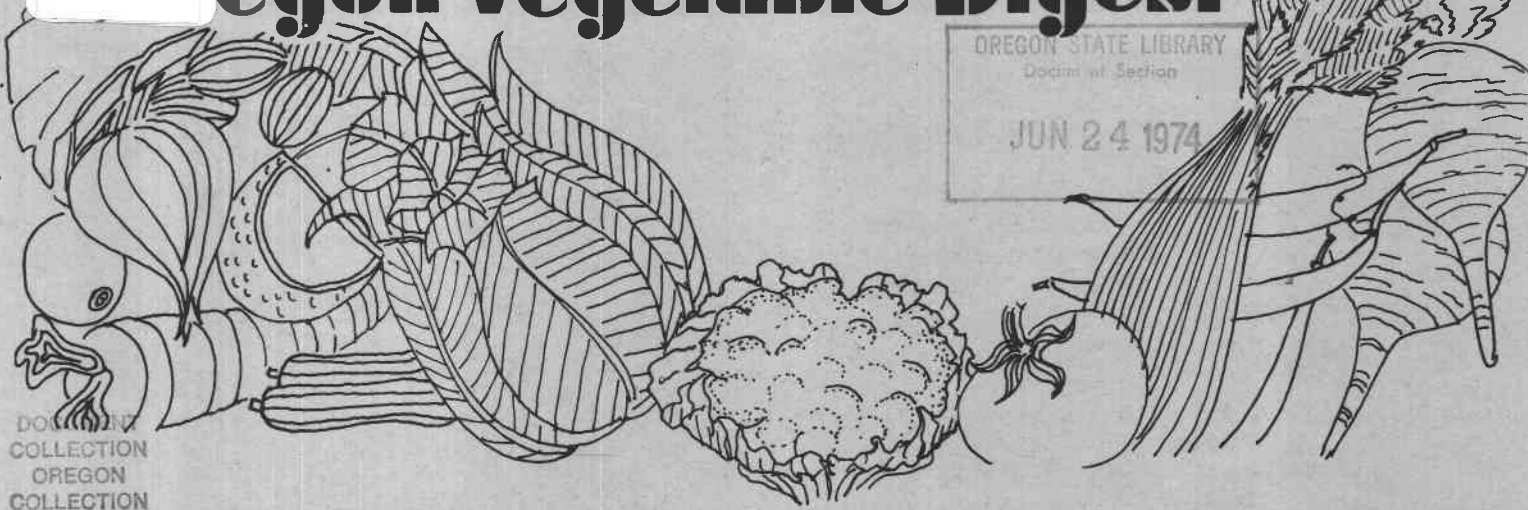
Oregon Vegetable Digest



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LIME: Response in spinach and other vegetables

An experiment was established at the North Willamette Experiment Station to determine the effect of soil-applied lime on nutrition and yield of certain vegetable crops. The lime treatments had been established in April, 1969, with applications of 0, 4, and 8 tons per acre. Three replications were established for all lime treatments with four replications on the lime check plot. Soil analyses for these treatments in March, 1973, are reported in Table 1.

Table 1. Effect of lime treatments on chemical analyses of soil samples

Rate of Lime T/A	pH	meg/100g Ca	Mg	SMP
0	5.8	5.7	1.3	6.2
4	6.3	9.3	1.3	6.6
8	6.6	12.5	1.2	6.8

Table beets, spinach, rutabagas, turnips, and radishes were planted on April 25, 1973. Seventy pounds of nitrogen per acre as ammonium nitrate were applied to all crops except spinach where the nitrogen rate was increased to 140 pounds per acre. All fertilizer treatments were broadcast and incorporated before planting. Sprinkler irrigation was applied as needed. Individual plots were 20 feet long with the center 12 feet being harvested for data.

Chemical analyses of leaf samples were conducted by the Department of Soil Science. Samples of the largest leaves were taken when roots of radishes, beets, rutabagas, and turnips were 0.75 inches in diameter. The most recently matured spinach leaves were sampled 6 weeks after emergence. Harvest dates for yield were as follows: radishes, May 30; spinach, June 12; turnips, July 26; rutabagas, July 30; and beets, August 17.

Lime treatments increased yields of spinach and beets, with most of the yield increase from the first 4 tons of lime per acre (Table 2). Manganese levels were 204 and 328 ppm for spinach and beets respectively on the zero lime plots. Application of 4 tons of lime per acre reduced the manganese content below 80 ppm on both crops (Table 3). This is below the toxic levels of manganese reported for these crops.

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Table 2. Effect of lime on mean yields of vegetable crops

Treatment*	Table Beets		Spinach		Rutabaga		Turnip		Radish	
	lbs roots and tops	lbs roots only	No. of plants	Wght. grams	No. of roots	lbs roots and tops	No. of roots	lbs roots	No. of roots	No. of mktable lbs
L_0	15.2	9.7	28	197	48	8.0	65	9.0	128	2.7
L_4	20.1	13.6	28	804	51	8.8	64	8.5	126	2.2
L_8	19.6	12.8	28	820	56	9.3	61	11.41	133	2.4

*All plots received optimum applications of nitrogen, phosphorus and sulfur.

Lime application also reduced the zinc content of beet and spinach leaves but the reduction was not enough to approach zinc deficiency.

The response from application of lime was variable on the other crops. It apparently was not associated with high levels of manganese since the radish was the only one of these three crops with manganese levels above 100 ppm in leaf samples.

The effects of lime application on leaf phosphorus and calcium were different with spinach and beets, the two crops showing possible manganese toxicity, than with the other crops. On both beets and spinach, lime reduced the manganese content and increased the phosphorus content. This is expected and is often associated with reduction of manganese toxicity. There was very little effect of lime on phosphorus content of turnips, rutabagas and radishes; this would be expected where manganese levels were not high enough to cause toxicity and where phosphorus levels in the soil are relatively high.

Table 3. Chemical analyses of leaf samples with different rates of lime

Crop	Treatment	Percent				PPM	
		Ca	Mg	P	K	Zn	Mn
Table Beets	L_0	2.04	1.24	0.51	6.91	71	328
	L_4	1.77	0.93	0.63	7.08	57	78
	L_8	2.19	0.95	0.65	6.75	45	71
Spinach	L_0	1.95	1.17	0.46	6.30	164	204
	L_4	1.82	1.08	0.67	7.80	137	70
	L_8	2.08	0.94	0.68	7.62	113	63
Rutabaga	L_0	2.18	0.28	0.53	5.11	34	70
	L_4	2.45	0.25	0.52	5.78	31	42
	L_8	2.28	0.22	0.58	4.70	32	42
Turnips	L_0	2.18	0.30	0.61	4.28	37	81
	L_4	2.51	0.29	0.62	4.43	32	53
	L_8	2.43	0.26	0.67	4.45	34	47
Radish	L_0	3.09	0.40	0.41	3.14	35	117
	L_4	3.39	0.34	0.42	3.40	33	72
	L_8	3.46	0.30	0.41	2.93	32	78

The reduction of calcium content in spinach and beets with the first 4 tons of lime applied may be explained as a dilution effect from increased yield of plant material. This explanation is supported by the increase in calcium content from the 8 ton lime application. Such effects are frequently observed when the first increment of a fertilizer treatment is associated with large increases in yield.

The effect of lime on calcium content of rutabaga, turnip, and radish leaves did not show any indication of dilution. The first increment of lime increased leaf calcium for these three crops but had only slight effect on phosphorus content.

Soil acidity in the Willamette Valley is an increasing problem with cropping and use of acid-forming nitrogen fertilizer.

It is important to recognize the wide difference in response from lime expected from different crops. These differences are associated with:

1. Marked differences in tolerance to manganese and the effect of lime application on reduction in manganese uptake.
2. Possible increased phosphorus uptake; this could be associated with manganese toxicity, which reduces phosphorus uptake, or increases microbial activity after liming which increases phosphorus released from the soil. This increased microbial activity could also increase availability of soil nitrogen.
3. Application of lime will usually decrease zinc uptake and could cause deficiency on those crops growing on soils that are relatively low in zinc and susceptible to zinc deficiency.

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Tomato varieties tested

In 1973, 13 tomato varieties were tested at the North Willamette Experiment Station for their adaptability to the northern Willamette Valley. Seed was planted in the greenhouse in early April and field-transplanted on May 15. Prior to transplanting, 500 lbs/A 10-20-10 fertilizer was broadcast and incorporated during the bed-shaping operation. The area was listed in October and rough ridges left over winter. Prepared with a Marvin Landplane Row-Master, beds were 6 inches high with tops 22 inches wide and 40 inches between bed centers.

One bed was covered with black polyethylene plastic (1.5 mil x 48"). Three plants of each variety were set 4 feet apart on bed centers. For irrigation, a porous wall tube ("Viaflo" by DuPont) was placed on the bed surface near the plants. Tubing was placed beneath the plastic mulch. A hole cut in the mulch permitted plants to be set.

Plants were tied to a trellis of woven wire fencing 42 inches high which was installed soon after planting.

Earliest tomatoes were from unmulched plants, but yield of marketable fruit from mulched plants was increased by an average of 114 percent over that of unmulched plants (Table 1). In addition, plastic mulch also increased fruit size an average of 13 percent, saved one irrigation, and prevented weed growth.

'Springset' and 'New Yorker' were the earliest maturing varieties. Approximately 50 percent of their total crop from plastic-mulched rows had been harvested by September 4. 'Springset' also produced the highest yield (50.8 tons/A). Quality based on smoothness, color, uniformity of shape and flavor was acceptable for all varieties except 'Delicious'. No difference between varieties was observed relative to fruit cracking, since little rain occurred during the harvest season and water requirements were met using trickle irrigation, which applied water directly on the soil surface.

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Table 1. Yield data and fruit size of tomato varieties

	Percent of total crop on picking date												Total marketable yield - T/A			Fruit size - oz.		
	8-8		8-13		8-22		9-4		9-12		9-20				Percent increase from plastic			Percent increase from plastic
Variety	P*	N**	P	N	P	N	P	N	P	N	P	N	P	N		P	N	
New Yorker		4			11	20	49	29	27	13	12	33	35.2	15.0	135	3.9	4.6	-15
Rushmore					4	10	15	20	54	49	27	19	33.8	20.6	64	8.4	6.7	+25
Jet Star				2		10	12	14	23	33	64	39	31.1	14.6	113	8.8	6.2	+40
Sunup						8	39	30	33	35	18	26	46.0	19.1	141	5.7	4.8	+19
Supersonic						7	11	23	32	20	57	49	29.7	14.1	111	8.5	6.6	+29
Heinz 1350						3	45	30	38	29	29	38	43.9	25.5	72	6.0	6.0	0
Springset		6		6	12	9	54	46	23	18	10	14	50.8	24.1	111	5.5	5.0	+10
Willamette						7	28	24	41	51	30	16	43.2	24.3	129	5.6	4.7	+19
Patio						5	14	21	32	25	54	50	31.1	13.3	134	4.3	3.9	+10
Fantastic				8	3	13	27	48	41	21	31	13	45.4	20.4	123	7.9	5.9	+34
Small Fry		3	4	3	11	12	45	43	27	23	13	16	37.8	12.9	193	0.3	0.4	-25
Delicious							7		9	14	83	86	7.5	4.4	70	14.6	12.8	+14
Castle							9	8	32	54	59	39	36.8	19.2	92	7.6	7.4	+ 3
														Average	114		Average	13

*P = Plastic
**N = No plastic

Spacing affects sweet corn yield

Six varieties of sweet corn were grown in 36-inch rows with plant spacings of 6 and 9 inches, giving populations of 29,055 and 19,340 plants/A. Varieties were: 'Charter 560', 'Goldie' (Northrup King), 'Jubilee' (Rogers), 'Niagara 2004', 'Rogers 2428', and 'Stylepak' (Ferry Morse). Fertilizer was banded at planting on May 26 to supply about 50 lbs N, 150 lbs P_2O_5, and 50 lbs K_2O per acre. Nitrogen fertilizer was sidedressed when plants were about 3 feet high to provide an additional 100 lbs N/A. Sprinkler irrigation was applied at 10- to 15-day intervals. Harvest was during September 10-14 and moisture content of kernels ranged from 74 to 79 percent.

There was a consistent increase in total yield of husked acceptable ears from the 6-inch spacing compared to the 9-inch spacing (Table 1). This increase averaged 19 percent for all varieties and was statistically significant. Weight of ears was reduced about 5 percent at the higher population. Varieties cannot be precisely ranked for yield since there was a difference in kernel moisture at harvest. However, if all varieties were adjusted to a 74 percent moisture level, the following ranking is obtained: 'Jubilee', '560', '2004', '2428', 'Stylepak', and 'Goldie'. Number of acceptable ears per plant was higher at the 9-inch spacing than at 6 inches. Percent cut-off was about the same at the two spacings. There was considerably more lodging of stalks for 'Goldie' than for other varieties.

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Table 1. Effect of within-row spacing on six varieties of sweet corn. Corvallis, 1973

Variety	Spacing	Yield[1]	Ear wt[1]	Accept. ears/plt	Cut-off[2]
	in.	T/A	lbs	no.	%
Jubilee	6	9.3	.61	1.04	60
	9	8.3	.62	1.34	59
Goldie	6	8.2	.61	0.92	55
	9	6.4	.62	1.05	56
C 560	6	9.4	.66	0.99	59
	9	8.4	.68	1.25	61
R 2428	6	9.4	.62	1.05	61
	9	8.1	.64	1.27	62
N 2004	6	9.3	.64	1.01	59
	9	7.7	.68	1.16	60
Stylepak	6	7.7	.60	0.89	58
	9	6.0	.66	0.92	58

[1] Husked, acceptable ears.
[2] Sample of 50 ears, non-replicated; cut-off expressed as percent of husked ear weight.

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