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REPORTS TO

AGRICULTURAL RESEARCH FOUNDATION

FOR THE

OREGON PROCESSED VEGETABLE COMMISSION

Submitted to the

Oregon Processed Vegetable Commission

By the Agricultural Research Foundation

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BEETS & CARROTS

VEGETABLE CROP RESEARCH

Report to the Oregon Processed Vegetable Commission
1995-1996

1. Title: Green Bean Breeding

2. Project Leaders: J. R. Baggett, Horticulture
Brian Yorgey, Food Science and Technology

   Cooperator: D. Mok

3. Project Status: Terminating June 30, 1996

4. Project Funding: $64,000 breeding
$10,560 processing

   Breeding funds were used for a major portion of the support of two vegetable breeding technicians, student labor, supplies, and research farm expenses. Processing funds were used for processing samples of experimental beans, laboratory analysis, and panel evaluations.

5. Objectives: Breed bush green beans for the western Oregon processing industry with:

   A. Improved potential for high yields at favorable sieve sizes and dependability
   B. Improved straightness, texture, and other quality factors
   C. Develop easy picking and small pod strains of Blue Lake type
   D. Resistance to white mold and root rot

6. Report of Progress:

Bean breeding lines and commercial introductions were tested in replicated yield trials planted April 26, May 16, May 30, June 22, and June 30. The April 26 and May 30 plantings included eight advanced lines or varieties; the May 16 and June 22 plantings included 22 lines and varieties; and the June 30 planting included seven OSU lines and 'Minuette' (Harris-Moran) at 36- and 18-inch row spacings. Plots were either one or two rows 20' long, replicated four times. Several 5-foot sections were harvested from each plot, usually at two-day intervals. Samples were canned and frozen at Food Science and Technology. They will be evaluated in February by industry representatives. Processed quality data will be published in a separate report.

Commercial varieties tested in 1995 included the small-sieve (baby bean) variety 'Minuette' (Harris-Moran), and medium-pod-size ('Slenderette'-type) varieties 'Maxima' (Rogers), 'Matador' (Asgrow), 'Banquet' (Asgrow), and HMS 2974 (Harris-Moran).

Data obtained from the replicated trials are summarized in Tables 1-10 and Figures 1-9. Of the normal sieve size OSU lines included, 'Oregon 54' and OSU 5416 produced the highest dollar return, clearly leading 'Oregon 91G' in the overall season averages presented in the table below:

Variety	Season Average $/A Based on		
	Trial Averages*	Selected Harvest**	Highest Harvest
Oregon 91G	1562	1566	1636
Oregon 54	1713	1685	1794
OSU 5416	1741	1769	1811
OSU 5520	1583	1525	1664
OSU 5558	1471	1480	1563
OSU 5563	1468	1490	1508
LSD @ 5%	138	186	146

*Average of 1-3 harvests from five trials.
**The harvest closest to 50% 1-4 sieve, usually (65% for 5558 and 5563).

The differences between 'Oregon 54' and OSU 5416 depend on the method of comparison, with 'Oregon 54' slightly higher if trial average of harvests or highest harvest are used, and OSU 5416 higher if selected harvests from the four trials are used (Figure 3). Further comparisons of 'Oregon 54' and OSU 5416 will be made in a later section. Of the advanced easy-pick lines included in the four trials, OSU 5520 was generally the best in 1995. Because of its earliness and immature green seed, 5520 will be continued in 1996, but OSU 5558 and OSU 5563 will be shelved. Newer easy-pick lines 5566 and 5575 will be tested in 1996 because they appear to be high-yielding for the easy-pick type.

Three new standard bush Blue Lake lines, OSU 5630, OSU 5635, and OSU 5651, included in the trials for the first time, looked promising and will be tested more thoroughly in 1996. These lines generally exceeded 'Oregon 54' in $ return in both the May 16 and June 22 trials, except that OSU 5651 was missed in harvesting the June 22 trial (Table 4, Figure 2). These lines appear to be earlier and more concentrated than 'Oregon 54' and less early and concentrated than 'Oregon 91G'. The parentage of these lines is: OSU 5630 (Oregon 91G x Oregon 54), OSU 5635 (Oregon 54 x OSU 5163), and OSU 5651 (Oregon 54 x OSU 5256). They have many sister lines, some of which will be tested in 1996.

Medium-sieve beans/'Slenderette' types. Four commercial varieties tested in 1995 have been grouped for comparison in Table 5. These yields and sieve sizes are presented with no adjustment of yields feasible. Comparison of yields and $ value is difficult because we did not know the optimum harvest maturity of each variety. Unless the pods appeared to be overmature, the last harvest was selected for statistical analysis. For 'Maxima', we cannot be sure that the yield of 9.0 tons and the $ return of $1,980 in the June 22 trial are realistic. Of the four varieties included, quality may be more of a problem with HMX 2974 than with the other three varieties.

Small-sieve beans. OSU 5446 and 'Minuette' were included in four trials. Although OSU 5446 is not likely to be grown commercially, it sets a high standard for yield and quality of small-sieve pods and has been used in many crosses. 'Minuette' is being grown commercially in Oregon. Though not Blue Lake in character, color and pod refinement are good and the growth habit is excellent. Depending on the relative importance placed on 3-sieve versus 4-sieve pods, and thus the harvest used for comparison, the $ return of 5446 was much higher in trial 1, and higher in trial 3. In trials 2 and 4, return for the two varieties was similar (Tables 6 and 7, Figures 6 and 7).

In trials 2 and 4, we included three new OSU lines, OSU 5600, OSU 5603, and OSU 5613, which came from the cross OSU 5163 x Rapier. Pods of these lines are very small and refined, with good Blue Lake color (not as good as OSU 5446) and some tendency for bumpiness. Of the three, OSU 5603 is the least promising and may be discontinued. OSU 5600, which was in trials in 1994, is the best in appearance. The growth habit of these lines is medium upright and somewhat leafy compared to OSU 5446. Only a small percentage of the pods reach 4-sieve, and they eventually reached a yield which compared favorably with 'Minuette' at a similar ratio of 3-sieve:4-sieve pods. However, they become seedy without developing many 4-sieve pods and evaluation of processed pods will be necessary to estimate their yield potential. Dollar return estimates compared with 'Minuette' were sometimes reduced because there was a higher percentage of 1-sieve pods, which were not included. A summary of $ value for the small-sieve varieties is given in the following tables.

	Season Average $ Value From Four Trials Based on Harvest With:	
Variety	Highest $ Value	Highest T/A 3-sieve
5446	1559	1451
Minuette	1460	1376

	Season Average $ Value From Two Trials Based on Harvest With:	
Variety	Highest $ Value	Highest T/A 3-sieve
5446	1504	1419
Minuette	1485	1485
5600	1463	1463
5603	1275	1275
5613	1621	1621

Row spacing trial. Selected varieties and lines were grown at 36- and 18-inch row spacing to determine if there was an interaction between the varieties and row spacing. Different responses to row spacing could relate to differences in vigor and degree of uprightness in habit. As in 1993 and 1994, there was a marked increase in yield and $ return when 18" rows were compared with 36" rows (Tables 8 and 9, Figures 8 and 9). Average adjusted tons/acre from 18" rows was 120% of that from 36" rows. However, this value was 138% for 'Oregon 91G', 124% for OSU 5416, and 127% for 'Oregon 54' (data from only one harvest date). Values for the easy-pick lines were 113% (OSU 5520), 116% (OSU 5558), and 135% (OSU 5563). For OSU 5446, the yield for 18" rows was only 105% of that for 36" rows, and 112% for 'Minuette'.

Thus, the results contradicted our expectations that OSU 5446 with a small plant, 'Minuette' with a medium-sized upright plant, and the easy-pick lines with distinct upright habits would gain more from closer rows than the standard bush Blue Lake varieties such as 'Oregon 91G'. This trial was under heat and drought stress for a time before flowering, which was especially noticeable in the 18" row plots, but later became quite vigorous with an indeterminate crop and high yields. The more vigorous varieties may have been able to outgrow the early stresses better than OSU 5446 or 'Minuette'. Statistically, the interaction between spacing and varieties was barely significant at 5% ($F = 2.46$).

Because of the rank growth and late season with much rain, white mold was a serious problem in the spacing trial. 'Oregon 54' was especially damaged because it was several days later than the other standard varieties and mold was increasing rapidly as it matured so that only one harvest date was possible for this variety. The plots were scored for mold damage near the end of the harvest period. As shown in Table 13, mold was considerably worse at 18" in 'Oregon 91G', 'Oregon 54', and OSU 5416, but not in the less susceptible varieties. Note that 'Oregon 91G' had a higher score than 'Oregon 54' at 18", but it was possible to harvest on three dates as planned because 'Oregon 91G' matured several days earlier, before the mold reached its peak. It should be noted that no chemical control for mold was applied to any of our trials.

Root rot and white mold trials. All of the lines included in yield trials were planted in the root rot test plots along with a limited number of lines derived from crosses with specific resistant accessions. Root rot scores are shown in Table 11. There is a tendency for lines with higher white mold susceptibility to have lower root rot scores, since plant vigor tends to increase white mold, while early, concentrated, and less vigorous varieties often get higher root rot scores. Root rot scores in 1995 were not high enough to show great differences.

All trial lines were also included in the white mold plots along with all OSU breeding lines with sufficient seed and lines from specific white mold crosses. Infection scores shown in Table 12 were high and reasonably consistent across replications. Since our readings are taken at the end of the season, some differences that exist at harvest time may not be apparent in the data. For example, the high readings of OSU 5446 and the easy-pick lines may not indicate the degree of the problem at harvest maturity.

Comparison of OSU 5416 with 'Oregon 54'. Of the many lines similar to and having parentage similar to that of 'Oregon 54' (OSU 5402), only OSU 5416 was included in 1995 yield trials. Several others, such as OSU 5421, have been carried in recent years but were shelved in 1995. OSU 5416 is probably the best of these related lines for pod quality, but the pods are not quite as smooth or straight as 'Oregon 54' pods. However, in many trials, OSU 5416 seems to be less affected by conditions that appear to result in a delayed set in 'Oregon 54' and a delay of harvest maturity by a day or two. OSU 5416 is often harvested a day or two earlier than 'Oregon 54' in our trials, or the percentage of 1-4 sieve pods indicates that OSU 5416 matures about a day earlier. Since yields of OSU 5416 are sometimes better, data from 37 separate replicated, hand-picked trials was analyzed, using $ return/acre from both averages of harvests in each trial, or selected harvests based on sieve-size percentage. Paired $ values of selected harvests from the 37 trials are shown in Figure 10. OSU 5416 values were higher in 24 of the 37 trials. Summary data are shown in the following table for the 37 trials from 1989-1995.

Variety	Average of Harvests $/acre	Selected Harvest $/acre
Oregon 54	1617	1648
OSU 5416	1635	1660
Difference (non-significant)	18	12

Though the difference is small, and is non-significant statistically because of the variation among trials, continuation of OSU 5416 and possibly retesting it in commercial trials may be advisable. OSU records indicate that there was a reserve of 57 lbs. held by Rogers and 56 held by Ferry Morse after 700 lbs. were shipped to Norpac and 450 lbs. were shipped to Agripac for trial in 1992. These reserves should be available for additional seed increase if that is desired.

Commercial performance of 'Oregon 91G' and 'Oregon 54' in 1995. Substantial acres of 'Oregon 54' were grown along with 'Oregon 91G' in western Oregon in 1995. Data provided by two processing companies are summarized in the following table.

	Company A				Company B				Overall AV	
Variety	Acres Grown	Gross T/A	Net T/A	$/A	Acres Grown	Gross T/A	Net T/A	$/A	Net T/A	$/A
Oregon 91G	6129	7.0	6.2	1093	680	7.5	6.5	1053	6.4	1073
Oregon 54	1592	6.2	6.5	1172	1274	7.6	6.7	1143	6.6	1158

[z]Last two weekly periods omitted because very few acres of Oregon 54 included.

7. Summary:

Three standard Blue Lake, three easy-pick, and two small-sieve varieties were grown in five replicated hand-picked trials, one of which included planting at both 36- and 18-inch row spacings. Four 'Slenderette'-type commercial varieties and nine newer OSU lines of easy-pick, standard, or small-sieve types were included in two of the trials. OSU 5416 produced more $/A than 'Oregon 54', with 'Oregon 91G' producing less than 'Oregon 54'. Several new standard bush Blue Lake varieties, OSU 5630, OSU 5635, and OSU 5651 look promising. Small-sieve OSU 5446 usually exceeded 'Minuette' in $/A, but these two varieties were sometimes close in production. Three new OSU small-sieve lines, OSU 5600, OSU 5603, and OSU 5613 are very refined and may yield well enough for commercial production. Development of new materials and testing of breeding lines for resistance to white mold and root rot continued.

8. Signatures:

Project Leader: Redacted for Privacy

Project Leader: Redacted for Privacy

Department Head: Redacted for Privacy

Department Head: Redacted for Privacy

Table 1. **Yields of standard green bean varieties, May 16 planting, Corvallis, 1995.[z]**

Line	Av. Stand	Harvest 1 Days	Harvest 1 % 1-4	Harvest 1 T/A	Harvest 1 Adj. T/A	Harvest 2 Days	Harvest 2 % 1-4	Harvest 2 T/A	Harvest 2 Adj. T/A	Harvest 3 Days	Harvest 3 % 1-4	Harvest 3 T/A	Harvest 3 Adj. T/A	Av. Adj. T/A
91G	150	69	69	8.0	9.5	71	58	7.8	8.4*	72	37	8.7	7.5	8.5
Oregon 54	150	72	66	8.8	10.2	73	54	9.2	9.6*					9.9
5416	150	72	60	9.6	10.5	73	50	9.5	9.5*					10.0
5520	150	69	82	8.6	11.4	71	65	9.2	10.6	72	44	10.3	9.6*	10.5
5558	150	71	88	7.4	8.7	73	65	8.2	8.2*					8.4
5563	150	71	92	7.5	9.1	73	78	8.0	8.9*					9.0
5566	150	71	74	8.8	9.5	72	74	8.8	9.4	73	64	9.9	9.9*	9.6
5568	150	71	84	7.5	8.6	73	71	7.8	8.1*					8.4
5575	150	69	82	8.2	10.8	71	63	9.3	10.5*					10.6
5630	150	69	84	7.3	9.8	71	64	8.9	10.1	72	61	9.4	10.5*	10.1
5635	150	71	81	8.4	11.0	73	64	8.8	10.0*					10.5
5651	150	69	97	7.3	10.7	71	89	8.4	11.6	73	73	9.5	11.7*	11.3

[z]Mean of 4 replications; subplots of 5' were harvested from 20' plots on each harvest date; rows 36" apart; days = days from planting; % = percent 1-4 sieve grades; adj. T/A = tons per acre adjusted to 50% 1-4 sieve (except 5558, 5563, 5566, and 5568, which were adjusted to 65% 1-4 sieve). Analysis of variance calculated using the harvest closest to 50% 1-4 sieve (65% 1-4 sieve for 5558, 5563, 5566, and 5568) for each line marked with *. LSD for comparing * means (unadjusted) was 1.1 T/A at 5% significance; for comparing adjusted * means LSD was 1.2 T/A at 5% significance.

Table 2. Yields of standard green bean varieties, June 22 planting, Corvallis, 1995.[z]

Line	Av. Stand	Harvest 1 Days	Harvest 1 % 1-4	Harvest 1 T/A	Harvest 1 Adj. T/A	Harvest 2 Days	Harvest 2 % 1-4	Harvest 2 T/A	Harvest 2 Adj. T/A	Harvest 3 Days	Harvest 3 % 1-4	Harvest 3 T/A	Harvest 3 Adj. T/A	Av. Adj. T/A
91G	150	60	65	9.9	11.4	62	50	10.9	10.9*	64	39	11.4	10.1	10.8
Oregon 54	150	63	69	10.6	12.6	65	49	11.1	11.0*	67	30	12.5	10.0	11.2
5416	149	62	69	9.4	11.2	64	60	10.3	11.4*	67	40	11.7	10.5	11.0
5520	150	60	83	8.2	10.8	62	59	9.7	10.6	64	49	10.3	10.2*	10.5
5558	148	62	93	7.3	8.8	64	85	7.7	8.9*					8.8
5563	149	62	91	7.4	8.8	64	86	7.5	8.7*					8.8
5566	148	62	79	8.4	9.3	64	73	9.4	10.0*	67	46	11.3	9.7	9.7
5568	149	62	92	7.8	9.4	64	84	7.5	8.6*					9.0
5575	148	61	53	9.4	9.7*	63	40	10.8	9.7					9.7
5630	150	61	79	9.8	12.6	63	65	10.2	11.8	65	49	10.2	10.1*	11.5
5635	150	62	88	9.2	12.8	64	75	9.9	12.3	67	37	12.9	11.2*	12.1

[z]Mean of 4 replications; subplots of 5' were harvested from 20' plots on each harvest date; rows 36" apart; days = days from planting; % = percent 1-4 sieve grades; adj. T/A = tons per acre adjusted to 50% 1-4 sieve (except 5558, 5563, 5566, and 5568, which were adjusted to 65% 1-4 sieve). Analysis of variance calculated using the harvest closest to 50% 1-4 sieve (65% 1-4 sieve for 5558, 5563, 5566, and 5568) for each line marked with *. LSD for comparing * means (unadjusted) was 2.1 T/A at 5% significance; adjusted * means were not significantly different at 5% significance.

Table 3. **Yields of selected OSU green bean lines on two planting dates, Corvallis, 1995.**[z]

Planting	Line	Av. Stand	Harvest 1 Days	Harvest 1 % 1-4	Harvest 1 T/A	Harvest 1 Adj. T/A	Harvest 2 Days	Harvest 2 % 1-4	Harvest 2 T/A	Harvest 2 Adj. T/A	Harvest 3 Days	Harvest 3 % 1-4	Harvest 3 T/A	Harvest 3 Adj. T/A	Av. Adj. T/A	LSD[y] T/A	LSD[y] Adj. T/A
April 26 Planting	91G	150	77	83	5.9	7.9	79	65	6.7	7.8	82	43	8.5	7.9*	7.9	1.5	1.5
	Oregon 54	150	82	53	9.0	9.2	83	47	8.8	8.5*	84	32	8.6	7.1	8.3		
	5416	148	82	59	9.1	9.9	83	50	8.8	8.8*	84	36	8.6	7.4	8.7		
	5520	150	77	91	5.4	7.7	79	71	6.2	7.5	82	41	8.5	7.8*	7.7		
	5558	148	79	93	4.9	5.9	82	69	6.7	6.9*	83	53	5.8	5.2	6.0		
	5563	150	79	93	5.0	6.0	82	66	6.2	6.2*	83	51	6.9	6.1	6.1		
May 30 Planting	91G	150	63	76	9.3	11.7	64	61	9.5	10.5	65	44	10.4	9.8*	10.7	1.0	1.0
	Oregon 54	149	65	69	10.4	12.4	66	66	8.9	10.3*	69	35	10.8	9.2	10.6		
	5416	149	65	58	9.4	10.1	66	55	10.1	10.6*	69	33	11.3	9.4	10.0		
	5520	150	63	81	7.5	9.8	64	68	8.5	10.0	65	53	9.2	9.5*	9.8		
	5558	150	65	92	8.0	9.7	66	83	7.3	8.3*	69	47	8.7	7.5	8.5		
	5563	150	65	88	7.6	8.9	66	78	8.0	8.9*	69	54	8.3	8.1	8.6		

[z]Means of 4 replicates; subplots of 5' were harvested from double 20' plots on each harvest date; rows 36" apart; days = days from planting; % = percent 1-4 sieve grades; adj. T/A = tons/acre adjusted to 50% 1-4 (except 5558 and 5563, which were adjusted to 65% 1-4).

[y]Analysis of variance calculated using the harvest marked *; LSD was calculated at 0.05 significance to compare values marked *.

Table 4. Dollar return/acre for standard OSU lines, four trials, 1995.[z]

Trial	Line	Harvest 1 Days	Harvest 1 %	Harvest 1 $	Harvest 2 Days	Harvest 2 %	Harvest 2 $	Harvest 3 Days	Harvest 3 %	Harvest 3 $	Avg. $/A[y]	Selected $/A[x]
1 April 26	91G	77	83	1193	79	65	1190	82	43	1312	1232	1312
	Ore. 54	82	53	1476	83	47	1403	84	32	1315	1398	1403
	5416	82	59	1519	83	50	1441	84	36	1270	1410	1441
	5520	77	91	1081	79	71	1054	82	41	1301	1145	1145
	5558	79	93	991	82	69	1236	83	53	950	1059	1236
	5563	79	93	1035	82	66	1101	83	51	1090	1075	1101
2 May 16	91G	69	69	1412	71	58	1280	72	37	1223	1305	1280
	Ore. 54	72	66	1594	73	54	1548				1571	1548
	5416	72	60	1663	73	50	1547				1605	1547
	5520	69	82	1652	71	65	1635	72	44	1553	1613	1553
	5558	71	88	1423	73	65	1468				1446	1468
	5563	71	92	1493	73	78	1575				1534	1575
	5566	71	74	1660	72	74	1590	73	64	1802	1684	1802
	5568	71	84	1481	73	71	1407				1444	1407
	5575	69	82	1552	71	63	1646				1599	1646
	5630	69	84	1580	71	64	1617	72	61	1588	1595	1588
	5635	71	81	1603	73	64	1557				1580	1557
	5651	69	97	1396	71	89	1703	73	73	1832	1644	1832
3 May 30	91G	63	76	1696	64	61	1595	65	44	1573	1621	1573
	Ore. 54	65	69	1863	66	66	1590	69	35	1566	1673	1590
	5416	65	58	1702	66	55	1686	69	33	1599	1662	1686
	5520	63	81	1461	64	68	1554	65	53	1526	1514	1514
	5558	65	92	1589	66	83	1472	69	47	1398	1486	1472
	5563	65	88	1515	66	78	1593	69	54	1408	1505	1593
4 June 22	91G	60	65	1768	62	50	1770	64	39	1663	1734	1770
	Ore. 54	63	69	1907	65	49	1755	67	30	1708	1790	1755
	5416	62	69	1714	64	60	1800	67	40	1663	1726	1800
	5520	60	83	1601	62	59	1652	64	49	1662	1638	1638
	5558	62	93	1467	64	85	1582				1525	1582
	5563	62	91	1523	64	86	1492				1508	1492
	5566	62	79	1623	64	73	1745	67	46	1619	1662	1745
	5568	62	92	1637	64	84	1503				1570	1503
	5575	61	53	1520	63	40	1630				1575	1520
	5630	61	79	1917	63	65	1850	65	49	1637	1801	1637
	5635	62	88	1908	64	75	1899	67	37	1873	1893	1873

[z]Based on a value of $242 for 2-4 sieve pods; $108 for 5 and 6 sieve pods. Yield of 2-sieve pods was obtained by taking one-half of the combined graded 1-2 sieve pods.

[y]Average $/acre is a rough estimate because of non-uniform number of trials and maturities included.

[x]Selected best values for comparison. Usually the same value used for analysis of variance in Tables 1, 2, and 3.

Table 5. Performance of Slenderette-type green bean varieties on two planting dates, Corvallis, 1995.[z]

Trial	Variety	Days	Percent Sieve Size 2[y]	3	4	5	Tons/Acre Sieve Size 2	3	4	5	Total[x]	$/Acre
2 May 16	Banquet	69	13	71	16	0	0.7	3.7	0.8	0	6.1	1247
		71	9	71	20	1	0.5	4.0	1.1	0.1	6.5	1379
		72	5	58	35	2	0.3	3.6	2.1	0.1	6.7*	1456
	Matador	71	11	64	23	2	0.7	3.9	1.4	0.1	7.1	1461
		73	8	60	28	5	0.5	3.9	1.8	0.3	7.4*	1551
	HMX 2974	69	12	67	19	1	0.6	3.2	0.9	0.4	5.5	1128
		71	8	60	31	1	0.4	3.2	1.7	0.1	6.3*	1299
		72	4	55	37	4	0.2	2.9	2.0	0.2	6.2	1245
	Maxima	69	16	73	12	0	0.8	3.6	0.6	0	6.1	1212
		71	9	66	25	1	0.6	4.6	1.7	0.1	7.9*	1677
		72	7	64	28	1	0.4	4.0	1.8	0.1	7.1	1515
4 June 22	Banquet	63	15	77	8	0	0.7	3.3	0.4	0	5.1	1045
		65	7	68	25	1	0.4	4.2	1.6	0.1	7.0	1510
		67	5	66	27	2	0.3	4.4	1.8	0.1	7.4*	1589
	Matador	61	17	61	20	2	0.7	2.7	0.9	0.1	5.5	1049
		63	11	61	26	2	0.6	3.6	1.6	0.1	7.0	1422
		65	7	45	44	4	0.5	3.1	3.0	0.3	7.9*	1638
	HMX 2974	61	18	63	17	2	0.7	2.8	0.8	0.1	3.8	1058
		63	10	68	21	1	0.5	3.8	1.2	0.1	6.4*	1330
		65	4	42	48	6	0.3	3.2	3.7	0.5	8.3	1790
	Maxima	61	11	74	15	0	0.7	4.5	0.9	0	7.0	1485
		63	7	76	16	1	0.5	5.0	1.1	0.1	7.5	1593
		65	5	60	34	1	0.4	4.9	2.8	0.1	9.0*	1980

[z]Means of 4 replicates; subplots of 5' were harvested from 20' plots on each harvest date; rows 36" apart; days = days from planting; % = percent 1-4 sieve grades. $/acre based on $275/ton for 2-4 sieve; $120/ton for 5 sieve.

[y]2 sieve values calculated as 50% of the combined 1 + 2 sieve weights from grader.

[x]Total weight of harvested beans, including sieve sizes 1-5. Analysis of variance calculated using the harvest market *, usually the harvest with the highest yield unless sieve size distribution or notes indicated the variety was overmature; LSD at 5% significance to compare values marked * was 1.0 T/A for trial 2 and 1.6 T/A for trial 4.

Table 6. Performance of small sieve green bean varieties, Corvallis, 1995.

Trial	Variety	Days	Percent Sieve Size 2[z]	3	4	5	Tons/Acre Sieve Size 2	3	4	5	Total[y]	$/Acre[x]
1 April 26	5446	85	15	71	4	0	0.71	3.44	0.22	0.00	5.40	1057
		86	12	69	6	0	0.71	3.95	0.36	0.00	5.66	1215
		87	11	69	9	1	0.67	4.42	0.58	0.04	6.38	1377
		88	7	70	14	1	0.47	4.46	0.91	0.07	6.42	1420
		89	6	69	19	1	0.36	4.42	1.23	0.04	6.74	1460
	Minuette	86	22	52	4	0	0.52	1.23	0.11	0.00	6.65	452
		88	11	64	14	0	0.40	2.32	0.51	0.00	6.70	781
		89	8	63	19	1	0.31	2.28	0.69	0.04	3.95	798
		92	3	45	40	8	0.16	2.32	2.07	0.44	5.47	1148
2 May 16	5446	66	18	51	13	1	0.85	2.46	0.65	0.04	5.00	965
		68	6	38	38	12	0.38	2.54	2.54	0.80	7.10	1406
		70	4	31	41	20	0.27	2.36	3.08	1.52	7.83	1546
	5600	69	24	52	0	0	1.30	2.86	0.00	0.00	5.73	1009
		71	24	52	0	0	1.54	3.37	0.04	0.00	6.78	1197
		72	14	60	11	1	0.92	3.84	0.72	0.04	6.89	1333
	5603	67	32	37	0	0	1.41	1.67	0.00	0.00	4.64	746
		69	25	50	0	0	1.25	2.54	0.00	0.00	4.86	917
		71	15	69	1	0	0.87	3.92	0.04	0.00	5.94	1167
	5613	67	36	28	0	0	1.52	1.20	0.00	0.00	4.53	658
		69	23	55	0	0	1.18	2.86	0.00	0.00	5.69	978
		71	17	67	0	0	1.07	4.28	0.00	0.00	6.71	1294
	Minuette	69	6	71	16	1	0.33	3.77	0.83	0.04	5.51	1197
		71	5	65	24	1	0.34	4.57	1.70	0.07	7.32	1609
3 May 30	5446	59	24	49	2	0	1.45	2.90	0.11	0.00	6.16	1079
		62	7	51	9	0	0.65	4.89	0.83	0.00	7.32	1544
		64	4	59	32	1	0.29	4.50	2.46	0.11	7.83	1766
	Minuette	62	25	50	0	0	1.16	2.36	0.00	0.00	4.89	851
		64	7	71	14	1	0.45	4.39	0.87	0.04	6.49	1386
		66	3	44	47	3	0.24	3.26	3.52	0.22	7.83	1721

Table 6. Performance of small sieve green bean varieties, Corvallis, 1995 (cont.).

Trial	Variety	Days	Percent Sieve Size 2[z]	3	4	5	Tons/Acre Sieve Size 2	3	4	5	Total[y]	$/Acre[x]
4 June 22	5446	57	14	64	8	0	0.76	3.52	0.44	0.00	5.80	1140
		60	7	58	26	2	0.45	3.73	1.67	0.14	6.82	1432
		62	6	54	31	3	0.36	3.55	2.03	0.22	7.94	1462
	5600	62	26	46	1	0	1.38	2.39	0.07	0.00	5.58	930
		64	27	46	1	0	1.61	2.76	0.07	0.00	6.42	1075
		67	13	66	8	0	0.96	5.00	0.62	0.00	7.98	1592
	5603	60	26	47	2	0	1.12	2.03	0.07	0.00	4.60	781
		62	18	62	1	0	0.92	3.08	0.07	0.00	5.29	987
		64	14	70	3	0	0.89	4.60	0.22	0.00	7.00	1382
	5613	62	25	50	1	0	1.21	2.46	0.04	0.00	5.18	899
		64	16	64	3	0	1.05	4.10	0.22	0.00	6.74	1298
		67	7	76	10	0	0.58	6.60	0.87	0.00	9.17	1947
	Minuette	60	22	51	6	0	0.94	2.25	0.25	0.00	4.64	833
		62	15	63	7	0	0.78	3.26	0.36	0.00	5.51	1066
		64	8	73	11	0	0.51	4.46	0.65	0.00	6.42	1360

[z] 2 sieve values calculated as 50% of the combined 1 + 2 sieve weights from grader.

[y] Total weight of harvested beans, including sieve sizes 1-5.

[x] $/acre based on $242/ton for 2-4 sieve; $108/ton for 5 sieve.

Table 7. Statistical comparison of yields and dollar return of small sieve green bean lines, Corvallis, 1995.[z]

	Variety	Trial 1	Trial 2	Trial 3	Trial 4	AV
T/A	5446	6.3	5.8	7.4	6.2	6.5
	Minuette	4.8	6.9	7.4	5.9	6.2
	LSD @ 5%	2.1 (NS)	1.2 (NS)	NS	0.4 (NS)	NS
$/A	5446	1743	1602	2046	1705	1774
	Minuette	1325	1893	2024	1623	1716
	LSD @ 5%	578 (NS)	341 (NS)	NS	114 (NS)	NS
T/A	5446		5.8		6.2	6.0
	Minuette		6.9		5.9	6.4
	5600		5.9		6.9	6.4
	5603		5.1		6.1	5.6
	5613		5.6		8.5	7.1
	LSD @ 5%		0.7		1.3	0.8
$/A	5446		1602		1705	1654
	Minuette		1893		1623	1758
	5600		1610		1908	1759
	5603		1390		1674	1532
	5613		1549		2346	1947
	LSD @ 5%		195		351	218

[z]Based on one selected harvest for each variety in each trial, which was the last harvest (highest $/A) unless sieve size distribution or notes indicated the variety was overmature.

Table 8. Yield of selected bean lines at 36- and 18-inch row spacing, June 30 planting, Corvallis, 1995.[z]

Variety	Harvest 1						Harvest 2						Harvest 3						Av. T/A		AV Adj. T/A	
	% 1-4 Sieve		Tons/Acre		Adj. T/A		% 1-4 Sieve		Tons/Acre		Adj. T/A		% 1-4 Sieve		Tons/Acre		Adj. T/A					
	36	18	36	18	36	18	36	18	36	18	36	18	36	18	36	18	36	18	36	18	36	18
91G	73	65	12.1	17.3	14.9	19.8	61	59	11.7	16.5	13.0	18.0	38	45	13.7	17.8	12.1	16.9	12.5	17.2	13.3	18.3
Oregon 54	41	50	14.4	16.7	13.1	16.7	—	39	—	16.8	—	15.0	—	—	—	—	—	—	—	—	—	—
5416	83	85	12.4	14.6	16.5	19.8	51	67	15.1	15.9	15.2	18.6	35	55	15.2	16.2	12.9	17.1	14.2	15.6	14.9	18.5
5520	58	63	13.1	15.0	14.1	17.0	55	52	11.1	14.3	11.6	14.6	35	33	15.1	15.0	12.8	12.5	13.1	14.8	12.9	14.7
5558	69	64	11.4	15.1	11.7	15.0	70	54	11.0	14.3	11.4	13.1	58	53	11.5	13.0	10.9	11.8	11.3	14.1	11.4	13.3
5563	53	69	11.3	14.7	10.3	15.2	59	56	10.0	13.7	9.5	12.7	55	58	10.4	12.8	9.6	12.1	10.6	13.7	9.8	13.3
5446	99	100	9.7	10.4	9.7	10.4	93	99	10.0	11.4	10.0	11.4	91	93	11.6	11.0	11.6	11.0	10.4	10.9	10.4	10.9
Minuette	99	100	7.8	9.1	7.8	9.1	99	99	8.6	9.4	8.6	9.4	90	97	10.6	11.7	10.6	11.7	9.0	10.1	9.0	10.1
LSD @ 5%[y]			1.8	1.8	2.0	2.0			2.2	2.2	2.3	2.3			3.0	3.0	2.8	2.8	2.0	2.0	2.0	2.0
Spacing means			11.5	14.1	12.3	15.4			11.1	13.6	11.3	14.0			12.6	13.9	11.5	13.3	11.6	13.8	11.7	14.1
LSD @ 5%[x]			0.6		0.7				0.8		0.9				1.1		1.1		0.7		0.8	

[z]Means of 4 replications; 5 feet of row in each harvest. The 18" row plots consisted of three rows; only the center row was harvested. Adj. T/A = tons per acre adjusted to 50% 1-4 sieve for 91G, Oregon 54, 5416, and 5520; to 65% 1-4 sieve for 5558 and 5563; 5446 and Minuette were not adjusted. Oregon 54 was omitted from harvest average calculations, spacing means, and analysis of variance except for harvest 1.

[y]LSD values on this line apply to numbers within columns (comparing variety means) and between columns (comparing spacing within varieties).

[x]LSD values on this line for comparing spacing means.

Table 9. Dollar return of selected bean lines grown at 36- and 18-inch row spacing, June 30 planting, 1995.[z]

Variety	Harvest (days)	Total (2-6 sieve) 36	Total (2-6 sieve) 18	2-4 sieve 36	2-4 sieve 18	5-6 sieve 36	5-6 sieve 18
91G	62	1872	2839	1570	2228	301	611
	63	1897	2696	1439	1991	458	705
	65	1988	2600	1083	1605	904	994
	AV	1919	2712	1364	1942	555	770
Oregon 54	67	2131	2487	1263	1649	877	838
5416	63	2364	2823	2145	2588	219	235
	66	2372	2673	1601	2140	771	532
	68	2170	2618	1136	1851	1034	767
	AV	2301	2705	1627	2193	675	512
5520	62	2151	2553	1583	1974	568	579
	63	1776	2282	1263	1562	513	720
	66	2091	2083	1092	1026	998	1057
	AV	2006	2306	1313	1521	693	786
5558	67	1644	2532	1347	1991	297	540
	69	1936	2304	1592	1622	345	681
	70	1940	2090	1443	1456	497	634
	AV	1840	2309	1461	1690	380	619
5563	67	1747	2656	1211	2202	536	454
	69	1690	2189	1268	1570	423	619
	70	1718	2083	1237	1535	482	548
	AV	1719	2309	1238	1769	480	540
5446	59	1924	1921	1912	1921	12	0
	61	2012	2235	1961	2219	51	16
	63	2358	2235	2272	2149	86	86
	AV	2098	2131	2048	2097	50	34
Minuette	62	1547	1719	1540	1719	8	0
	63	1732	1762	1724	1754	8	8
	66	1382	2416	1316	2377	67	39
	AV	1554	1966	1526	1950	27	16

[z]Dollars/acre based on $242/ton for sieves 2-4 and $108/ton for sieves 5 and 6. Yield of 2-sieve pods was obtained by taking one-half of the combined graded 1-2 sieve pods.

Table 10. **Summary of average yields of selected OSU lines, 1991-1995.[z]**

Line	AV Adj. T/A						AV $/A					
	1991	1992	1993	1994	1995	Overall AV[y]	1991	1992	1993	1994	1995	Overall AV[y]
91G	8.0	8.8	7.7	10.6	9.5	8.9	1511	1376	1390	1555	1473	1461
Oregon 54	9.0	9.3	8.1	10.6	10.0	9.4	1720	1531	1460	1648	1608	1593
5416	9.1	9.2	8.4	11.0	9.9	9.5	1735	1560	1550	1674	1601	1624
5520	7.4[x]	8.5		8.6	9.6		1375[x]	1154		1715	1478	
5558		9.1[x]	7.6	8.4	7.9			1390[x]	1322	1406	1379	
5446							1469[x]	1505	1173	1385	1355	1377

[z]All averages are estimates because of non-uniform number of trials and maturities included; most are averages of 4-7 trials.

[y]Averages from 27 trials were used to calculate the overall averages for 91G, Oregon 54, and 5416; for 5446, averages from 25 trials were used.

[x]Average of two trials only.

Table 11. Fusarium root rot infection, Corvallis, 1995.

Line	Score[z]		
	Rep 1	Rep 2	Avg.
91G[y]	3.5	3.5	3.5
Oregon 54	3.5	3	3.25
5416	2	3	2.5
5446	3	3.5	3.25
5520	2	2	2.0
5558	3.5	3	3.25
5563	3	3	3.0
5566	3	3	3.0
5568	2.5	3.5	3.0
5575	3	2.5	2.75
5600	2	4	3.0
5603	3	3.5	3.25
5604	3	2.5	2.75
5613	2.5	3.5	3.0
5630	1.5	2.5	2.0
5635	2.5	3	2.75
5651	2	3	2.5
B7471-5-3B	2	2.5	2.25
B7126-33-1-2	1.5	3	2.25
B7126-33-2-1	2	3	2.5
B7126-54-2-1	3	2.5	2.75
B7237-13	1.5	3	2.25
B7239-5-1	4	1.5	2.75
B7239-11-1	3	3	3.0
B7239-11-2	4	3.5	3.75
B7240-2	2.5	2	2.25

Table 11. Fusarium root rot infection, Corvallis, 1995 (cont.).

Line	Score[z] Rep 1	Rep 2	Avg.
DM6NY1	2	2.5	2.25
DM4NY6	1	2	1.5
DM3NY1	0.5	0.5	0.5
Maxima	1.5	1.5	1.5
HMX 2974	1.5	2.5	2.0
Matador	2	2.5	2.25
Banquet	3	3	3.0
Minuette	3	3.5	3.25
Wis 46 RR	1	0.5	0.75
Wis 83 RR	1	1.5	1.25
RR4270	1	1.5	1.25
RR6950[y]	0.75	0.75	0.75

[z]Scores: 1-5 scale, 1 = no or very slight surface infection, 5 = roots mostly dead, plants severely stunted.

[y]Each value is an average of 2 plots.

Table 12. White mold infection, Corvallis, 1995.[z]

Line	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
*91G	7	6	6	6	6.25
*Oregon 54	8	8	8	8	8.0
5403	7	5	8	7	6.75
*5416	6	7	8	7	7.0
5421	7	8	8	7	7.5
5426	5	6	7	6	6.0
5445	7	8	8	8	7.75
*5446	6	10	7	8	7.75
5453	7	8	7	6	7.0
5513	5	5	5	5	5.0
*5520	7	6	5	6	6.0
5556	6	7	6	6	6.25
*5558	8	8	7	7	7.5
*5563	8	8	6	7	7.25
*5566	9	7	7	6	7.25
*5568	8	8	5	6	6.75
5573	5	7	7	7	6.5
*5575	6	7	5	7	6.25
5582	5	7	6	5	5.75
5590	4	5	6	5	5.0
5592	5	3	5	4	4.25
5597	6	4	7	4	5.25
*5600	5	6	6	6	5.75
5602	6	5	6	6	5.75
*5603	8	7	6	6	6.75
5604	7	6	5	8	6.5
5607	7	7	7	7	7.0
5609	6	7	8	7	7.0
5611	4	5	7	5	5.25
*5613	6	8	7	8	7.25
5615	6	4	6	5	5.25
5616	6	5	7	5	5.75
5618	6	6	5	6	5.75
5620	7	7	5	6	6.25

Table 12. White mold infection, Corvallis, 1995 (cont.).[z]

Line	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
5629	8	6	6	8	7.0
*5630	8	7	7	7	7.25
5632	6	5	6	6	5.75
5633	7	7	8	7	7.25
*5635	9	8	7	7	7.75
5640	6	7	7	7	6.75
5641	7	6	7	7	6.75
5643	5	7	6	6	6.0
5644	5	6	6	6	5.75
5647	7	6	5	6	6.0
*5651	9	8	8	8	8.25
5656	4	5	5	6	5.0
5659	5	5	6	6	5.5
5664	6	5	6	6	5.75
5665	4	5	4	5	4.5
5669	7	7	7	8	7.75
5671	5	6	6	6	5.75
5673	6	7	7	7	6.75
5675	5	7	6	7	6.25
5679	6	8	5	7	6.5
5680	7	5	6	6	6.0
5681	6	5	7	7	6.25
5682	6	4	6	7	5.75
5692	8	7	8	7	7.5
5697	7	7	7	7	7.0
5699	7	5	6	4	5.25
5701	6	6	6	7	6.75
5702	5	6	6	5	5.5
5705	5	6	5	5	5.75
5706	6	7	7	6	6.5
B7471-5-3B	7	9	5	7	7.0
B7030-24	5	6	6	5	5.5
B7126-1-1-1	5	5	6	4	5.0
B7126-33-1-2	5	6	6	6	5.75

Table 12. White mold infection, Corvallis, 1995 (cont.).[z]

Line	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
B7126-33-2-1	6	5	5	5	5.75
B7126-54-2-1	5	6	3	7	5.25
B7237-1-3	7	7	9	5	7.0
B7237-11-3	6	5	5	5	5.25
B7237-13	10	9	8	6	8.25
B7237-14-3	9	8	7	7	7.75
B7237-14-4	8	9	7	6	7.5
B7238-15	2	8	6	7	5.75
B7238-22	4	6	5	6	5.25
B7239-4	4	7	6	7	6.0
B7239-5-1	5	8	8	6	6.75
B7239-5-2	6	6	5	7	6.0
B7239-5-4	7	7	4	7	6.25
B7239-11-1	4	4	2	4	3.5
B7239-11-2	6	6	3	7	5.5
B7239-11-3	5	7	4	6	5.5
B7240-2	6	7	7	7	6.75
DM3NY1	8	7	7	6	7.0
DM4NY6	3	6	5	7	5.25
DM6NY1	4	6	7	6	5.75
169787	2	5	6	3	4.0
180753	4	5	6	6	5.25
204717	5	4	5	5	4.75
225846	5	2	2	4	3.25
226865	2	4	3	1	2.5
824775	4	4	4	2	3.5
MO 162	1	0.5	1	4	1.6
Black Valentine	8	9	7	7	7.75
3525	8	7	8	8	7.75
L192	3	3	2	2	2.5
Gabriella	9	6	6	6	6.75
Black Turtle	6	7	7	7	6.75
Aurora	6	6	8	7	6.75
Exrico	5	5	6	6	5.5

Table 12. White mold infection, Corvallis, 1995 (cont.).[z]

Line	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
2235	7	7	7	5	6.5
Tendercrop	5	5	6	6	5.5
Easy Pick	8	7	8	7	7.5
Maxima	6	6	7	7	6.5
Minuette	6	7	6	5	6.0
Matador	4	6	4	6	5.0
HMX 2974	7	5	5	6	5.75
Banquet	5	6	6	5	5.5

[z]White mold scores: 1-10 scale, 1 = low incidence, sometimes slight symptoms, 10 = high incidence, usually severe symptoms.

*Lines are advanced breeding lines which were included in the yield trials. Others are breeding lines being screened, or controls.

Table 13. White mold infection at 36" and 18" row spacing, Corvallis, 1995.[z]

Line	36" Reps 1	2	3	4	5	AV	18" Reps 1	2	3	4	5	AV
91G	3	4	7	4	5	4.6	8	10	6	5	8	7.4
Oregon 54	4	4	7	6	8	5.8	6	6	5	7	7	6.2
5416	2	2	4	4	4	3.2	3	10	10	6	8	7.4
5520	8	6	4	4	3	5.0	7	4	9	4	5	5.8
5558	1	5	3	4	3	3.2	2	2	5	3	4	3.2
5563	5	3	3	2	2	3.0	2	4	3	3	3	3.0
5446	6	5	4	4	5	4.8	2	5	4	4	8	4.6
Minuette	3	2	2	5	2	2.8	3	2	1	3	2	2.2
LSD @ 5% for varieties within spacing or for individual varieties between spacing						2.1						2.1
Spacing means						4.1						5.0
LSD @ 5% for spacing means[y]						0.7						

[z]White mold scores: 1-10 scale, 1 - low incidence, sometimes slight symptoms; 10 = high incidence, usually severe symptoms.

[y]The interaction variety x spacing (*F* 2.6) was significant at the 5% but not at the 1% level.

FIGURE 1

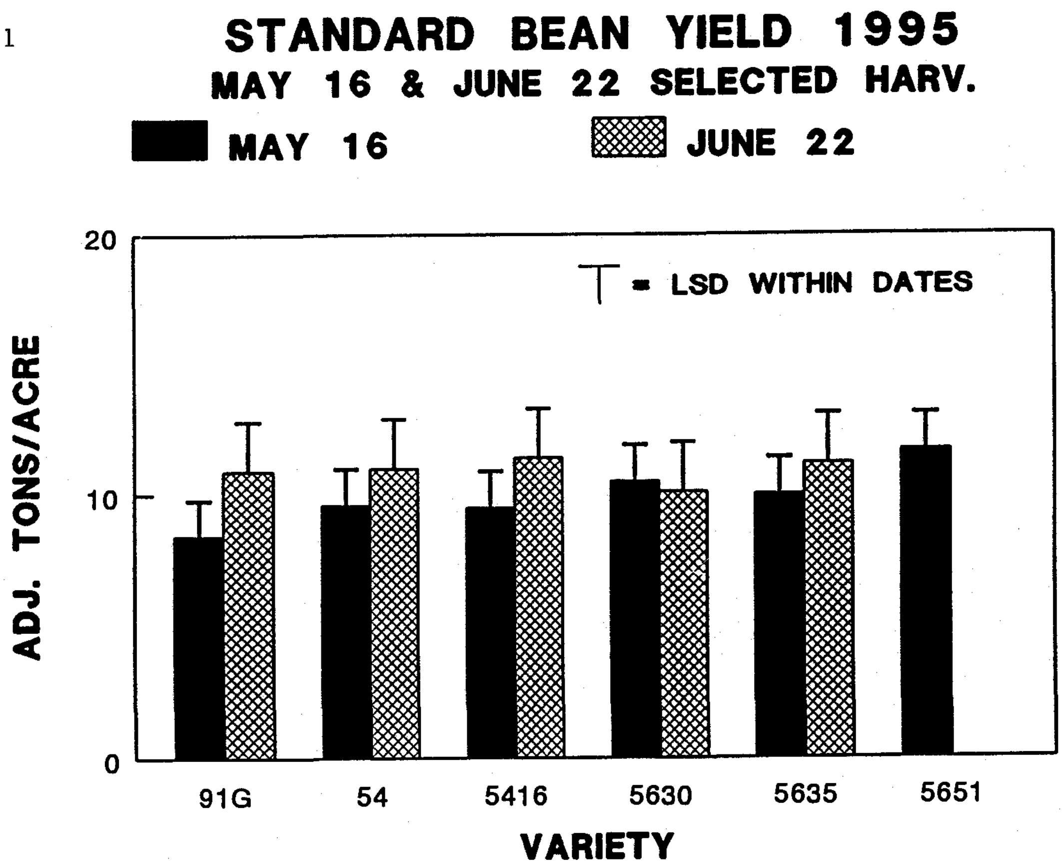


FIGURE 2

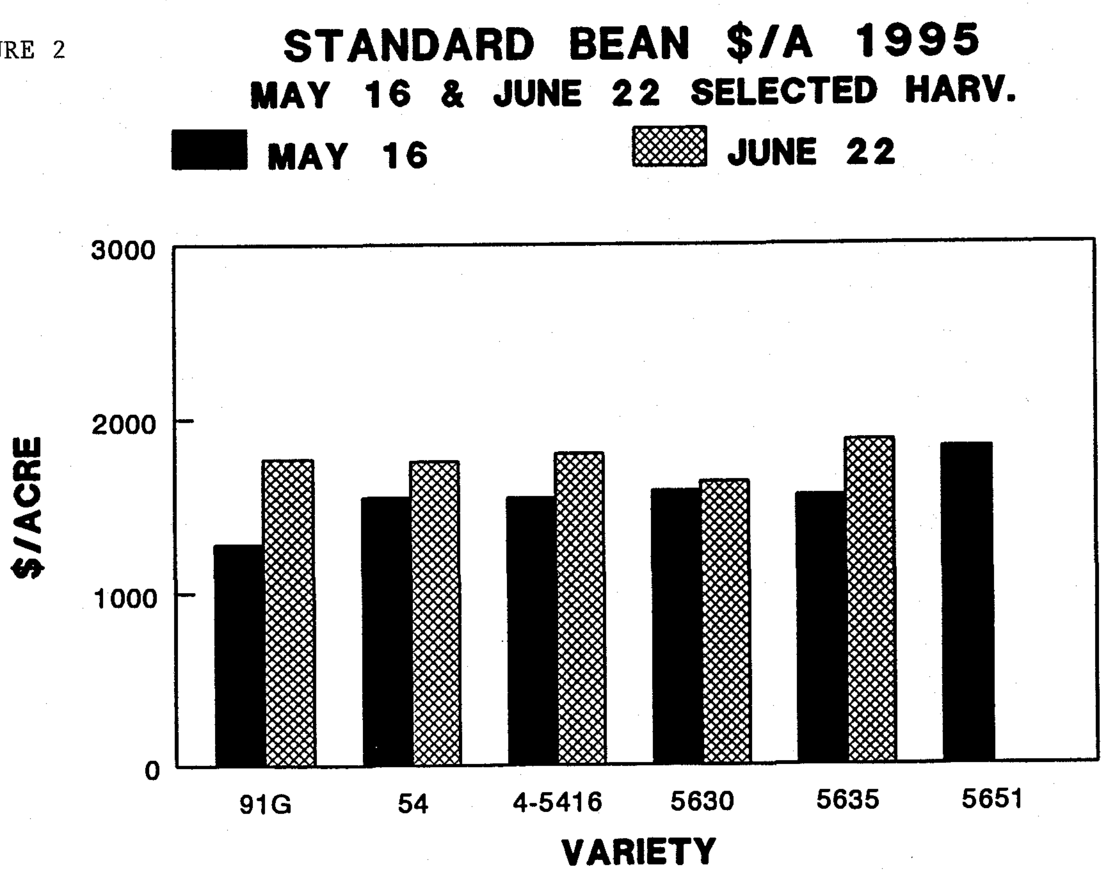


FIGURE 3

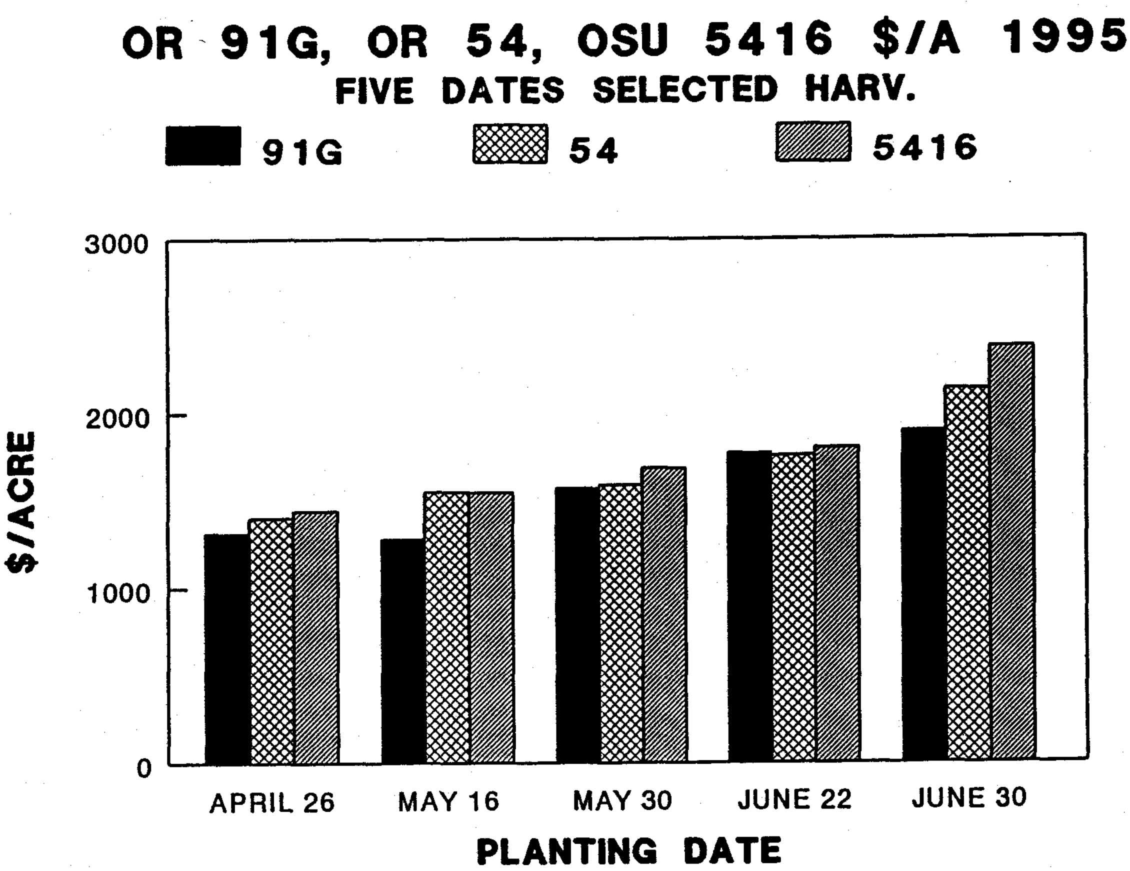

OR 91G, OR 54, OSU 5416 $/A 1995
FIVE DATES SELECTED HARV.
91G
54
5416
3000
2000
1000
0
$/ACRE
APRIL 26
MAY 16
MAY 30
JUNE 22
JUNE 30
PLANTING DATE

FIGURE 4

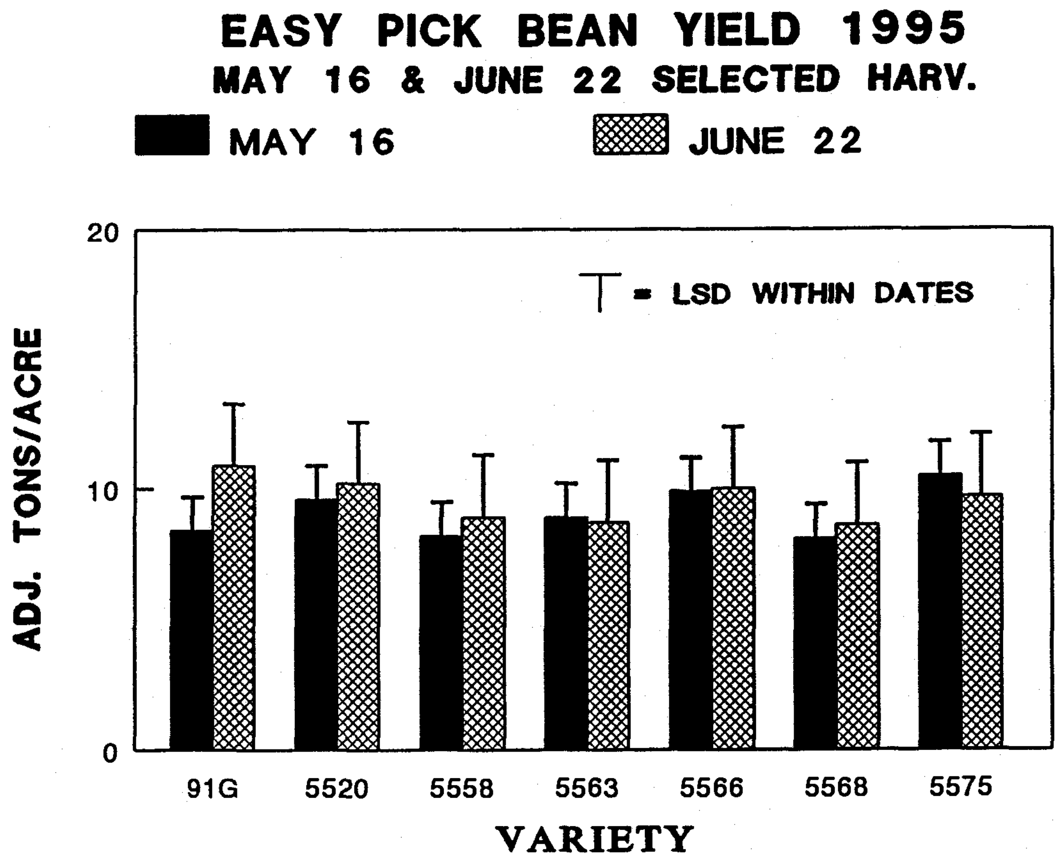


FIGURE 5

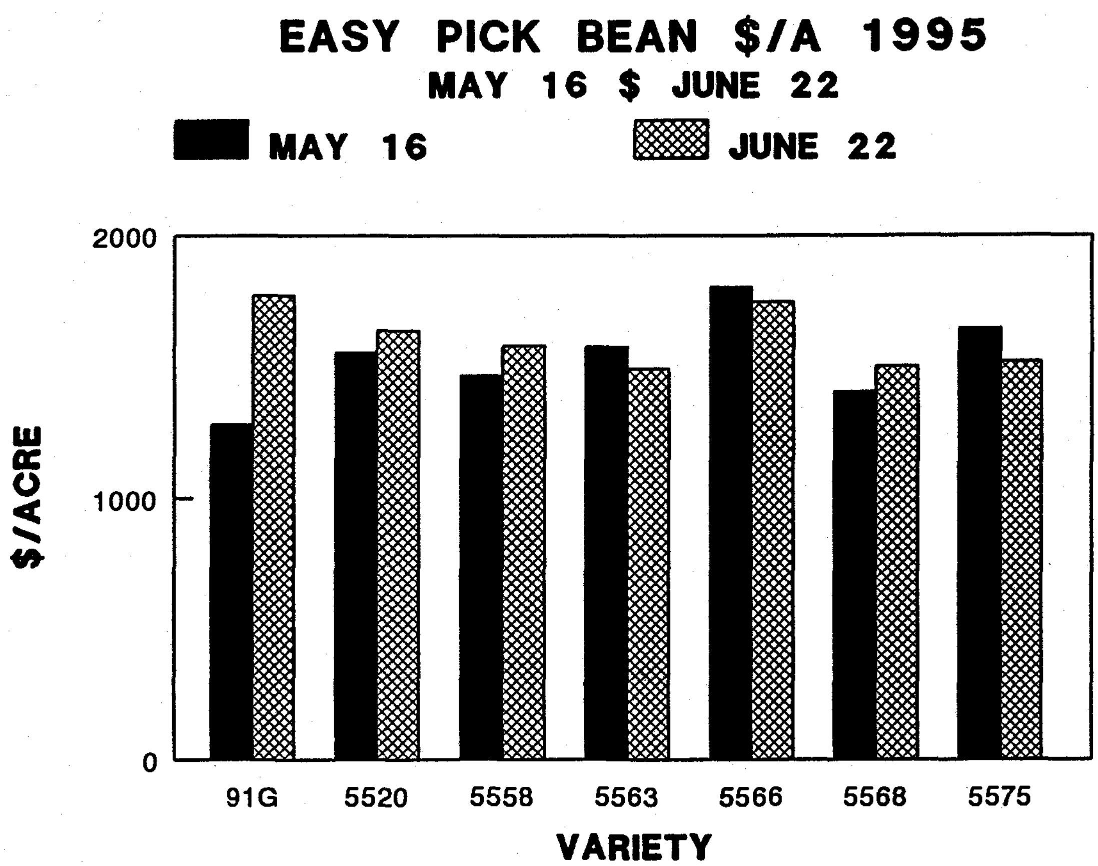


FIGURE 6

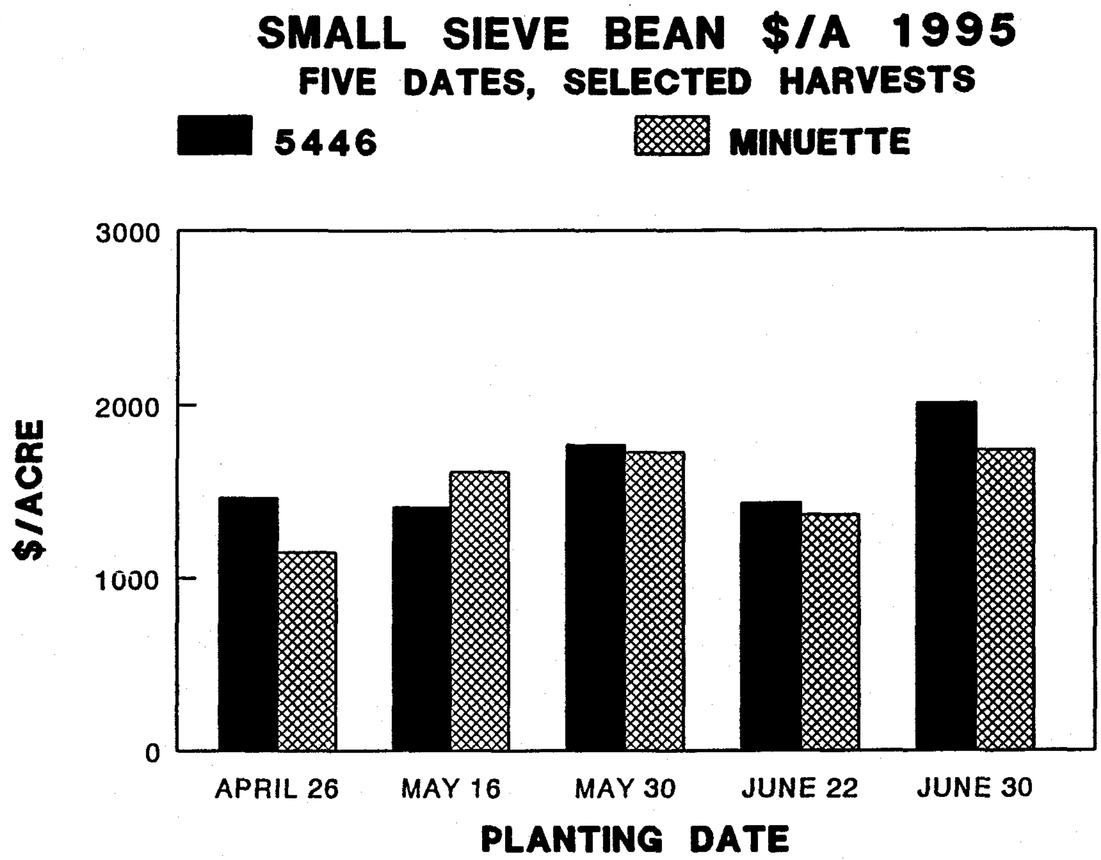


FIGURE 7

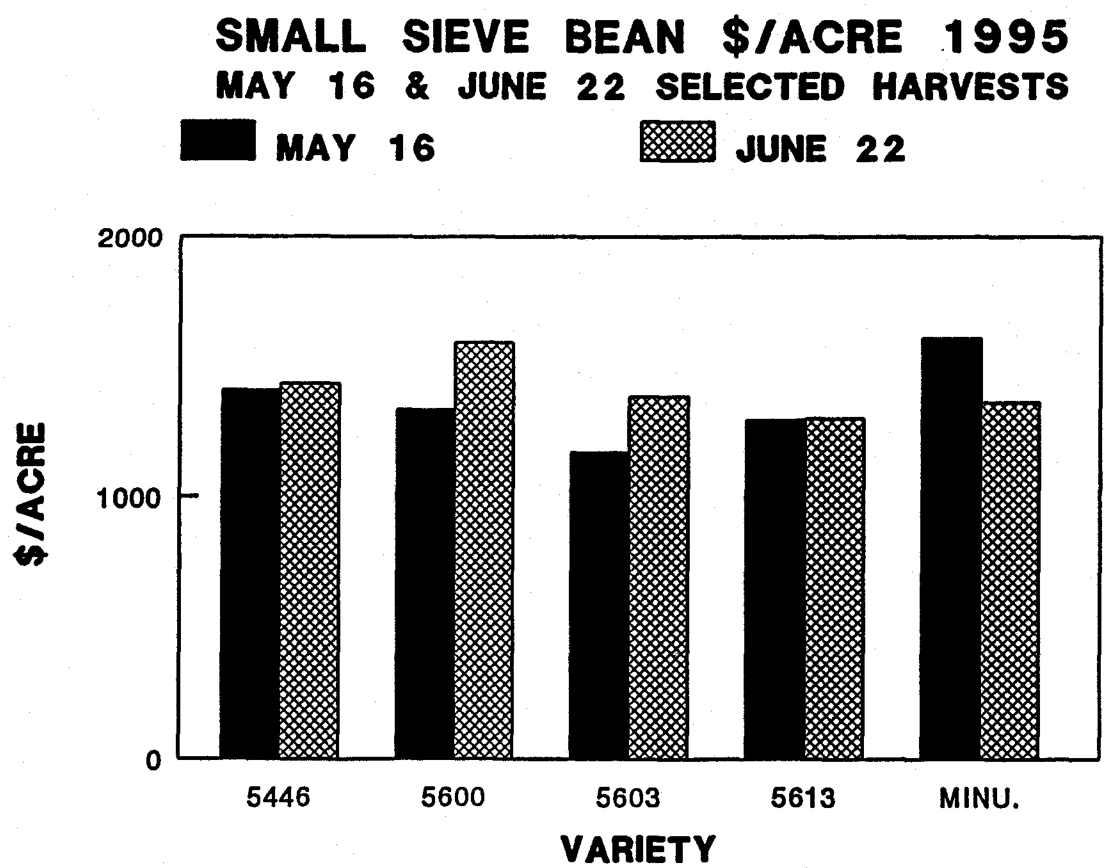


FIGURE 8

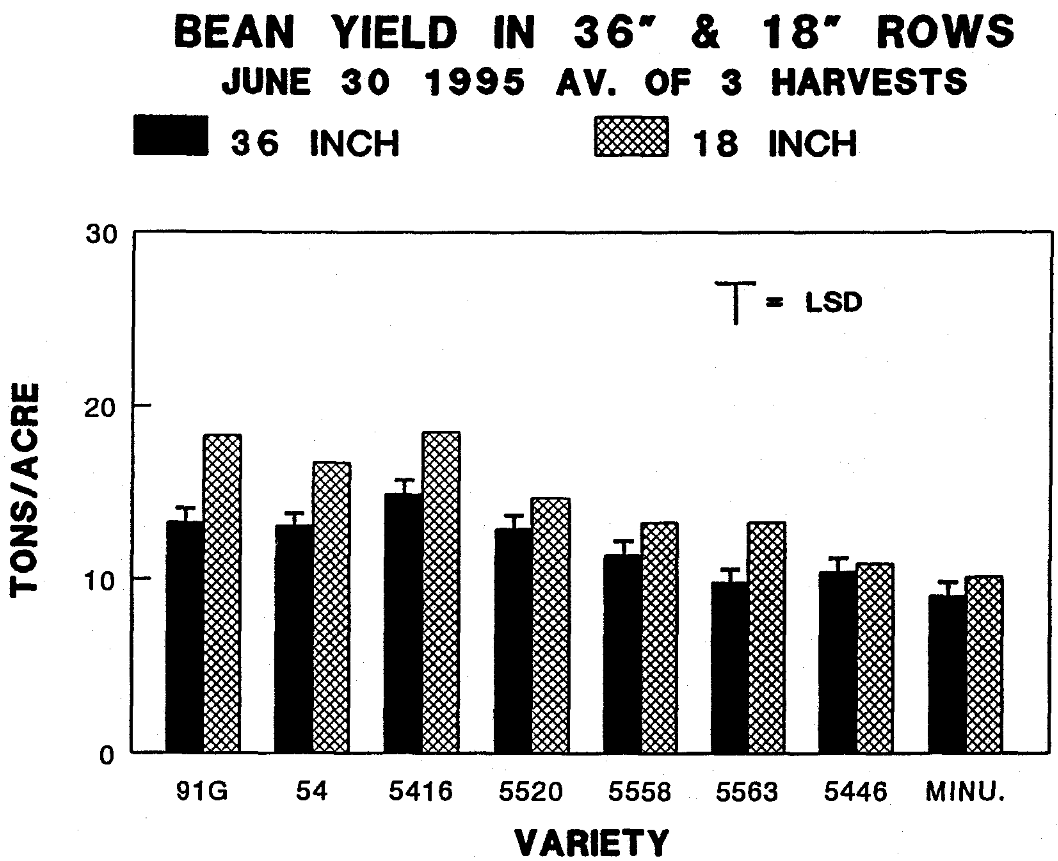


FIGURE 9

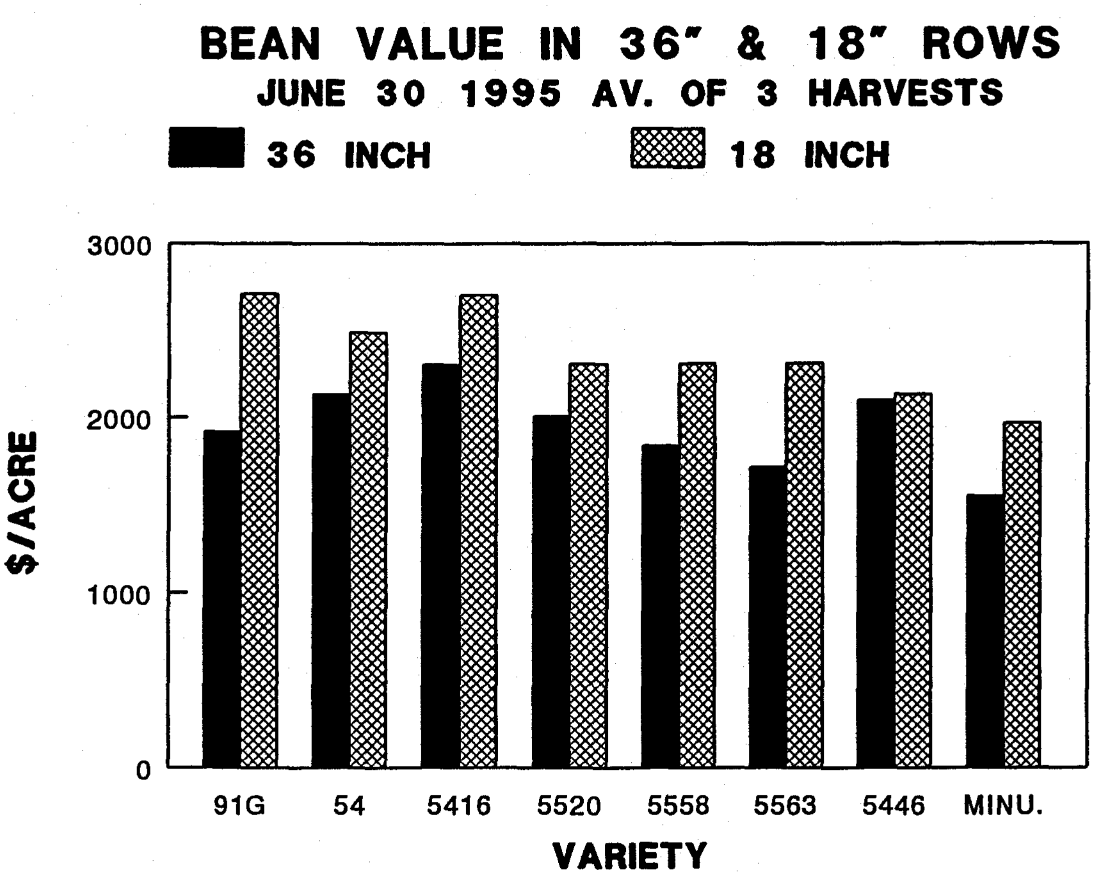
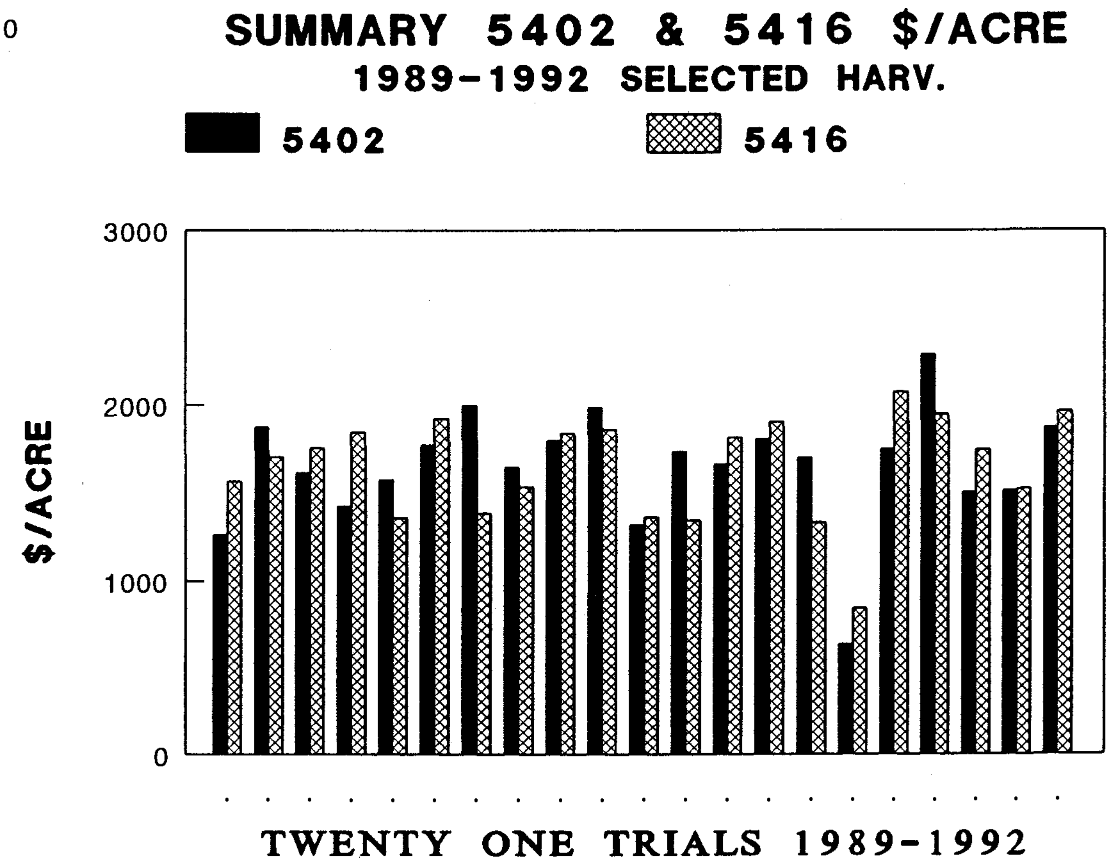
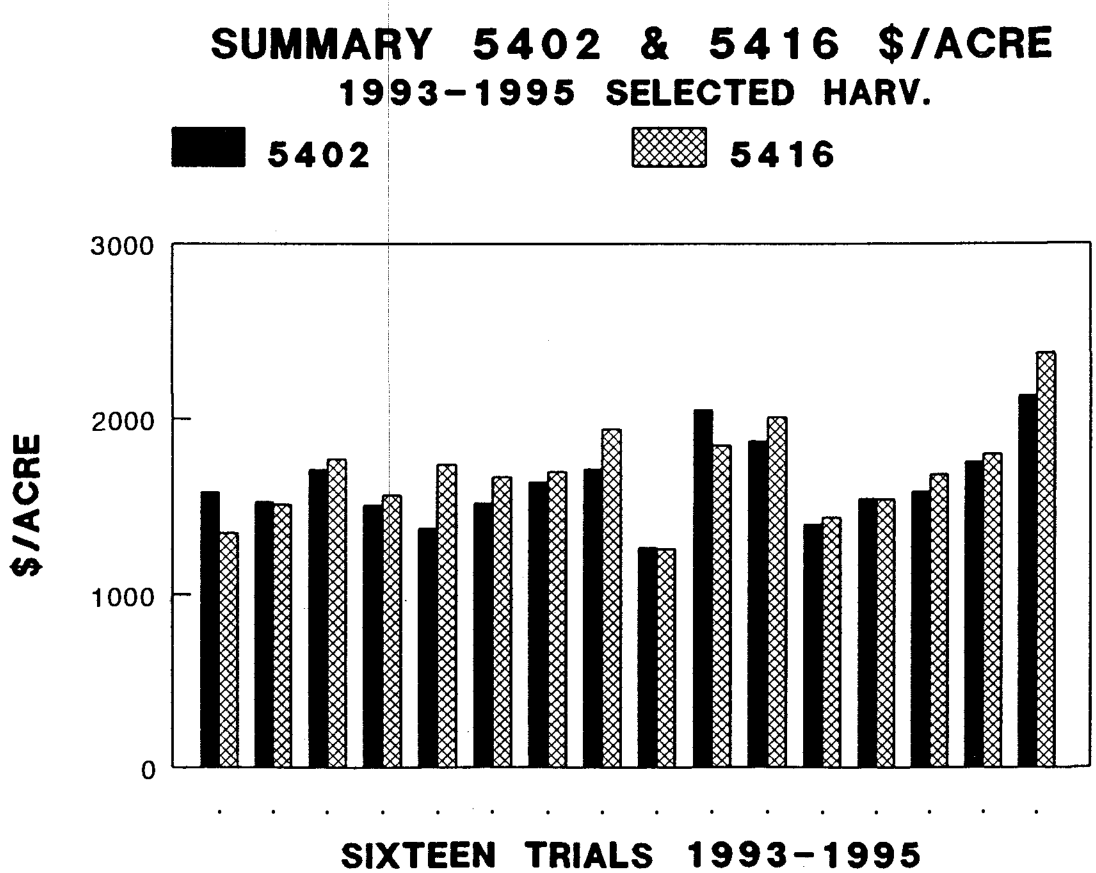


FIGURE 10


SUMMARY 5402 & 5416 $/ACRE
1989-1992 SELECTED HARV.
5402
5416
3000
2000
1000
0
$/ACRE
TWENTY ONE TRIALS 1989-1992


SUMMARY 5402 & 5416 $/ACRE
1993-1995 SELECTED HARV.
5402
5416
3000
2000
1000
0
$/ACRE
SIXTEEN TRIALS 1993-1995

RESEARCH REPORT SUBMITTED
TO
OREGON PROCESSED VEGETABLE COMMISSION
VIA
AGRICULTURAL RESEARCH FOUNDATION
December 1995

TITLE: Genetic Transformation of Beans

PROJECT LEADERS: David Mok and Machteld Mok, Horticulture, OSU

PROJECT STATUS: Third of five years

PROJECT FUNDING FOR THIS PERIOD: $36,400

Funds were used to support a research technician, a student lab aid, to purchase chemicals and other disposable items.

OBJECTIVES:

1. To devise regeneration systems in beans adaptable to transformation using *Agrobacterium* infection.

2. To design and optimize conditions to deliver DNAs using particle bombardment.

PROGRESS:

Background:

Specific traits in plants can be modified by inserting either foreign genes or altered native genes. The process of delivering genes is called transformation. In plants, two general approaches are employed to obtain transformation, although specific conditions of either approach vary greatly between species. The first approach utilizes the bacterium, *Agrobacterium*, which infects plants and inserts a piece of its own DNA (T-DNA) into the host chromosomes. If a foreign gene is spliced into the T-DNA, the foreign gene can be incorporated into the plant. This approach works well in conjunction with regeneration of plants from tissue culture which involves selection of transformed cells and subsequently deriving plants from single cells to avoid chimeras. The second approach employs a "gene gun" which delivers DNA coated tungsten or gold particles directly to the growth points of the plant. Seeds are then obtained from treated plants to select for transformed progeny in subsequent generations. Methods to successfully transform beans (as well as many other large-seeded legumes) have yet to be devised.

An important consideration is which genes should be targeted for change. In recent years, many genes controlling a number of traits have been isolated from plants as well as other organisms. Regardless of the source of origin, these genes can be modified and transferred into plants.

In beans, perhaps one of the most obvious ojectives is resistance to viral, bacterial and fungal diseases. For viral resistance, overexpressing either coat protein genes of the virus in plants, or generating a number of untranslatable viral RNAs in transgenic plants confer immunity to viral infection. For bacterial diseases such as *Pseudomonas* infection, a gene-for-gene relationship governs the resistance via hypersensitivity reaction (infected cells die thereby limiting the spread of the bacteria). Resistance genes isolated from one host plants can be transferred to others and confer resistance. For fungal diseases such as *Botrytis*, genes encoding proteins inhibiting growth of fungus have also been isolated recently and presumably can be utilized to confer resistance. It is not known at present if such proteins have an effect on inhibiting the growth of white mold (*Sclerotinia*), a serious problem in Oregon. In addition, a number of genes encoding general disease defense enzymes such as glucanase and chitinase can also be overexpressed to elevate the degree of general resistance to pathogens. In test plants such as tobacco and *Arabidopsis*, these approaches have been tested and found to be successful. Therefore, the utilization of such genes to increase disease resistance of beans will be the eventual goal of the project. (An oral presentation of the background and progress will be made at the January 16 Vegetable Growers meeting in Salem.)

Progress:

In the past years, we have utilized both *Agrobacterium* infection and gene gun to successfully deliver DNAs with a reporter gene (GUS gene) to a variety of bean tissues including hypocotyls, callus and meristem of germinating seeds. Transformed cells are evidenced by the formation of a blue color when treated with appropriate reagents, the result of the expression of the foreign reporter gene, GUS. Immature embryos and seedlings germinated under sterile conditions were used. Approximately 2% of the cells in treated samples were GUS positive. Although using the GUS gene is convenient in visually detecting transformation, the assay is destructive (cells are killed). Therefore, in the past year, additional selection markers, herbicide resistance genes were incorporated into the DNA in addition to the GUS gene. These genes confer resistance to kanamycin or the Bialaphos and treated tissues were grown on medium containing these selective agents to allow only transformed cells to grow. Samples of surviving cells were then used for the GUS assay to reconfirm the presence of foreign DNA. This modified procedure resulted in recovering transformed cells in all tissues treated. However, shoots derived from treated meristems did not give rise to transformed seeds. The exact cause of transformed cells not included in meiotic cells (derived from layers 2 and 3 cells of the meristem which give rise to pollen and eggs) is not clear. One of the most likely explanation is the escape of larger number of non-transformed cells from herbicide selection which out competed the low number of transformed cells. Future efforts will be directed at increasing the frequency of transformed cells by using much younger tissues (such as immature embryos under 1 cm in length) and stronger selection pressure (higher concentration of herbicides) to eliminate non-transformants.

SIGNATURES:

Project Leaders:

Redacted for Privacy — Redacted for Privacy

David W. S. Mok	Date	Machteld C. Mok	Date
Professor		Professor	

Redacted for Privacy

Charles Boyer, Head — Date

Submitted to the
Oregon Processed Vegetable Commission
and the
Agricultural Research Foundation
1995-1996

Title: Impact of Cereal Cover Crop Residues Weed Emergence and White Mold Severity and Incidence in Snap Beans

Project Leaders: Ray William and Ed Peachey, Horticulture Department
Project Status: Concluding one year
Amount Requested: $6,000

Summary

Two trials were established with a late season planting to evaluate the potential of manipulating tillage and vegetation to suppress white mold severity in snap beans. Small grain cereals were spring planted and killed in June to provide a dead mulch into which snap beans were planted with a cross-slot planter. In the first trial, white mold severity was greatest in the *Wheeler* rye residue, and least in the conventional tillage plot with Ronlian. Eliminating tillage was the most effective practice in reducing white mold severity but the difference was statistically unimportant. Plant nutrient analysis at harvest indicated no difference in nitrogen content between plants collected from these treatments. However, levels of calcium, magnesium and manganese were highest in the fallow treatment with no cereal residue, the same treatment with the lowest level of white mold. Snap bean yield was highest in the Ronilan treated plot and lowest in the residue plots, partially due to delayed maturity.

In the second trial, white mold severity was lowest in the conventional tillage treatment with Ronilan and highest in the conventional tillage treatment without Ronilan. Within residue plots, snap beans planted into unflailed residue had lower white mold ratings. However, plant density also was highest in plots that were flailed. Trends also indicate that *Wheeler* rye treatments again had the highest level of white mold while *Micah* barley may have reduced white mold to some extent. Bean plant biomass yield was primarily a factor of white mold severity and did not reflect the direct impact of cereal residues on plant growth..

Objective

Evaluate the interaction of cereal residue management with weed emergence and growth, white mold incidence and snap bean yield.

Project Progress

Methods. This study is a continuation of trials evaluated in 1993 and 1994 trials. *Steptoe* and *Micah* barley and *Wheeler* rye were drilled into prepared 15 by 60 foot plots on May 23, 1995 that were fertilized with 600 lbs/acre of 12-29-10. Cereals and weedy vegetation growing in fallow plots were killed on July 3 with glyphosate. Just before planting, one of the two fallow plots was chisel plowed and rototilled for the conventional tillage seedbed. In Trial 1, the cereal residues were rolled and snap beans planted with the cross-slot planter. Liquid fertilizer was banded at planting (50 gal/acre of 10-34-0; ie 70 lbs N). After planting, the residue was flailed in one-half of each plot. Metolachor was applied immediately after planting to all but 15 foot of the plot to allow for evaluation of residue on weed emergence. Glyphosate (1 lb./A) was again applied to the entire plot at this time to kill surviving weeds such as common purslane, particularly in the fallow and *Wheeler* rye plot. Basagran was applied to the entire plot on August 8, timed to kill emerging weeds in the conventional tillage plot. Any remaining weeds were removed by hand, except from the area that was used for weed evaluation. Ronilan was applied to one half of the conventional tillage plot with a backpack sprayer and nozzle angled at 45 from both sides of the row.

In trial # 2, snap beans were planted on July 19 into unflailed residue and the conventional tillage seedbeds with the cross-slot planter. Metolachlor and glyphosate were applied (tank mixed) immediately afterward, then half of each plot flailed. One plot was covered with a landscaping fabric to simulate a soil barrier to white mold spores.

Weed emergence was determined from 4 ft^2 on August 7, 4 WAP in the first trial only. Snap beans were harvested from 15 foot of row and total bean biomass and pod weights determined. White mold severity was evaluated on a 0-4 scale (1=single point infection on the plant stems, 2=multiple stems infected, 3=multiple point infection with wilting stems or damaged pods, 4=dead plant). White mold incidence was determined by the number of plants with any sign of infection.

Beginning at first bloom, the canopy was wetted with 15 minutes of irrigation late in the evening to encourage white mold development.

Results. Experiment 1. Growth was vigorous in this trial because of the high fertility conditions. White mold developed on a high percentage of the plants. Bean yield was highest for the treatment with Ronilan probably because of reduced mold pressure. White mold severity was least for the Ronilan treatment and greatest for the *Wheeler* rye plot. Though treatment differences were significant, the primary difference was between the Ronilan treated plot and the same tillage treatment without Ronilan. *Wheeler* rye also tended to increase white mold severity and whole-plot visual observations (aside from single plant evaluations) in the field confirmed this. *Steptoe* and *Micah* barley (very similar residue types) had similar levels of white mold, and disease severity in these plots was slightly less than the conventional tillage treatment. The lowest level of mold was in the fallow plots with no cover crop. However, variability in the data prohibit any consensus as to whether this is an actual fact or simply an artifact of plot location and other unknown effects. Flailing the residue seemed to have little consistent effect on white mold incidence.

We evaluated several factors to understand what might be influencing these results. Regression analysis indicated a very poor relationship between white mold development and plant density (R^2=0.002). Snap bean yield regressed against white mold severity indicated a moderate correlation, as would be expected if the disease pressure is high and damaging plant growth. We also hypothesized that cereal residues may limit nitrogen uptake by the beans, thus reducing susceptibility to white mold. However, nutrient analysis of the plants indicated no differences between any of the treatments for the macro elements N, P, or K. However, calcium and the micronutrients manganese and magnesium were at significantly higher levels in plants collected from the fallow plot with no cover crops. These same plots had the lowest amount of white mold. Weeds were completely controlled in the plot and did not influence white mold results.

Snap bean yield was highest in the conventionally tilled plot with Ronilan. Even though white mold severity tended to be lower in the barley plots, yields were also lowest. Maturity was slightly delayed in these plots, possibly attributing to the yield decline. Flailing the residue increased the yield of beans in the *Micah* barley plot, decreased it in the *Steptoe* barley plot and had little effect on the *Wheeler* rye treatment. *Wheeler* rye is a winter annual and had a very grass-like appearance, produced a low amount of biomass, and was easy to plant into. However, the data seem to indicate that *Wheeler* rye aggravated white mold severity.

Weed evaluations from the untreated areas indicated that the barley residues were most effective at minimizing weed emergence. *Micah* barley completely suppressed nightshade though reduced tillage was the most important component of this effect. Total weed density was reduced in all residue treatments compared to the conventional tillage plot.

Experiment #2. As in the first experiment, trends indicate a possible reduction of white mold severity due to treatment. However, the comparison between white mold severity in flailed and unflailed treatments was statistically more important ($P=0.02$). Residue treatments that were unflailed had comparatively lower white mold ratings. The conventional tillage plot without Ronilan had the highest level of white mold, but applying Ronilan effectively reduced white mold to the lowest levels. Trends also indicate that *Micah* barley treatments may have reduced white mold severity compared to the conventional tillage plot, particularly in the unflailed subplot. However, this treatment also had the lowest plant density, and the relationship between plant density and white mold severity was very low in this experiment ($R^2=0.06$). Bean biomass accumulation was not a good indicator of plant canopy or bean plant growth because white mold was very severe in this plot. It is possible that the greater residue of barley delayed bean development slightly and therefore, white mold onset, although field observations did not support this. *Wheeler* rye again had the highest white mold rating. The simulated barrier reduced white mold compared to the same treatment with no barrier, but statistically the difference is not significant.

Table 1. Cover crop residue impacts on white mold development and snap bean yield, Vegetable Research Farm, Corvallis, OR, 1995.

Cover crop	Management	Stand at 4 WAP	White mold at harvest				Plants harvested	Bean pod yield	Maturity	Bean plant biomass
		(no./2 ft)	severity (0-4)[1]		incidence (% plants)		no./15'	t/ac	% 2-4	kgs/15'.
1. Micah barley	Unflailed	12.0	0.81	*0.60*	38	*0.20*	66	6.7	61	12.0
Micah barley	Flailed	10.3	0.76	*0.50*	45	*0.30*	73	7.9	60	14.0
2. Steptoe barley	Unflailed	12.0	0.65	*0.30*	39	*0.20*	79	8.4	60	13.9
Steptoe barley	Flailed	10.3	1.15	*0.70*	58	*0.80*	73	6.8	61	12.5
3. Wheeler rye	Unflailed	11.0	1.45	*0.20*	61	*1.00*	68	6.9	66	12.2
Wheeler rye	Flailed	10.0	1.18	*0.60*	59	*0.90*	70	7.5	60	13.6
4. None	Unflailed	9.5	0.56	*0.20*	43	*0.30*	63	8.5	56	14.6
None	Flailed	9.3	0.81	*0.60*	34	*0.10*	64	8.8	53	14.8
5. Conventional tillage	No fungicide	9.6	1.00		61		73	8.1	56	13.9
6. Conventional tillage	Ronilan	-	0.21	*0.03*	19	*0.20*	68	9.3	56	14.9
Main effect means										
1 Micah barley		11.1	0.78 ab[2]		41 ab		69	7.3	61	13.0
2 Steptoe barley		11.1	0.90 ab		48 ab		76	7.6	61	13.2
3 Wheeler rye		10.5	1.31 a		60 a		69	7.2	63	12.9
4 None		9.6	0.68 ab		38 ab		67	8.1	57	14.2
5 Tilled		9.6	1.00 a		61 a		73	8.1	56	13.9
6 Tilled+ Ronilan		9.6	0.21 b		19 b		68	9.3	56	14.9
LSD (P=0.05)							19	2.0	-	1.0

[1] Probability of a difference between the mean in this cell compared to the conventional tillage treatment without Ronilan.

[2] Means in the same column followed by the same letter are statistically equal (Duncan's multiple range test, P=0.05)

Table 2. Cover crop residue and tillage impacts on weed emergence in snap beans, Vegetable Research Farm, Corvallis, OR, 1995.

Cover crop	Management	Weed control					
		Pigweed	Sheperdspurse	Purslane	Nightshade	Misc.	Total weeds
			--------------------	(no./m sq)	--------------------		
1 Micah barley	Unflailed	0.5	3.5	2.3	0.0	3.3	9.5
Micah barley	Flailed	0.5	1.3	0.5	0.0	0.8	3.0
2 Steptoe barley	Unflailed	0.3	0.0	1.5	0.8	0.8	3.3
Steptoe barley	Flailed	2.0	0.8	1.5	0.5	1.0	5.8
3 Wheeler rye	Unflailed	0.8	4.3	3.0	1.5	0.8	10.3
Wheeler rye	Flailed	0.8	0.8	1.0	0.0	2.0	4.5
4 None	Unflailed	1.5	8.8	2.0	0.5	1.0	13.8
None	Flailed	1.3	2.8	4.3	0.3	1.0	9.5
5 Conventional tillage	No fungicide	2.0	15.2	8.0	3.4	5.8	34.4
LSD (P=0.05)		2.1	13.0	5.8	1.2	6.5	14.2
Main effects							
1 Micah barley		0.5	2.4	1.4	0.0	2.0	6.3
2 Steptoe barley		1.1	0.4	1.5	0.6	0.9	4.5
3 Wheeler rye		0.8	2.5	2.0	0.8	1.4	7.4
4 None		1.0	1.8	2.6	0.1	1.5	7.0
5 Tilled		2.0	15.2	8.0	3.4	5.8	34.4

Table 3. Trial #2: Cover crop residue impacts and tillage impacts on white mold incidence in snap beans, Vegetable research Farm, Corvallis, OR, 1995.

Cereal	Management	White mold at harvest		Plants harvested	Bean plant biomass
		severity (0-4)[3]	incidence (% plants)	no./15'	kgs/15'.
1 Micah barley	Unflailed	1.33 abc	65 bc	31 a	4.7 a
Micah barley	Flailed	2.21 ab	92 a	41 a	5.0 ab
3 Wheeler rye	Unflailed	2.38 a	86 ab	38 a	4.8 ab
Wheeler rye	Flailed	2.72 a	97 a	37 a	4.4 ab
4 Simulated barrier		1.93 abc	75 bc	32 a	5.6 ab
No cover crop	-	2.73 a	98 a	36 a	5.2 ab
5 Conventional tillage	Ronilan	0.98 c	46 c	34 a	6.0 a
Conventional tillage	No fungicide	2.95 a	96 ab	36 a	3.8b

[3] Means followed by the same letter are statistically equal (P=0.05). This comparison treated subplots as individual treatments.

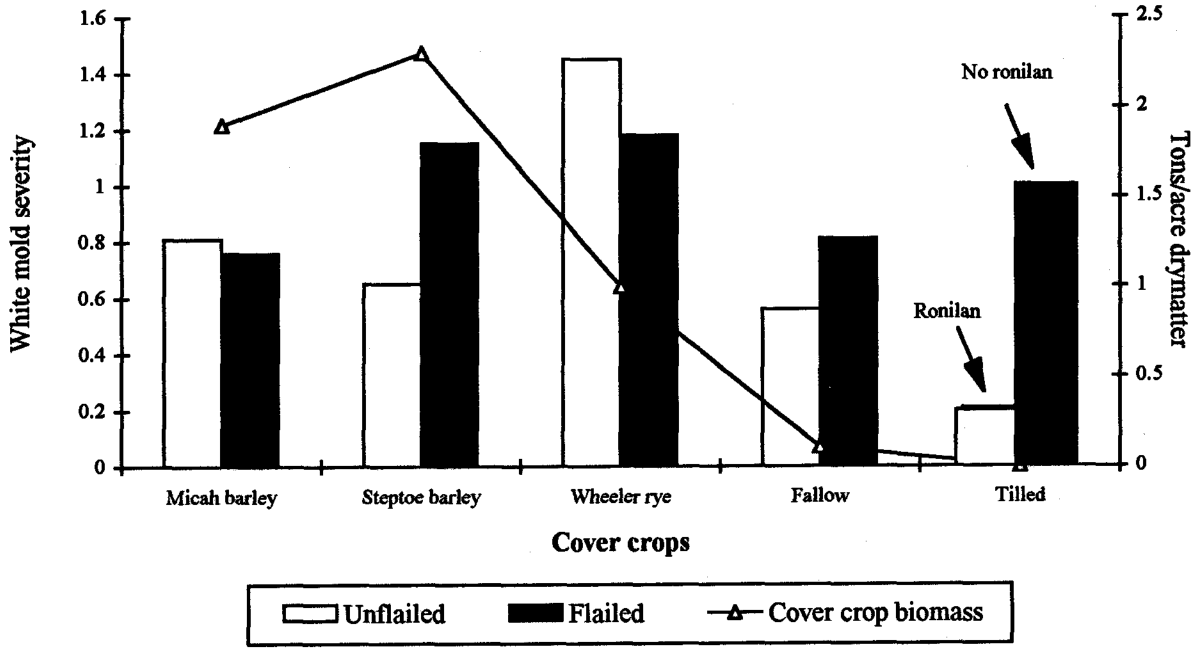


Figure 1. Impact of cereal cover crop residues and tillage on white mold severity, (Experiment #1).

Report to the Oregon Processed Vegetable Commission
1995-1996

1. Title: Broccoli Breeding

2. Project Leader: J. R. Baggett, Horticulture

3. Project Status: Terminating June 30, 1996

4. Project Funding: $12,000

   Funds were used for research farm expenses, student labor for pollination in the greenhouse and field plot work, and provided partial support of two vegetable breeding technicians.

5. Objectives:

   Develop broccoli varieties for processing in western Oregon stressing:

   A. Elongate habit with exserted heads, easily accessible for harvest

   B. Large, openly branched and segmented heads with heavy, clean stems for easy trimming and separation into spears or chunks

   C. Small, firm, uniform florets with short pedicels and good color which are retained after freezing

   D. Early to mid-season maturity, concentrated high yield potential

   E. Club root and downy mildew resistance

6. Report of Progress:

   A. Emphasis in 1995 was on continued evaluation by direct observation and evaluation of experimental hybrids of our newer inbred lines. Nineteen of these lines were retained after the 1994 field evaluations (15 of these were released to broccoli breeders in 1994, along with nine OSU 240-5 sublines, to facilitate development of commercially usable F_1 hybrids with the high exsertion, segmented character considered of promise for processing; the released inbred lines were sent to breeders at Harris-Moran, Ferry Morse, Asgrow, Rogers, Bejo, Sakata, Takii, Shamrock, Peto, Royal Sluis, and Daehnfeldt seed companies).

      In 1995, the potential of the new inbred lines was tested by crossing them with several of the OSU 240-5 sublines. The inbreds and hybrid were direct-seeded July 5. Because the crosses and reciprocal crosses obtained by crossing a new inbred with the OSU 240-5 subline were so similar, and because they matured over a short period of time, the group of hybrids from a single new inbred was assigned a single score and description (Table 1). Decisions to save or discard a particular line were based on these scores and on observations of the inbred line itself. Intercrosses between some of these lines were also made and evaluated. These intercrosses were generally smaller and lower scoring than crosses involving an S240-5 parent.

Selections were made in F_5 families from new crosses involving commercial hybrids 'Arcadia', 'Emerald City', and 'Marathon'. These new lines appear to be retaining good size as they are inbred, and are very promising for head and plant type. Because of the use of commercial hybrids as parents, the chance exists for obtaining new incompatibility factors which could facilitate developing usable F_1 hybrids. The new selections have been propagated for self-pollination in the greenhouse.

B. Commercial broccoli hybrids were tested in a replicated trial (Tables 2 and 3). Many of these varieties yielded well, but many of them had very poor head exsertion and were difficult to cut, or had poor color. Varieties considered very poorly exserted were 'Packman', 'Excelsior', 'Regal', and 'Pirate'. 'Arcadia' and 'Emerald City' had good dome form and good florets, but 'Arcadia' had yellow rosettes and yellow undercolor and 'Emerald City' had dead florets and soft rot. Outstanding for plant and head type was HMX 1134. This hybrid had tall plants and large, firm exserted dome heads similar to hybrids we have produced from our inbreds. Although they lacked segmentation, they were considered to be promising for commercial use in Oregon.

C. Commercial variety observations are reported in Table 4. In that table, varieties with an overall score of 3.5 or over are considered to be worth including in future trials, but while these scores reflect some outstanding attributes, they do not fully reflect processing potential. The only variety receiving scores of 3.5 in 1995 was HMX 1134.

7. Summary:

Nineteen new inbred lines were evaluated by direct observation and by producing and observing 113 experimental crosses between these lines and OSU 240-5 sublines. These evaluations resulted in retention of 17 of the newer inbreds. Selection continued on a new cycle of inbred lines derived from crosses of OSU lines x 'Arcadia', 'Emerald City', and 'Marathon'. HMX 1134 was considered the outstanding commercial hybrid tested in a replicated trial. Others, while high yielding, usually had poor head exsertion and/or color.

8. Signatures:

Redacted for Privacy

Project Leader: ____________

Redacted for Privacy

Department Head: ____________

Table 1. **Hybrid performance of crosses between new OSU broccoli breeding lines and OSU 240-5 sublines, Corvallis, 1995.[z]**

Breeding Line	Score[y]	Size (in.)	Florets	Head Stem Color	Exsertion[x]	Notes
S370	4.0	8	fine	G	G	firm, good segments, deep-branched, fair yield
S373	3.0	5	fine	G	G	rougher, smaller heads, and later than S370 crosses
S384	4.0	7	fine	G	G	deep dome, good big segments
S387	4.0	8	fine	G	G	deep-branched, very good firm segments
S388	3.5	8	fine	G	VG	tall, deep-branched dome but some rough with too much segmentation, sunken centers and soft rot
S389	3.75	8	fine	G	G	deep-branched, highly segmented dome, some sunken centers, rosettes and soft rot
S391	4.0	8	fine	G	G	highly segmented, deep-branched dome
S392	4.5	8	fine	G	G	very good, firm, well separated segments
S394	3.0	8	fine	G	G	too rough
S396	3.75	6	fine	G	VG	very good form and segments but may be too small
S398	3.75	6	fine	G	G	highly segmented dome but may be too small
S399	4.0	8	fine	G	VG	tall segmented dome, firm
S400	4.0	7	fine	G	VG	tall deep-branched dome, some slightly rough
S401	4.0	8	med. fine	G	G	deep-branched, firm segments
S403	4.0	9	fine	G	G	good size, highly segmented, some slightly rough
S410	3.5	6	fine	G	G	segments possibly too small and uneven
S411	4.0	9	fine	VG	G	good size, firm segments
S413	3.75	7	fine	VG	VG	deep-branched, good segments
S414	3.75	7	fine	G	VG	tall, deep-branched, good segments, some slightly rough

[z]Direct-seeded July 5 in 3' rows, thinned to about 15" between plants. All scores and measurements are based on overall observations of all hybrids made with each breeding line (about 6 hybrids, including reciprocals). All hybrids were hand-made in the greenhouse. The OSU 240-5 sublines served as a common parent.
[y]General score 1-5 scale, 5 = best and would indicate a good fit with the current concept of a good processing head: highly segmented, segments firm with small florets with short pedicels, good color, and good head exsertion.
[x]Exsertion refers to protrusion of heads above foliage for easy cutting.

Table 2. Broccoli yield trial, Corvallis, 1995.[z]

Variety	Source[y]	Total No. Heads/A	Total T/A	Lbs/ Head	No. Weeks Harvested	Avg. Tons/ Week	Largest Tons/ Week
Pirate	1	16895	5.9	0.71	2	3.0	4.7
HMX 1134	2	20383	9.3	0.92	2	4.7	6.5
Excelsior	2	24416	6.5	0.53	2	3.3	6.0
Regal	3	18857	6.6	0.71	1	6.6	6.6
Emerald City	2	24089	9.4	0.78	2	4.7	6.1
Arcadia	4	24307	9.5	0.78	2	4.8	5.7
Packman	1	15914	5.4	0.69	1	5.4	5.4
LSD @ 5%		3783	1.4	0.07			

[z]Direct-seeded July 7 in 30' plots, 20" between rows, 2 rows per plot, thinned to 10" between plants; 900 lbs/A 12-29-10 broadcast at planting time and 100 lbs N side-dressed on August 29.

[y]Sources: 1 = Peto, 2 = Harris-Moran, 3 = Ferry Morse, 4 = Sakata.

Table 3. Pattern of maturity in broccoli hybrids, Corvallis, 1995.

Variety	T/A For Week Of			
	9/18	9/25	10/2	10/9
Pirate			4.7	1.2
HMX 1134			6.5	2.8
Excelsior		6.0	0.4	
Regal	6.6			
Emerald City		6.1	3.3	
Arcadia		5.7	3.8	
Packman	5.4			

Table 4. Commercial broccoli variety observations, Corvallis, 1995.[z]

Variety	Source[y]	Mat. Date	Score[x]	Head Diam. (in.)	Florets	Head Stem Color	Exser- tion[w]	Notes
Emerald City	1	9/20	2.5	10	medium fine	F	P	yellow undercolor, some bad soft rot, dead florets, heavy heads, good dome shape
HMX 1134	2	9/30	3.5	10	medium	F	G	tightly segmented, firm, heavy, big head, rosettes, light color, tall plant
Cruiser	3	9/15	2.5	8	coarse	F	P	flat heavy heads with large tight segments
Arcadia	1	9/20	3.0	6-8	fine	F	F	good firm dome, some yellow rosettes and yellow undercolor
Patriot	1	9/20	3.0	11	medium	F	P	firm, heavy, compact heads, light floret color, poor processing potential
Gem	4	9/12	2.5	5-6	medium fine	F	G	very rough and uneven
Excelsior	2	9/20	2.5	8	medium	P	P	tight, compact dome, heavy stem, somewhat soft
Barbados	5	9/24	3.0	10	medium	P	F	solid heavy head, uneven florets, color varies from blue-green to yellow-green
Claudia	5	9/19	2.5	10	coarse	P	P	very large, solid umbrella, non-branching plant, uneven florets, soft rot
S89020	3	9/15	2.5	9	medium	F	F	very uniform, non-segmented, large compact heads, long pedicels, poor processing potential
Hi-Caliber	2	9/12	3.0	8-9	coarse	F	G	tall plant, tightly segmented dome, long pedicels, poor processing potential
Pinnacle	2	9/20	3.0	8	medium	F	G	late branching, tall plant, rosettes, yellow undercolor, large firm dome head
PS 21290	6	9/22	2.0	8-10	fine	VP	P	very short, compact, shallow-branched plant, yellow undercolor, soft rot
Pirate	6	9/30	3.0	9	medium	F	P	uneven florets, some sunken centers, compact plant, late
PS 19590	6	9/20	2.0	9-10	fine	P	VP	brownish-yellow florets, dead florets, very short plant
PSX 16284	6	9/21	2.0	10	coarse	P	P	short, compact plant, light color
Packman	6	9/12	2.5	10	medium coarse	P	P	non-branching plant, large, flat, compact head

[z]Direct-seeded July 5 in 3' rows, thinned to about 15" between plants.

[y]Sources: 1 = Sakata, 2 = Harris-Moran, 3 = Royal Sluis, 4 = Asgrow, 5 = Ferry Morse, 6 = Peto.

[x]General scores, 1-5 scale, 5 = best.

[w]Exsertion refers to protrusion of heads above foliage for easy cutting.

Report to the Oregon Processed Vegetable Commission
1995-1996

1. Title: Sweet Corn Variety Evaluation

2. Project Leaders: J. R. Baggett, Horticulture
   Brian Yorgey, Food Science and Technology

3. Project Status: Terminating June 30, 1996

4. Project Funding: $ 6,000 field trials
   $ 4,872 processing
   $10,838

   Funds were used for research farm expenses and labor for harvesting, processing, and evaluation of corn samples.

5. Objectives:

   To determine the production and processing potential of new introductions of sweet corn.

6. Report of Progress:

   A. Replicated plot trials of standard sugary (su) and SE (sugary enhanced) corn varieties were planted on May 31, and supersweet (sh) varieties were planted in a separate field on June 23. In each case, there were four replications, each 30 feet long in rows three feet apart. Replications were arranged in randomized blocks. The plots received 450 lbs/A of 12-29-10 fertilizer banded at planting, and a sidedress of 100 lbs N as urea on 25 July. In the May 31 planting, the SE varieties were separated from the su varieties by a block of SE rows to minimize the effect of the su on SE varieties. Yellow and bi-color varieties were grown together. Additional varieties of each type of corn were planted in non-replicated plots for observation and yield estimates.

   In each planting, plots were overseeded and thinned to stand about 9" apart, or a population of 19,000 per acre. Harvests were made at about 72% moisture for su and SE varieties and about 77% for supersweet varieties, as determined by vacuum oven method. Factors observed are shown in the tables. Except for descriptive observations (Tables 3 and 6), and for the observation plots, all data were obtained separately for each replication.

   Varieties which appeared to have promise for processing were canned and frozen at the Food Science and Technology pilot plant. Objective data and panel evaluations of processed corn samples will be reported at a later date.

   B. Varieties which were noted to have sufficient merit to justify further trial are listed below. All these varieties were processed.

SE Varieties:

GH 1887 - refined, attractive ears, good cylindrical shape, good yield (9.3 T/A), tender, sweet

GH 2684 - very good cylindrical shape, uniform, straight rows, good yield (8.9 T/A), tender, sweet

Empire yielded very well (10.4 T/A), but was generally rough in appearance. GH 5608 had good flavor and appearance, but yields were below average and toughness readings were the highest in the sugary-SE trial.

Sugary (su) Varieties:

DMC 20-04 - uniform, attractive but poor tip fill, many good second ears, good yield (8.1 T/A)

GH 1861 - uniform, very good tip fill, good yield (8.4 T/A), good flavor

Jubilee - very uniform, nice looking ears, deep kernels, good yield (9.1 T/A), good flavor

DMC 20-38 yielded very well (9.9 T/A), but poor ear uniformity may be a problem.

Supersweet (sh_2) Varieties:

Crisp 'n Sweet 710A - uniform, fair yield (6.9 T/A), attractive, neat ears, but fairly tough

Marvel - uniform, large ears, fair yield (7.4 T/A), sweet and very tender

Victor - large ears, good yield (8.5 T/A), but tough

Supersweet Jubilee - very uniform, refined, attractive ears, fair yield (7.6 T/A), very good flavor

Krispy King - fat ears, very uniform, very good tip fill, good yield (8.4 T/A), good flavor but tough

FMX 416 yielded very well (9.0 T/A), but ear uniformity and shape and toughness may be problems.

7. Summary:

Seventeen SE and sugary (su) varieties and 19 supersweet varieties of corn were tested in replicated or observation plots. Four SE, four sweet, and six supersweet varieties were considered to be of interest and candidates for further testing. Twenty varieties were canned and frozen for objective evaluations and industry panel evaluations.

8. Signatures:

Redacted for Privacy

Project Leader: ____

Redacted for Privacy

Project Leader: ____

Redacted for Privacy

Department Head: ____

Department Head:

Redacted for Privacy

Table 1. **Yield and ear measurements, sugary enhancer (se) and sweet (su_1) corn replicated trial, Corvallis, 1995.**[z]

Variety	Source[y]	Type[x]	Silk Date	Days to Harvest	% H_2O	Stand	Good Ears 1000/A	Good Ears T/A	Good Ears No/Plant	Culls 1000/A	Culls T/A	Lbs/ Ear	Ear Length (in.)	Ear Diam. (in.)	Kernel Depth (mm)	Pericarp Toughness[w]
DMC 20-10	1	Su	8/1	91	72.8	34	25.6	7.0	1.3	2.6	0.5	0.55	8.3	1.80	10.0	101
DMC 20-04	1	Su	8/1	91	72.7	33	28.8	8.1	1.5	1.7	0.4	0.57	8.2	1.88	10.8	116
GH 1861	2	Su	7/31	94	70.8	34	24.1	8.4	1.2	2.6	0.6	0.70	8.3	2.02	12.0	117
GH 1887	2	Se het.	8/5	98	72.2	33	28.5	9.3	1.5	2.2	0.4	0.65	8.5	2.05	12.2	99
GH 5608	2	Se het.	8/7	99	72.6	32	17.9	7.0	1.0	2.8	0.7	0.78	8.8	2.15	12.0	146
GH 2684	2	Se het.	8/6	100	72.7	34	25.1	8.9	1.3	0.9	0.2	0.71	9.0	2.01	12.2	88
Jubilee	2	Su	8/6	102	71.9	33	26.7	9.1	1.4	0.9	0.2	0.69	8.4	2.02	13.2	92
Splendor	3	Su	8/7	102	73.3	34	22.4	8.7	1.1	4.4	1.2	0.78	9.2	2.06	12.0	96
DMC 20-38	1	Su	8/7	103	72.8	33	26.1	9.9	1.4	4.2	1.1	0.76	8.7	2.11	13.2	127
Empire	2	Se het.	8/7	103	72.2	34	27.7	10.4	1.4	1.9	0.4	0.75	8.9	2.10	13.5	122
DMC 20-35	1	Su	8/9	105		34	23.2	7.3	1.2	1.9	0.4	0.63	8.0	2.02	11.0	94
LSD at 5%							4.2	1.5	0.2	1.8	0.4	0.04	0.2	0.06	0.7	10

[z]Planted May 31 in rows 36" apart, thinned to 9" between plants. All values shown are means of 4 replications arranged in randomized complete blocks. All data except cull no. and T/A were obtained from typical husked good ears. For ear length, ear diameter, and tenderness, the value shown is the average of 10 individual ear measurements. All varieties are yellow.
[y]Sources: 1 = Harris Moran, 2 = Rogers, 3 = Crookham.
[x]Endosperm type: su = sweet, se = sugary enhancer.
[w]Comparative scale determined by a spring-operated puncture gauge; lower numbers indicate more tender pericarp.

Table 2. Yield and ear measurements, sugary enhancer (se) and sweet (su_1) corn observation trial, Corvallis, 1995.[z]

Variety	Source[y]	Type[x]	Silk Date	Days to Harvest	Stand	Good Ears			Culls		Lbs/ Ear	Ear Length (in.)	Ear Diam. (in.)	Kernel Depth (mm)	Pericarp Toughness[w]
						1000/A	T/A	No/Plant	1000/A	T/A					
Swis 519-3	1	Se	8/6	103	33	22.1	8.8	1.2	4.1	1.1	0.80	10.0	2.0	12	148
Swis 490-0	1	Se	8/7	103	28	23.8	9.3	1.5	2.9	0.7	0.79	9.0	2.1	13	104
Swis 1-3	1	Se	8/8	104	31	16.3	5.0	0.9	0.6	0.1	0.61	8.0	1.9	12	132
Swis 399-3	1	Se	8/8	104	32	23.2	6.7	1.3	7.0	1.6	0.58	7.8	1.9	12	106
Swis 717-9	1	Se	8/19	88	28	20.3	6.5	1.3	2.3	0.7	0.64	8.4	2.0	12	149
Swis 887	1	Se	8/23	92	24	26.1	7.3	1.9	3.5	0.6	0.56	7.9	1.9	10	145

[z]Planted May 31 (except Swis 717-9 and Swis 887, which were planted June 23) in rows 36" apart, thinned to 9" between plants. Yield estimates are from a single 25' plot. All data except cull no. and T/A were obtained from typical husked good ears. For ear length, ear diameter, and tenderness, the value shown is the average of 10 individual ear measurements. All varieties are yellow.

[y]Sources: 1 = United Agri Products.

[x]Endosperm type: su = sweet, se = sugary enhancer.

[w]Tenderness determined by a spring-operated puncture gauge; lower numbers indicate more tender pericarp.

Table 3. **Descriptive observations, sugary enhancer (se) and sweet (su_1) corn variety trial, Corvallis, 1995.[z]**

Variety	Source[y]	Kernel Refinement	Row Straightness	Tip Fill	Cylind. Shape	Ear Unif.	Mat. Unif.	Kernel Unif.	Flavor	Overall Score	Row #	Notes
DMC 20-10	1	3	2	3.5	3	3	4	2	4	3	14-18	small ears, shallow kernels, curved, good corn flavor
DMC 20-04	1	3	3	2	3	3.5	4	3.5	3	3.5	14-18	some curved ears, nice looking except for tip fill, many good second ears
GH 1861	2	3	2	5	3	3.5	4	2	4	3	18-20	no suckers, many curved ears, large, uniform but rough looking ears, good flavor
GH 1887	2	4	3	2.5	4	2.5	3	3	4	3.5	18-20	variable for tip fill, size and shape; good color, tender, sweet, good yield
GH 5608	2	4	3	3	4	2.5	3	3	4	3	20-22	no suckers, only one ear per plant, long ears, some with poor husk cover, some curved
GH 2684	2	3	4	3	4.5	2.5	4	4	4	4	16-18	hard to pick, several deformed ears, most ears are long, cylindrical, straight rows, tender and sweet
Jubilee	2	4	4	4	4.5	4.5	4.5	4	4	4.5	16-18	best looking corn in the trial, very deep kernels
Splendor	3	4	2	4	2	3	2.5	2	3	2.5	20-24	badly curved ears, rough appearance, jumbled tips
DMC 20-38	1	3	3	3	2	2.5	3	3	2	3	16-24	best ears look good but many have bad tips, some curved, some very fat, good yield
Empire	2	3	2	2.5	3	3	4	2	2	2.5	16-18	hard to pick and husk, pale color, curved ears, rough appearance, very good yield
DMC 20-35	1	4	2	3	2	1.5	2	3	1.5	2	16-20	pale color, many ears with poor tip fill, shallow kernels, strong flavor, not sweet
Swis 519-3	4	2	3	2	1	2	2	3	2	2	18-22	long pointed ears, tips protrude from husks and turn green; tough, not sweet

Table 3. Descriptive observations, sugary enhancer (se) and sweet (su_1) corn variety trial, Corvallis, 1995 (cont.).[z]

Variety	Source[y]	Kernel Refinement	Row Straightness	Tip Fill	Cylind. Shape	Ear Unif.	Mat. Unif.	Kernel Unif.	Flavor	Overall Score	Row #	Notes
Swis 490-0	4	3	2.5	4	2	3	3	2	2	2.5	16-18	pale color, curved ears, rough appearance, not sweet
Swis 1-3	4	3	3	4	2	2	3	2	4	2	16-20	poor yield, less than one ear per plant, uneven pollination at butt end, good flavor
Swis 399-3	4	4	2	3	2	2	3	2	4	2.5	16-18	small ears, some very rough appearance from uneven kernels, good flavor
Swis 717-9	4	3	3	2.5	3	1.5	3	3	2	2	14-18	highly variable, many rough, poorly pollinated ears with poor tip fill, not sweet, tough
Swis 887	4	4	3	3	4	2.5	3	4	2	3	18-20	generally refined but poor tips, some rough poorly pollinated ears, shallow kernels, tough

[z]Planted May 31. Scores 1-5 scale, 5 = best. Overall score, related to general characteristics of harvested ears, is based on processing potential and does not necessarily reflect home garden potential.

[y]Sources: 1 = Harris Moran, 2 = Rogers, 3 = Crookham, 4 = United Agri Products.

Table 4. **Yield and ear measurements, supersweet (sh_2) corn replicated trial, Corvallis, 1995.[z]**

Variety	Source[y]	Silk Date	Days to Harvest	% H_2O	Stand	Good Ears			Culls		Lbs/ Ear	Ear Length (in.)	Ear Diam. (in.)	Kernel Depth (mm)	Pericarp Toughness[w]
						1000/A	T/A	No/Plant	1000/A	T/A					
Contender	1	8/14	83	78.7	35	20.3	6.6	1.0	1.5	0.3	0.65	8.1	2.00	11.0	114
Crisp 'n Sweet 710A	1	8/22	87	79.9	36	20.3	6.9	1.0	0.4	0.1	0.68	8.5	2.00	11.8	137
FMX 324	2	8/22	87	78.5	34	19.0	7.0	1.0	1.3	0.3	0.74	7.9	2.14	11.0	130
Marvel	1	8/22	88	77.8	34	20.5	7.4	1.0	0.7	0.2	0.72	8.4	2.08	11.8	107
FMX 412	2	8/22	88		33	17.3	4.6	1.0	0.4	0.1	0.53	7.7	1.90	11.0	121
FMX 416	2	8/23	90	78.6	38	25.9	9.0	1.2	1.6	0.3	0.70	7.6	2.10	11.3	154
Victor	2	8/22	90	78.4	38	22.2	8.5	1.0	0.7	0.2	0.77	8.2	2.11	10.8	159
Supersweet Jubilee	3	8/23	90	76.8	34	26.9	7.6	1.4	1.7	0.3	0.57	8.1	1.93	12.0	118
GSS 6273	3	8/23	91	78.7	34	21.1	6.1	1.1	4.4	0.9	0.58	8.0	1.99	11.0	104
LSD at 5%						2.7	0.9	0.1	2.0	0.4	0.02	0.1	0.03	NS	10

[z]Planted June 23 in rows 36" apart, thinned to 9" between plants. All values shown are means of 4 replications arranged in randomized complete blocks. All data except cull no. and T/A were obtained from typical husked good ears. For ear length, ear diameter, and tenderness, the value used for each replication was the average of 10 individual ear measurements. All varieties are yellow.

[y]Sources: 1 = Crookham, 2 = Ferry Morse, 3 = Rogers.

[w]Tenderness determined by a spring-operated puncture gauge; lower numbers indicate more tender pericarp.

Table 5. **Yield and ear measurements, supersweet (sh_2) corn observation trial, Corvallis, 1995.**[z]

Variety	Source[y]	Silk Date	Days to Harvest	Stand	Good Ears 1000/A	Good Ears T/A	Good Ears No/Plant	Culls 1000/A	Culls T/A	Lbs/ Ear	Ear Length (in.)	Ear Diam. (in.)	Kernel Depth (mm)	Pericarp Toughness[x]
Sheba	1	8/11	81	29	13.9	4.0	0.8	0.6	0.1	0.58	8.5	1.9	11	98
Krispy King	2	8/22	88	36	23.8	8.4	1.2	4.1	0.8	0.70	8.1	2.2	13	148
Shis 31-1	3	8/22	88	26	25.0	6.6	1.7	1.7	0.3	0.53	8.1	1.9	11	131
Endeavor	1	8/22	88	40	20.9	6.5	0.9	1.7	0.3	0.63	7.8	2.0	12	152
FMX 415	4	8/22	88	36	22.1	7.4	1.1	0.6	0.1	0.67	8.0	2.0	12	162
Punchline	1	8/22	88	44	26.1	7.0	1.0	0	0	0.53	7.7	1.9	10	132
Shaker	1	8/22	89	33	24.4	6.9	1.3	0	0	0.56	8.7	1.9	11	117
Shis 44-1	3	8/24	92	32	19.2	6.9	1.0	2.9	0.7	0.72	8.4	2.0	12	122
XPH 3091	1	8/25	92	34	20.9	6.5	1.1	0.6	0.3	0.62	8.6	1.9	11	134
XPH 3121	1	8/25	94	30	16.8	4.4	1.0	2.9	0.6	0.52	7.7	1.9	12	126

[z]Planted June 23 in rows 36" apart, thinned to 9" between plants. Yield estimates are from a single 25' plot except in the case of Krispy King, where an average of 2 plots was used. All data except cull no. and T/A were obtained from typical husked good ears. For ear length, ear diameter, and tenderness, the value shown is the average of 10 individual ear measurements. All varieties are yellow.

[y]Sources: 1 = Asgrow, 2 = Rogers, 3 = United Agri Products, 4 = Ferry Morse.

[x]Comparative scale determined by a spring-operated puncture gauge; lower numbers indicate more tender pericarp.

Table 6. **Descriptive observations, supersweet (sh_2) corn trial, Corvallis, 1995.[z]**

Variety	Source[y]	Kernel Refine-ment	Row Straight-ness	Tip Fill	Cylind. Shape	Ear Unif.	Mat. Unif.	Kernel Unif.	Flavor	Overall Score	Row #	Notes
Contender	1	2	2-4	3	3	2	2	3	3	2.5	16-20	pale color, kernels get quite coarse, fairly tender, very sweet but not much corn flavor
Crisp 'n Sweet 710A	1	3	4	3	3.5	4	4	4	3.5	4	16-18	very uniform, nice looking, neat ears, somewhat tough, sweet
FMX 324	2	4	2	4	2	3	3.5	2.5	3.5	2.5	20-22	picks very easily, short fat ears, some with bad gaps, jumbled rows and uneven kernels, very sweet
Marvel	1	3	3	3	3	3	4	3	3.5	3	18-20	some rough ears with jumbled rows, many ears with skips and jumbled tips, tender
FMX 412	2	4	3	4	3	2.5	2.5	3	4	2	18	small ears, poor yield, many with blanks in butt end, possible home garden, very good flavor
FMX 416	2	3	3	4.5	2	2.5	3.5	3	2.5	2.5	18	variable for kernel refinement and row straightness, short fat ears, many curved, tough
Victor	2	3	3.5	3.5	3	3	3.5	3	3.5	3	16-20	some curved ears, pale color, tough
Supersweet Jubilee	3	4	4.5	3.5	4	4	4	4.5	5	4.5	16-18	good color, many small but useable second ears, very refined, attractive ears, very good flavor
GSS 6273	3	4	3	2	3	2.5	2.5	3	5	2.5	18-20	quite variable in size, shape and maturity, many very rough ears, some curved, very sweet and tender
Sheba	4	3.5	3	2	3	3	2	3	4	2.5	18	very poor yield, less than one ear per plant, hard to pick, poorly developed tips, possible good home garden variety, early and sweet
Krispy King	3	2.5	3	5	4	4	4	3.5	4	3.5	18	fat ears, somewhat coarse, sweet but fairly tough
Shis 31-1	5	3.5	4	2	3	2	3	3.5	3.5	2.5	14-18	pale color, small ears, some very poorly filled tips, some coarse ears
Endeavor	4	2.5	2.5	3	3.5	3	3	2.5	2.5	2.5	16-18	less than one ear per plant, fairly coarse and rough, tough

Table 6. Descriptive observations, supersweet (sh_2) corn trial, Corvallis, 1995 (cont.).[z]

Variety	Source[y]	Kernel Refinement	Row Straightness	Tip Fill	Cylind. Shape	Ear Unif.	Mat. Unif.	Kernel Unif.	Flavor	Overall Score	Row #	Notes
FMX 415	2	2.5	2.5	4	2.5	2	3	2.5	3.5	2.5	16	variable shape, some fat, some thin, some curved, pale color, tough
Punchline	4	3	3	3	3	2.5	3	3	4	3	16-18	good color, neat small ears but some very small, shallow kernels
Shaker	4	4	3.5	2	3	3.5	4	4	4	3	16-18	very long narrow ears, neat but very poor tip fill, sweet and tender
Shis 44-1	5	2	3	2	2	2	2	3	2	2	16-20	long, pointed, curved ears, coarse
XPH 3091	4	1.5	3	2	2.5	3	3	2	3.5	2	16-18	very long narrow ears, tips poorly filled and jumbled, coarse kernels
XPH 3121	4	3.5	3.5	2.5	3	2	2	3.5	3.5	2.5	16-18	poor yield, small ears, some pointed, some very poor tips, very sweet

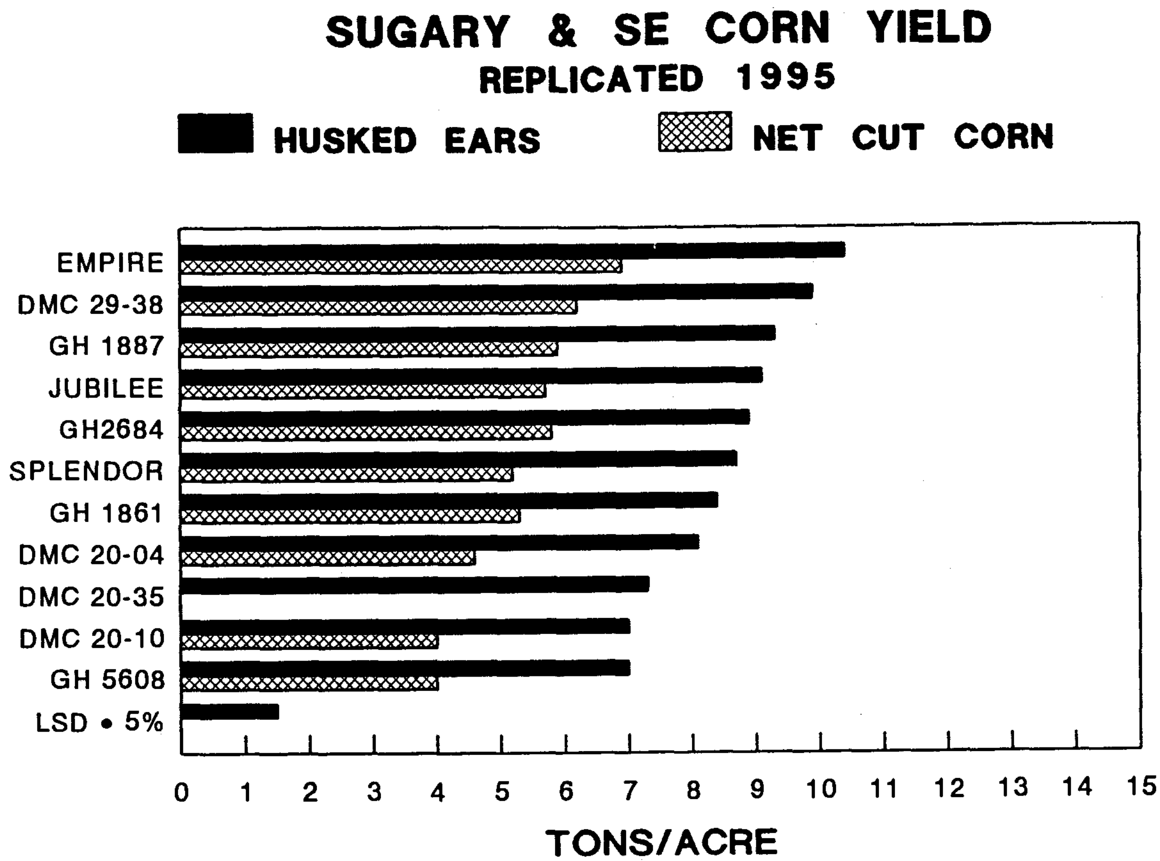
[z]Planted June 23. Scores 1-5 scale, 5 = best. Overall score, related to general characteristics of harvested ears, is based on processing potential and does not necessarily reflect home garden potential.

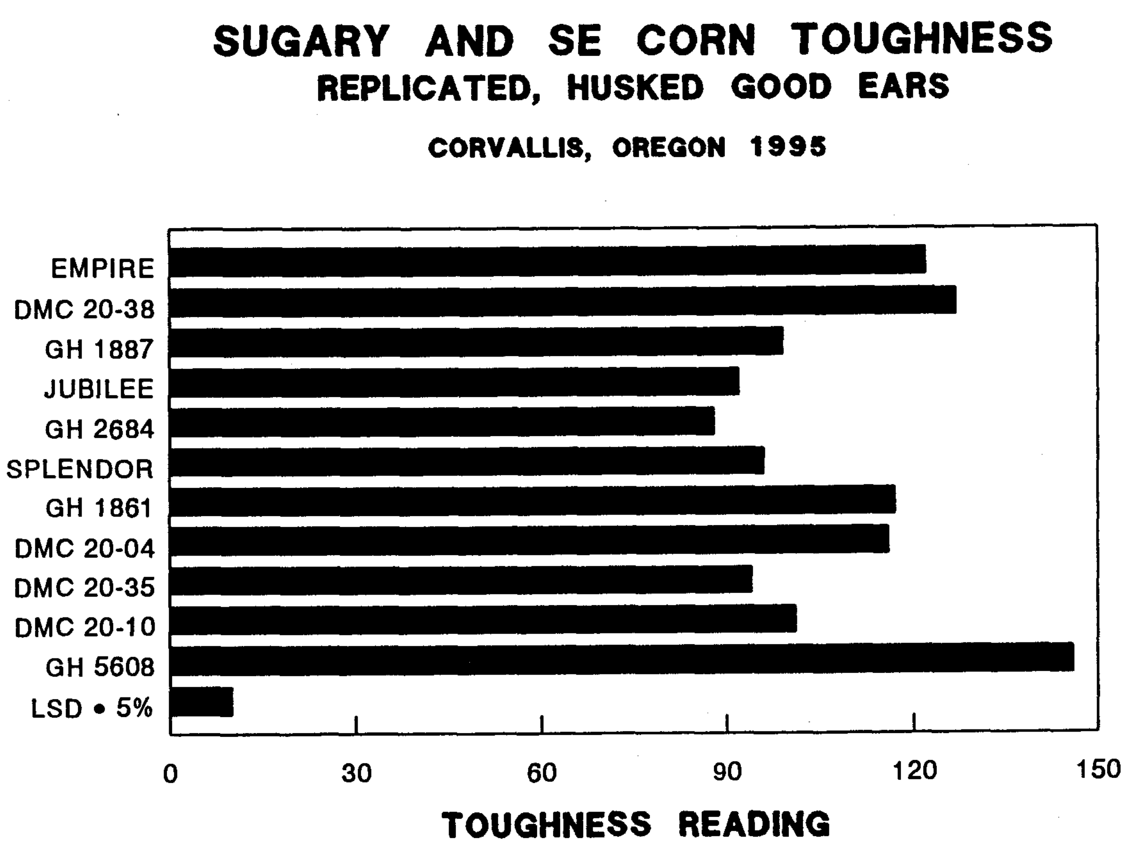
[y]Sources: 1 = Crookham, 2 = Ferry Morse, 3 = Rogers, 4 = Asgrow, 5 = United Agri Products.

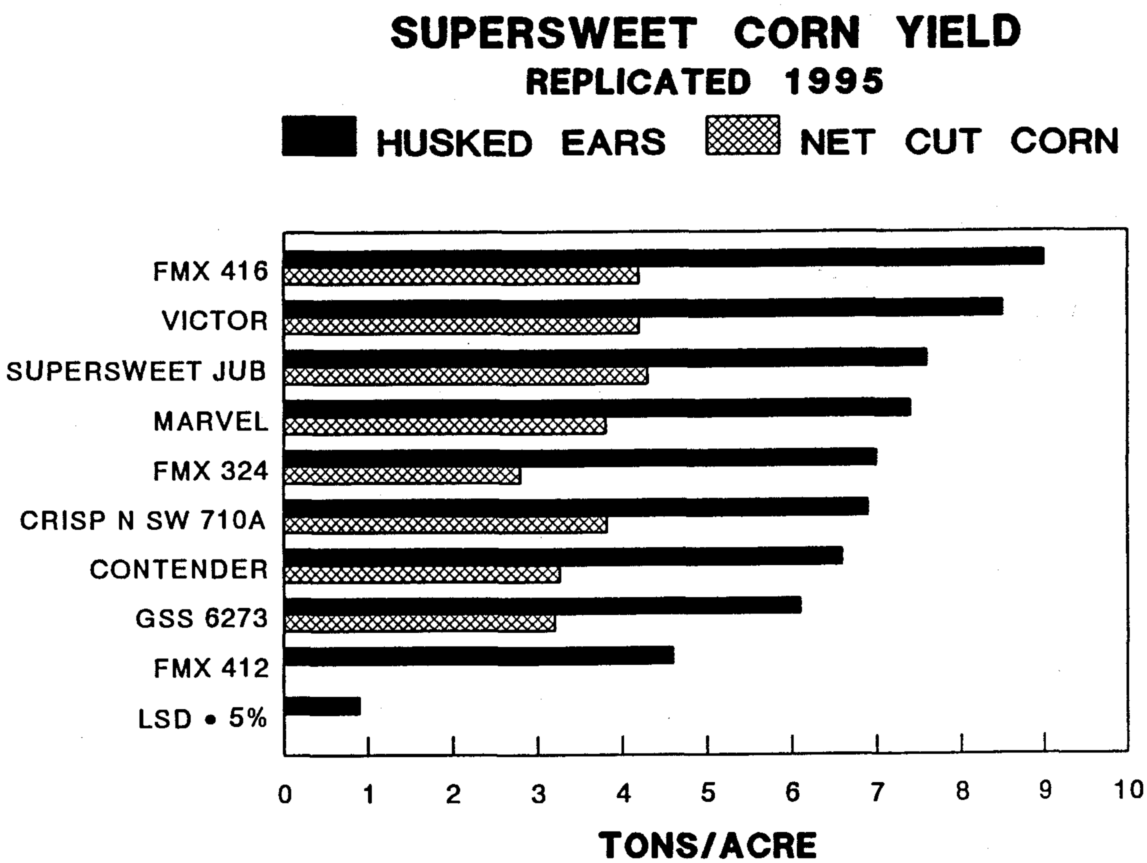
Table 7. Seedling vigor, sugary enhancer (se) and sweet (su_1) corn trial, Corvallis, 1995.

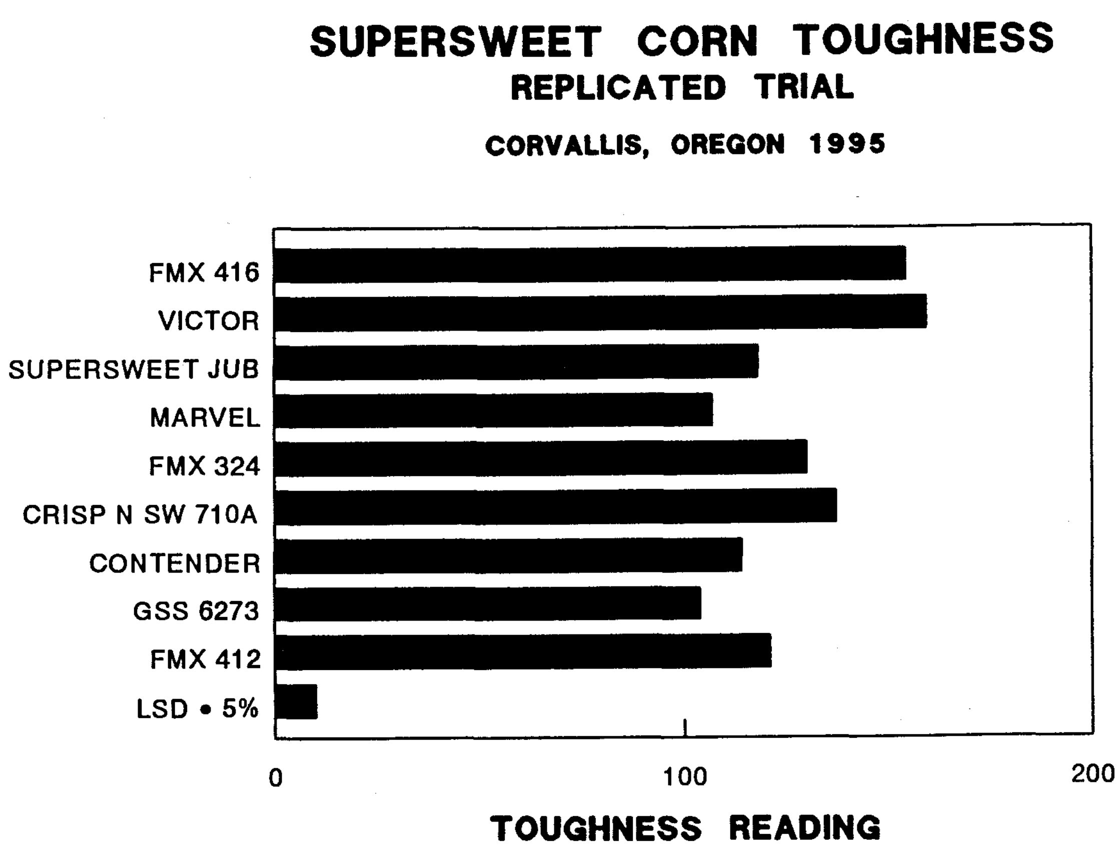
Variety	Scores[z] Rep 1	Rep 2	Rep 3	Rep 4	AV
DMC 20-10	4	4	3	3	3.5
DMC 20-04	4	3	5	5	4.25
GH 1861	3	3	3	3	3.0
GH 1887	2	2	1	1	1.5
GH 5608	3	3	3	3	3.0
GH 2684	2	3	2	2	2.25
Jubilee	2	2	1	1	1.5
Splendor	3	2	1	2	2.0
DMC 20-38	3	2	2	2	2.25
Empire	3	2	2	2	2.25
DMC 20-35	3	4	2	2	2.75
Swis 519-3	3				
Swis 490-0	3				
Swis 1-3	2				
Swis 399-3	3				

[z]Scores 1-5 scale, 5 = most vigorous.

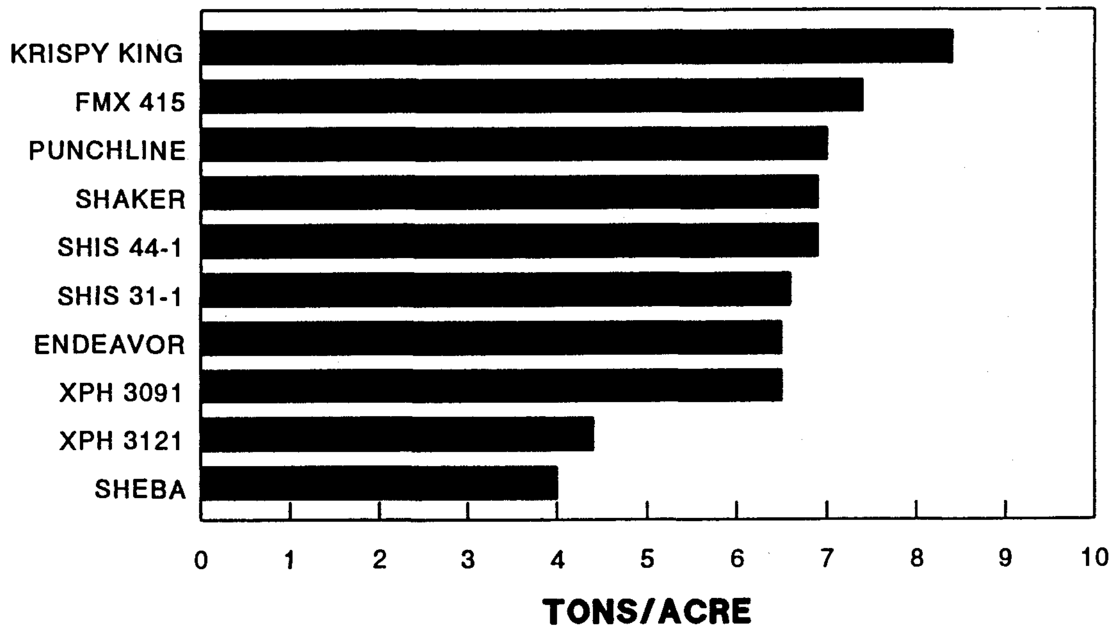

SUGARY & SE CORN YIELD
REPLICATED 1995
HUSKED EARS
NET CUT CORN
EMPIRE
DMC 29-38
GH 1887
JUBILEE
GH2684
SPLENDOR
GH 1861
DMC 20-04
DMC 20-35
DMC 20-10
GH 5608
LSD • 5%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TONS/ACRE


SUGARY AND SE CORN TOUGHNESS
REPLICATED, HUSKED GOOD EARS
CORVALLIS, OREGON 1995
EMPIRE
DMC 20-38
GH 1887
JUBILEE
GH 2684
SPLENDOR
GH 1861
DMC 20-04
DMC 20-35
DMC 20-10
GH 5608
LSD • 5%
0 30 60 90 120 150
TOUGHNESS READING

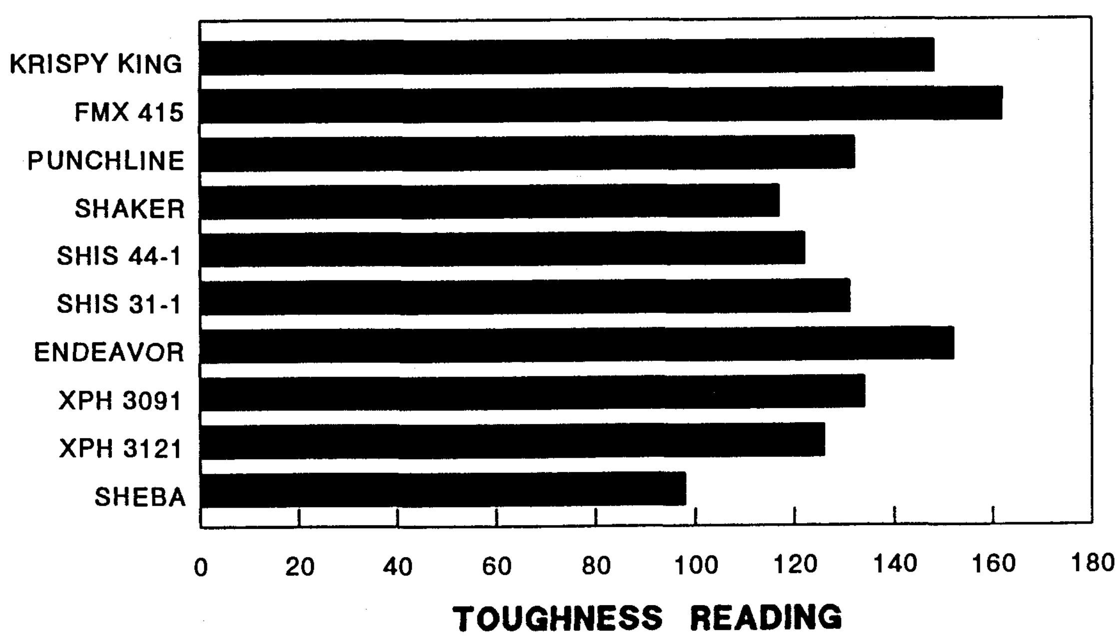

SUPERSWEET CORN YIELD
REPLICATED 1995
HUSKED EARS
NET CUT CORN
FMX 416
VICTOR
SUPERSWEET JUB
MARVEL
FMX 324
CRISP N SW 710A
CONTENDER
GSS 6273
FMX 412
LSD • 5%
0
1
2
3
4
5
6
7
8
9
10
TONS/ACRE


SUPERSWEET CORN TOUGHNESS
REPLICATED TRIAL
CORVALLIS, OREGON 1995
FMX 416
VICTOR
SUPERSWEET JUB
MARVEL
FMX 324
CRISP N SW 710A
CONTENDER
GSS 6273
FMX 412
LSD • 5%
0
100
200
TOUGHNESS READING

SUPERSWEET CORN YIELD
OBSERVATION PLOTS
CORVALLIS, OREGON 1995



SUPERSWEET CORN TOUGHNESS
OBSERVATION PLOTS
CORVALLIS, OREGON 1995



1995-96

REPORT TO THE OREGON PROCESSED VEGETABLE COMMISSION

Title: Testing Sweet Corn for Stalk Rot Resistance

Project Leaders: N. S. Mansour, Horticulture
J. R. Baggett, Horticulture

Cooperators: M. Powelson, Botany and Plant Path
D. McGrath, Marion County Extension

Project Statues: Terminating December 31, 1995

Project Funding: Project funding for this reporting period: $1,000.

Funding was used to establish, evaluate, analyze data, and report the data from two plots in the Stayton area where 15 sweet corn varieties with the su and se endosperm were evaluated for stalk rot resistance.

Objectives:

Determine the relative susceptibility of sweet corn cultivars to Fusarium stalk rot in the Willamette Valley.

Report of Progress:

Early in 1995 Mr. Jim Belden, Chairman of the Oregon Processed Vegetable Commission Corn Subcommittee, brought to the University's attention a concern regarding stalk rot of corn in the Stayton area. Although this disorder has been noted in the area for some time, it has become particularly troublesome in the past 4-5 years as corn acreage has increased and rotation times shortened or eliminated. Although the cause of this disorder in Oregon had not been determined, it was thought to be a disease caused by Fusarium.

Currently, there are no fungicides registered for Fusarium stalk rot control and cultural practices involving the use of chloride fertilizers and water management have not been evaluated for their efficacy in Oregon. The most effective control of Fusarium stalk rot is probably the use of genetically resistant hybrids. However, there is little information on resistance of su and se corn hybrids suitable to Oregon growers and processors to this disease. Therefore, the objective of this study was to identify corn lines with resistance to Fusarium stalk rot.

On March 16, 1995 a meeting was held with corn growers from the Stayton area (Tim Butler, Jim Belden, Ryan Bishop, Steve and Alan Keudell) to discuss possible sites for a disease screening trial. Based on disease history two fields scheduled for planting to corn in 1995 were identified: Mr. Tim Butler's on Rainwater Drive which had corn in 1994, and Mr. Jim Belden's on Brick Road which had corn in 1993 and wheat in 1994.

Major U.S. seed companies were contacted (Harris-Morran, Asgrow, Rogers, Ferry Morse, and Crookham). Seed of 15 su and se varieties, and 7 sh2 varieties were obtained. The variety "Reward-C" was chosen as a check for it's known susceptibility. Because no sh2 sweet corn fields with a recent history of stalk rot were available in which to plant the sh2 lines, sh2 varieties were not included in the trials. In discussions with seed company breeders, lines were grouped in three harvest groups (Table 1).

Materials and Methods

Field Trials. The Brick Road trial was planted on 27 May and the Rainwater Drive trial on 1 June. The su and se lines were planted in single row plots 20 feet (6.0 m) long and thinned to about 25 plants per plot about 3 weeks after planting. Plots were spaced 30 inches (0.76 m) apart. Varieties were arranged in a completely randomized design at the Brick Road location and a randomized complete block design at the Rainwater Drive location and replicated five times.

Fertilizers applied per acre at the Brick Road site consisted of a total of 210 lbs. each of nitrogen and P_2O_5 and 136 lbs. K_2O from muriate of potash providing also 54 lbs. of chloride. Weed control consisted of Dual and Atrazine, and Dyfonate was applied for insect control.

At the Rainwater Drive location, a total of 225 lbs. nitrogen, 234 lbs. P_2O_5 and 100 lbs. K_2O from muriate of potash were used. The potassium formulation provided 40 lbs. of chloride. Sulfate and magnesium applications were 50 and 30 lbs., respectively. Micronutrients applied were 5 lbs. zinc and 1 lb. boron. Dual and Laddok were used for weed control, and Lorsban and Metasystox for insect control. Irrigation was by big-gun overhead sprinklers.

Emergence and vigor evaluations were made on the Rainwater Drive planting. Seedling vigor is presented in Table 1.

Disease Assessment:

Disease severity was rated using an arbitrary 1-5 disease index rating scale where 0=no symptoms; 1=leaf at first node necrotic; 3=leaves at the first and second node necrotic; 4=leaves at the first three nodes necrotic; and 5=all leaves to the ear node necrotic and the ear flaccid and drooping. Each of 10 plants within each plot was rated for symptoms of stalk rot. Disease evaluation procedures were decided upon through discussions with seed company breeders. Disease evaluations, which corresponded with harvest group (early, main season and late, Table 1), were made on 5, 12 and 15 September and 15, 21 and 25 September for the Brick Road and Rainwater Drive trials, respectively. Varieties in each harvest group were evaluated on the same date.

Isolations.

Isolations were made primarily from crowns with symptoms of decay or necrotic tissue. The tissue from the leading edge of the rot was used. Plates were incubated for 1 week in the dark and then Fusarium isolates were single-spored on potato dextrose agar. Monoconidial isolates were subcultured onto carnation leaf agar for species identification.

Summary:

Four varieties were identified with excellent resistance to stalk rot. These four varieties were Champ, Dugan, GH2757, and GH9056 (Table 2). Although research from other parts of the United States indicate that the use of chloride might be beneficial, the disease was still severe in susceptible varieties where chloride rates were applied at 40 and 54 lbs/acre. Processing evaluations were not within the scope of this study and were not made.

Two species of Fusarium were recovered from syptomatic plants: F. moniliforme and F. graminearum, the latter being a pathogen also on wheat.

Stalk rot was more severe at the Brick Road location than at the Rainwater Drive location. The reasons for this are not clear.

References:

1. Heckman, Joseph R. 1995. Chloride suppresses corn stalk rot. Better Crops/Vol. 79 No. 2.

2. Shurtleff, M.C. 1980. Compendium of corn diseases. APS Press, St. Paul MN 55121.

3. Younts, S.E., and R.B. Musgrave. 1958. Growth, maturity, and yield of corn as affected by chloride in potassium fertilizer. Agronomy J. 50:423-426.

4. Younts, S.E., and R.B. Musgrave. 1958. Chemical composition, nutrient absorption, and stalk rot incidence of corn as affected by chloride in potassium fertilizer. Agronomy J. 50:426-429.

Signatures:

Project Leader(s) Redacted for Privacy

Redacted for Privacy

Department Head Redacted for Privacy

Table 1. Sweetcorn endosperm types, maturity groups and seedling vigor.

Variety	Company	Endosperm Type	Days to maturity*	Harvest Group	Seedling Vigor**
Reward-C	Rogers	su	-9	"Early"	2.30 cd
Dugan	Asgrow	su-se	-9	"	3.58 a
Champ	Asgrow	su-se	-9	"	2.30 cd
DMC 20-10	Ferry-Morse	su	-7	"	3.30 ab
GH 1887	Rogers	se het.	-2	"Main Season"	2.38 cd
Jubilee	Rogers	su	0	"	2.05 cd
GH 9073	Rogers	su	+1	"	2.38 cd
XPH 3047	Asgrow	su-se	+1	"	3.55 ab
GH 2757	Rogers	se het.	+2	"	1.72 d
GH 9056	Rogers	su	+2	"	2.80 bc
Sundial	Harris-Moran	se	+3	"Late"	2.00 cd
Servo	Asgrow	su-se	+3	"	2.00 cd
Excellency	Ferry-Morse	su	+5	"	1.80 d
DMC 20-35	Ferry-Morse	su	+5	"	1.98 cd
DMC 20-38	Ferry-Morse	su	+5	"	2.40 cd

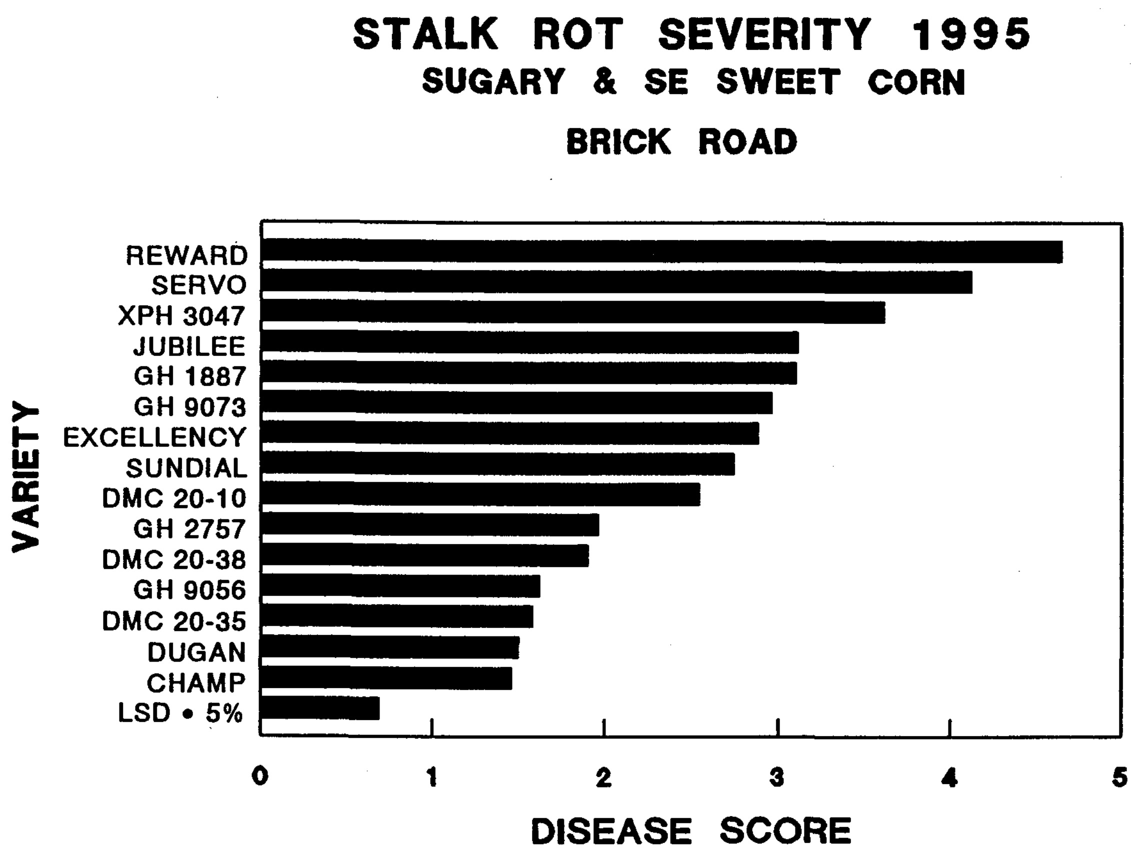
* Days to maturity were based on days earlier or later than Jubilee as provided by the source seed company sweetcorn breeder or research person.

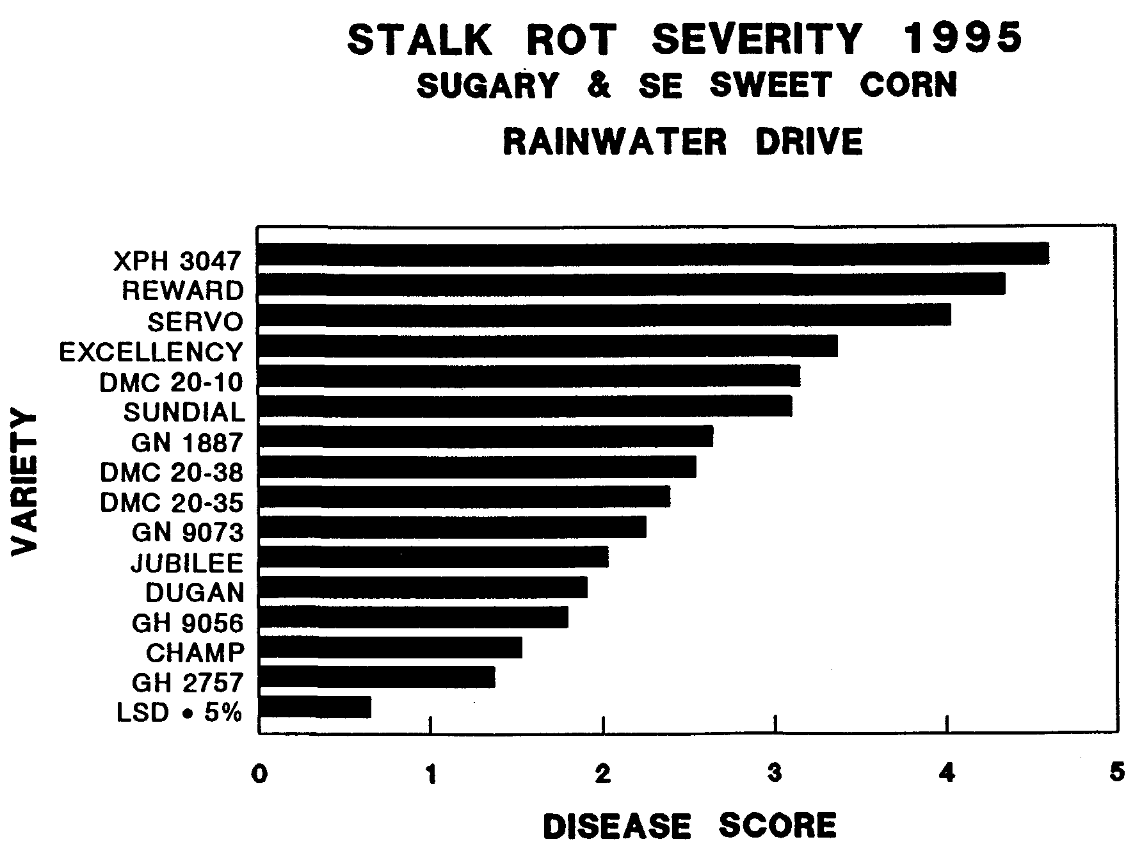
** 1 to 5 indicating weak to vigorous; values connected by the same letter are not significantly different.

Table 2. Mean disease severity values[a] of su and se corn varieties to stalk rot in 1995 near Stayton, OR.

Brick Rd.[b]		Rainwater Dr.[c]	
Variety	Mean[d]	Variety	Mean[d]
Reward	4.65 A	XPH 3047	4.61 A
Servo	4.12 AB	Reward	4.35 A
XPH 3047	3.61 BC	Servo	4.03 A
Jubilee	3.11 CD	Excellency	3.37 B
GH 1887	3.10 CD	DMC 20-10	3.15 BC
GH 9073	2.96 CD	Sundial	3.10 BC
Excellency	2.88 D	GH 1887	2.64 CD
Sundial	2.74 D	DMC 20-38	2.54 DE
DMC 20-10	2.54 DE	DMC 20-35	2.39 DEF
GH 2757	1.96 EF	GH 9073	2.25 DEF
DMC 20-38	1.90 EF	Jubilee	2.03 DEFG
GH 9056	1.62 F	Dugan	1.91 EFGH
DMC 20-35	1.58 F	GH 9056	1.80 FGH
Dugan	1.50 F	Champ	1.53 GH
Champ	1.46 F	GH 2757	1.37 H

[a] Ratings on a 1-5 scale: 1=no symptoms and 5=leaves necrotic and ear flaccid and drooping.
[b] Planted 27 May.
[c] Planted 1 June.
[d] Means within a column with the same letter are not significantly different by least significant difference test (P=0.05).


STALK ROT SEVERITY 1995
SUGARY & SE SWEET CORN
BRICK ROAD
VARIETY
REWARD
SERVO
XPH 3047
JUBILEE
GH 1887
GH 9073
EXCELLENCY
SUNDIAL
DMC 20-10
GH 2757
DMC 20-38
GH 9056
DMC 20-35
DUGAN
CHAMP
LSD • 5%
0
1
2
3
4
5
DISEASE SCORE


STALK ROT SEVERITY 1995
SUGARY & SE SWEET CORN
RAINWATER DRIVE
VARIETY
XPH 3047
REWARD
SERVO
EXCELLENCY
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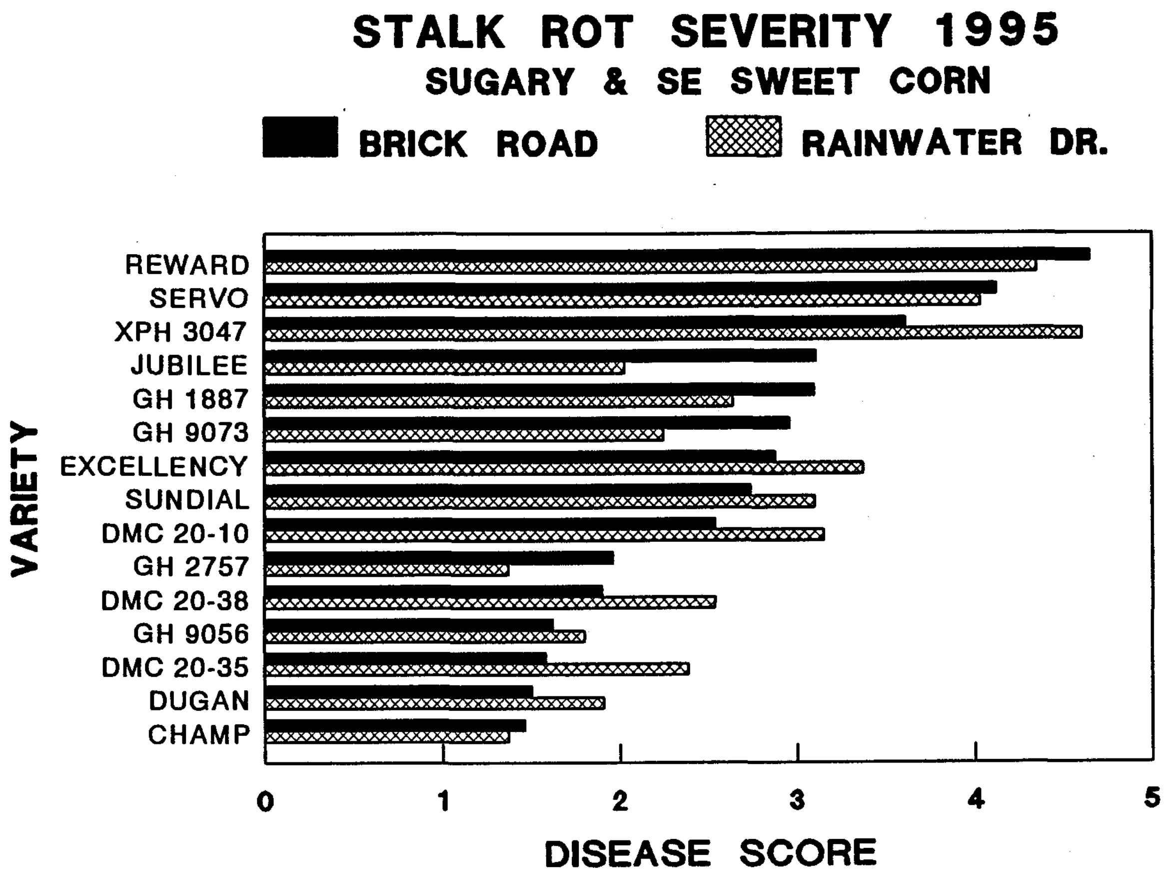
SUNDIAL
GN 1887
DMC 20-38
DMC 20-35
GN 9073
JUBILEE
DUGAN
GH 9056
CHAMP
GH 2757
LSD • 5%
0
1
2
3
4
5
DISEASE SCORE


STALK ROT SEVERITY 1995
SUGARY & SE SWEET CORN
BRICK ROAD
RAINWATER DR.
REWARD
SERVO
XPH 3047
JUBILEE
GH 1887
GH 9073
EXCELLENCY
SUNDIAL
DMC 20-10
GH 2757
DMC 20-38
GH 9056
DMC 20-35
DUGAN
CHAMP
VARIETY
0
1
2
3
4
5
DISEASE SCORE

December 5, 1995

1. **Sweet corn variety evaluations for the Treasure Valley**

2. Dr. Clinton C. Shock, Malheur Experiment Station, OSU, 595 Onion Ave., Ontario, OR 97914 telephone (541) 889-2174.

3. Continuing project.

4. Funding for the 1995 season, $2000.00
Processing company contribution $2500.00
Seed company contributions $3400.00

5. Objectives were to evaluate the yield and quality of supersweet and normal sweet corn varieties under Treasure Valley conditions.

6. 7. Progress report and a brief interpretation of results is attached.

Redacted for Privacy

8. Signature ____________________

Prof. Crop and Soil Science and Superintendent

1995-1996 Research Report Submitted to the Oregon Processed Vegetable Comm. and the Agricultural Research Foundation

SWEET CORN VARIETY EVALUATION FOR THE TREASURE VALLEY

Clint Shock, Erik Feibert, Greg Willison and Monty Saunders
Malheur Experiment Station
Oregon State University
Ontario, Oregon

Objectives

Sweet corn and supersweet corn varieties were evaluated for agronomic and processing performance.

Procedures

Two trials were conducted on a Owyhee silt loam following sugar beets. One hundred pounds per acre of phosphate and 10 lbs per acre of zinc were plowed down in the fall of 1994. The was field was then groundhogged twice and worked into 30-inch beds. Alachlor (Partner) at 3 lbs ai/ac was broadcast and incorporated with a bed harrow on April 10, 1995. Eighteen supersweet corn (SH_2) and 17 sweet corn (SU_1) varieties were planted in separate trials. Each trial had a randomized complete block design with five replicates. The seed had standard fungicide seed treatments applied by the suppliers. The supersweet varieties were planted on April 26 and the sweet varieties on May 12. Seed was planted at 2-inch depth using an Amalco cone seeder on a John Deere 77 Flexi Planter.

A soil sample taken on May 5 showed 84 lbs per acre of available N in the upper two feet of soil. Urea at 150 lb N/ac was sidedressed on June 8. The field was furrow irrigated as needed on alternate furrows starting on May 31.

All plots in the supersweet trial were evaluated for vigor on May 12. Vigor was a subjective evaluation based on stand, uniformity, overall growth, color and health. Following emergence counts on May 12, May 23, and May 30, (only May 30 for the sweet corn) all plots were thinned to 24000 plants/ac (1 plant every 8.71 inches) on June 10. Starting on July 5, the silk stage of 20 plants in one of the middle two rows of each plot in the first replicate was evaluated. Varieties were considered to be at the mid-silk stage when 40 to 60% of the plants were silking. About 16 days after the mid-silk stage, ear samples from the border rows were taken and analyzed for moisture content to determine the stage of maturity. The target ear moisture for harvest was 78% for the supersweet varieties and 71% for the sweet varieties.

At harvest all ears in the central 15 feet of the middle two rows in each plot were picked and weighed. A 10 ear subsample was weighed, shucked, weighed and evaluated for length, maximum diameter, diameter 6 inches from the base, and kernel row number. Ear taper was calculated by the difference between the maximum diameter and the diameter at 6 inches from the base. Ear taper is a descriptive measure of ear shape; the higher the ear taper, the less cylindrical the shape of the ear. Another subsample was taken to the American Fine Foods processing lab and evaluated for moisture and processing recovery. The processing recovery was calculated as the percentage of the weight of the unhusked ears that was recovered as cut corn. Processing recovery data for each variety was based on a composite sample and was not replicated.

Results and Discussion

Emergence for the supersweet corn started on May 9. Varieties HMX 2384S, Zenith, XPH 3091, XPH 3121, Krispy King, GSS 6273, Endevour, and C&S 710 had among the highest emergence on May 12 (Table 1). Supersweet Jubilee and Sweet Ear had among the lowest subjective estimates of vigor and GSS 6273, Challenger, and HMX2384S had high subjective estimates of vigor on May 12. Final emergence counts on May 30 ranged from 50 to 91%. GSS 6273 and HMX 2384S had among the highest emergence on May 30. Yield of Supersweet Jubilee (50% emergence) could have been compromised by low stand, despite the high seeding rate. Varieties GSS 6273 and Marvel lodged heavily. Yields of unhusked ears ranged from 8 to 13 t/ac (Table 2). Krispy King, Marvel, Shaker, and HM 701 had among the highest yield. Marvel, Shaker, Challenger, and HM701 had ears with among the least taper (most cylindrical ears). Recovery of cut corn ranged from 33.1 to 54.0 % among varieties.

Emergence for the sweet corn started on May 22 and ranged from 30 to 90% (Table 3). Soil conditions were less favorable for emergence of the sweet corn than for the supersweet varieties. Yield of variety DMC 2035 (30% emergence) could have been compromised by low stand, despite the high seeding rate. Yields of unhusked ears ranged from 8 to 11 t/ac. GS 1861, GS 9056, Splendor, Tracer, and DMC 20-38 had among the highest yields. Elite and GS9056 had ears with among the least taper (most cylindrical ears). Recovery of cut corn ranged from 32.9 to 54.8 %.

Acknowledgments

Support for this study was provided by the Oregon Processed Vegetable Commission, American Fine Foods Inc., and Rogers/Sandoz, Ferry Morse, Crookham, Asgrow, and Harris-Moran Seed Companies.

Table 1. Supersweet corn stand counts. Corn was planted on April 26, 1995 and emergence started on May 9. Malheur Experiment Station, Oregon State University,

Variety	Seed source[1]	Stand count		
		May 12	May 23	May 30
		----------------	%	----------------
Krispy King	1	69.2	90.5	87.0
Supersw. Jubilee	1	6.7	53.7	50.3
GSS 6273	1	68.0	94.2	91.5
Sweet Ear	2	18.7	72.8	68.0
Victor	2	52.3	82.7	78.3
Marvel	3	42.2	73.0	69.0
Contender	3	31.7	67.7	65.3
C & S 710	3	68.2	85.7	84.2
Shaker	4	37.2	73.2	71.2
Challenger	4	60.7	91.2	83.3
Endevour	4	68.2	87.8	84.8
Sheba	4	57.8	85.0	83.3
XPH 3091	4	75.7	90.7	89.5
XPH 3121	4	70.0	89.7	83.8
HM 701	5	47.2	80.7	77.2
HMX 4399S	5	29.7	87.0	82.2
Zenith	5	69.7	85.7	82.7
HMX 2384S	5	70.5	91.3	90.8
Average		52.4	82.4	79.0
LSD (0.05)		13.3	7.5	5

[1]Sources: 1= Rogers/Sandoz, 2= Ferry-Morse, 3= Crookham, 4= Asgrow, 5= Harris-Moran

Table 3. Yield and quality of sweet corn varieties in 1995. Malheur Experiment Station, Oregon State University, Ontario, Oregon.

Variety	Seed source[1]	Days to mid-silk[2]	Days to harvest[2]	Degree days to harvest[3]	Emergence	Yield[4]	Harvest date	Ear weight	Ear length	Max. ear diameter	Taper[5]	Rows	Moisture	Recovery[6]
					%	t/ac		lb	----- inches -----			#	----- % -----	
GS 9056	1	63	92	1,351	78.3	11.2	August 21	0.35	9.2	1.9	0.15	19.3	68.9	51.7
GS 1861	1	52	80	1251	85.7	11.0	August 9	0.33	8.6	2.0	0.31	18.7	69.6	47.4
Elite	1	62	89	1319	86.3	9.5	August 18	0.33	8.4	1.9	0.17	19.5	72.5	43.8
FMX 333	2	52	80	1251	78.5	10.2	August 9	0.31	8.6	2.0	0.32	17.9	70.0	50.4
Excalibur	2	62	88	1314	91.0	10.2	August 17	0.31	8.5	2.0	0.32	20.5	71.2	45.1
StylePak	2	61	89	1319	89.8	9.9	August 18	0.33	8.7	1.9	0.23	20.7	72.0	44.9
FMX 293	2	61	87	1314	87.2	9.5	August 16	0.33	8.9	2.0	0.26	19.8	70.8	51.7
Splendor	3	61	87	1314	87.5	11.3	August 16	0.33	8.8	2.0	0.28	21.8	70.7	49.9
Bolero	3	56	85	1303	86.8	10.9	August 15	0.31	7.9	2.0	0.43	17.4	69.6	54.8
Bingo	3	54	80	1251	82.5	9.1	August 9	0.29	7.6	2.0	0.55	18.7	69.2	51.1
Tracer	4	62	88	1314	89.8	11.0	August 17	0.39	9.3	2.1	0.21	17.5	75.8	48.6
More	4	62	92	1351	89.3	10.0	August 21	0.30	8.1	2.0	0.39	19.4	66.6	44.2
DMC 20-38	5	61	88	1314	76.2	11.9	August 17	0.36	8.7	2.0	0.27	19.3	72.3	32.9
DMC 20-04	5	56	85	1303	84.0	9.8	August 15	0.26	8.2	1.9	0.44	16.6	65.8	46.9
DMC 20-10	5	54	85	1303	90.5	9.8	August 15	0.27	8.2	1.9	0.44	16.5	66.9	49.6
HMX 4397	5	61	88	1314	79.8	9.3	August 17	0.35	8.5	2.1	0.33	21.3	72.8	51.3
DMC 20-35	5	63	92	1351	27.0	8.1	August 21	0.30	8.5	2.0	0.42	16.3	69.7	40.7
Average		59	87	1308	81.8	10.1		0.32	8.5	2.0	0.33	18.9	70.3	47.4
LSD (0.05)					4.7	0.8		0.02	0.2	0.1	0.06	0.8		

[1]Sources: 1= Rogers/Sandoz, 2= Ferry-Morse, 3= Crookham, 4= Asgrow, 5= Harris-Moran

[2]from emergence. [3]Degree days (50 - 86 ^{o}F) from emergence [4]yield of unhusked ears.

[5] max. diameter minus diameter 6" from the base. [6] % of unhusked ear weight recovered as cut corn.

Table 2. Yield and quality of supersweet corn varieties in 1995. Malheur Experiment Station, Oregon State University, Ontario, Oregon.

Variety	Seed source[1]	Days to mid-silk[2]	Days to harvest[2]	Degree days to harvest[3]	Vigor[4]	Yield[5]	Harvest date	Ear weight	Ear length	Max. ear diameter	Taper[6]	Rows	Moisture	Recovery[7]
					1-5	t/ac		lb	----- inches -----			#	------ % ------	
Krispy King	1	64	91	1315	4.8	13.5	August 8	0.36	8.0	19.0	0.25	19.0	76.9	48.8
Super Sw. Jubilee	1	70	93	1331	1.2	10.0	August 10	0.31	8.6	18.1	0.25	18.1	76.7	50.6
GSS 6273	1	70	93	1331	5.0	9.5	August 10	0.31	8.7	20.1	0.31	20.1	75.8	33.1
Sweet Ear	2	66	91	1315	2.4	12.5	August 8	0.40	9.0	18.1	0.24	18.1	76.0	54.0
Victor	2	66	91	1315	3.9	12.1	August 8	0.36	8.6	19.6	0.22	19.6	75.8	47.0
Marvel	3	66	90	1309	3.5	13.1	August 7	0.35	8.8	18.8	0.19	18.8	75.6	35.8
Contender	3	61	90	1309	3.0	11.2	August 7	0.34	8.5	16.7	0.20	16.7	75.8	51.1
C & S 710	3	62	91	1315	4.3	11.1	August 8	0.32	8.5	18.8	0.29	18.8	76.1	46.7
Shaker	4	66	90	1309	3.3	13.0	August 7	0.30	8.9	16.9	0.19	16.9	76.1	43.2
Challenger	4	66	90	1309	5.0	11.7	August 7	0.31	8.5	18.0	0.16	18.0	76.8	46.9
Endevour	4	64	91	1315	4.1	11.4	August 8	0.30	8.3	18.4	0.27	18.4	75.8	47.4
Sheba	4	59	84	1220	3.9	11.0	July 31	0.25	8.1	14.6	0.38	14.6	76.0	45.1
XPH 3091	4	70	93	1331	4.2	10.5	August 10	0.31	8.7	19.2	0.33	19.2	75.2	45.4
XPH 3121	4	70	92	1322	4.1	8.7	August 9	0.25	8.3	18.4	0.29	18.4	76.1	43.0
HM 701	5	65	90	1309	3.8	13.0	August 7	0.33	8.7	18.0	0.17	18.0	77.7	36.2
HMX 4399S	5	74	93	1331	4.0	10.9	August 10	0.33	9.2	19.8	0.40	19.8	76.5	36.9
Zenith	5	70	92	1322	4.7	10.0	August 9	0.26	7.8	18.1	0.37	18.1	75.5	40.9
HMX 2384S	5	70	93	1331	5.0	9.3	August 10	0.29	8.5	16.7	0.36	16.7	75.5	46.2
Average		67	91	1313	3.9	11.3		0.32	8.5	1.9	0.27	18.1	76.1	45.5
LSD (0.05)					0.6	1.3		0.02	0.01	0.1	0.05	0.7		

[1]Seed sources: 1= Rogers/Sandoz, 2= Ferry-Morse, 3= Crookham, 4= Asgrow, 5= Harris-Moran

[2]from emergence. [3]degree days (50 - 86 °F) from emergence. [4]1= low, 5= high. [5]yield of unhusked ears.

[6] max. diameter minus diameter 6" from the base. [7] % of unhusked ear weight recovered as cut corn.

Research Report Submitted
to the
Oregon Processed Vegetable Commission
and the
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1995-96

Title: Vegetation Management in Sweet Corn

Project Leader: Ray William and Ed Peachey, Horticulture Department
Project Status: Concluding one year
Amount Requested: $12, 400

Summary

Several weed management options for sweet corn were tested in two on-farm sites and at the research farm. Dimethenamid, acetochlor and metolachlor controlled atrazine tolerant pigweed when applied post plant, preemergence to the soil surface (PES). Efficacy was greatly reduced and corn injury potential increased by pre-plant incorporating these herbicides. Wild proso millet suppression was best with acetochlor but far from adequate. Split applications of these herbicides did not improve millet control. Nicosulfuron applied postemergence after metolachlor completely controlled both pigweed and proso millet. However, herbicide injury was evident where nicosulfuron was broadcast. Minimizing herbicide contact with newly emerging corn leaves dramatically reduced yield loss. Cost of these herbicides range from $15-18/acre at suggested label rates, a significant increase over the cost of atrazine.

Propane flaming was used effectively to control pigweed and suppress other weeds emerging within the corn row without reducing corn yield. One to two applications were needed at a total cost of $9-18/acre (propane only). Common purslane was the most difficult weed to control. Flaming corn just before or after sweet corn emergence significantly improved control of common purslane.

Planting into undisturbed cover crop residues dramatically lowered summer annual broadleaf emergence. Pigweed control with dimethenamid was reduced slightly by the cover crop residues compared to metolachlor. Incorporating cover crops essentially removed any effect on weed suppression. Planting into undisturbed soil was made possible by a two-row cross slot drill that improved seed to soil contact and reduced disturbance in the row. Fertilizer (100 lbs N/acre) was banded at planting without any effect on the sweet corn. Average yields in the cover crop residue plots were equal to or greater than the conventional tillage plot.

Objectives

1. Evaluate herbicides with near term availability such as dimethenamid, acetochlor, and nicosulfuron for both weed control efficiency and effect on sweet corn growth.

2. Determine tolerance of sweet corn to propane flaming and efficiency of in-row weed control

3. Evaluate impacts of cover crop residues and tillage systems on weed emergence.

4. Evaluate a novel planter design for planting in conventional and conservation tillage environments.

Report of Progress

1. Weed control with herbicides

Treatments were applied at three sites to plantings of Golden Jubilee sweet corn. In Stayton, high populations of atrazine tolerant pigweed and wild proso millet were present. Atrazine tolerant weeds were also present at the Junction city site. Tolerance of sweet corn to herbicides was evaluated at the Vegetable Research Farm in Corvallis. After the initial weed evaluation, plants were thinned and plots kept weed free with hand hoeing and cultivation. Dyfonate was broadcast before planting at Corvallis to evaluate possible interactions with postemergence herbicides. Rates used in these trials represent comparative labeled rates for each herbicide. See Table 2 for herbicides tested, and rates used in these trials.

Table 1. Site descriptions and application timing.

Site	Planting date	PPI Preplant incorporated	PES Preemergence surface	EPOST Early postemergence	POST Late postemergence	Comments
Stayton Table 3	May 22	May 19	May 23	June 9	June 30	Atrazine tolerant pigweed and wild proso millet.
Junction city Table 4	June 28	-	July 1	July 13	July 29	Atrazine tolerant pigweed
Corvallis Table 5-7	June 6	June 7	June 8	July 11	July 14	Tolerance trial, plots weeded

Table 2. Herbicides tested in trials.

Herbicide	Product Names	Rates tested in these trials	Registration Status	Comments
Acetochlor	Harness, Surpass	2.00	Unknown	chloroacetamide similar to metolachlor and dimethenamid
Dimethenamid	Frontier, Guardian	1.20	Possible 1996	Guardian=dimethenamid+atrazine
Halsosulfuron	Battalion (safener) Permit	.031 POST .065 PES	Unknown	PPI,PES and POST; good control of pigweed, nightshade tolerant
Metolachlor	Dual, Dual II	2.00	Current	II has a safener with slighlty higher cost
Metribuzin + chloroacetamide	Axiom	0.72	3+ Years	Suppression of proso millet in some situations, PES and POST
Nicosulfuron	Accent	.031	Possible 1996	SU, good on millet and pigweed, injury concern with OP insecticides
Prosulfuron	Peak (proposed)	0.179	Unknown	Sulfonylurea (SU), postemergence with residual
Pyridate	Tough	0.75-0.94	Unknown	Sweet corn tolerance may be a concern

<u>**Preemergence:**</u> Preplant Incorporated (PPI) and Preemergence Surface (PES).

Atrazine tolerant pigweed control was best with dimethenamid, metolachlor, and acetochlor applied preemergence after planting (PES). Preplant incorporating (PPI) the herbicides significantly reduced efficacy. The reduction in weed control was the most dramatic for metolachlor when applied PPI, particularly at the Stayton site where the soil was very cloddy. Adding atrazine at a low rate improved pigweed control for dimethenamid at the Stayton site but did not improve efficacy at the Junction City site.

In rainy conditions shortly after planting (Corvallis site), pigweed control with metolachlor deteriorated more rapidly than dimethenamid. Lambsquarter control was very poor with dimethenamid. However, dimethenamid controlled nightshade better than metolachlor. Split applications did not improve herbicide efficacy for any of the preemergence herbicides.

Wild proso millet suppression was good with acetochlor, fair for dimethenamid, and fair to poor with metolachlor (Table 3). However, proso millet control with dimethenamid and even acetochlor was far less than required in most situations. EPTC with a safener (Eradicane) applied preplant and incorporated immediately after it was applied suppressed wild proso millet in the adjacent field better than metolachlor and dimethenamid and slightly better than acetochlor. Split applications of metolachlor, dimethenamid and acetochlor did not improve millet control and in some cases reduced millet control. The success of this strategy is determined by the location of the weed seed.

<u>**Postemergence:**</u> 6 inch corn (EPOST) and 12 inch corn (POST).

Atrazine tolerant pigweed. Pyridate was a very effective herbicide for early postemergence control of atrazine tolerant pigweed. However, signs of corn injury were evident at all three locations. Prosulfuron and nicosulfuron are sulfonylurea herbicides that effectively controlled pigweed when applied to actively growing pigweed. However, injury from both herbicides was evident in some situations.

Wild Proso millet. Nicosulfuron applied postemergence after metolachlor controlled both pigweed and wild proso millet but corn showed some signs of injury if the herbicide was broadcast and organo-phosphate insecticides such as Dyfonate were used. Additional constraints are soil carryover to succeeding crops, especially in high pH soils. Semi directed applications significantly reduced the potential for injury.

Pyridate (EPOST) in combination with dimethenamid (PPS) suppressed proso millet but the impact was short lived and had no residual effect. Injury was apparent from this treatment.

<u>**Sweet corn injury**</u>

Early season injury was highest when dimethenamid and acetochlor were applied PPI, and confirms results of previous years. Injury tends to be less with metolachlor applied PPI. Mean corn yields of all the treatments were slightly lower with metolachlor, dimethenamid, and acetochlor compared to the atrazine treated control, though the differences were not great (Table 7). Even treatments that showed no sign of injury early in the season may have been injured and yield reduced. Split applications may reduce the risk of injury for dimethenamid but there was no advantage to this strategy over PES applications for control of either pigweed or wild proso millet. Directed applications of nicosulfuron reduced injury to sweet corn significantly (Table 8). Nozzles were placed so that spray droplet contact with newly emerging corn leaves (whorl area) was minimized. The same application technique did not reduce prosulfuron injury.

Table 3. Atrazine tolerant pigweed and wild proso millet control in sweet corn, Stayton, OR, 1995.

No.[1]	Herbicide	Timing	Rate	Percent weed control				Corn injury
				June 22 (4 WAP)		July 7 (6 WAP)		
			lbs ai/A	Pigweed	Proso millet	Pigweed	Proso millet	-%-
1.	Dimethenamid	PPI	1.2	83	35	70	15	18
2.	Dimethenamid	PES	1.2	93	57	70	35	13
3.	Dimethenamid	PPI	0.7	83	40	68	30	10
	Dimethenamid	PES	0.5					
4.	Dimethenamid	PPI	1.2	88	50	43	15	13
	Atrazine	PES	0.5					
5.	Dimethenamid	PES	1.2	100	65	99	43	5
	Atrazine	PES	0.5					
6.	Dimethenamid	PPI	1.15	90	30	43	10	18
	Atrazine	PPI	1.32					
7.	Dimethenamid	PES	1.15	98	67	98	28	3
	Atrazine	PES	1.32					
8.	Dimethenamid	PPI	0.75	100	73	100	63	8
	Atrazine	PPI	0.87					
	Dimethenamid	PES	0.75					
	Atrazine	PES	0.87					
9.	Metolachlor II	PPI	2.0	45	15	18	5	15
10.	Metolachlor II	PES	2.0	95	50	83	48	3
11.	Metolachlor II	PPI	1.25	100	45	73	43	3
	Metolachlor II	PES	0.75					
12.	Metolachlor II	PES	2.0	95	40	38	28	8
	Atrazine	PES	0.5					
13.	Acetochlor	PPI	2.0	100	53	73	30	10
14.	Acetochlor	PES	2.0	100	85	100	53	0
15.	Acetochlor	PES	2.0	100	80	74	55	8
	Atrazine	PES	0.5					
16.	Acetochlor	PPI	0.93	75	65	100	23	3
	Acetochlor	PES	0.67					
17.	Metolachlor II	PES	2.0	-	-	100	28	-
	Prosulfuron directed	POST	0.0179					
18.	Metolachlor II	PES	2.0	-	-	100	30	-
	Prosulfuron broadcast	POST	0.0179					
19.	Metolachlor II	PES	2.0	-	-	98	98	-
	Nicosulfuron directed	POST	.0310					
20.	Metolachlor II	PES	2.0	-	-	100	100	-
	Nicosulfuron broadcast	POST	.0310					
23.	Dimethenamid	PES	1.2	100	78	100	65	18
	Pyridate	EPOST	0.94					
24.	Dimethenamid	PES	1.2	100	83	86	58	13
	Pyridate	EPOST	0.70					
	Atrazine	EPOST	0.5					
25.	Dimethenamid	PPI	1.2	100	70	73	48	23
	Pyridate	EPOST	0.94					
26.	Dimethenamid	PPI	1.2	98	72	78	70	30
	Pyridate	EPOST	0.70					
	Atrazine	EPOST	0.94					
27.	Atrazine	PES	1.0	8	10	0	5	33[2]
28.	Control		-	0	0	-	-	0
29.	Atrazine	EPOST	0.5	18	0	-	-	0
30.	Atrazine	EPOST	1.0	33	0	-	-	0
	LSD (P=0.05)			25	23	45	27	16

[1] Treatment numbers correspond with treatments listed in following tables.

[2] High injury because of severe competition from wild proso millet.

Table 4. Weed control and crop injury at Crosson Farms, Junction City OR.

No.	Herbicide	Timing	Rate	July 29, 1995 4 WAP		August 17, 1995	
				Pigweed control	Corn injury	Pigweed control	Corn injury
			lbs ai/A	-%-	-%-	-%-	-%-
2.	Dimethenamid	PES	1.20	95	0	100	0
5.	Dimethenamid	PES	1.20	95	0	100	0
	Atrazine	PES	0.50				
7.	Dimethenamid	PES	1.15	88	0	100	0
	Atrazine	PES	1.32				
10.	Metolachlor	PES	2.00	98	0	100	0
12.	Metolachlor	PES	2.00	92	0	100	0
	Atrazine	PES	0.50				
14.	Acetochlor	PES	2.00	98	0	100	0
15.	Acetochlor	PES	2.00	100	0	67	33
	Atrazine	PES	0.50				
17.	Metolachlor	PES	2.00	-	-	97	3
	Prosulfuron (directed)	POST2	0.0179				
18.	Metolachlor	PES	2.00	-	-	100	33
	Prosulfuron (broadcast)	POST2	0.0179				
23.	Dimethenamid	PES	1.20	-	-	100	13
	Pyridate	POST	0.94				
24.	Dimethenamid	PES	1.20	-	-	100	20
	Pyridate	POST	0.94				
	Atrazine	POST	0.50				
27.	Atrazine	PES	0.50	0	0	0	0
28.	Control			0	0		
29.	Axiom	PES		72	0	95	0
30.	Basagran	POST	1.00	85	0	100	0
	Atrazine	POST	0.50				
31.	Atrazine	POST	0.50	0	0	0	0
32.	Pyridate	POST	0.94	95	0	100	7
33.	Pyridate	POST	0.94	100	7	100	3
	Atrazine	POST	0.50				
35.	Basagran	POST	1.00	95	0	50	0
37.	Prosulfuron (broadcast)	POST2	0.0179	-	-	57	13
	LSD (P=0.05)			10	6	30	23

Table 5. Control of **non-tolerant** weeds in sweet corn with pre-plant incorporated and preemergence herbicides, Vegetable Research Farm, Corvallis, OR, 1995.

No.	Herbicide	Timing	Rate	Percent broadleaf weed control			
			lbs ai/ac	Pigweed	Lambsquarter	Nightshade	Common purslane
1.	Dimethenamid	PPI	1.20	77	100	47	97
2.	Dimethenamid	PES	1.20	100	97	95	100
3.	Dimethenamid	PPI	0.70	99	98	83	100
	Dimethenamid	PES	0.50				
4.	Dimethenamid	PPI	1.20	100	100	95	100
	Atrazine	PES	0.50				
5.	Dimethenamid	PES	1.20	100	100	100	100
	Atrazine	PES	0.50				
6.	Dimethenamid	PPI	1.15	93	100	80	100
	Atrazine	PPI	1.32				
7.	Dimethenamid	PES	1.15	75	75	75	75
	Atrazine	PES	1.32				
8.	Dimethenamid	PPI	0.75	100	100	100	100
	Atrazine	PPI	0.87				
	Dimethenamid	PES	0.75				
	Atrazine	PES	0.87				
9.	Metolachlor II	PPI	2.00	73	70	33	60
10.	Metolachlor II	PES	2.00	98	84	98	98
11.	Metolachlor II	PPI	1.25	59	98	25	88
	Metolachlor II	PES	0.75				
12.	Metolachlor II	PES	2.00	100	100	96	100
	Atrazine	PES	0.50				
13.	Acetochlor	PPI	2.00	100	96	88	90
14.	Acetochlor	PES	2.00	100	100	100	100
15.	Acetochlor	PES	2.00	100	100	100	100
	Atrazine	PES	0.50				
16.	Acetochlor	PPI	0.93	100	80	100	100
	Acetochlor	PES	0.67				
29.	Axiom	PES	0.72	100	100	30	100
27.	Atrazine	PES	1.00	100	100	100	100
28.	Control:no herbicide			0	0	0	0
	LSD (P=0.05)			23	38	33	34

Table 6. Tolerance of sweet corn to __preemergence__ herbicides, Vegetable Research Farm, Corvallis, OR, 1995.

No.	Herbicide	Timing	Rate lbs ai/ac	Corn injury -%- (4 WAP)	Corn emergence (no.4' row)	Sweet corn yield -t/A-	No ears (no/15' row)	Avg. ear wt lb.	Maturity index (100= mature)
1.	Dimethenamid	PPI	1.20	0	9.3	11.6	23	0.73	94
2.	Dimethenamid	PES	1.20	0	9.0	10.5	23	0.69	96
3.	Dimethenamid Dimethenamid	PPI PES	0.70 0.50	3	9.0	10.7	23	0.71	96
4.	Dimethenamid Atrazine	PPI PES	1.20 0.50	3	10.0	11.7	22	0.65	93
5.	Dimethenamid Atrazine	PES PES	1.20 0.50	0	9.3	10.6	23	0.70	99
6.	Dimethenamid Atrazine	PPI PPI	1.15 1.32	5	9.0	10.9	24	0.72	96
7.	Dimethenamid Atrazine	PES PES	1.15 1.32	0	10.5	10.4	24	0.69	99
8.	Dimethenamid Atrazine Dimethenamid Atrazine	PPI PPI PES PES	0.75 0.87 0.75 0.87	8	10.0	10.3	23	0.68	91
9.	Metolachlor II	PPI	2.00	0	10.8	11.2	24	0.75	96
10.	Metolachlor II	PES	2.00	0	10.3	10.8	22	0.72	99
11.	Metolachlor II Metolachlor II	PPI PES	1.25 0.75	0	8.0	11.5	25	0.76	98
12.	Metolachlor II Atrazine	PES PES	2.00 0.50	0	10.5	10.4	23	0.69	94
13.	Acetochlor	PPI	2.00	25	9.0	10.3	23	0.68	96
14.	Acetochlor	PES	2.00	0	9.8	11.1	24	0.74	97
15.	Acetochlor Atrazine	PES PES	2.00 0.50	0	10.0	10.5	22	0.70	97
16.	Acetochlor Acetochlor	PPI PES	0.93 0.67	15	9.3	11.1	25	0.74	94
29.	Axiom	PES	0.72	3	10.3	11.4	22	0.67	96
27.	Atrazine	PES	1.00	0	9.0	12.0	25	0.79	98
28.	Control:no herbicide			0	9.0	10.8	25	0.71	97
	LSD (P=0.05)			15	2.4	2.1	4.8	0.18	6

Table 7. Tolerance of sweet corn to <u>postemergence</u> herbicides at the vegetable research farm, Corvallis, OR, 1995.

No.	Herbicide	Timing	Rate	Sweet corn yield	No ears	Avg. ear wt	Maturity index
			lbs ai/ac	(t/ac)	(no/15 ft row)	lbs/ear	(100=mature)
17.	Metolachlor II	PES	2.00	11.4	24	0.76	96
	Prosulfuron directed	POST	0.0179				
18.	Metolachlor II	PES	2.00	11.3	24	0.75	98
	Prosulfuron broadcast	POST	0.0179				
19.	Metolachlor II	PES	2.00	11.8	25	0.78	99
	Nicosulfuron directed	POST	0.0310				
20.	Metolachlor II	PES	2.00	8.6	20	0.57	93
	Nicosulfuron broadcast	POST	0.0310				
21.	Metolachlor II	PES	2.00	10.5	21	0.70	98
22.	Dimethenamid	PES	1.20	10.9	23	0.72	96
23.	Dimethenamid	PES	1.20	9.4	21	0.63	91
	Pyridate	EPOST	0.94				
24.	Dimethenamid	PES	1.20	11.1	24	0.73	97
	Pyridate	POST	0.70				
	Atrazine	POST	0.50				
25.	Dimethenamid	PPI	1.20	10.6	23	0.71	90
	Pyridate	EPOST	0.94				
26.	Dimethenamid	PPI	1.20	10.3	23	0.69	95
	Pyridate	POST	0.70				
	Atrazine	POST	0.50				
27.	Atrazine	PES	1.00	12.0	25	0.75	98
28.	Control:no herbicide			10.8	25	0.71	97
30.	Halosulfuron	POST	0.031	10.6	23	0.70	99
	LSD (p=0.05)			2.1	4.8	0.18	6

2. Propane flaming for in-row weed control.

Experiments were placed at the Vegetable research farm in plantings of Jubilee sweet corn. We directed the flame dispensers from both sides of the row at 45 degrees from horizontal and approximately 10 inches from both sides of the row to target weeds growing within the row. Tractor speed was 3 MPH. Flame dispensers were mounted on skids such as used for directed herbicide application equipment to keep the flame at a consistent distance from the ground. The two middle rows of each plot were flamed while the two outside border rows were not treated and were used for comparison of flame effectiveness. Additionally, half of each plot was kept weed free with atrazine and handhoeing to evaluate tolerance of sweet corn to flame intensity. Treatments were applied singly or in multiple applications when the growing tip of the emerging corn leaf was 2,10,16, and 22 inches above the soil. A stale seed bed system was used to encourage weed seed germination before crop emergence in treatments 1 through 6.

Sweet corn tolerance (Table 8). Sweet corn was very tolerant of propane flaming when applied to corn that was 10 or more inches tall. Slight decreases in yield were noted with application rates of 18 gal/acre (40 PSI at the nozzle) when the corn was 22 inches high.

Sweet corn was also tolerant of flaming when the first true leaf of sweet corn was just emerging. Results last year indicated there is little advantage to flaming corn when corn is less than 10 inches tall because weed control potential is very limited and risk of damage to the corn is high. However, flaming at this very early stage would be a great advantage for early emerging and difficult to control weeds such as common purslane. In this trial, sweet corn yields were not reduced when the flame was directed vertically toward the ground at a rate of 9.0 gal/acre (20 PSI at the nozzle at 3 MPH).This essentially burned the first emerging leaf to the ground but did not seem to affect growth or yield. Weed control was greatly improved however, especially for more difficult to kill weeds such as purslane.

Weed control (Table 9). The success of propane flaming to control weeds is very dependent on timing. This trial was designed to look primarily at tolerance, but treatments coincided relatively well with appropriate timing for most efficient weed control. These results indicate that in optimum conditions, and in concerted effort with cultivation to control weeds between rows, propane flaming can be used to effectively control in-row weeds and reduce competition. A single application of propane at 9 gal/A adequately suppressed pigweed but did not adequately control purslane or barnyardgrass. One additional flaming greatly improved weed control, particularly of purslane. Table 10 demonstrates that the weed control contributed by propane flaming can significantly improve yield. Several treatments yielded as well as the weed free control and significantly better than the unweeded treatment that only had in-row cultivation for weed control.

Table 8. Tolerance of sweet corn to propane flaming in weed free conditions.

	Propane timing			Propane rate			Fresh wt.	No. ears	Average ear wt	Culls	Earworm damage
	1	2	3	1	2	3					
	-corn height (in)-			-gal/acre/application-			-t/ac-	-15'/row-	-g-	-%-	-%-
4.	2" 1st leaf			4.5			12.5	32	272	21	16
5.	2" 1st leaf			9.0			12.1	35	239	21	10
6.	2" 1st leaf	10"	16"	9.0	4.5	9.0	12.8	34	251	6	7
7.	10"			4.5			12.6	35	251	21	16
8.	10"			9.0			12.1	34	256	20	15
9.	10"	16"		4.5	9.0		11.9	30	267	17	16
10.	10"	16"	22"	4.5	9.0	13.5	12.0	31	263	17	10
11.	16"			9.0			12.1	34	252	18	16
12.	16"			13.5			11.7	31	263	18	8
13.	16"	22"		9.0	13.5		11.5	30	266	22	18
14.	22"			13.5			11.7	32	253	8	7
15.	22"			18.0			11.1	29	241	17	21
16.	No propane applied						12.0	31	267	10	5
	LSD						2.3	5	24	14	7

Table 9. Impact of propane flaming on in row weed control in sweet corn at 8 WAP.

	Propane timing			Propane rate			Stale seedbed	Pigweed	Purslane	Nightshade	Barnyard grass
	1	2	3	1	2	3					
	-corn height (in)-			-gal/acre/application-				- Percent weed control -			
1.	No propane applied			Control			+	0	0	0	0
2.	before emergence	10"	16"	4.5	4.5	9.0	+	52	58	25	50
3.	before emergence	10"	16	9.0	4.5	9.0	+	100	100	100	100
4.	2" 1st leaf			4.5			+	13	0	8	25
5.	2" 1st leaf			9.0			+	88	69	75	50
6.	2" 1st leaf	10"	16"	9.0	4.5	9.0	+	100	50	100	75
7.	10"			4.5			-	80	30	65	58
8.	10"			9.0			-	93	13	48	17
9.	10"	16"		4.5	9.0		-	98	63	85	75
10.	10"	16"	22"	4.5	9.0	13.5	-	98	66	100	100
11.	16"			9.0			-	65	17	42	38
12.	16"			13.5			-	61	13	61	25
13.	16"	22"		9.0	13.5		-	50	42	63	50
14.	22"			13.5			-	18	14	46	50
15.	22"			18.0			-	62	58	68	40
16.	No propane applied						-	0	0	0	0
	LSD (P=0.05)							30	32	33	32

Table 10. Impact of propane flaming on weed control and sweet corn yield. Propane flaming was the only weed control for the area within the rows. Cultivation was used to control weeds in the row middles to within a 10 inch band of the row.

Propane timing			Propane rate				Sweet corn yield	Weed control estimate		
1	2	3	1	2	3	Total[1]		Pigweed	Purslane	Barnyardgrass
-corn height in inches-			-gal/acre/application-				-t/ac-	-%-	-%-	-%-
2 (1st leaf emerged)			9.0			9.0	12.8	88	69	50
10"			4.5			4.5	12.2	80	30	58
10"			9.0			9.0	12.4	93	13	17
10"	16"		4.5	9.0		13.5	11.4	98	63	75
10"	16"	22"	4.5	9.0	13.5	27.0	11.5	98	66	100
No flaming, weed free			-	-	-	-	12.0	100	100	100
No flaming, unweeded			-	-	-	-	10.0	0	0	0
LSD (P=0.05)							2.3	30	32	32

[1] Cost of propane ranges from $0.75 to $0.99/gallon.

3 & 4. Cover crop residues, reduced tillage, and cross-slot planter performance.

Two trials were located at the vegetable research farm to assess impact of cover crop residues on weed emergence and efficacy of herbicides, and tolerance of sweet corn to cover crop residues. In the **first trial** (Table 12 and 13) four cover crops were planted in October, 1994, killed with glyphosate in April of 1995, and sweet corn planted with a cross-slot planter on May 27, 1995. Cover crops were rolled before planting and one half of each plot flailed. The fallow plot was split and one half was chisel plowed and rototilled to prepare a seedbed. Dimethenamid and metolachlor were broadcast PES perpendicular to the plots with a small area left untreated. Sweet corn was harvested from 15 feet of row within the metolachlor treated area. Though weed control was exceptional in the cover crop plots, handweeding was used to remove any weeds from the area that was to be harvested for sweet corn yield determination.

In the **second trial** (Table 14), four cover crops were planted in October of 1994. Each main plot was split in half; one half was killed with glyphosate in April of 1995 and the other half was flailed in April and May and then chisel plowed and rototilled in June. Sweet corn was planted on 36 inch rows with the cross-slot planter into both the undisturbed cover crop residue and the tilled soil on June 27. Weed evaluations were made 4 weeks after planting.

Weed suppression. Fall planted cereals killed in the spring with corn planted directly into undisturbed soil and cover crop residue reduced weed emergence as much as 95 to 99. Summer annual weed emergence averaged across the cover crop treatments was reduced by 80 percent by eliminating spring tillage (Table 14). Adding the cover crop increased suppression by a maximum of 10 percent compared to untilled winter fallow. Eliminating spring tillage reduced nightshade emergence more than pigweed emergence. Though the difference is modest in these results, previous research suggests this trend. Even at 8 WAP, weed control in the cover crop residue plots was near 60 percent compared to the conventional tillage plot (Table 13). Treatments with a cereal plus a legume generally did not suppress weed as well as treatments without a legume.

Pigweed control with metolachlor was not affected by the cover crop residue with the exception of the *Hesk* barley and common vetch. Pigweed control with dimethenamid in cover crop residues was slightly lower than the conventional tillage plot, especially in the *Micah* barley and common vetch treatment with unflailed residues. These differences were possibly due to the nature of the residue. *Micah* barley was more upright and soil coverage was much less than treatments with a legume.

Common purslane control was greatly improved by the cover crop residues and was near 100 percent in the triticale and crimson clover plot (Table 13). The combination of cover crop residue plus herbicide dramatically improved purslane control compared to the conventional tillage plot. Total weed control was best with metolachlor plus a cover crop residue.

Corn tolerance. Sweet corn yield was usually greatest when the cover crop residues were flailed. However, there was a noticeable exception in the Micah barley plot early in the season as corn growth was much more vigorous in the unflailed plot. Again the upright stature of this variety may have allowed more soil warming and therefore, improved growth. Flailing this cereal dramatically increased soil coverage and corn growth. This growth advantage did translate into a yield increase at seasons end compared to the flailed plot.

Overall yields in this plot were exceptional. Corn was planted at a slightly higher density to ensure adequate stands. However, emergence was very similar across treatments and plants were not thinned. The cross slot planter was used in this trial and performed well. Some residues were more difficult to plant into than others, particularly those with common vetch that formed a mat and kept the soil wet. Otherwise, planting went well, even when applying 80 gal/acre of 10-34-0 at planting. The cross-slot planter bands fertilizer approximately one inch from the seed.

Table 11. Weed control and sweet corn yield as influenced by tillage, cover crop residue, and cover crop management in weed free plots.

Treatment (cover crop and tillage regime)	Management	Sweet corn yield -t/ac-	No. ears/15 ft of row	Maturity index	Cover crop biomass	
				%	Tons/ acre	Ratio legume/cereal
Barley	Flailed	10.3	28	88	1.6	-
	Unflailed	13.4	29	93		
Barley + c.vetch	Flailed	13.9	32	95	2.6	.14
	Unflailed	11.3	24	90		
Triticale and C. clover	Flailed	11.8	27	94	2.0	.1
	Unflailed	10.1	27	86		
Hesk barley and c. vetch	Flailed	13.2	33	90	2.2	.26
	Unflailed	14.1	33	90		
Fallow : untilled	-	13.1	33	100	0.9	-
Chisel plow + rotara	-	13.6	30	95	0.9	-
LSD (P=0.05)		2.8	NS	NS	-	-

Table 12. Cover crop, tillage and herbicide effects on weed emergence.

Treatment	Management	Herbicide	Pigweed	Common purslane - % control - (8 WAP)	Total
1 Micah barley	unflailed	dimethenamid	83	98	75
		metolachlor	94	95	90
		none	58	97	64
	flailed	dimethenamid	89	83	76
		metolachlor	94	95	78
		none	59	63	46
2 Micah barley + c. vetch	unflailed	dimethenamid	55	100	74
		metolachlor	90	98	86
		none	38	50	43
	flailed	dimethenamid	74	75	70
		metolachlor	94	85	90
		none	43	60	48
3 Triticale + crimson clover	unflailed	dimethenamid	93	95	86
		metolachlor	93	98	91
	flailed	none	66	100	70
		dimethenamid	80	96	70
		metolachlor	90	100	79
		none	58	99	61
4 Hesk barley + c. vetch	unflailed	dimethenamid	81	73	75
		metolachlor	80	96	76
		none	59	80	58
	flailed	dimethenamid	80	78	75
		metolachlor	71	83	75
		none	41	63	36
5 Fallow	Untilled	dimethenamid	86	59	75
		metolachlor	93	85	89
		none	18	38	20
6 Fallow	Tilled	dimethenamid	100	50	68
		metolachlor	86	43	65
		none	0	0	0
LSD (P=0.05)			41	36	31

Table 14. Cover crop and tillage effects on broadleaf weed emergence in sweet corn

Cover crop treatment	Spring tillage	Pigweed	Nightshade	Total broadleaf weeds
		-no/m^2-	-no/m^2-	-no/m^2-
1. Micah barley	-	9 *	1 *	11 *
2. Micah barley	+	106	33	143
3. Wheeler rye	-	23 *	0 *	25 *
4. Wheeler rye	+	80	69	149
5. Monida oat	-	15 *	0 *	16 *
6. Monida oat	+	85	96 *	194
7. Winter fallow, no cover crop	-	21 *	7 *	31 *
8. Winter fallow, no cover crop	+	79	51	154

[1] Untilled with minimal disturbance at planting designated by '-'; tillage (chisel plow + rotara is designated by '+')):
[2] Means in the same column followed by an asterisk differ significantly from treatment 8 (no cover crop and tilled soil) p=0.05.

REPORT TO THE OREGON PROCESSED VEGETABLE COMMISSION, 1995-1996

TITLE: Pesticide Evaluation and Education, Ethoprop (MOCAP) Field Residue Trial in Carrots/Beets

PROJECT LEADER: Robert B. McReynolds, District Extension Agent, North Willamette Research and Extension Center

COOPERATORS: Rick Melnicoe, Western Region IR-4
Glenn Fisher, Extension Entomology
Jeffrey Jenkins, Extension Agricultural Chemistry

PROJECT STATUS: Field study completed.

FUNDING: $4,000 in 1995-96 from the OPVC.

OBJECTIVES:

The objective of this research was to collect samples of carrot roots from soil in which ethoprop had been applied. Samples from the treated plot were to be analyzed for ethoprop residues and compared to untreated samples from the same field. The results were to be used to establish a residue tolerance level for carrots. The data collected from this field study was to become part of a petition to be submitted to EPA by IR-4 requesting that a national residue tolerance be established for ethoprop (MOCAP) in carrots.

Collecting data on the effectiveness of ethoprop in controlling either nematodes or insects was not an objective of this project.

PROGRESS REPORT:

One field trial was established in a carrot field at Cereghino Farms on Sauvie Island. The trial was conducted following an IR-4 protocol for magnitude of residue field studies. Appropriate Standard Operating Procedures were employed and the trial was conducted under provisions outlined in guideline 40 CFR Part 100 (IN ACCORDANCE WITH EPA'S GOOD LABORATORY PRACTICE STANDARDS).

Characterized ethoprop was applied broadcast at a rate of 6 lb ai/acre with a CO_2 backpack sprayer and immediately incorporated on May 31, 1995. One 40 x 40 foot area was treated with the test substance. The carrot variety 'Cheyenne' was seeded the same day. The trial area was maintained by the grower. No other chemicals were applied in the plot area. On September 5, 1995, carrot root sample were harvested from the test area and from an untreated area within the same field. The samples were labeled and stored at 0°F at the NWREC. On September 11, the samples were shipped by freezer truck to the USDA-ARS, Environmental Chemistry Lab in Beltsville, MD for residue analysis. The Field Data Book, documenting the conduct of the field study, was finalized on November 30, 1995 and sent to the Western Regional IR-4 office at U.C. Davis.

As of December 18, 1995, the residue analyses of the carrot samples had not been completed. 'Freezer spikes' had been initiated, as the samples were not expected to be completed until March 1996. Freezer spikes are necessary when a residue analysis can not be performed at the time the samples arrive at the lab and must be stored. The test is being conducted to measure the stability of ethoprop in the carrots when stored at 0° F and document its dissipation. Once the samples are analyzed, the freezer spike data will be incorporated into the test.

SUMMARY:

The ethoprop/carrot magnitude of residue field trial was successfully completed. The treated carrot roots are being stored at the analytical lab and will be analyzed in March, 1996. The petition request will probably be submitted to EPA by December 1996.

SIGNATURES: Redacted for Privacy

Project Leader

Department Head Redacted for Privacy

REPORT TO THE OREGON PROCESSED VEGETABLE COMMISSION, 1995-1996

TITLE: Nitrogen Management in Vegetable Crops and Their Rotations

PROJECT LEADERS: Delbert D. Hemphill, North Willamette R&E Center
Richard Dick and John Hart, Dept. of Crop & Soil Science

COOPERATORS: John Luna and N.S. Mansour, Dept. of Horticulture
John Selker, Dept. of Bioresources Engineering; Marvin Kauffman, Soil Scientist, Neil Christensen, Crop and Soil Science, and 16 vegetable growers

PROJECT STATUS: Continuing

FUNDING: $18,790 in 1995-96 from OPVC. Additional funding from OSU and ODA. Funds spent for fertilizers; soil and tissue analysis; sample collection; labor for plot establishment, maintenance and harvest; travel, Corvallis to Aurora.

OBJECTIVES FOR 1995:

Broccoli

1. To evaluate effects of several winter cover crop systems, including drilled and overseeded cereal rye, drilled cereal rye plus winter pea, and overseeded clover on yield and quality of broccoli fertilized at three rates of N. The cover crops follow sweet corn fertilized with three rates of N.
2. To evaluate the effect of these cover crops and the N applied to broccoli on the amount of nitrate leached below the root zone.

Cauliflower and Sweet Corn

1. To evaluate the use of pre-sidedress testing of soil, plant sap, or leaf tissue N, to predict the level of additional N needed to grow the crop to good yield and quality.
2. To evaluate the effect of alternative between-row spacings, at constant population, on N uptake efficiency and residual N (**sweet corn only**).

Bean, Beet, Carrot

1. To establish small yield vs. N rate trials to use in comparison with grower soil survey results.
2. To estimate N uptake efficiency by these crops and uptake efficiency at recommended N application rate.

All Crops

1. To collect and analyze soil samples to 48-inch depth before and after crops of sweet corn, broccoli, cauliflower, beans, table beet, and carrot. Survey growers to determine nitrogen application, soil type, and relevant cultural practices.

PROGRESS REPORT:

Nitrogen Rate and Cover Crop on Broccoli Yield

'Gem' broccoli was direct-seeded on 7 June in rows 20 inches apart and thinned to about 9 inches in the row. During winter the plots had been fallow, or in the cover crops listed under Objectives. Plot size was 600 sq. ft. N rates were 0, 125, and 250 lb/acre, with half the N applied one week after seeding and the remainder applied five weeks after seeding. At this time the appropriate plots were overseeded to triticale or red clover in preparation for the 1996 experiments. Harvest was on 31 August. Stands were greatly reduced by root maggot damage. Yield and mean head weight did not vary significantly by previous cover crop but head weight responded normally to increasing rate of applied N, with greatest size at 250 lb N/acre (Table 1). The largest mean head weight was with the combination of cereal rye cover crop and 250 lb N.

Pre-sidedress Soil Nitrate Test for Cauliflower

In the plots at NWREC, 'Snowball Y Improved' cauliflower was seeded on 8 June in a greenhouse. Plugs were transplanted on 12 July. Four levels of soil N were established on 17 July by applying either 40, 80, 120, or 160 lb N/acre, as urea, just after transplanting. Transplants were set in three-row plots with 30 inches between rows and 18 inches between plants in the row. On 21 August, the plots were sidedressed with either 0, 60, or 120 lb N/acre.

Although repeated applications of Lorsban and diazinon were made, root maggot damage and loss of stand were severe. Plots were harvested only once, on 4 October. Head size was below normal, attributable to maggot-damaged root systems. Head weight and yield did not vary significantly with the amount of N applied at planting (when averaged over sidedressed N), but both tended to decline with increasing rate of N, indicating that excessive N at planting may have stunted the plants or delayed maturity (Table 2). Both yield and head weight tended to increase with the greater rates of sidedressed N. Approximately equivalent head sizes were obtained with many different combinations of N at planting and sidedressed N, indicating that a predictive test might be useful in determining the appropriate amount of sidedress N to apply in cauliflower fields.

PSNT trials were also carried out in two commercial cauliflower trials. In the first trial, the PSNT soil test was 25 ppm nitrate-N and cauliflower midribs contained 12,400 ppm nitrate-N at time of intended sidedress. Addition of the full amount of sidedress N planned by the grower resulted in significantly increased yields at both the first and second harvests. In the second trial, the PSNT value was 35 ppm and the cauliflower midribs contained 16,800 ppm nitrate. Addition of sidedressed N produced an insignificant increase in yield at the first harvest but an insignificant decrease in yields at both the second and third harvests, indicating that the soil and plant nitrate levels were sufficient at time of the intended sidedressing (Fig. 1). These results again point to the possible value of a predictive soil or tissue nitrate test in cauliflower. However, the multiple harvests necessary with cauliflower and the lack of uniformity of maturity of most varieties makes it unlikely that a useful PSNT can be developed for cauliflower. The rate of applied N also affects maturation in cauliflower, further complicating the picture.

Pre-sidedress Soil Nitrate Test for Sweet Corn

NWREC plots

'Jubilee' sweet corn was planted with 30-inch row spacing on May 16. Prior to planting, 40 lb N/acre (400 lb/acre 10-20-20) was broadcast and disked into the entire area. At planting, nitrogen (as urea) was applied at four rates (0, 40, 80, 120 lb N/acre). Before applying mid-season sidedress N, a pre-sidedress soil nitrate test (PSNT) sample was collected from the surface foot of soil and analyzed for nitrate-N (NO_3-N) and ammonium-N (NH_4-N) (Table 3). Sidedressed N rates of 0, 40, or 80 lb N/acre were superimposed on each of the initial treatments, resulting in total N rates ranging from 40 to 240 lb N/acre. On July 7, SPAD chlorophyll meter readings were taken and leaf samples were collected and analyzed for total N content. At harvest, stalk samples were collected from six treatments (Table 4, treatments 1, 2, 3, 10, 11, 12) and analyzed for NO_3-N concentration. Corn was harvested from 40 row feet. Total yield, ear weight, ear length, and tipfill were evaluated. Following harvest, soil was sampled from 0-1 and 1-2 foot depths and analyzed for NO_3-N and NH_4-N.

Maximum yields and ear weights were attained at total N rates of 120 lb N/acre or more (Fig. 2). Maximum yields were attained at the 120 lb N/acre rate when N applications were split, but yields were reduced when all 120 lb N/acre was applied at planting. When 160 lb N/acre was applied at planting, the

PSNT value was 36 ppm NO_3-N and additional N at sidedress did not improve yields or ear weight (Table 4). All treatments receiving sidedress N at 80 lb N/acre attained maximum yield and ear weight, regardless of N rate at planting. This suggests that split N applications may result in more efficient N fertilizer use.

SPAD meter readings were correlated with leaf N concentration and sweet corn yield (Table 5). This suggests the meter may be useful for evaluating crop N status. The advantage of the SPAD meter is ease of use and instantaneous analysis. The meter has been used successfully in field corn production in many parts of the U.S. Due to variability between sites, however, a high N comparison plot must be established at each field where the meter is to be used. The high N plot is used as a reference for determining if the rest of the field is N deficient.

Residual soil nitrate concentrations increased with both N at planting and sidedress N rates. Residual soil nitrate tended to be low at N rates at or below that needed for maximum yield (Fig. 3). As N rates exceeded crop demand, yields remained constant while residual soil nitrate increased. Residual soil nitrate was about 35 and 80 lb NO_3- N/acre for the 160 and 240 lb N/acre treatments, respectively, with no significant increase in sweet corn yield from the added fertilizer. Timing of N application had no apparent effect on residual soil nitrate in the surface foot of soil.

Nitrate concentrations in corn stalks at harvest have been used to evaluate crop N status for field corn. While a harvest test is obviously too late for correcting problems, the test can be useful for diagnosing causes of poor crop performance or evaluating efficiency of N management. Stalk nitrate concentrations at harvest remained low when N was not sufficient for maximum yield (Fig. 4a). As N rates increased beyond the level necessary for maximum yield, stalk nitrate concentrations also increased (Fig. 4b). The data suggest that stalk nitrate concentrations above a range of about 2000-4000 ppm indicate N was applied in excess of crop demand. More data is needed to better define a critical range. Stalk nitrate concentrations also gave an indication of residual soil nitrate concentrations (Fig. 5). The stalk test is easier to perform than the soil test and may be preferred by some growers as a means for evaluating N management efficiency.

On-farm PSNT experiment

Sixteen experiments were conducted on 6 farms. Growers planted and managed corn according to normal practices. Prior to applying mid-season sidedress N, the surface foot of soil was sampled and analyzed for nitrate-N (NO_3-N) and ammonium-N (NH_4-N). The grower then applied sidedress N, but left an unfertilized check plot. The unfertilized plot was divided into three subplots, each four rows wide and 20 feet long. Three subplots of were also marked in the fertilized field. At harvest, corn from the center two rows of each plot was picked and weighed. Also at harvest, the bottom eight-inch section of stalk was cut from ten plants in each subplot. Stalk samples were analyzed for NO_3-N content.

Percent relative yield was defined as the average yield from the unfertilized plots divided by the average yield from the fertilized plots. If yield from the unfertilized plots was less than 94% of yield from the fertilized plots, the site was identified as N-responsive. The 94% cutoff allows for variability and considers the diminishing rate of returns as increasing amounts of fertilizer are needed to attain smaller yield increases as maximum yield is approached. A 6% yield reduction represents approx. 1/2-ton/acre (assuming 10 ton/acre yields). Relative yield data was then compared to PSNT soil test data to determine if there is a soil nitrate concentration above which response to fertilizer N is unlikely. Relative yield data was also compared to nitrate concentrations in corn stalks at harvest to determine if the test can be used to evaluate N sufficiency and N management efficiency.

PSNT and yield data are shown in Table 6. The data is plotted in Fig. 6a. The graph is divided into four quadrants. Quadrant III contains sites that had *low* PSNT values and were N-responsive. Quadrant II contains sites that had *high* PSNT values and were *not* N-responsive. Both of these quadrants contain "correct predictions"; i.e., sites where the PSNT test successfully predicted yield response to N fertilizer. Quadrant I contains sites that had low PSNT values but did not show a yield response with added N. Quadrant IV contains sites that had high PSNT values and an unexpected yield response with added

N. Quadrants I and IV represent "incorrect predictions"; i.e., sites where using the PSNT test would have resulted in the wrong decision.

The dotted line in Fig. 6a represents the expected PSNT critical value of 25 ppm NO_3-N. The 25 ppm critical value was expected based on sweet corn studies conducted in New Jersey and field corn studies conducted in the Willamette Valley and many eastern states. The lack of high PSNT sites in this study prevented us from confirming the critical value for sweet corn in western Oregon.

PSNT values on 13 of the 16 sites were below 25 ppm NO_3-N, suggesting sidedress N applications are needed on most Willamette Valley sweet corn fields. Site 16 was the only site with a PSNT value above 30 ppm NO_3-N. The field had a history of manure applications and, therefore, potential for large amounts of N mineralization.

Stalk nitrate data suggest a critical value of approximately 2700 ppm NO_3-N (Fig. 6b). If NO_3-N concentrations in the stalk at harvest are below 2700 ppm, then N may have limited yield. This agrees with the stalk nitrate data from the 1995 NWREC plots.

Five sites (2, 5, 8, 10, 12) with low PSNT values did not show a difference in yield between fertilized and unfertilized plots (Fig. 6a, Quadrant I). At first, these appear to be incorrect predictions and raise questions regarding the effectiveness of the PSNT. Closer examination of the data, however, shows that four of these sites had low yields in *both* the fertilized and unfertilized plots (Table 6). Corn stalk nitrate concentrations were also low in the fertilized plots at these low yielding sites, suggesting that the fertilized plots were N deficient. N deficiency on the fertilized plots may have prevented us from identifying a potential N-response.

The small number of high PSNT sites suggests that determination of a critical value above which no sidedress N is needed may be of limited value. Nine of 16 sites, however, had PSNT values in the range of 17-25 ppm NO_3-N. Sites in this range may be able to produce maximum yield with a reduced sidedress N application, as soil NO_3-N levels are close to the level that is expected to be sufficient. Future research may want to focus on establishing a PSNT critical value above which sidedress N applications can be reduced to 75 lb N/acre.

Nitrogen Rate and Row Spacing on Sweet Corn Yield and Residual Nitrate

'Jubilee' sweet corn was seeded on 24 May with a hand planter at between-row spacings of 18, 27, and 36 inches. Plot preparation included a broadcast and incorporated application of potassium sulfate at 250 pounds per acre, disking and cultimulching. Fifty pounds of nitrogen per acre as urea was applied to all plots immediately after planting. All plots were thinned to a population of 25,000/acre. Target in-row spacing was 13.9, 9.3, and 7.0 inches for 18, 27, and 36-inch between-row spacing, respectively. The remaining N was applied to the appropriate plots on 22 June. Plots were harvested on 24 August. Post-harvest soil samples were collected on 21 September.

Yield was greater at 200 than at 50 lb applied N/acre but did not vary significantly with row spacing (Table 7). This was anticipated since the number of plants/acre was held constant by adjusting the in-row spacing. Residual soil nitrate at the 0-1 and 1-2 foot depths was greater at 200 than at 50 pounds N/acre but did not vary significantly with between-row spacing (Table 8). Our hypothesis was that decreasing the spacing between rows might lead to more efficient uptake of N since the proportion of the surface area of soil explored by feeder roots might increase. However, this did not turn out to be the case. Uptake efficiency, as measured by either yield or residual N, did not vary within the spacings used in this experiment.

Green Bean Response to Nitrogen

Plot preparation included a broadcast and incorporated application of potassium sulfate at 250 lb/acre and standard pesticides. Pre-plant soil samples for nitrate and ammonium analysis were obtained to four-foot depth on 27 April. The N source was urea. The first 40 lb N/acre was broadcast at planting; the remaining N was broadcast on 16 June. "Oregon 91G" beans were seeded on 15 May and harvested on 25 July. Post-harvest soil samples were collected on 21 September.

Yield increased with increasing rate of applied N to 80 lb/acre. Rates as high as 160 lb N/acre did not further increase yield (Table 9). This is consistent with results obtained in 1994. Residual nitrate and ammonium in the surface foot of soil increased with greater rates of applied N (Table 10). However, the optimal N rate of 80 lb/acre did not result in much increase of either soil nitrate or ammonium concentrations.

Table Beet Response to Nitrogen

Plot preparation included a broadcast and incorporated application of potassium sulfate at 250 pounds per acre, disking and cultimulching. Pre-plant soil samples for nitrate and ammonium were obtained to four-foot depth, in one-foot increments, on 27 April. The N source was urea. The first 40 lb N/acre was broadcast at planting; the remaining N was broadcast on 16 June. 'Detroit Dark Red' table beets were seeded on 15 May and harvested on 9 August. Post-harvest soil samples to two-foot depth were obtained on 21 September from areas which had been harvested.

Beet yield increased with each increment of N (Table 11), indicating an optimum for yield of at least 240 lb/acre. This is consistent with results obtained last year. Residual soil mineral N tended to increase with N rate but, as in 1994, the levels were quite low (Table 12).

Carrot Response to Nitrogen

Plot preparation, soil sampling, and fertilization were similar to those for beans and beets. 'Six Pac' carrots were seeded on 15 May and harvested on 13 September. Post-harvest soil samples were collected on 21 September. Yield was greatest at 120 applied N/acre, just as in 1994 (Table 13). Overall yields in 1995 were lower than in 1994, reflecting a change in site from a sandy loam to a silt loam soil. Residual soil nitrate increased with increasing N rate at both the 0-1 and 1-2 foot depths (Table 14). Residual soil ammonium also increased with increasing N at the 0-1 foot depth. The residual nitrate in the surface layer of soil was more than double that experienced in 1994, perhaps reflecting the lower crop yield and reduced N uptake.

Post-Harvest Mineral Nitrogen Status in Grower Fields

Soil samples were taken to a depth of 5 feet both before and after crops of beans, beets, broccoli, carrot, cauliflower, and sweet corn, for determination of mineral nitrogen (ammonium-N and nitrate-N) content. Thirty-four fields were again sampled, representing 12 growers in Marion and Lane counties, and 9 soil types. The growers were interviewed to determine field history and cropping and fertilization intentions and were asked to keep records of fertilizer applications.

Samples were taken from 4 beet, 4 carrot, 6 broccoli, 5 cauliflower, 8 bean, and 7 corn fields. Departures from planned numbers of samples were because of growers' need to change planting intentions in response to the rainy spring.

In order to preserve anonymity, only average soil test values are presented in this report. Pre-plant nitrate concentrations in the surface foot of soil were nearly identical to those found in 1993 and 1994, averaging 5.2, 5.1, 2.8, and 2.9 ppm nitrate-N at the 1, 2, 3, and 4 foot depths, respectively. Ammonium levels were slightly higher than in previous years, averaging 6.5, 4.6, 4.1, and 3.9 ppm, respectively. As in 1993 and 1994, most cases of higher levels of nitrate or ammonium could be explained by a past history of manure application or by the presence of a legume cover crop.

Not surprisingly, much greater differences among fields existed at harvest. Average nitrate and ammonium levels at harvest vary both with crop and with grower cultural practices (data not shown). For example, in top foot of the soil, nitrate concentrations were greater for sweet corn than for the other crops (Fig. 7). This is in agreement with our results indicating that sweet corn is relatively inefficient in taking up N and with results obtained in 1993 and 1994 grower surveys. Levels of nitrate following beans were nearly as high as with corn, a trend noticed in 1994. Nitrate levels following broccoli were considerably higher than in previous years, but not as high as for corn or beans. For all crops, nitrate levels were generally elevated, not only in the surface foot of soil, but also at greater depths. This contrasts with our experience at NWREC and may indicate that improvements could be made in irrigation practices. Post-harvest ammonium concentrations varied less between pre-season and post-harvest sampling than did nitrate, but ammonium levels tended to be higher than the last two years, particularly for broccoli fields and in the surface foot of soil (Fig. 8). However, the high average for ammonium following broccoli harvest was due to one site. This sample will be reanalyzed. The grower cooperators will be mailed a copy of the data from their fields in the next month, along with the average for all fields.

SUMMARY

Three years of data from the grower survey indicates the need to concentrate efforts to improve N uptake efficiency on sweet corn, and possibly, beans. Data from the three years will be summarized this spring and the Commission will be provided with a more in-depth report. For most crops, the data should be of value in demonstrating that current fertility management practices are not major causes of nitrate pollution of water. For the problem crops, it is clearly time to focus on methods to reduce residual mineral N in fields. Possible approaches include continuing research on the use of winter cover crops, and the PSNT or other predictive test for sidedress N applications, based on the amount of N present in the soil or plant at mid-season. Our initial results with sweet corn PSNT and SPAD readings were promising and this work should be continued. It is now time to focus on methods to reduce the impact of residual mineral N and to improve the predictability of sweet corn response to sidedressed N.

Table 1. Main effects of preceding cover crop and rate of applied nitrogen on yield of broccoli, NWREC, 1995

Treatment	Yield (kg/plot)	Mean head wt. (g)
Cover crop		
Fallow	1.1	132
Cereal rye	1.0	145
Rye + pea	1.3	130
Overseeded rye	1.5	143
Overseeded clover	1.5	148
	NS	NS
N rate, lb/acre		
0	1.5	115
125	1.1	134
250	1.2	170
LSD (0.05)	NS	52

Table 2. Main effects of rate of N at planting and sidedressed nitrogen on yield and head size of cauliflower, NWREC, 1995

N rate (lb/acre)	Mean head wt. (g)	Total yield (tons/acre)
At planting		
40	673	9.2
80	777	9.0
120	705	7.3
160	702	7.0
	NS	NS
Sidedressed		
0	650	6.5
60	788	8.3
120	763	9.5
	NS	NS

Table 3. Effect of N at planting on soil nitrate and ammonium concentration five weeks after planting, NWREC, 1995

N at planting (lb/acre)	Soil nitrate-N (ppm)	Soil ammonium-N (ppm)
40	12.3	4.4
80	21.8	7.9
120	30.0	13.4
160	36.0	17.4
Significance	**	*

Table 4. Effect of N at planting and sidedressed N on yield and quality parameters of sweet corn, NWREC, 1995

N at planting[z] (lb/acre)	Sidedress N[y] (lb/acre)	Yield (tons/acre)	Ear wt. (g)	No. ears per plot	Ear length (inches)	Tipfill[x]
40	0	4.3	216	42	8.3	2.6
40	40	6.3	235	56	8.8	3.0
40	80	9.3	306	63	9.1	3.8
80	0	7.5	266	55	8.6	3.4
80	40	9.1	287	66	8.9	3.5
80	80	9.2	301	64	9.2	3.7
120	0	8.6	276	65	8.7	3.6
120	40	8.7	293	62	8.8	3.6
120	80	9.7	297	68	9.0	3.4
160	0	9.3	311	63	9.0	3.8
160	40	9.3	304	64	9.3	3.5
160	80	10.6	309	71	8.9	3.9
Significance[w]						
N at planting		**	**	**	**	
N sidedressed		**	**	**	**	
Planting x sidedress		*	*	NS	**	
Interaction LSD		1.6	35		0.3	

[z]40 lb/acre broadcast as 10-20-20 one day before planting. Remainder broadcast as urea one day after planting.

[y]broadcast as urea five weeks after planting.

[x]Five-point scale with 5=perfect fill, 1=2 inches unfilled kernels.

[w]NS,*,**: not significant and significant at 5% and 1% levels, respectively.

Table 5. Correlation coefficients (Pearson's pairwise) for leaf dry weight, SPAD readings, leaf N concentration, and leaf N content, NWREC sweet corn, 1995

Variable	by Variable	Correlation coefficient	Probability
Leaf dry wt.	N concentration	0.1927	0.367
SPAD	N concentration	0.5981	0.002
SPAD	Leaf dry wt.	0.3942	0.057
N content	N concentration	0.6217	0.001
N content	Leaf dry wt.	0.8866	0.000
N content	SPAD	0.5836	0.003
Yield	SPAD	0.8528	0.000
Mean ear wt.	SPAD	0.7839	0.000

Table 6. Sweet corn yield and stalk nitrate concentrations at harvest for plots with and without sidedress N on 16 grower fields. PSNT data indicates soil nitrate concentration at time of sidedressing, 1995

Site Number	PSNT (ppm NO_3-N)	Stalk nitrate (ppm) No sidedress N	Stalk nitrate (ppm) With sidedress N	Sweet corn yield (ton/acre) No sidedress N	Sweet corn yield (ton/acre) With sidedress N	Relative yield (%)
1	11	42	4156	7.7	9.9	78.2
2	11	498	756	7.8	7.4	104.8
3	12	2262	7261	9.1	9.7	93.4
4	12	1925	2806	10.1	11.6	87.2
5	17	2297	814	8.4	8.0	105.1
6	17	657	3943	12.2	13.1	93.0
7	17	120	3219	8.1	9.9	82.3
8	19	892	1871	9.5	9.3	101.8
9	20	1248	3376	9.4	10.3	91.2
10	22	2379	4826	11.7	10.9	107.8
11	22	1473	3242	9.5	13.7	69.3
12	23	893	2312	9.3	9.4	98.6
13	24	447	5793	9.9	11.1	89.0
14	29	6224	10573	8.7	9.5	91.2
15	29	4489	6290	9.1	9.2	98.8
16	47	9044	10309	10.4	11.2	93.5

Table 7. Main effects of row spacing and N rate on sweet corn yield, NWREC, 1995

Treatment	Yield (tons/acre)	Mean ear wt. (g)	Ear length (inches)
Row spacing (inches)			
18	6.5	266	11.1
27	7.4	232	11.0
36	6.4	257	11.1
LSD (0.05)	NSD	NSD	NSD
N rate (lb/acre)			
50	4.5	220	10.5
200	9.0	283	11.6
Significance	**	**	**

Table 8. Main effects of row spacing and N rate on residual soil nitrate and ammonium concentrations (ppm) at two depths following[z] harvest of sweet corn spacing trial, NWREC, 1995

Treatment	Nitrate 0-12 inch	Nitrate 12-24 inch	Ammonium 0-12 inch	Ammonium 12-24 inch
Row spacing (inches)				
18	4.7	1.6	3.6	3.2
27	7.2	1.1	3.6	3.5
36	4.7	1.1	3.6	2.8
Significance	NSD	NSD	NSD	NSD
N rate (lb/acre)				
50	0.2	0.2	3.0	2.9
200	10.9	2.3	4.2	3.5
Significance	*	*	NSD	NSD

[z]Pre-plant soil nitrate concentration was 0.2 ppm at both depths. Pre-plant soil ammonium concentration was 2.8 ppm at 0-12 inch depth and 3.2 ppm at 12-24 inch depth.

Table 9. Effect of broadcast N on yield of green beans, NWREC, 1995

N rate (lb/acre)	Total yield (tons/acre)
0	9.2
40	9.0
80	7.3
120	7.0
160	8.0
LSD (0.05)	2.3

Table 10. Effect of rate of broadcast nitrogen on soil nitrate and ammonium concentrations (ppm) at two depths following bean harvest, NWREC, 1995

Sample depth (inches)		Rate of applied urea, lb/acre					
		0	40	80	120	160	LSD(0.05)
	Pre-plant	--------Post-harvest--------					
Nitrate							
0-12	0.2	5.5	7.3	7.5	17.1	13.8	6.1
12-24	0.2	1.4	1.9	2.0	2.0	3.4	NSD
Ammonium							
0-12	3.6	3.1	3.1	3.8	5.6	8.4	1.7
12-24	3.1	3.2	3.1	3.3	3.6	4.6	NSD

Table 11. Effect of broadcast N on yield of beets, NWREC, 1995

N rate (lb/acre)	Total yield (tons/acre)
0	3.6
60	14.1
120	14.8
180	17.5
240	19.8
LSD (0.05)	1.9

Table 12. Effect of rate of broadcast nitrogen on soil nitrate and ammonium concentrations (ppm) at two depths following beet harvest, NWREC, 1995

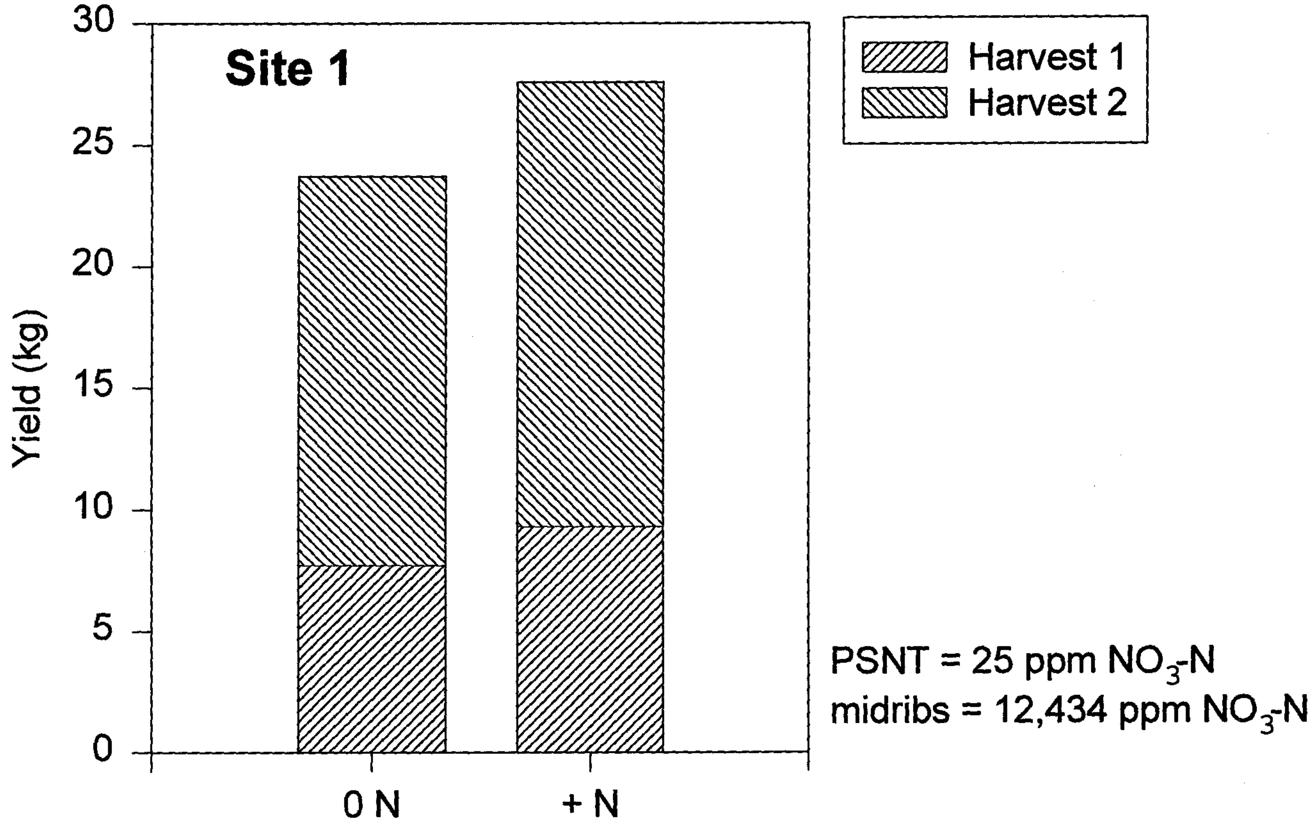
Sample depth (inches)		N rate, lb/A					
		0	40	80	120	160	LSD(0.05)
	Pre-plant	-------Post-harvest-------					
Nitrate							
0-12	0.2	0.9	1.3	4.6	6.6	7.7	4.2
12-24	0.2	0.5	1.1	0.8	1.0	2.6	NSD
Ammonium							
0-12	3.6	2.9	3.3	5.8	10.2	18.2	NSD
12-24	3.1	3.2	2.8	3.5	5.0	8.2	NSD

Table 13. Effect of broadcast N on yield of carrots, NWREC, 1995

N rate (lb/acre)	Total yield (tons/acre)
0	10.9
40	14.7
80	15.9
120	19.6
160	18.0
LSD (0.05)	3.4

Table 14. Effect of rate of broadcast nitrogen on soil nitrate and ammonium concentrations (ppm) at two depths following carrot harvest, NWREC, 1995

Sample depth (inches)		N rate, lb/A					
		0	40	80	120	160	LSD(0.05)
	Pre-plant	---------Post-harvest-------					
Nitrate							
0-12	0.2	1.0	1.1	4.7	14.5	21.0	4.0
12-24	0.2	0.2	1.5	1.1	2.7	3.3	1.8
Ammonium							
0-12	3.6	3.5	3.1	3.6	3.4	5.8	1.3
12-24	3.1	2.8	3.5	2.8	3.0	3.2	NSD



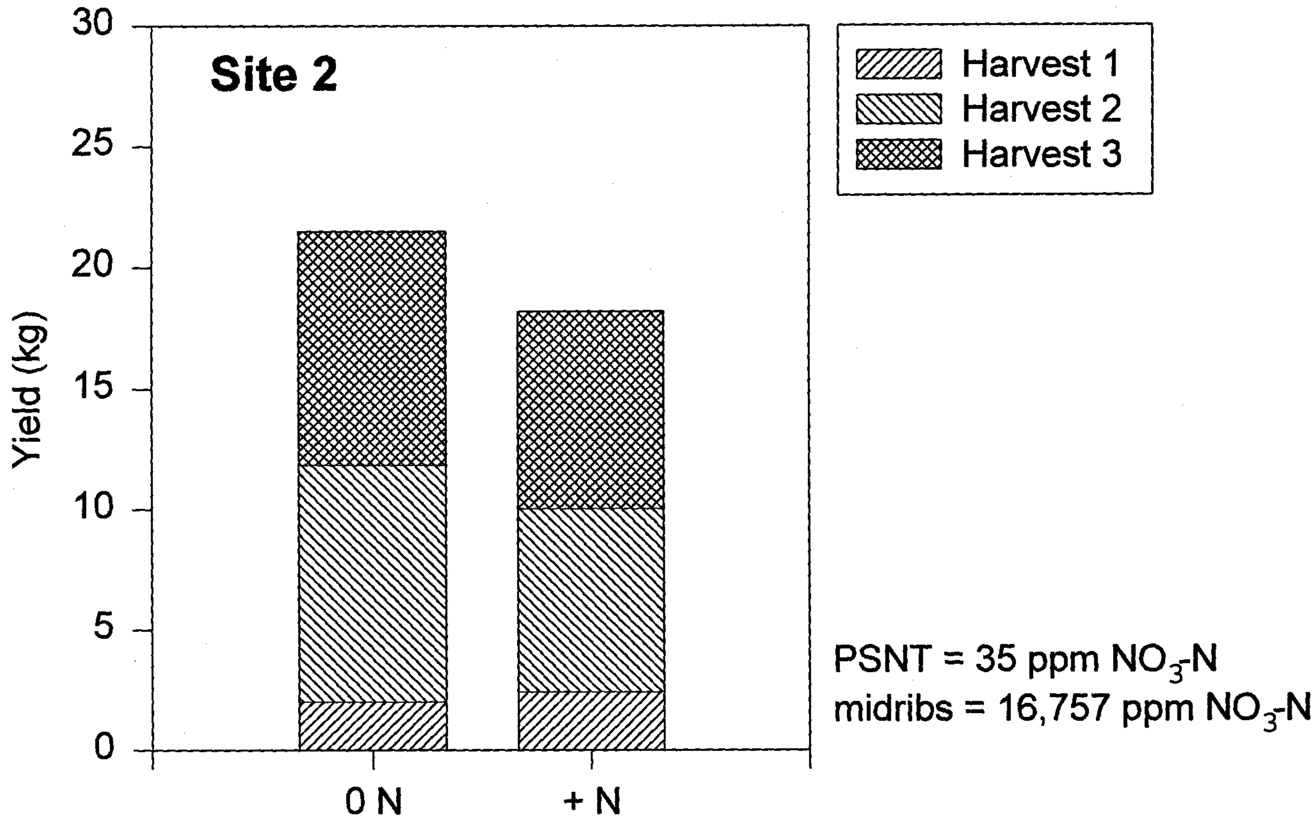


Fig. 1. 1995 Cauliflower PSNT yield.

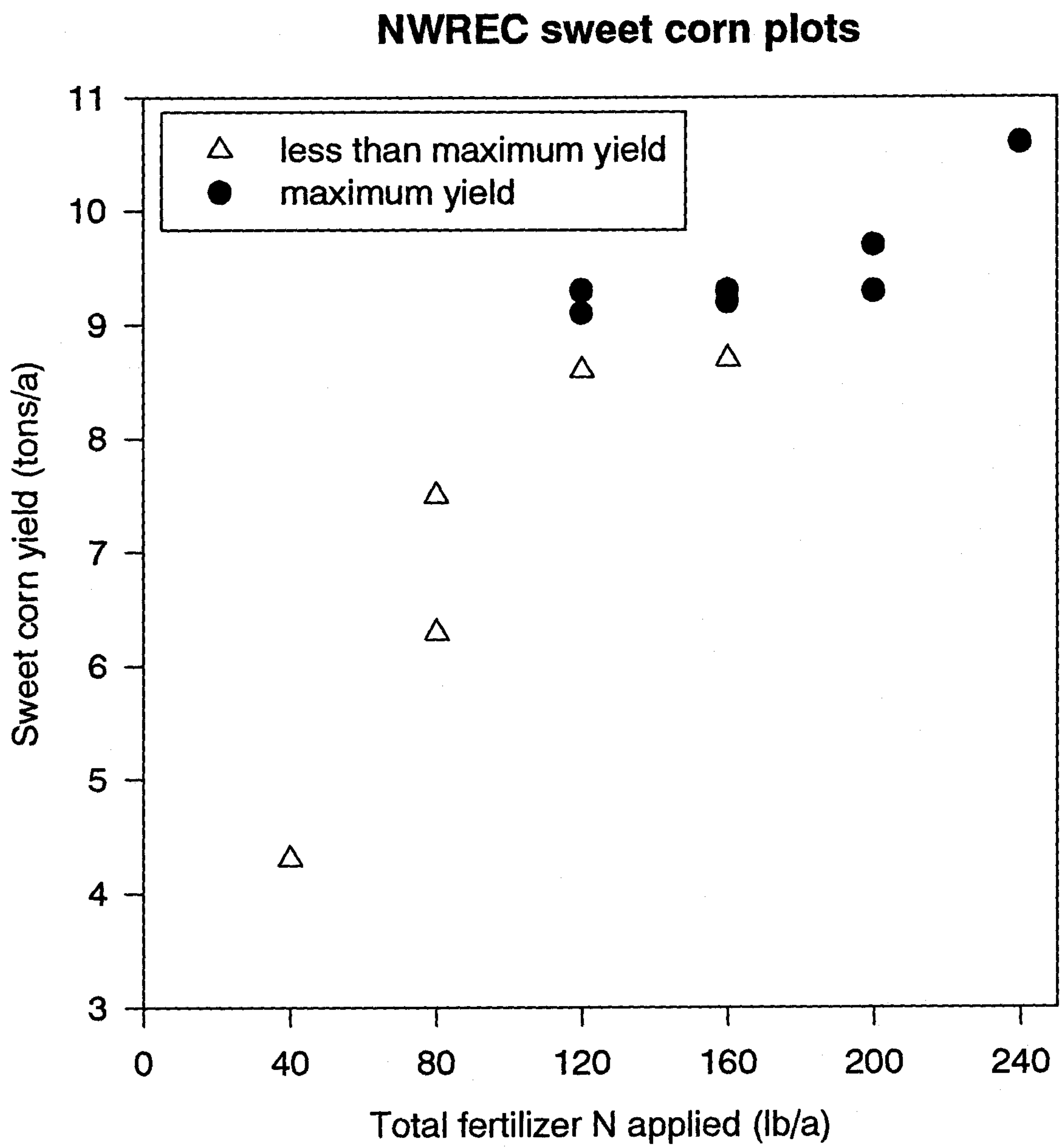


Figure 2. Sweet corn yield vs. nitrogen fertilizer applied on NWREC plots. Treatments with yields significantly less ($P<0.05$) than the maximum are marked with (△).

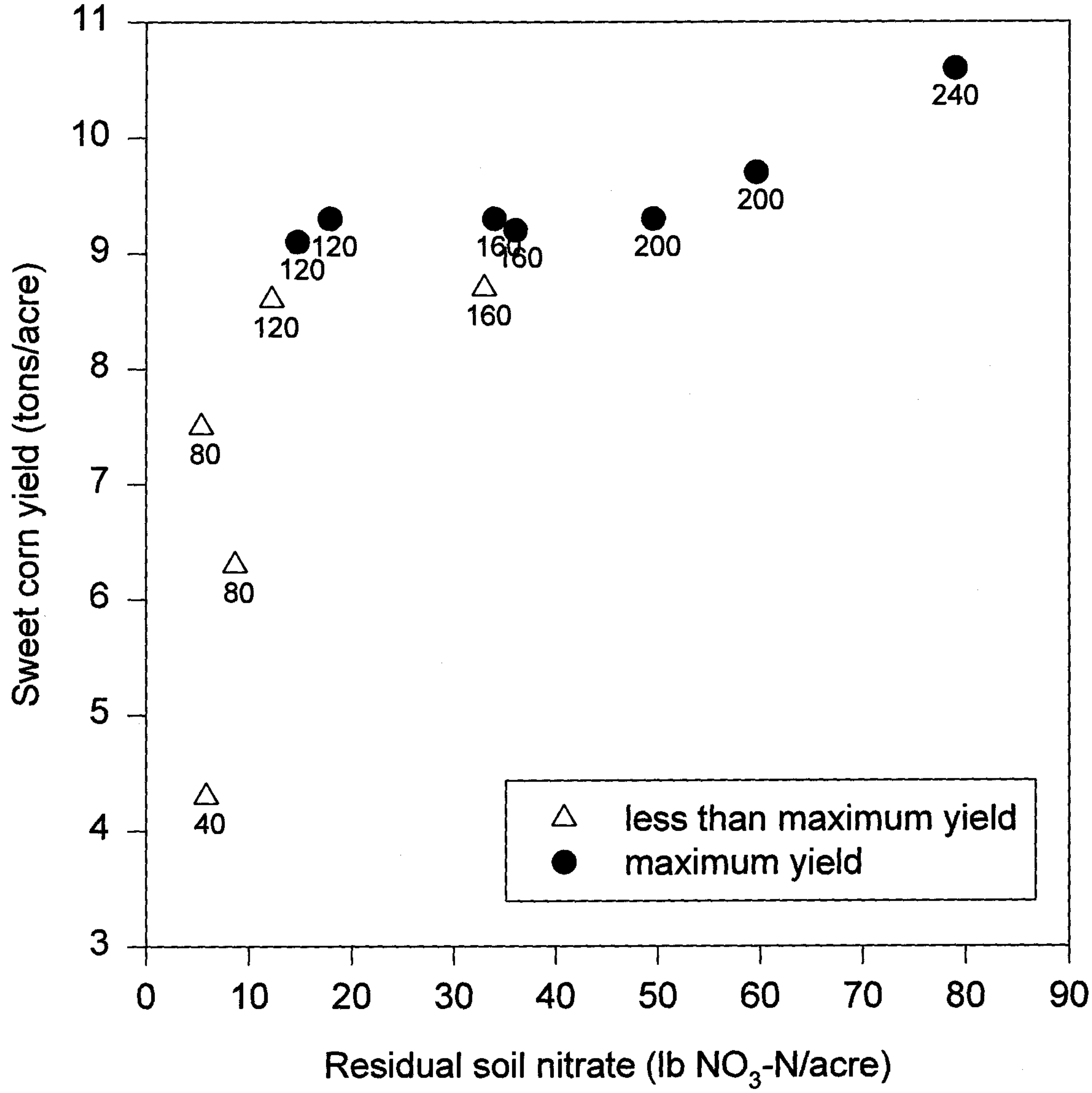


Fig. 3. Relationship between N rate, sweet corn yield, and residual soil nitrate. Numbers indicate total N applied (lb N/acre).

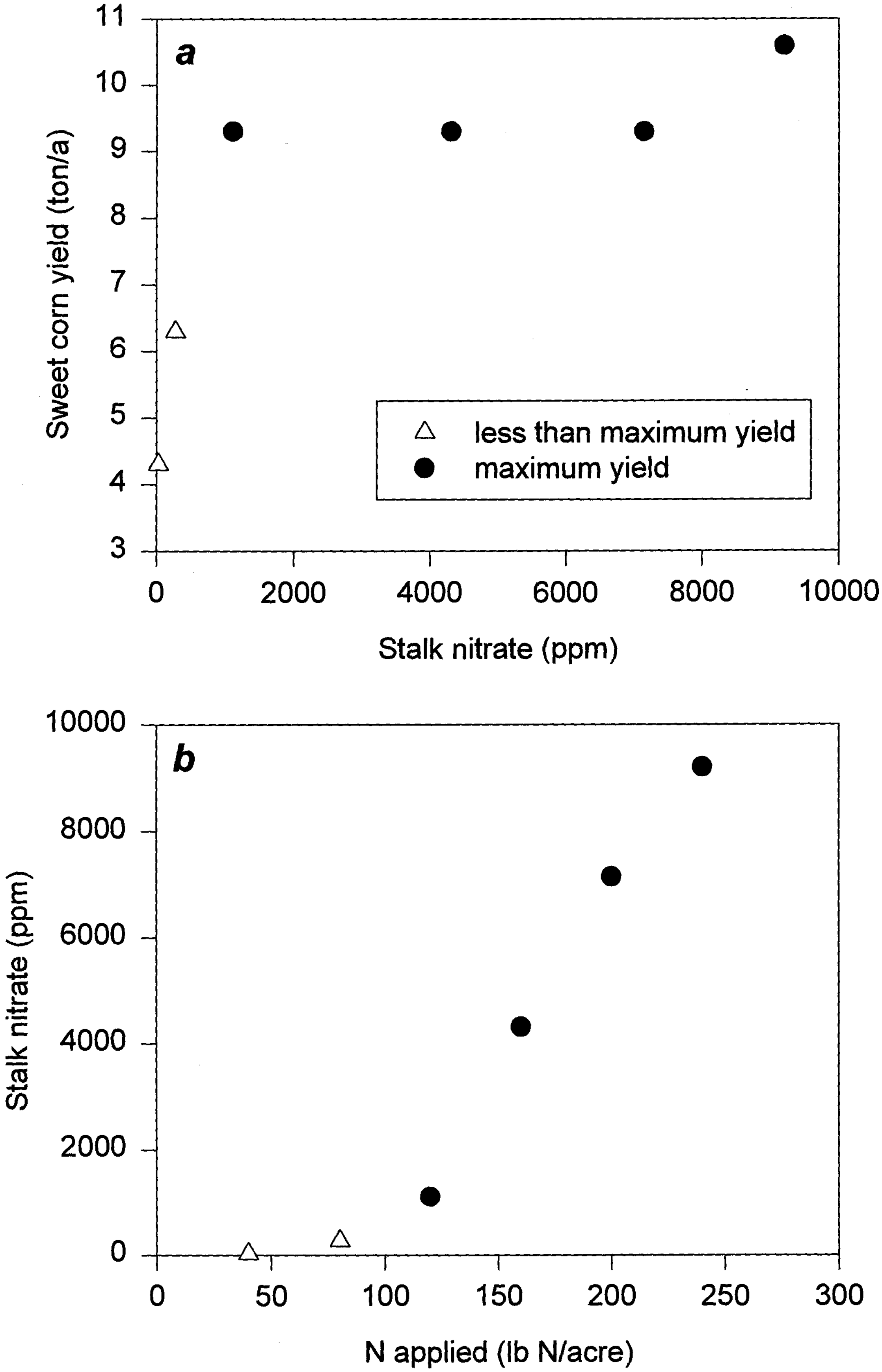


Fig. 4a. Relationship between stalk nitrate concentration at harvest and sweet corn yield (NWREC, 1995)
Fig. 4b. Relationship between total N applied and stalk nitrate concentration at harvest (NWREC, 1995).

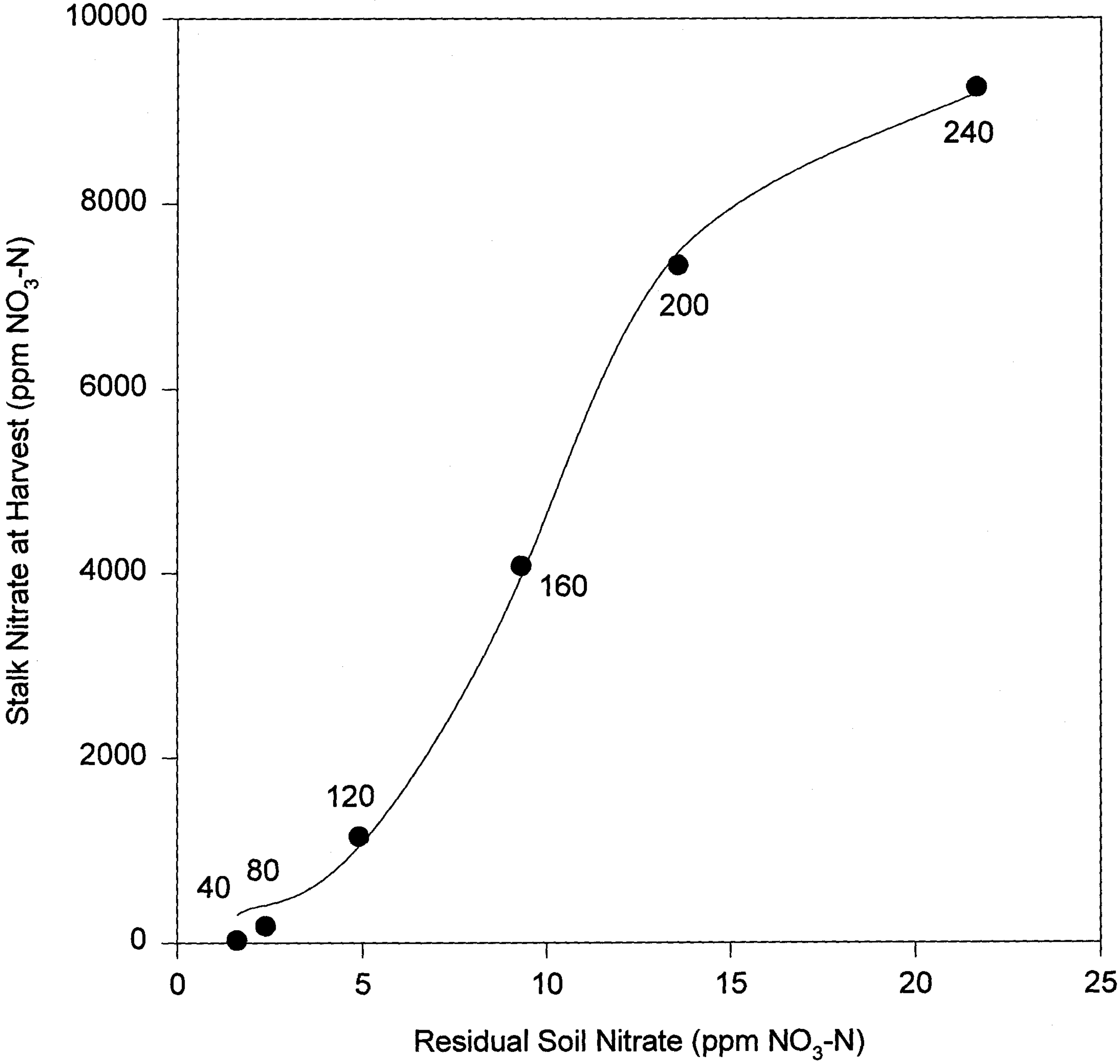


Fig. 5. Residual soil nitrate and stalk nitrate concentration at harvest for six N rates (NWREC, 1995). Numbers indicate total N/acre applied.

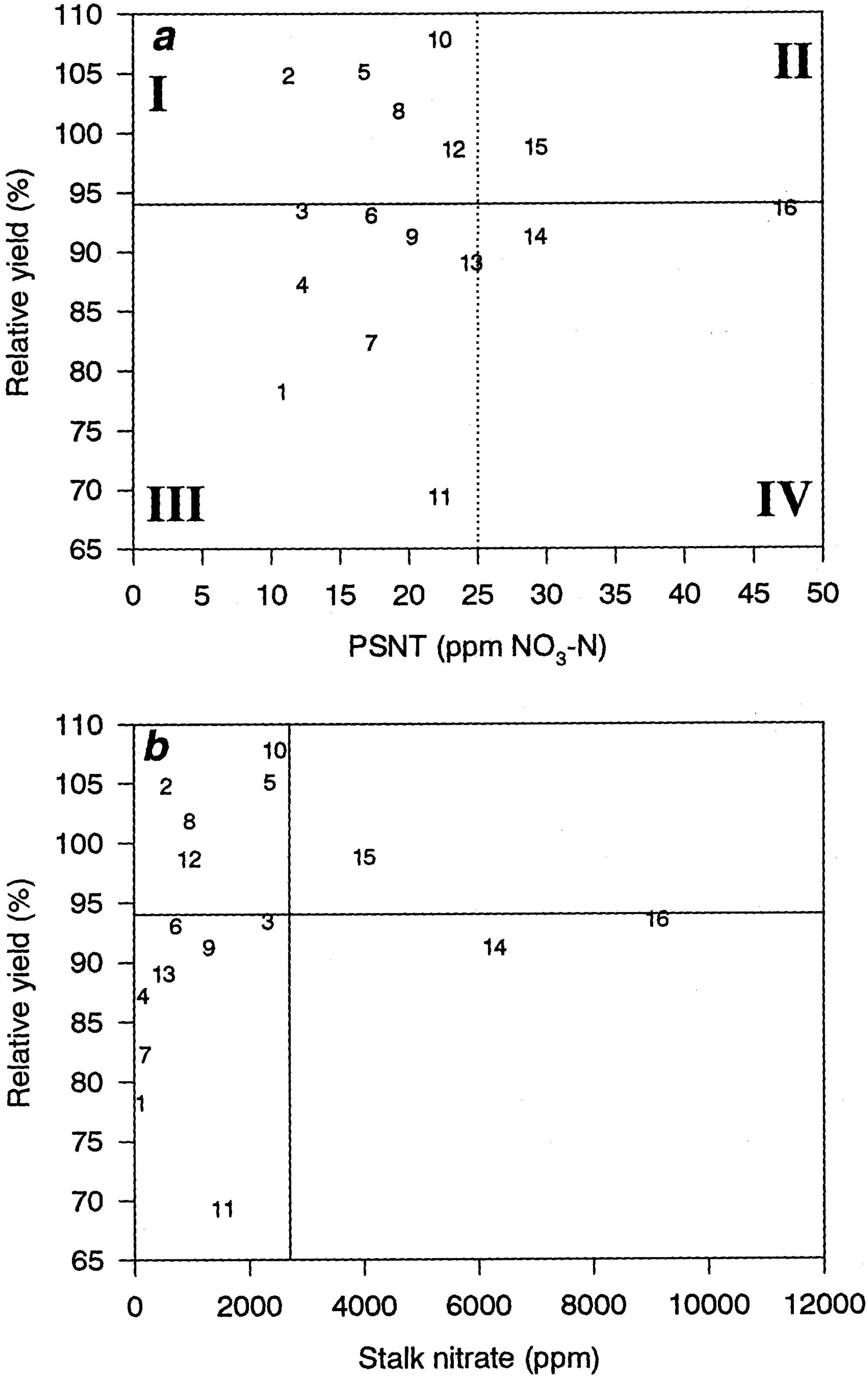
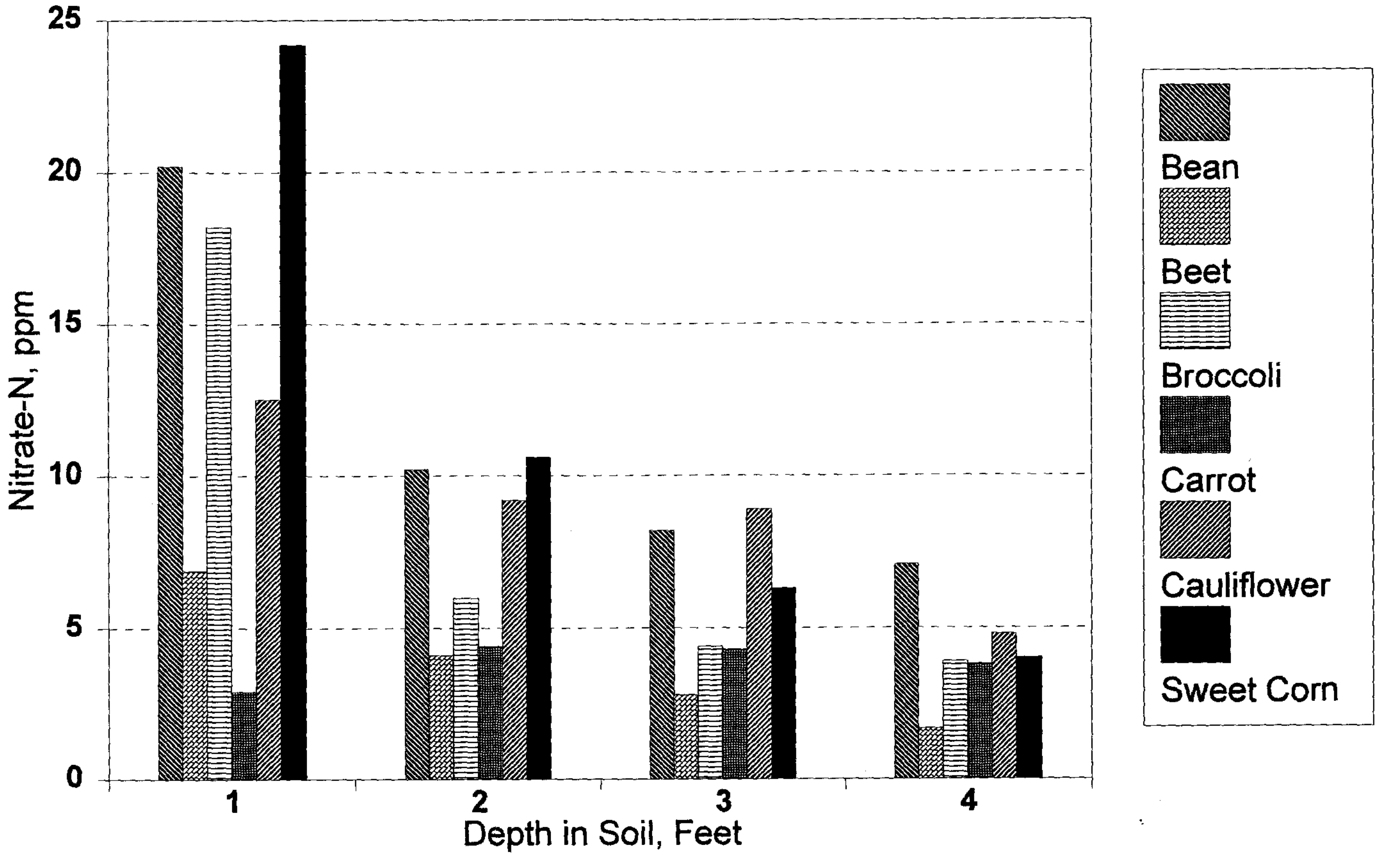


Fig. 6. PSNT and relative yield for sweet corn plots on grower's fields, 1995 (6a). Dotted line at 25 ppm NO_3-N indicates expected critical value. Graph 6b shows relationship between stalk nitrate concentration at harvest for the same plots. Values below 2700 ppm may indicate yields were limited by N availability. For both graphs, numbers are site numbers.

Fig. 7. Crop on Post-Harvest Nitrate
1995 Grower Survey



SIGNATURES

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December 18, 1995

Report to: Oregon Processed Vegetable Commission and the OSU Agriculture Research Foundation

From: Dan McGrath, OSU Extension

Regarding: **"Insect, Disease, and Weed Control Survey for Sweet Corn, Snap Beans, Broccoli, and Cauliflower"**

The majority of Willamette Valley processed vegetable growers are most likely to respond to mail out surveys during the winter off season. Survey tools for sweet corn and snap beans pest management are finished and ready for testing and approval by the OSU Survey Research Center. They will be mailed out in January of 1996 to a statistically valid sample of all the processed sweet corn and snap bean growers in Oregon. The broccoli and cauliflower survey tools should be finished and ready for testing in late January. They will be mailed out by the end of February. We should have the survey results gathered and analyzed by the end of April, 1996.