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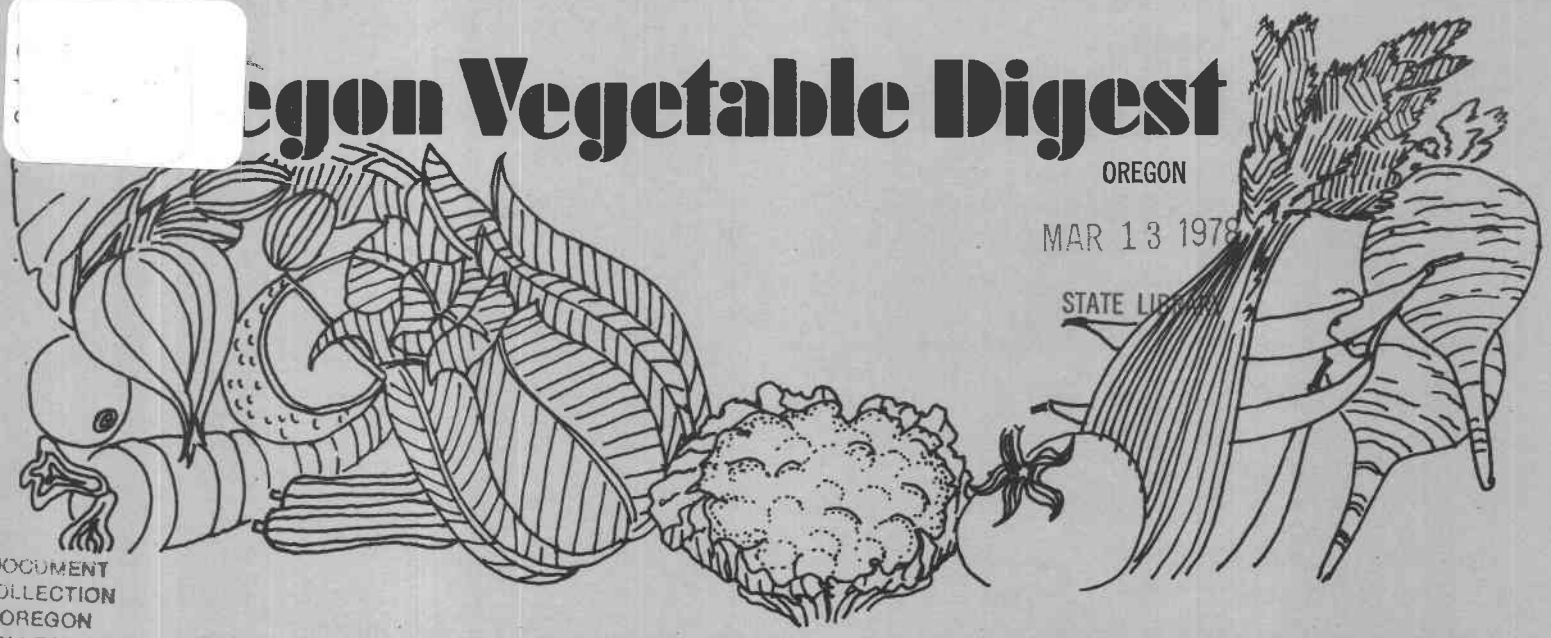

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Sweet corn tested for resistance to head smut in 1977

Sweet corn varieties were tested for resistance to head smut (Spacelotheca reiliana) at the Vegetable Research Farm, Oregon State University, near Corvallis. An increasing concern for this disease problem by the processing industry of western Oregon has prompted a change in emphasis from the horticultural evaluation of sweet corn hybrids to testing of both commercial hybrids and breeding lines for resistance. This evaluation, essentially as a service to commercial sweet corn breeders, could eventually result in a higher level of resistance in F_1 hybrid varieties available for production in the area.

In this issue . . .

The trials were planted on June 6 in an infested area where head smut tests had been established during two previous years. Each of the 59 entries from seed companies was planted in 2 plots, 20 feet long. The susceptible variety 'Sugar Daddy' was included as the control in 14 plots, scattered throughout the trial. Before planting, all seeds were thickly coated with smut spores, using a methylcellulose sticking agent. The spore coating was thoroughly dried. To improve the chances for infection, seeds were planted in individual hills covered first with a handful of vermiculite carrying smut spores, then with about 1 inch of soil. The inoculum was prepared by lightly moistening the vermiculite (until it was dust-free), then mixing in about 1 cup of dry spores to each 1-1½ gallon of vermiculite. One or two plants were left in each hill, resulting in up to 40 plants in each plot. Stand was variable, however, and many plots contained less than 20 plants.

Data were obtained when infection had reached maximum, in early September, when most varieties were at or near maturity. Any plant with definite evidence of head smut, ranging from full sporulation in ears or tassels to a few affected

kernels in a small immature ear, were counted as infected (Table 1).

Infection in the 14 plots of 'Sugar Daddy' averaged 95%, indicating the level of infection pressure applied against the test varieties was good. 'Jubilee', which may have as much as 20-30% infection in severely infected commercial fields, averaged 48% in this trial. Levels of susceptibility were well differentiated, with several varieties totally uninfected. Variations in results between the two plots of some varieties indicated environmental effects, possibly moisture variation, which must be considered in interpreting results. For most varieties, the two replications were either very close in percent infection, or at least clearly in the same range.

Inoculation Experiments

In a non-infested area adjacent to the variety resistance trials, several methods or combinations of methods of inoculation were tried for possible future use. Using susceptible varieties 'Sugar Daddy', 'Sundance', and 'Tokay Sugar', and resistant 'Gold Cup', the tests listed on Table 2 were established. The most important objective was to determine if the vermiculite-spore mix applied with the seed in a V-belt planter would result in adequate infection, and additionally if the spore coating on the seed resulted in increased infection when used alone or in combination with spores in vermiculite. When the belt of the planter was filled with 1 pint of vermiculite and used in 25 feet of row, about 100% infection of 'Sugar Daddy' resulted, with slightly less in the case of 'Sundance' and nearly 50% in 'Tokay Sugar'. Addition of spores on the seed did not improve this result though spore-coated seeds alone resulted in a useful level of infection in these three varieties (Table 2).

An additional method was tried on a limited scale. Pouring about one cup of water containing spores (Table 2 footnote) over emerging seedlings gave results similar to those from vermiculite on the V-belt planter.

The variety 'Gold Cup' essentially was uninfected in all of the inoculation treatments.

Variations in infection, between sections of the field, were found when the inoculation experiments were being observed. It was apparent that a higher percent of infection was associated with smaller plants, and this was possibly related to variations in the patterns of irrigation. Unnecessary irrigation was avoided from the time of planting because of previous indications that excess soil moisture, especially during the initial infection period of the young seedlings, may reduce head smut incidence.

Summary

The tests made in 1977 indicate it is possible to differentiate between wide levels of susceptibility in sweet corn varieties and breeding lines, using infected soils supplemented by various methods of inoculation. Use of a V-belt planter to apply a vermiculite-spore mixture with the seeds, appears to have promise as a convenient method of inoculating large scale test plots.

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Sources of the varieties listed in Table 1 are as follows:

1. Crookham Company
2. Asgrow Seed Co.
3. Northrup King & Co.
4. FMC Corporation
5. Keystone Seeds
6. Charter Research
7. Rogers Brothers Seed Co.
8. Joseph Harris Co.

Table 1. Head smut infection of commercial sweet corn hybrids and breeding lines, Corvallis, Oregon, 1977.

Code	Variety or Type[1]	Source	Rep.1 number infect	Rep.1 number total	Rep.1 % infect	Rep.2 number infect	Rep.2 number total	Rep.2 % infect	Aver. % infect
1	Br. line 1	1	7	31	23	4	24	17	20
2	Br. line 2	1	16	21	76	5	13	38	57
3	Br. line 3	1	2	20	10	7	24	29	20
4	Br. line 4	1	2	22	9	1	11	9	9
5	Br. line 5	1	21	38	55	7	20	35	45
6	Br. line 6	1	12	41	29	9	28	32	31
7	Br. line 7	1	1	38	3	1	30	3	3
8	Br. line 8	1	1	38	3	3	42	7	5
9	Br. line 9	1	2	15	13	4	31	13	13
10	Br. line 10	1	2	22	9	2	11	18	14
11	Salute	2	12	29	41	7	26	27	34
12	XP 2500	2	16	37	43	9	30	30	37
13	Commander	2	6	20	30	5	27	18	24
14	NK 4625	3	4	31	13	3	34	9	11
15	NK 4627	3	5	32	16	4	32	12	14
16	NK 4633	3	0	35	0	0	33	0	0
17	NK 4637	3	0	43	0	0	22	0	0
18	NK 4644	3	7	30	23	8	35	23	23
19	Reliance	3	2	38	5	3	22	14	10
20	Sugarloaf	3	0	39	0	2	24	8	4
21	Hallmark	3	7	36	19	5	33	15	17
22	XP 3256	3	2	33	6	1	19	5	6
23	XP 2583	3	0	37	0	1	28	4	2
24	NCX 2019	4	5	28	18	4	27	15	16
25	NCX 2015	4	12	32	38	12	31	38	38
26	NCX 2020	4	1	37	3	5	30	17	10
27	Candyman	5	8	18	44	4	15	27	36
28	Exp. Hyb. 7597	5	8	37	22	2	25	8	10
29	H 75201-38 EH	6	6	40	15	7	40	18	16
30	H 75300	6	10	33	30	14	23	61	46
31	H 75201-54 EH	6	9	35	26	8	39	20	23
32	72-1683	7	7	39	18	6	27	22	20
33	69-1689	7	7	29	24	18	34	53	38

Code	Variety or Type[1]	Source	Rep 1 number infect	Rep 1 number total	Rep 1 % infect	Rep 2 number infect	Rep 2 number total	Rep 2 % infect	Avg. % infect
34	75-1719	7	11	38	29	1	32	3	16
35	73-1748	7	12	32	38	4	33	12	25
36	74-1763	7	9	31	29	3	30	10	20
37	75-1766	7	5	34	15	7	36	19	17
38	75-2016	7	6	34	18	4	28	14	16
39	75-2084	7	12	41	29	11	34	32	30
40	72-2093	7	4	39	10	7	24	29	20
41	75-2191	7	5	37	14	17	36	47	30
42	75-2294	7	5	29	17	6	36	17	17
43	75-2610	7	12	31	39	10	27	37	38
44	74-3044	7	8	27	30	7	31	23	26
45	74-3045	7	12	22	55	19	36	53	54
46	Jubilee	7	6	13	46	17	35	49	48
47	Patriot	7	6	39	15	3	35	9	12
48	Pageant	7	7	24	29	3	28	11	20
49	Fanfare	7	4	5	80	15	28	54	71
50	Exp. Hyb. W9315	8	11	36	31	18	27	67	49
51	Hyb. 1101-777 T	8	5	21	24	11	29	38	31
52	Exp. Hyb. W7015	8	8	33	24	7	30	23	24
53	Exp. Hyb. W9625	8	13	40	32	8	26	31	32
54	Exp. Hyb. EB 895	8	25	36	69	14	28	50	60
55	Exp. Hyb. WH 1235	8	0	8	0	2	29	7	4
56	Exp. Hyb. YW 1865	8	0	18	0	0	33	0	0
57	Bellringer	8	10	18	56	10	32	31	44
58	Sweet Sue	8	2	14	14	5	22	23	18
59	Exp. Hyb. WH-106	8	0	16	0	3	30	10	5
--	Sugar Daddy		29	31	94	16	16	100	
--	" "		29	37	78	29	31	94	
--	" "		39	40	98	24	26	92	
--	" "		24	25	96	30	30	100	
--	" "		26	27	96	21	21	100	
--	" "		28	29	97	28	29	97	
			23	23	100	31	34	91	

[1]Entries 42-49 were extra lines and were grown beyond the main infected area; infection in this area, with inoculation, was equal to that in the main area. Sugar Daddy plots were scattered through the entire test area.

Table 2. Head smut infection in sweet corn varieties as affected by inoculation treatments, Corvallis, Oregon, 1977.[1]

Treatment	Sugar Daddy			Sundance			Tokay Sugar			Gold Cup		
	Infect	Total	%	Infect	Total	%	Infect	Total	%	Infect	Total	%
1. Seed coated with spores[2]	21	76	28	94	199	47	72	146	49	1	75	1
2. Spores coated on seed and in vermiculite[3]	65	65	100	61	73	84	32	74	43	0	67	0
3. Clean seed, spores in vermiculite	66	67	98	52	64	81	28	60	47	2	83	2
4. Clean seed - control[4]	6	29	21	13	38	34	8	28	29	2	36	6
5. Clean seed, spores in water[5]	9	9	100	7	9	78	2	12	17	1	11	9
6. Spores coated on seed and in water[5]				12	12	100	3	11	27			
7. Spores coated on seed and in vermiculite in hills[6]				25	29	86						
8. Clean seed, spores in vermiculite in hills				25	27	93						
9. Spore coated seed; adjacent control for treatments 7 and 8				24	49	49						

[a] Plots in an area not previously infected, but adjacent to the infected area.

[b] Seed heavily encrusted with spores in a methyl-cellulose binding agent.

[c] About 1 cup of spores 1 gallon of vermiculite, applied with the seed in V-belt planter at about 1 pint per 25 ft of row.

[d] Infections of control could have been from drift infestation of the area or from contamination of seed by V-belt planter

[e] Approx. 2 quarts of spores in 30 gallons of water; ½ cup per plant poured over seedling at emergence of coleoptile.

[f] Seed in planting hole covered with one handful of spore-vermiculite mix, then with about 1 inch of soil.

Beet varieties differ in resistance to powdery mildew, rust, and leafspot diseases

Varietal differences in susceptibility to powdery mildew were noted in a small group of beet varieties in 1975. A larger collection of types and varieties were thus obtained for observation in 1977. Powdery mildew of beets, caused by Erysiphe polygoni, first became prevalent in western Oregon about 1975, and is especially of concern in sugar beets grown for seed.

Mildew overwintering on sugar beet seed crops could be a source of early infection on table beets. Although this possibility has been lessened by the use of sulfur dusts or sprays by sugar beet growers, infection occurred in table beets again in September 1977. Beet growers, seedsmen, and breeders maybe interested in knowing varietal differences in susceptibility.

Of the other diseases observed, beet rust (Uromyces betae) and Alternaria (Alternaria tenuis) occur commonly on table beets in the area and appear to do appreciable damage to the foliage. Ramularia leaf spot (Ramularia beticola) is considered to be a minor leaf spot disease, although in this trial certain varieties were severely affected.

The variety collection included all table beet varieties listed in seed catalogs available in the United States, and a number of varieties from Europe. Since sugar beets, mangels, and Swiss chard are also beets (Beta vulgaris) botanically, some varieties of these forms were included.

Each variety was grown in a 15-20 ft. plot on the Vegetable Research Farm with a preplant band application of 600 lbs/acre of 8-24-8 fertilizer and adequate water to induce good growth. Planting was in late June.

The late appearance of powdery mildew in the planting possibly was related to the late planting date. Infections were scored on October 12 on a 0 to 5 scale, where 0 = no mildew, 1 = a trace, and 5 = very severe infection with plants totally covered. As might be expected, because beets are cross pollinated and sometimes variable, some varieties were variable for susceptibility to all four diseases as indicated by the footnote notation in the table.

A range of susceptibility was noted for each disease. In most cases varieties resistant to one disease were susceptible to one or more others. Some, such as red beet 'Fire Chief' and chard 'Ruby', had good to fair resistance to all four diseases. Both commercial strains of 'Detroit Dark Red' were highly susceptible to powdery mildew and Alternaria, and one strain was heavily infected with rust. 'Detroit Dark Red' is the most important processing variety in western Oregon.

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Snap bean seed performance evaluated

Snap bean seeds from a nitrogen fertilizer--row spacing experiment at the O.S.U. Vegetable Research Farm were harvested in 1976 and performance was evaluated under uniform culture in field plots during 1977. Results of green pod yields in 1976 from these plots were reported earlier in the July, 1977 issue of Oregon Vegetable Digest. Row spacings in 1976 were 12 and 36 inches and nitrogen rates were 50, 100, 150 and 200 pounds N per acre.

Data in Table 1 show a slight but non-significant increase in seed yield of Oregon 1604 in 1976 when nitrogen rates were increased to 200 pounds per acre. A significantly higher yield of seed was obtained from 12-inch rows than from 36-inch rows (90 percent increase). Seeds were separated into six sizes by use of screens with oblong openings of 3/4-inch length and widths of 9/64, 10/64, 11/64, 12/64, 13/64, and 14/64 inches. Size distribution of seed by weight was similar

(Cont. on page 9)

Table 1. Susceptibility of beet varieties to powdery mildew, rust, Alternaria, and Ramularia leaf spot.

Variety	Source[a]	Disease incidence score[b]			
		mildew	rust	Alternaria	Ramularia
Red Table Beets					
Fire Chief	1	0	2	2	T
Little Ball	2	3	2	2	4
Detroit Dark Red	3	4	3-5	4	2
Redpack	3	0	5	3	1
Asgrow Wonder	3	5	T	3	1
Greentop Bunching	1	0-1	3	2	1
Crosby's Egyptian	4	0-2	1	3	1
Ruby Queen	5	0-4	3	3	2
Stokes Special Early	4	4	2	3	2
Burgundy King	6	0-1	3	3	3
Detroit Dark Red Ferry's	7	5	1	4	2
Vermillion	4	0-2	4	2	1
Cylinder Long Red	6	0-2	2	2	2
Little Egypt	4	2	1	1	2
Early Red Ball	4	2	1	2	2
Spring Red	4	4	2	3	3
Early Blood Turnip	8	3	2	2	3
Gracia	9	1	2	3	1
Bikores	9	0-2	3	3	1
Tendersweet	10	0	4	3	1
Globe	11	0-2	4	3	2
Early Bunch	11	2	2	3	2
Dwergina	9	0-1	3	2	1
Early Wonder	10	4	3	4	3
Honey Red	12	2	5	4	2
Rebolta	9	0-3	1	3	3
Bikor	9	1	4	3	4
Ruby Queen	13	1	1	4	2
Early Wonder Staysgreen	13	3	3	4	3
Red Cross	6	0	1	3	2
Burpee's Red Ball	14	0-2	4	3	2
Spinel	15	2	3	3	1
Formanova	16	0-1	5	3	3
Crosby's Egyptian Redhart	14	3	2	4	3
Regala	9	0-1	2	2	1
New Globe	2	0-2	3	2	1
Sugar Beets or Misc. Beets					
Lutz Green leaf	14	0-2	3	3	2
Klein Warzleben	8	4	1	1	4
Yellow Eckendorf	6	0-4	2	2	1
Swiss Chard					
Common Green	17	0-2	T	2	2
White King	4	3	0	2	4
Ruby	1	0-3	1	1	2
Lucullus	6	0-3	1	2	1
Perpetual	14	3	0	2	2
Fordhook Giant	1	2-3	T	T	5

[a] Sources of varieties: 1 - Seedway; 2 - Sluis and Groot; 3 - Asgrow; 4 - Stokes; 5 - FMC Seeds; 6 - Dessert; 7 - Ferry Morse; 8 - Farmers; 9 - Beemsterboer; 10 - Burgess; 11 - Suttons; 12 - Agway; 13 - Twilley; 14 - Burpee; 15 - Herbst; 16 - Park; 17 - Takii.

[b] Scores 0-5 with 0=no infection to 5=severe and T=trace. For mildew a range is often shown, i.e., 0-4, where the underlined number was the predominant infection class.

Table 2. Horticultural notes on beet varieties (score 1-5, with 5 best)

Variety	Overall Score	Notes
Red Table Beets		
Fire Chief	4	short top, shape uneven
New Globe	2	variable size
Little Ball	3	bright red, rough shoulder
Detroit Dark Red	3	top-shaped, variable crowns, tops weak
Redpack	4	vigorous top, smooth, fair color
Asgrow Wonder	1	flat top, bad color, uneven color, heart shape, rough shoulder
Greentop Bunching	1	broad top, heart shape, poor color
Crosby's Egyptian	1	medium flat, zones, strong top
Ruby Queen	4	variable crown, good color, good shape & shoulders, smooth
Stokes Special Early	1	zones, flat, vigorous tip, poor color
Burgundy King	3	too flat, very good color, large crown, good top growth
Detroit Dark Red Ferry's	3	weak top, good color
Vermillion	2	slightly flat, smooth, big crown
Cylinder Long Red	3	bright color
Little Egypt	1-	flat, knobby, zones
Early Red Ball	2	good top, uneven color, uniform shape, zones
Spring Red	4	variable shape, dark color, medium top, crowns ok
Early Blood Turnip	1	zones, strong top, flat
Gracia	2	bright color, small crown, zones, variable size and shape
Bikores	2	heart-shape, slab sides, some large crowns, good color
Tendersweet	3	good color, good top
Globe	1	heart shape, uneven shape, angular, poor color
Early Bunch	2	fair color, medium top
Dwergina	2	fair color, bright red, medium top
Early Wonder	2	angular, top-shaped to flat
Honey Red	4	dark color, some zones, vigorous top, smooth shape, good crowns
Rebolta	3	corky crown, bright color, uniform shape good
Bikor	2	angular sides, good color, poor shape
Ruby Queen	4	uniform, globe shape, bright red, smooth variable crowns
Early Wonder Staysqueen	1	large crown, flat, vigorous top
Red Cross	2	dark zones, flat, large crowns
Burpee's Red Ball	3	med. color, small crown, variable shape
Spinel	2	zones, vigorous top, color variable, deep angular root
Formanova	4	good color, smooth shoulder, poor zones, small crown
Crosby's Egyptian Redhart	1	bad zones, large crowns, vigorous top
Regala	3	smooth shoulders, small crown

for row spacing and nitrogen treatments, and averaged as follows for the six respective sizes shown above: 9/64 - 2%, 10/64 - 3%, 11/64 - 19%, 12/64 - 28%, 13/64 - 39%, and 14/64 - 9%. Weights per 1000 seeds for the 10, 11, 12, and 13/64 inch sizes were about 180, 228,266, 300 grams respectively, equivalent to about 2500, 1990, 1715, and 1515 seeds per pound.

Seeds from selected treatments were analyzed for mineral content and results are shown in Table 2. No marked differences due to treatments appeared, but there was a higher nitrogen content of seeds at the highest nitrogen fertilizer rate with a slightly lower phosphorus content. Other slight differences in composition also were found.

Samples of 100 seeds from each treatment were planted on June 15, 1977 in single row plots, 12 feet in length. Row spacing was 36 inches. Plots received uniform fertilizer & irrigation. The 32 treatments were replicated four times. Stand counts were recorded for each plot on June 24. Ten plants were taken at random from each plot and fresh weight obtained on July 13 (sample 1) when the third trifoliate leaf was beginning to expand, and on August 1 (sample 2), about five or six days after first bloom. Only two replications were harvested for pod yield on August 17.

A summary of effects of 1976 treatments on seed performance in 1977 is presented in Table 3. Row spacing treatments in 1976 did not affect seed performance. Nitrogen rates affected stand because of a trend for higher stands from seeds receiving higher nitrogen rates. Yield in 1977 was not significantly affected by seed produced at different nitrogen rates in 1976. Seed size did not affect stands, but larger seed produced larger plants and higher yields than smaller seed. No comparisons were made between these four seed sizes and samples of unsized seed. A study of this aspect is needed to better assess the value of seed sizing and performance. No significant interactions were obtained.

These results indicate a potential for higher yields of seed from narrow row plantings. Seed performance was comparable to seed produced in wider rows. Snap bean seed production in the Willamette Valley would be limited by climate and potential disease problems, but it was not the intent of this study to evaluate these factors. Earlier studies by Dr. Grabe of the Crop Science Department were also related to bean seed quality factors (Proc. Ore. Hort. Soc. 66:34-37. 1975)

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Table 1. Effects of nitrogen fertilizer and row spacing on yield (lbs/A) of Oregon 1604 bush bean seed. Corvallis, 1976.

N rates lbs/A	Row spacing 12-inch	36-inch	N rate avg.
50	2255	1101	1678
100	2364	1198	1781
150	2317	1210	1764
200	2410	1401	1906
Row spacing avg.	2336	1228	

Table 2. Effects of nitrogen fertilizer and row spacing on chemical composition of Oregon 1604 bush bean seed. Corvallis, 1976.

Row spacing inches	Nitrogen rate lbs/A	Seed size inches	Percent					ppm				
			N	P	K	Ca	Mg	Mn	Cu	B	Zn	Fe
12	50	10/64	3.69	.56	1.46	.15	.13	24	13	12	57	107
	200	10/64	4.11	.54	1.54	.16	.15	20	13	15	58	102
	50	13/64	3.91	.70	1.33	.13	.19	23	19	15	63	142
	200	13/64	3.94	.52	1.34	.11	.13	23	15	11	56	95
36	50	10/64	3.74	.62	1.41	.19	.16	19	15	14	60	126
	200	10/64	4.17	.54	1.44	.19	.17	18	14	15	61	107
	50	13/64	3.49	.55	1.34	.15	.15	17	15	12	56	106
	200	13/64	4.17	.55	1.21	.12	.17	20	14	11	56	101
Avg.	12-inch rows		3.91	.58	1.42	.14	.15	22	15	13	58	112
	36-inch rows		3.89	.56	1.35	.16	.16	18	14	13	58	110
	50 lbs N/A		3.71	.61	1.38	.16	.16	21	15	13	59	120
	200 lbs N/A		4.10	.54	1.38	.14	.16	20	14	13	58	101
	10/64		3.93	.56	1.46	.17	.15	20	14	14	59	110
	13/64		3.88	.58	1.30	.13	.16	21	16	12	58	111

Table 3. Effects of nitrogen and row spacing treatments in 1976 and seed size on seed performance in 1977 of Oregon 1604 snap beans, Corvallis.

Treatment avg.	No. plants/plot	Fresh wt-gms/plant Sample 1	Fresh wt-gms/plant Sample 2	Yield T/A
Nitrogen rate (lbs/A)				
50	72	16.2	102.7	7.4
100	78	15.4	93.8	6.6
150	78	15.5	98.8	6.9
200	81	15.3	91.2	7.0
LSD .05	4	NSD	7.2	NSD
.01	5	NSD	9.5	NSD
Row spacing				
12 inches	78	15.8	98.3	7.2
36 inches	78	15.4	95.1	6.8
No significant difference between treatment means				
Seed thickness (inches)				
10/64	76	14.1	91.6	6.7
11/64	79	15.4	95.5	6.6
12/64	78	15.8	98.1	7.5
13/64	76	17.1	101.3	7.1
LSD .05	NSD	0.9	NSD	0.6
.01	NSD	1.2	NSD	NSD

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