twice, once with each fungicide at the rates indicated in Table 4.

Table 3. Results of cooperative seed treatment trials (Series A)

Treatment no.	Product name	Formulation *	Dosage (oz/bu)	Smutted heads (Yo)**			Barley seedling blight**		Flax	
				Wheat	Oats	Barley	Emergence (%)	Disease rating (%)	Dosage (oz/bu)	Emergence (%)
1	Untreated check			21.88	18.64	7.22	58.4	23.8		56.2
2	Res-Q	WP	1.00	0.00	1.94	0.00	64.0	20.1	4.00	66.7
3	Panogen 15B	Sn	0.75	0.40	0.00	0.00	70.9	9.6	1.50	65.2
4	TD5124 A	WP	2.00	11.17	4.42	6.77	60.8	16.2	4.00	42.7
5	TD5124A t charcoal	WP	2.00	13.50	9.68	10.20	57.1	18.3	4.00	45.1
6	TD5056	WP	2.00	0.24	7.14	0.00	60.4	23.0	4.00	53.9
7	Ascurit	D	2.00	0.00	7.64	0.74	55.9	18.2	4.00	54.6
8	SWF 780	D	1.00	0.39					4.00	62.9
			2.00		0.61	0.16	65.9	20.8		
9	SWF 2250	D	1.00	0.00					4.00	62.1
			2.00		2.22	0.00	63.4	19.0		
10	SWF 2260	D	1.00	0.09	3.32	0.30	66.3	23.6	4.00	58.5
			2.00							
11	SWF 2270	D	1.25	0.00	2.34	0.15	63.0	19.7	5.00	64.1
			2.50							
12	SWF 2280	D	1.00	0.09	4.74	0.04	65.6	19.9	4.00	66.1
			2.00							
13	SWF 2290	D	1.25	0.00	2.23	0.00	60.3	19.6	5.00	63.5
			2.50							
14	EP-411C	L	0.67	0.19	0.06	0.08	59.2	23.7	2.50	57.8
15	EP-411C	L	1.25	0.08	0.06	0.08	66.1	20.7	5.00	48.4
16	EP-342-A	WP	1.00	0.13	13.05	4.55	61.5	26.0	2.00	50.8

Table 3. (Concluded)

Treatment no.	Product name	Formulation *	Dosage (oz/bu)	Smutted heads (%)**			Barley seedling blight**		Flax	
				Wheat	Oats	Barley	Emergence (%)	Disease rating (%)	Dosage (oz/bu)	Emergence (%)
17	EP-342-A	WP	2.00	0.21	14.24	8.08	51.0	22.8	4.00	52.0
18	EP-476	L	2.00	0.73	5.71	4.40	58.9	17.9	4.00	47.7
19	EP-473-B	L	5.00	19.81	8.72	5.67	53.1	17.6	5.00	53.7
20	EP-477	L	8.00	7.65	6.76	4.60	57.1	22.2	8.00	60.5
21	EP-371-A	WP	2.00	0.00	0.00	0.00	63.9	18.9	4.00	63.9
22	EP-439-B	WP	2.00	0.13	3.74	0.70	58.1	14.1	4.00	61.3
23	EP-458-A	WP	2.00	0.14	12.10	0.53	58.0	22.3	4.00	59.1
24	BEJ 11	D	3.00	4.12	3.00	0.49	55.5	24.3	3.00	52.9
25	BEJ 11	D	6.00	2.50	3.05	0.30	56.6	23.1	6.00	49.9
26	BEJ 12	L	3.00	1.75	1.98	0.44	64.9	20.1	3.00	55.6
27	BEJ 12	L	6.00	0.10	0.40	0.15	63.8	20.2	6.00	61.7
28	BEI 24	D	1.00	0.04	0.06	0.00	70.8	15.2	2.00	56.3
29	BEI 24	D	2.00	0.00	0.00	0.00	66.6	9.3	4.00	54.0
30	BEJ 14	D	1.00	0.00	3.68	0.00	61.8	19.4	2.00	63.8
31	BEJ 14	D	2.00	0.15	3.50	0.04	64.7	19.9	4.00	59.4
32	BEJ 15	L	6.00	0.70	0.10	0.68	51.9	10.3	6.00	34.4
33	BEJ 16	L	6.00	8.38	0.11	0.00	63.4	23.6	6.00	34.7
34	TCMTOB (2%)	D	1.00	11.70	11.33	6.08	60.9	24.1	2.00	55.2
35	TCMTOB (2%)	D	2.00	17.88	9.17	2.88	51.9	20.0	4.00	58.3
36	TCMTOB (10%)	D	1.00	3.49	3.20	1.07	61.0	22.7	2.00	60.9
37	TCMTOB (10%)	D	2.00	2.57	0.79	0.44	62.9	20.6	4.00	62.3
38	TCMTOB (2%)	L	0.75	8.12	10.09	7.45	57.4	25.2	1.50	60.1
39	TCMTOB (2%)	L	1.50	8.76	3.75	3.07	57.6	19.6	3.00	57.7
40	TCMTB	L	1.00	9.75	3.02	5.79	60.4	23.7	2.00	50.8
41	TCMTB	L	2.00	4.94	1.74	2.96	61.9	27.5	4.00	44.3
42	TCMTB	D	1.00	19.23	10.14	5.28	58.2	18.5	2.00	58.0
43	TCMTB	D	2.00	11.70	8.52	9.96	58.1	20.4	4.00	50.5
44	2988	D	2.00	0.67	0.23	0.04	63.6	22.3	2.00	60.6
45	2988	D	4.00	0.10	0.00	0.00	64.2	27.2	4.00	47.6
46	2988	D	6.00	0.04	0.00	0.00	59.9	21.6	6.00	49.0
47	2988	D	8.00	0.00	0.00	0.00	58.3	20.5	8.00	48.6
48	2989	D	2.00	12.30	0.00	0.04	63.6	19.4	2.00	49.0
49	2989	D	4.00	7.57	0.06	0.00	58.9	16.4	4.00	53.5
50	2989	D	6.00	3.09	0.00	0.00	61.8	18.8	6.00	52.8
51	2981	D	2.00	0.16	0.00	0.00	67.1	19.0	2.00	44.9
52	2981	D	4.00	0.04	0.00	0.00	66.9	12.5	4.00	55.6
53	2981	D	6.00	0.00	0.00	0.00	67.0	8.9	6.00	50.5
54	W-O-M-DB	D	2.00	0.04	0.35	0.04	65.8	15.5	4.00	62.8
55	1813-V25	D	2.00	14.10	1.57	4.77	61.9	19.9	4.00	48.8
56	1813-V25	D	4.00	12.30	0.55	2.53	60.7	22.6	8.00	49.3
57	1813-V10	D	2.00	20.10	6.38	6.76	61.6	21.4	4.00	51.8
58	1813-V10	D	4.00	14.40	2.44	4.59	61.8	21.1	8.00	55.1
59	Manzate D	WP	2.00	0.00	0.04	0.00	70.1	13.0	4.00	65.7
60	Untreated check			31.07	17.19	11.44	57.1	23.4		57.8
LSD	(.05)			5.91	4.44	3.22	5.7	5.9		9.3

* Formulation code: D = dust; L = liquid; Sn = solution; WP = wettable powder

** See text

Table 4. Results of cooperative seed treatment trials (Series B)

Treatment no.	Product name	Formulation*	Dosage (oz/bu)	Smutted heads (%)**			Barley seedling blight**		Flax	
				Wheat	Oats	Barley	Emergence (%)	Disease rating (%)	Dosage (oz/bu)	Emergence (%)
61	Untreated check			29.06	13.25	11.04	60.1	22.0		64.5
62	TF15-69	D	2.00	0.00	0.46	0.00	65.8	15.8	4.00	66.0
63	TF16-69	D	2.00	0.00	0.72	0.00	65.8	18.8	4.00	70.5

Table 4. (Con't)

Treatment no.	Product name	Formulation*	Dosage (oz/bu)	Smutted heads (%)**			Barley seedling blight+*		Flax	
				Wheat	Oats	Barley	Emergence (%)	Disease rating (%)	Dosage (oz/bu)	Emergence (%)
64	TF17-69	D	2.00	0.00	0.39	0.08	68.1	19.9	4.00	73.9
65	TF20-69	D	2.00	23.25	16.35	15.63	57.1	26.5	4.00	57.8
66	TF21-69	D	2.00	0.00	0.00	0.04	56.5	33.0	4.00	56.1
67	TF22-69	D	2.00	0.06	0.89	0.00	65.4	16.7	4.00	68.3
68	TF23-69	D	2.00	0.18	1.19	0.26	70.4	14.9	4.00	69.7
69	Benlate	D	2.00	0.00	0.00	0.00	55.4	31.5	4.00	58.8
70	Benlate t	SL	2.00	0.00	0.00	0.00	56.6	25.4	4.00	66.8
	Arasan 70-S		1.00	0.00	0.00	0.00			2.00	
71	Benlate t	D	2.00	0.00	0.00	0.43	69.6	28.0	4.00	70.3
	Agrox NM		1.00						2.00	
72	Arasan 70-S	WP	1.00	0.26					4.00	70.0
			2.00		1.85	0.38	61.5	21.1		
73	Agrox NM	D	1.00	0.00					4.00	71.6
			2.00		0.96	0.04	68.4	18.0		
74	TN-702-50-3	L	8.00	0.00	0.00	0.00	60.7	12.0	8.00	37.4
75	TN-702-50-5	L	4.00	0.00	0.00	0.00	61.7	11.6	4.00	41.1
76	TN-702-50-6	L	4.00	0.06	0.00	0.00	66.8	16.1	4.00	43.9
77	TN-702-50-6	L	8.00	0.00	0.23	0.00	59.0	11.9	8.00	33.9
78	TN-702-50-7	L	8.00	0.04	0.00	0.16	61.1	20.7	8.00	38.9
79	TN-702-50-8	L	8.00	1.20	2.79	2.30	58.6	27.3	8.00	52.0
80	TN-702-50-9	D	2.00	0.94	5.69	2.95	54.5	24.6	4.00	62.3
81	TN-702-50-9	D	4.00	0.00	2.53	0.79	59.3	29.0	4.00	52.8
82	TN-702-50-11	L	8.00	0.04	0.00	0.08	52.4	7.7	8.00	26.3
83	TN-702-50-12	L	8.00	0.40	1.81	0.10	54.1	25.7	8.00	51.6
84	Vitavax 40S	L	3.80	0.00	0.00	0.00	78.7	21.1	3.80	62.7
85	Vitavax 100	D	3.60	0.08	0.00	0.00	84.0	15.9	6.00	70.9
86	Vitavax 101	D	4.00	0.00	0.00	0.00	81.3	10.0	4.00	68.9
87	Vitavax 101	D	8.00	0.00	0.00	0.00	78.1	9.2	8.00	73.7
88	Vitavax 200	D	3.50	0.00	0.00	0.00	83.1	14.9	3.50	72.7
89	Vitavax 201	D	4.50	0.00	0.00	0.00	80.4	11.1	4.50	66.3
90	Vitavax 201	D	9.00	0.00	0.00	0.00	80.4	11.2	9.00	69.9
91	Vitavax 300	D	4.00	0.00	0.00	0.00	79.3	12.2	4.00	75.3
92	78175	WP	2.00	0.59	3.58	3.52	55.9	23.6	4.00	52.9
93	78175	WP	4.00	0.14	1.70	3.05	57.9	26.2	8.00	55.6
94	5506	WP	1.00	0.35	0.23	0.08	64.7	20.5	2.00	61.0
95	5505	WP	2.00	0.21	0.00	0.00	60.8	72.0	4.00	21.3
96	Vitavax 75W	D	2.00	0.23	0.00	0.00	65.9	75.8	4.00	14.6
97	Res-Q Dual	D	1.25	0.00					5.00	23.8
			2.50		4.64	0.20	70.1	67.3		
98	Dithane 45	D	2.00	0.00	0.69	0.00	68.1	71.4	4.00	23.8
99	Mergamma NM	D	2.00	0.00	0.54	0.14	74.4	76.9	4.00	22.7
100	Untreated check			29.75	15.77	12.17	62.8	57.8		24.9
LSD	(.05)			3.48	4.19	1.91	8.3	4.8		

* Formulation code: D = dust; L = liquid; SL = slurry; WP = wettable powder

** See text

Among the better all-round treatments were Panogen 15B (mercurial), EP 371A (unidentified), Manzate D (80% maneb), and the Vitavax formulations that contained maneb and thiram. However, many other chemicals gave results that are not statistically different from the above ($P > 0.05$).

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