RESEARCH REPORTS

TO THE

OREGON PROCESSED VEGETABLE COMMISSION

December 1989

Submitted for Review by the

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RESEARCH REPORTS
to the
OREGON PROCESSED VEGETABLE COMMISSION
from the
AGRICULTURAL RESEARCH FOUNDATION
OREGON STATE UNIVERSITY

Report to the Oregon Processed Vegetable Commission
1989

1. Title: Green bean breeding and evaluation

2. Project Leaders: J. R. Baggett, Horticulture
   G. W. Varseveld, Food Science and Technology

3. Project Status: Continuing, indefinite

4. Project Funding for Reporting Period:

   Breeding: $39,000
   Processing Evaluation: $11,450

   Funds allotted to breeding were used for research farm assessments, supplies and labor for planting, plot maintenance, harvest, crosses, seed production and cleaning. Funds allotted to evaluation were used for processing labor and packaging, analytical work, conducting panel evaluations, and analysis of results.

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:

   a) A major effort in 1989 was the evaluation and comparison of a group of breeding lines for which yield and processing trials began in 1988. These were the OSU lines numbering from 5402 to 5422 which came from crosses of OSU 5078 and 5079 with a number of older OSU lines, including 5052, 5169, 5207, 5191, and Oregon 91G. The crosses were made to combine the high yield potential and upright habit of 5078 and 5079 with better pod quality, especially better smoothness, but also better color and less fiber. The best of these new lines appear to have some of the desired improvements. Several were included in yield trials in 1988, and 13 were included in 1989 replicated trials. Because of seed shortages, only 5402, 5411, and 5417 were in all six of the 1989 trials, with all of the lines included only in trials 2 and 4. Table 1 shows results of trials 1, 3, 5, and 6, while trials 2 and 4 are reported in Table 2. Based on preliminary examination of the plots and comparisons in our seed increase-observation plots, 5406 and 5422 were not harvested in the trials and 5411 and 5412 were not harvested in trial 4.

   Observations in the various plots and a field day at which processor field representatives examined harvested pods resulted in the choosing of the most promising lines. These were 5402 and 5403, sister lines from 5078 x 5052, and 5421 from 5079 x 5207. Lines of secondary interest are 5404, 5416, and 5420. The best lines appear to consistently have smoother pods than Oregon 91G, equal color, and better length in the smaller sieve pods.

Yields in 1989 trials, while requiring repetition for several years before reliable conclusions can be made, indicated a potential for higher yields than Oregon 91G (Tables 1, 2, and 3). Data from panel quality evaluations are not available at this writing.

Commercial seed increases of 5402 were started in 1989 with the production of 17 lbs. in Idaho and a similar amount in California. Seed increases at Corvallis in 1989 were adequate to permit the initiation of commercial increases of 5403 and 5421 in 1990. An additional supply, possibly 50 lbs., of 5402 was produced at Corvallis and may be included in 1990 increases in Idaho.

b) Older breeding lines which have been in a seed increase program, 5163 and 5256, were included in all six yield trials in 1989 and were continued in commercial seed increases. Adjusted yields of 5163 usually exceeded those of Oregon 91G, while yields of 5256 were close to those of Oregon 91G (Tables 1, 2, and 3). Both of these lines are considered to be smaller sieve than Oregon 91G and often require harvest at 60% 1-4 sieve or over for good quality, getting seedy in 5-sieve pods if harvested later (depending on environmental conditions). While processors have been interested in these lines, there has been no immediate interest in growing them in competition with Oregon 91G.

c) Yield trials included three Romano type beans, Roma II, Roma 350, and Primo. Yield comparisons are difficult because there is no precise grading system and because Primo is slightly more plump than the Roma lines.

Roma 350 and Roma II were very similar, except that Roma 350 may have been slightly longer and darker or richer green in color. Primo has darker color, a thicker, more fleshy pod, and is several days earlier but may yield a little less on the average (Tables 1 and 2).

d) Selection continued in small sieve and easy picking lines. Elimination for strings, fiber, and poor color has been heavy in the small sieve material, but a number of lines have been continued. New crosses involving some newly acquired small sieve varieties (i.e. Faria, Masai) as parents were in the F_1 or F_2 stage in 1989. Some of the easy picking selections have excellent plant habit and long straight pods, but most have immature white seeds which are less desirable than immature green seeds. Lines in these groups will be ready for plot trials about 1991.

e) Sublines of Oregon 91G were examined for off-types and a number of the best lines were continued. New single plant selections were made in Oregon 91G, and each of the priority new lines (5256, 5163, 5402, 5043, etc.) to establish populations initially free from flat pod and other rogues. It is our intention to compare these populations annually, during the period the lines are being tested for potential release, to determine if there are genetic differences in susceptibility to the mutations that result in flat pods.

Observations of the flat pod type which occurs at the base of the plant late in the plant's life, indicate that it is not heritable in most cases. Distinct heritable types which are semi-sterile have been confirmed in OSU 5206. Since it does not appear that this type of mutant is a significant problem in commercial seed production and processing, it may not be studied further.

f) Root rot and white mold plots were effective in evaluating breeding lines in 1989 (Tables 4 and 5). Generally, all acceptable Blue Lake types beans are highly susceptible to both diseases when compared under high levels of infection. Some of the new 5400 series of lines are more susceptible to white mold and root rot than Oregon 91G. Some new lines from white mold resistant crosses have approximate Blue Lake type and noticeably less susceptibility. However, the additional cycles of breeding needed to achieve competitive type and yield will likely result in loss of most of the observed resistance. New breeding lines are being obtained from the Geneva, New York Experiment Station to make additional crosses.

7. <u>Summary</u>:

1989 breeding line evaluations emphasized a new series of lines from crosses of OSU 5078 and 5079 x older OSU lines. These lines are potentially high yielding and several (OSU 5402, 5403, and 5421) have excellent pod smoothness and straightness surpassing Oregon 91G in 1989 trials. OSU 5402, 5403, and 5421 will be commercially increased in 1990. In the case of 5402, this will be a second year of increase and will result in several hundred lbs. of seed. Older breeding lines OSU 5163 and 5256 were increased further in 1989. OSU 5163 exceeded Oregon 91G, and OSU 5256 approximately equalled Oregon 91G in 1989 yield trials. Selection in newer material of small sieve and easy picking type continued. Root rot and white mold tests indicated most new breeding lines are equal to Oregon 91G in susceptibility to both diseases.

8. <u>Signatures</u>:

Submitted by:

Redacted for Privacy

Project Leader — Date

Redacted for Privacy

Project Leader — Date

Approved by:

Redacted for Privacy

Department Head — Date

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Department Head — Date

Table 1. Yields of selected OSU bean lines on four planting dates, Corvallis, Oregon, 1989[1]

Planting	Line	Av. Stand	Harvest 1 Days	Harvest 1 %	Harvest 1 Tons	Harvest 1 Adj.	Harvest 2 Days	Harvest 2 %	Harvest 2 Tons	Harvest 2 Adj.	Harvest 3 Days	Harvest 3 %	Harvest 3 Tons	Harvest 3 Adj.	Harvest 4 Days	Harvest 4 %	Harvest 4 Tons	Harvest 4 Adj.	Harvest 5 Days	Harvest 5 %	Harvest 5 Tons	Harvest 5 Adj.	Avg.[2] Adj. T/A	LSD[3] Adj. T/A
May 1 Planting	91G	150	76	71	8.2	9.9	78	41	9.1	8.2*	79	37	10.7	9.7	80	33	11.6	9.6					9.3	1.4
	5163	150	76	76	7.0	8.3	78	61	9.2	9.7	79	52	9.5	9.2*	80	42	9.7	8.6	82	38	11.5	9.7	9.1	
	5256	150	78	69	8.5	9.6	79	57	7.9	8.1	80	57	8.6	8.7*	82	48	9.5	8.9					8.8	
	5402	150	78	74	8.5	10.5	79	62	8.6	9.6	80	54	9.4	9.8	81	53	10.6	10.9*	83	40	11.2	10.0	10.0	
	5411	150	75	63	8.1	9.1*	78	28	9.6	7.5	79	21	11.1	7.9									8.2	
	5417	147	76	86	7.0	9.5	78	66	8.4	9.8	80	52	10.3	10.5*	82	43	11.5	10.7					9.9	
	Roma 350	146	78	79	5.4		80	76	6.6*		82	91	9.6										7.2	
	Roma II	148	78	71	8.3		80	66	8.7		82	50	9.1*										8.7	
	Primo	146	74	86	5.4		76	76	6.6		78	47	7.6*										6.5	
	Hystyle	150	74	58	4.9	5.0*	76	49	5.7	5.3	78	30	7.4	5.7	80	28	8.6	6.5					5.3	
May 26 Planting	91G	150	71	52	10.4	10.6*	73	42	11.1	10.2	75	25	10.6	8.0									9.6	1.9
	5163	148	71	70	9.2	10.5	73	61	9.7	10.2*	75	45	10.6	9.6									10.1	
	5256	150	71	76	8.4	10.0	73	67	9.1	10.1	75	53	8.6	8.4*									9.5	
	5402	150	73	68	11.6	13.7	75	41	11.6	10.6*	77	35	11.1	9.4									11.2	
	5411	149	70	66	9.0	10.4	73	37	5.9	5.1*													7.8	
	5417	130	73	50	9.3	9.3*	75	34	11.0	9.2	77	33	12.1	10.0									9.5	
	Roma 350	144	68	85	8.2		70	77	7.9		73	73	9.3*										8.5	
	Roma II	140	68	84	8.7		70	78	8.1		73	62	9.4*										8.7	
	Primo	142	68	73	7.3		70	62	7.3		73	55	8.4*										7.7	
	Hystyle	150	68	74	8.0	9.4	70	54	7.8	7.7*	73	47	8.4	7.8	75	31	10.0	7.7					8.3	
June 16 Planting	91G	150	66	44	12.1	11.4*	68	29	11.9	9.4	70	20	12.0	8.4									9.7	1.4
	5163	150	66	60	11.4	11.9*	68	34	12.9	10.4	70	28	12.7	9.5									10.6	
	5256	150	66	76	10.3	12.3	67	63	10.7	11.7*	69	42	11.6	10.4	71	33	12.4	9.9					11.5	
	5402	150	66	75	11.2	14.0	67	57	11.3	12.1*	69	38	11.6	10.2	71	30	13.1	10.5					12.1	
	5411	150	66	41	12.8	11.6*	68	22	13.7	9.8	70	15	15.8	10.2									10.5	
	5417	132	67	48	10.9	10.7*	69	32	13.0	10.7	71	25	14.1	10.6									10.7	
	Roma 350	144	66	81	9.6		68	71	8.0		70	60	10.6*										9.4	
	Roma II	150	66	78	10.3		68	56	10.4*		70	43	10.5										10.4	
	Primo	136	66	46	11.1*		68	27	13.3		70	22	13.3										12.6	
	Hystyle	150	66	36	9.8	8.0*	68	24	11.9	8.6	70	17	12.3	8.1									8.2	
June 26 Planting	91G	150	66	65	9.2	10.6	69	54	10.3	10.7*													10.6	1.8
	5163	150	67	67	9.8	10.8	69	58	9.9	10.1*													10.4	
	5256	150	67	80	9.3	11.4	69	74	8.8	10.3*													10.8	
	5402	150	69	67	10.3	12.0	71	55	11.1	11.6*													11.8	
	5417	130	67	73	9.8	12.0	69	56	8.8	9.4*													10.7	
	Roma 350	142	66	85	8.5		69	84	8.7*														8.6	
	Roma II	150	66	82	8.6		69	84	9.5*														9.1	
	Primo	132	66	74	7.3		69	62	8.6*														8.0	
	Hystyle	148	66	61	8.1	8.6*	69	43	9.6	8.6													8.6	

[1]Means of 4 replications; 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; tons = tons/acre; adj. = tons/acre adjusted to 50% 1-4 sieve, except 5163, 5256, and Hystyle, which were 55% 1-4 sieve. For Roma II, Roma 350, and Primo, yields shown as average adjusted yields were actually not adjusted.

[2]Average adjusted yields based on the first 3 harvests in the May 1, May 26, and June 16 plantings; for the first two harvests of the June 26 planting.

[3]Analysis of variance calculated using the harvest closest to 50% 1-4 sieve (55% for 5163, 5256, and Hystyle), marked *.

Table 2. Green bean yields, May 12 and June 6 plantings, Corvallis, Oregon, 1989[1].

May 12 Planting

Line	Av. Stand	Harvest 1 Days	Harvest 1 %	Harvest 1 Tons	Harvest 1 Adj.	Harvest 2 Days	Harvest 2 %	Harvest 2 Tons	Harvest 2 Adj.	Harvest 3 Days	Harvest 3 %	Harvest 3 Tons	Harvest 3 Adj.	Avg.[2] Adj. T/A
91G	150	73	46	8.4	8.1*	74	44	8.0	7.5	76	28	9.8	7.6	7.7
5073	150	70	71	7.1	8.6	71	66	7.5	8.7	73	41	7.9	7.2*	8.2
5090B	150	74	38	7.1	6.3*	76	22	10.1	7.2					6.8
5163	150	73	69	7.8	8.7	74	59	7.5	7.8*	76	38	9.0	7.6	8.0
5256	150	73	69	6.2	7.0	74	62	6.4	6.8*	76	34	7.3	5.9	6.6
5386	127	73	42	6.8	6.3*	75	28	8.6	6.7	76	31	8.7	7.0	6.7
5394	150	73	47	7.3	7.1*	75	29	8.8	7.0	76	20	10.3	7.2	7.1
5402	150	73	69	6.8	8.1	74	57	6.9	7.3*	76	29	9.5	7.5	7.6
5403	149	73	56	6.9	7.3*	75	33	9.0	7.4	76	31	9.7	7.9	7.5
5404	150	73	60	8.1	8.9	74	46	8.6	8.2*	76	30	9.9	7.9	8.3
5405	143	73	54	8.0	8.3*	75	44	8.9	8.3	77	23	9.6	7.0	7.9
5408	150	73	62	8.6	9.6	74	53	9.2	9.4*	76	38	9.5	8.3	9.1
5411	150	73	45	9.0	8.5*	75	27	9.0	7.0	77	17	10.1	6.8	7.4
5412	144	73	56	7.0	7.5*	75	30	9.0	7.2	77	20	9.0	6.3	7.0
5416	150	74	87	8.7	11.9	76	46	7.2	6.9*	77	38	8.7	7.7	8.8
5417	125	74	54	6.7	6.9*	76	29	8.8	6.9	77	23	9.1	6.6	6.8
5420	144	73	64	7.9	9.1	74	57	8.1	8.6*	76	35	9.1	7.7	8.5
5421	119	73	60	7.4	8.1	74	55	6.7	7.1*	76	28	9.9	7.7	8.4
Roma 350	145	74	81	6.8		76	70	8.2		77	69	8.0*		7.7
Roma II	127	74	85	5.6		76	77	7.0		77	67	6.6*		6.4
Primo	144	73	59	6.2*		76	39	7.1		77	34	8.8		7.4
Hystyle	150	70	72	5.5	6.3	71	67	5.0	5.6	73	46	6.1	5.6*	5.8

Table 2. Green bean yields, May 12 and June 6 plantings, Corvallis, Oregon, 1989[1] (cont.).

		June 6 Planting												
		Harvest 1				Harvest 2				Harvest 3				Avg.[2] Adj.
Line	Av. Stand	Days	%	Tons	Adj.	Days	%	Tons	Adj.	Days	%	Tons	Adj.	T/A
91G	150	65	65	4.7	5.5	67	48	7.9	7.7*	69	42	8.8	8.1	6.6
5073	150	65	53	7.4	7.7	67	47	9.0	8.7*					8.2
5090B	150	66	55	8.2	8.6*	69	35	9.5	8.1					8.4
5163	150	65	65	7.9	8.7	67	54	7.9	7.9*	69	49	8.0	8.6	8.3
5256	149	65	76	5.4	6.5	67	63	6.9	7.4	69	59	7.0	7.3*	7.0
5386	150	65	53	10.1	10.4	67	49	9.0	8.9*					9.6
5394	148	65	73	6.1	7.4	67	57	7.0	7.5*					7.4
5402	150	67	75	6.2	7.8	69	73	8.7	10.7	71	50	10.2	10.2*	9.2
5403	146	67	67	8.5	10.0	69	56	10.0	10.6*	71	44	11.2	10.6	10.3
5404	150	65	71	7.2	8.7	67	54	9.0	9.3*	69	42	9.6	8.9	9.0
5405	150	65	63	7.1	8.0	67	50	8.8	8.8*	69	34	10.3	8.7	8.4
5408	150	65	58	7.7	8.3	67	43	9.6	8.9*					8.6
5411														
5412														
5416	150	67	68	7.1	8.4	69	63	7.5	8.5	71	48	9.5	9.3*	8.4
5417	131	66	66	7.5	8.7	69	45	9.3	8.6*					8.6
5420	149	65	62	7.3	8.1	67	51	8.2	8.2*	69	34	7.2	6.0	8.2
5421	138	65	71	7.1	8.6	67	58	7.9	8.6	69	48	11.1	10.9*	8.6
Roma 350	148	65	84	5.7		67	78	7.2		69	74	7.8*		6.4
Roma II	148	65	90	6.5		67	84	6.3		69	71	7.9*		6.4
Primo	131	65	70	6.3		67	55	8.3*						7.3
Hystyle	148	64	59	5.2	4.6*	66	43	6.9	6.1					6.0

[1]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; tons = tons/acre; adj. = tons/acre adjusted to 50% 1-4 sieve, except 5163, 5256, and Hystyle, which were adjusted to 55% 1-4 sieve. Analysis of variance calculated using the harvest closest to 50% 1-4 sieve for each line (55% for 5163, 5256, and Hystyle), marked with *. LSD at 5% significance = 1.2 tons/acre for May 12 planting date and 1.5 tons/acre for June 6 planting date.

[2]Average adjusted yields shown for Roma 350, Roma II, and Primo are actually average yields. Yields were not adjusted for these varieties.

Table 3. Summary of average yields of selected Oregon State University bean lines, 1984-1989.

Line	1984 AV	1985 AV	1986 AV	1987 AV	1988 AV	1989 Planting Date 5-1	5-12	5-26	6-6	6-16	6-26	1989 AV	1989 5-12 & 6-6	1984-1989[2]	1984-1989[3]
	Adjusted[1] Tons/Acre														
Oregon 91G	8.1	7.6	9.9	10.0	7.2	9.3	7.7	9.6	6.6	9.7	10.6	8.9	7.2	8.6	8.3
5073	9.2	8.9	11.8	10.3	7.5	---	8.2	---	8.2	---	---	---	8.2		9.3
5090	8.4	6.4	10.4	9.4	6.6	---	6.8	---	8.4	---	---	---	7.6		8.1
5163	9.2	6.4	11.5	10.8	7.2	9.1	8.0	10.1	8.3	10.6	10.4	9.4	8.2	9.1	8.9
5256	9.1	6.8	10.5	9.3	6.4	8.8	6.6	9.5	7.0	11.5	10.8	9.0	6.8	8.5	8.2
5402	---	---	---	---	---	10.0	7.6	11.2	9.2	12.1	11.8	10.3	8.4		
5403	---	---	---	---	---	---	7.5	---	10.3	---	---	---	8.9		
5411	---	---	---	---	---	8.2	7.4	7.8	---	10.5	---	---	---		
5421	---	---	---	---	---	---	8.4	---	8.6	---	---	---	8.5		
Hystyle	---	---	---	---	6.1	5.3	5.8	8.3	6.0	8.2	8.6	7.0	5.9		

[1]Adjusted to 50% 1-4 sieve except that in 1986-1989 5256, 5163, and Hystyle were adjusted to 55% 1-4 sieve.

[2]Includes only the 5-12 and 6-6 trials in 1989.

[3]Includes all 1989 trials.

Weed Control Alternatives in Snap Bean Production

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Initiated 1987
[ ] Continue with Federal Grant

Funding: CSRS-USDA Special Grant

Results: See tables

Narrative:

Introduction

Recent shifts in the weed control program associated with snap bean production have resulted in use of herbicide combinations that achieve processor standards for weed contamination through additive control of problem weeds. Weed skips of particularly troublesome weeds such as hairy nightshade and redroot pigweed have occurred. In addition, preplant incorporated treatments of pendimethalin have seriously injured beans. Research during two seasons identified 2 diphenyl ether herbicides from the soybean market which looked promising in snap beans. Unfortunately, neither company wished to proceed with registration for snap beans.

To supplement current programs, research strategies in 1989 focused on possible use of 2 marginally acceptable diphenyl ether herbicides, acifluorfen and oxyfluorfen, along with postemergence treatments of Basagran under cool conditions, and Prowl applied preemergence.

Field trails were established at 5 sites in 1989; 4 with grower-cooperators and 1 at the OSU Vegetable Research Farm. Silt loams with 5-15% and clay contents and 2-10% OM were prevalent at 2 grower sites (trials 2 and 3), whereas silty clay loams with 27-40% clay contents and 10% OM were evident at sites 1 and 4. The OSU farm contains a silty clay loam with 30-40% clay content and 5-10% OM. Tables 1-5 display treatments, average crop injury ratings, weed control ratings and harvest yields. All treatments received Treflan preplant incorporated at trial 1, Eptam preplant incorporated to all treatments at trial 2, and a combination of both Treflan and Eptam preplant incorporated at trials 3 and 4.. Treatments at the OSU Vegetable Research Farm are as indicated.

Discussion

Preemergence Treatments:

Acifluorfen applied preemergence controlled pigweed (AMARE) and groundsel (SENVU) at the 2 sites with the greater clay contents, Tables 1 and 4. Unfortunately, unacceptable crop injury occurred along with relatively poor weed control at sites with less clay content, Tables 2 and 3. Bean symptoms were noted that delayed growth and development, but failed to exhibit any physical distortions or chlorosis. Yields appeared normal although harvest would have been delayed by approximately 2 weeks.

Oxyfluorfen applied as a preemergence band between rows provided selective control of pigweed, groundsel and shepherds purse (CAPBU), Tables 1-3, except where the herbicide overlapped within the bean row in trial 4, Table 4. Precision banding requires that nozzles be attached to the planter.

Prowl applied preemergence improved crop selectivity compared to preplant incorporation at the OSU site, Table 5. Prowl controlled nightshade (SOLSA) and wild mustard (BRSNI) 80-100%. Groundsel, however, was not controlled although yields were similar in the presence of this weed. At this site the Eptam/ Treflan/ chloramben combination resulted in higher yields than the Eptam/ Treflan/ Dual combination, although stunting was evident early in the season and mustard pressure probably reduced yields in the latter treatment.

Postemergence Treatments:

Acifluorfen applied postemergence caused intial severe leaf injury to the crop in all trials except at site 1, Tables 1-4. Symptoms, however, were negligible after three weeks. Yields were similar with these treatments. Grounsel was controlled with a combination of Eptam preplant incorporated/ acifluorfen postemergence, Table 3, but was marginal with Treflan preplant incorporated/acifluorfen preemergence, Table 1. Pigweed control was excellent with these treatments, including removal of 8-inch pigweed with a postemergence spray of acifluorfen.

Basagran treatments were inconsistent in groundsel control, Table 1 and 3. Shepherds purse was controlled at trial 3 with all Basagran treatments. While addition of Dash (a BASF proprietary blend of surfactants) improved weed control slightly, UAN 32 failed to improve control, Tables 2, 3, and 4. Yields with Basagran were erratic in trial 1, while rate increases from 0.5 lbs. ai/acre to 1.0 lbs. ai/acre did not improve weed control.

Directed sprays of acifluorfen reduced visual injury considerably, tables 3 and 4. Yields were similar to acifluorfen used postemergence.

Directed sprays of oxyfluorfen, while not drastically reducing yields, dramatically damaged bean foliage. However, weed control was excellent, Tables 3 and 4.

Conclusions

Acifluorfen applied preemergence caused unacceptable stunting at the sites containing scant clay, probably due to its water solubility. We plan to continue work towards registration of a postemergence or directed spray of acifluorfen for snap beans.

Oxyfluorfen applied as a preemergence band will also be pursued, but nozzles must be mounted on the planter. Future plans also include continued testing of oxyfluorfen as a postemergence directed spray with an emphasis on spray timing of the sprays.

Basagran controlled mustard weeds, but pigweed escaped treatments at all rates. Dash seemed to improve performance of Basagran slightly. herbicide.

Label changes should be considered for Prowl to improve crop safety and weed control using preemegence treatments. Tank mixes with Dual could improve broad spectrum control with a single application.

Table 1 Crop Injury, Weed Control and Yield Averages From OFF-STATION TRIAL # 1 (PEORIA)

TRT. NO.	PESTICIDE NAME	RATE	TYPE	BEANS %INJURY 6/05/89	BEANS % INJRY 6/26/89	SENVU % CNTRL 6/26/89	BEANS % INJRY 7/10/89	SENVU % CNTRL 7/10/89	YIELD T/A 8/02/89
01	ACIFLUORFEN	A		0	0	0	1	5	5.84
02	ACIFLUORFEN	B	POST	1	1	0	3	13	5.69
03	ACIFLUORFEN	A	PRE	1	1	100	3	100	6.23
04	ACIFLUORFEN	B	PRE	1	3	100	4	100	6.64
05	OXYFLUORFEN AMIBEN	A 2.25	BNDBR BNDOR	0	0	99	0	99	5.99
06	OXYFLUORFEN AMIBEN	B 2.25	BNDBR BNDOR	4	5	99	20	100	5.60
07	BASAGRAN	0.50	POST	1	0	0	0	0	5.81
08	BASAGRAN COC	0.50	POST	0	0	0	0	0	4.22
09	BASAGRAN UAN32 COC	0.50	POST POST	0	4	0	3	5	4.76
10	BASAGRAN	1.00	POST	0	1	0	4	10	5.72
11	BASAGRAN COC	1.00	POST	0	1	0	4	10	3.56
12	BASAGRAN UAN32 COC	1.00	POST POST	1	3	0	0	5	6.40
13	CONTROL			0	0	0	0	0	5.75
		LSD(0.05) =		3	4	1	12	17	2.4

[z] COC = crop oil concentrate, a BASF proprietory mixture, was added to treatments where indicated at 1.00 quart per acre.
[y] Dash = BASF surfactant, added to treatments where noted at a rate of 1.00 quart per acre.
[x] PPI = Pre-plant incorporated application.
[w] PRE = Preemergence application.
[v] POST = Postemergence application.
[u] BNDBR = Banded between rows application.
[t] BNDOR = Banded over rows application.

Table 2 Crop Injury, Weed Control and Yield Averages From OFF-STATION TRIAL # 2 (GRAND ISLAND)

TRT. NO.	PESTICIDE NAME	RATE	TYPE	BEANS % INJRY 7/06/89	AMARE % CNTRL 7/06/89	BEANS % INJRY 7/26/89	AMARE % CNTRL 7/26/89	YIELD TONS/A 8/04/89
01	ACIFLUORFEN	A	POST	0	0	4	89	7.74
02	ACIFLUORFEN	B	POST	1	0	10	93	6.59
03	ACIFLUORFEN	C	PRE	30	93	28	88	4.22
04	ACIFLUORFEN	D	PRE	73	98	58	97	1.47
05	OXYFLUORFEN	A	BNDBR	1	92	0	91	6.63
	AMIBEN	2.25	BNDOR					
06	OXYFLUORFEN	B	BNDBR	5	93	3	96	6.92
	AMIBEN	2.25	BNDOR					
07	BASAGRAN	0.50	POST	0	25	0	50	6.36
08	BASAGRAN	0.50	POST	0	13	0	51	6.67
	COC	0.25	POST					
09	BASAGRAN	0.50	POST	0	20	4	70	6.24
	COC	0.25	POST					
	UAN32	1.00	POST					
10	BASAGRAN	1.00	POST	0	0	0	66	5.65
11	BASAGRAN	1.00	POST	0	0	1	55	6.05
	COC	0.25	POST					
12	BASAGRAN	1.00	POST	0	0	3	53	5.72
	COC	0.25	POST					
	UAN32	1.00	POST					
13	DUAL	2.00	PRE	0	94	0	98	7.38
	BASAGRAN	0.500	POST					
14	AMIBEN	2.25	PRE	4	98	3	100	6.72
15	CONTROL			0	0	0	0	4.19
		LSD(0.05) =		6	40	8	26	1.40

Table 3 Crop Injury, Weed Control and Yield Averages From OFF-STATION TRIAL # 3 (Sidney)

TRT. NO.	PESTICIDE NAME	LBai/A	TYPE	BEANS % INJRY 7/24/89	SENVU % CNTRL 7/24/89	CAPBP % CNTRL 7/24/89	BEANS % INJRY 8/14/89	TOTALYD T/ACRE 8/21/89
01	ACIFLUORFEN	A	POST	5	89	88	0	9.04
02	ACIFLUORFEN	B	POST	13	93	96	3	9.07
03	ACIFLUORFEN	B	POSTD	0	0	0	0	9.18
04	ACIFLUORFEN	C	PRE	10	86	94	3	6.98
05	ACIFLUORFEN	D	PRE	41	93	100	13	4.18
06	OXYFLUORFEN AMIBEN	A 2.25	BNDBR BNDOR	0	66	68	0	9.68
07	OXYFLUORFEN AMIBEN	B 2.25	BNDBR BNDOR	0	93	93	0	9.95
08	OXYFLUORFEN	C	POSTD	0	0	0	10	7.78
09	OXYFLUORFEN	A	POSTD	0	0	0	29	10.08
10	BASAGRAN	0.50	POST	6	89	95	0	10.54
11	BASAGRAN DASH	0.50 0.25	POST POST	8	94	96	1	9.45
12	BASAGRAN DASH UAN32	0.50 0.25 1.00	POST POST POST	9	91	95	4	9.56
13	BASAGRAN	1.00	POST	9	93	96	0	10.39
14	BASAGRAN DASH	1.00 0.25	POST POST	10	96	96	1	8.09
15	BASAGRAN DASH UAN32	1.00 0.25 1.00	POST POST POST	10	93	98	1	10.23
16	DUAL BASAGRAN	2.00 0.500	PRE POST	1	84	98	0	9.33
17	AMIBEN	2.25	PRE	9	93	96	1	8.33
18	CONTROL			0	0	0	0	9.01
		LSD(0.05) =		3	16	16	8	2.20

Table 4 Crop Injury, Weed Control and Yield Averages From OFF-STATION TRIAL # 4 (IRISH BEND)

TRT. NO.	PESTICIDE NAME	RATE	TYPE	BEANS %INJURY 8/23/89	AMARE %CONTRL 8/23/89	TOTALYD T/ACRE 9/06/89
01	ACIFLUORFEN	A	POST	10	81	10.45
02	ACIFLUORFEN	B	POST	12	94	10.75
03	ACIFLUORFEN	B	POSTD	6	91	9.34
04	ACIFLUORFEN	C	PRE	3	83	10.67
05	ACIFLUORFEN	D	PRE	9	88	9.13
06	OXYFLUORFEN AMIBEN	A 2.25	BNDBR BNDOR	24	92	6.83
07	OXYFLUORFEN AMIBEN	B 2.25	BNDBR BNDOR	33	100	8.51
08	OXYFLUORFEN	C	POSTD	64	80	7.87
09	OXYFLUORFEN	A	POSTD	73	97	6.78
10	BASAGRAN	0.50	POST	0	41	9.26
11	BASAGRAN DASH	0.50 0.25	POST POST	3	58	11.27
12	BASAGRAN DASH UAN32	0.50 0.25 1.00	POST POST POST	7	38	10.91
13	BASAGRAN	1.00	POST	3	50	10.53
14	BASAGRAN DASH	1.00 0.25	POST POST	5	49	9.96
15	BASAGRAN DASH UAN32	1.00 0.25 1.00	POST POST POST	10	43	10.61
17	DUAL BASAGRAN	2.00 0.500	PRE POST	0	100	10.06
18	AMIBEN	2.25	PRE	1	98	10.59
19	CHECK			0	15	9.00
		LSD(0.05) =		14	35	2.95

Table 5 Crop Injury, Weed Control and Yield Averages From OSU VEGETABLE RESEARCH FARM, CORVALLIS OREGON

TRT. NO.	PESTICIDE NAME	LBai/A	TYPE	BEANS %INJURY 6/05/89	SOLSA % CNTRL 7/10/89	BRSNI % CNTRL 7/10/89	SENVU % CNTRL 7/10/89	TOTALYD T/ACRE 8/03/89
01	CONTROL			0	0	0	0	1.36
02	PROWL	1.50	PPI	16	40	50	0	.97
03	PROWL	0.75	PRE	0	64	60	20	4.69
04	PROWL	1.125	PRE	3	84	83	46	6.21
05	PROWL	1.50	PRE	0	84	85	46	7.28
06	PROWL	3.00	PRE	0	100	100	74	7.69
07	TREFLAN EPTAM DUAL	0.75 3.50 2.00	PPI PPI PRE	3	97	38	94	5.82
08	TREFLAN EPTAM AMIBEN	0.75 3.50 2.25	PPI PPI PRE	8	99	99	78	7.05
		LSD(0.05) =		8	9	11	26	1.56

z COC = crop oil concentrate, a BASF proprietory mixture, was added to treatments where indicated at 1.00 quart per acre.
y Dash = BASF surfactant, added to treatments where noted at a rate of 1.00 quart per acre.
x PPI = Pre-plant incorporated application.
w PRE = Preemergence application.
v POST = Postemergence application.
u BNDBR = Banded between rows application.
t BNDOR = Banded over rows application.

Signatures:

Project Leader Redacted for Privacy

Department Head Redacted for Privacy

Research Report
To
Oregon Processed Vegetable Commission
(for the year 1989)
Via
Agricultural Research Foundation

Title: Genetic Mapping of Beans via Restriction Fragment Length Polymorphism of DNA.

Project Leaders: David Mok and Machteld Mok, Horticulture

Project Status: Continuing to 1992.

Project Funding for this Period: $7,617

Funds were used to support a doctoral student working on the project. Other sources supporting the principal investigators include competitive grants from National Science Foundation, USDA and AID.

Objectives:

1. To utilize direct DNA mapping techniques to generate a linkage map of beans.

2. To associate particular DNA fragments with quantitative traits of economic importance in order to assist targeted selection in plant improvement.

Progress:

The long term objective of the project is to construct a genetic map (not available at present) of beans using DNA markers. This approach eliminates the effects of environment (and other non-biological factors) on the expression of characters which interfere with classical gene mapping. Ultimately, the information will be used to correlate specific DNA markers with economically important traits to assist breeding. Some of the potential applications include identification of desirable individuals in early generations, and association of qualitative traits and disease resistance with specific DNA fragments.

In the past eleven months, efforts have been directed at generating DNA probes which are polymorphic (different and can be distinguished between genotypes). Interspecific hybrids between common beans and runner beans exhibit a high degree of polymorphism and are suitable for DNA mapping. Ten DNA probes have been identified. Appropriate F_1 and F_2 populations have been established. Both callus cultures and plants are being used. DNA has been extracted from over one hundred F_2s and they will be systematically examined with DNA probes. Modifications of Southern hybridization (procedures to screen for DNA fragments) for beans have been devised. It is estimated that between 50 to 100 probes will be needed to give a genetic map representing all eleven linkage groups in beans. Future efforts will concentrate on generating additional DNA probes, screening of all the F_2s and determining the segregation patterns (mapping) of these probes.

When the genetic map is completed, breeding populations of common bean will be examined and existing data on their performance will be correlated with the segregation of particular DNA markers.

Summary:

The construction of a genetic map based on DNA markers and correlating specific markers with performance will facilitate variety improvement by providing a means to directly assess the genetic composition of breeding lines and predict their potentials.

Signatures:

Project Leaders: Redacted for Privacy Redacted for Privacy

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

Redacted for Privacy

C. J. Weiser, Head Date

RESEARCH REPORT TO THE OREGON PROCESSED VEGETABLE COMMISSION

Title: Cutworm Control in Processed Beets

Project Leaders:

Glenn Fisher, Kenneth West, Ralph Berry
Department of Entomology, Oregon State University

Funding History:

Project initiated 1987
Funding, 1987: $3595.00
Funding, 1988: $4015.00
Funding, 1989: $4015.00
Status: Completed.

Approximate distribution of funds received: 1989

Salaries and wages (student)	1200.00
Other payroll expenses (OPE) at 5%	60.00
Supplies (traps, chemicals)	800.00
Travel (State vehicle, 300mi/week)	1955.00
Total	4015.00

Specific objectives for 1989:

1. Evaluate the role of planting date on cutworm colonization.

2. Evaluate the role of plant height/age in cutworm colonization.

3. Determine the best time to apply insecticides for the black cutworm based on 1 and 2.

Planting date and cutworm colonization:

Pheromone traps baited with black cutworm pheromone were placed in or near ten fields, that were going to be planted with beets, during the first week of March 1989. One trap was placed per field and monitored weekly for black cutworms.

Results

Trapping

No black cutworms were detected until April 19 when most of the traps had at least one (fig 1.). Most of the table beets were planted during the last two weeks of April 1989 when black cutworms were actively flying into the area. Black cutworm catches remained high until the beginning of June. Thus, the immigration of the black cutworm into the Willamette Valley spanned the period of time when all of the beets were planted and had germinated. The migration pattern observed in 1989 is likely to be representative of an "average" year so it is unlikely that the time of planting will influence the level of the black cutworm population in an individual field.

Plant height/age

Black cutworm damage became easily observable in beets 2 to 3 inches tall. At this stage in plant growth the cutworms were second and third stage larvae. This implies that eggs were laid on beet plants as early as the appearance of the second pair of true leaves. Also, the cutworms in an individual field typically varied from second stage through fifth stage larvae suggesting that eggs were laid over a period of at least 1 - 2 weeks.

Insecticide applications

We tested Sevin (carbaryl), Lannate (methomyl), Javelin(Bt), and BioSafe(nematodes) for their efficacy against the black cutworm. The four treatments and an untreated check (water) were replicated 8 times in a black cutworm infested field. The treatments were assigned at random to forty 30 foot rows of beets. One row was left untreated between each treated row. Treatments were applied on June 20. Lannate was applied at 0.45 lbs ai. /acre, Sevin at 2.0 lbs ai./acre, and Javelin at the rate of 1.25 lbs of formulated material per acre. Applications of these treatments were made with a CO_2 powered backpack sprayer at the equivalent of 40 gallons per acre of water. BioSafe was applied at the rate of 500 infective juveniles per square inch to a six inch wide strip on each row of beets. Treatments were evaluated 5 days later by removing the beets in the rows and sifting the soil for larvae. Soil was removed to a depth of 4 inches with a seven inch wide shovel and sifted in the field. Cutworm larvae and cadavers were counted and returned to the laboratory. Live cutworms were placed in cups with artificial diet and observed for mortality. The numbers of cutworms dying were compared for treatment effects.

Results

Approximately 60% of the cutworms collected alive after 5 days were parasitized. Cutworms yielding parasites were counted as surviving the treatments. Since parasitism frequently stops cutworm feeding and cutworms that didn't feed encountered less insecticide, the differences in the treatments described below were probably much greater than is indicated. Only the Lannate treatment was significantly different from the check with 1.4 cutworms per 30 feet of row versus 2.8 for the check (table 1.). This contrasts with the results from 1988 where both Lannate and Sevin provided highly significant control of the black cutworm. Neither Javelin nor BioSafe provided significant control of the black cutworm.

Conclusions

Black cutworms are typically present in most table beet fields every year. They migrate into the Willamette Valley about the time beets are being planted (fig. 2). Eggs are deposited on young beet plants, as early as the appearance of the second pair of true leaves. Larvae cause damage by cutting young plants off at the base and scarring or tunneling older beet roots.

The black cutworm can be controlled with either Sevin or Lannate if applications are timed correctly. Early detection of the black cutworm by observation of wilted leaves and cut plants prior to the first cultivation is critical. Damage becomes more difficult to detect and the larvae are deeper in the soil after cultivation. Applications of insecticide should be made if there are more than two damaged plants in ten feet of row. Apply either Sevin or Lannate before cultivation.

Figure 1.

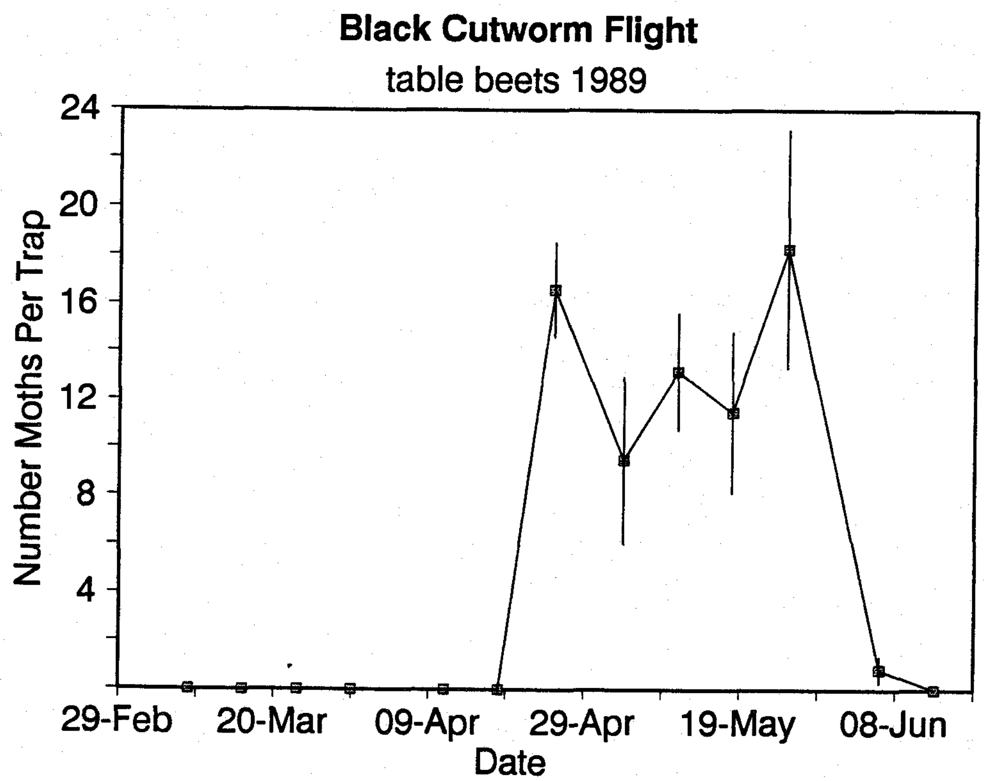

Figure 2.

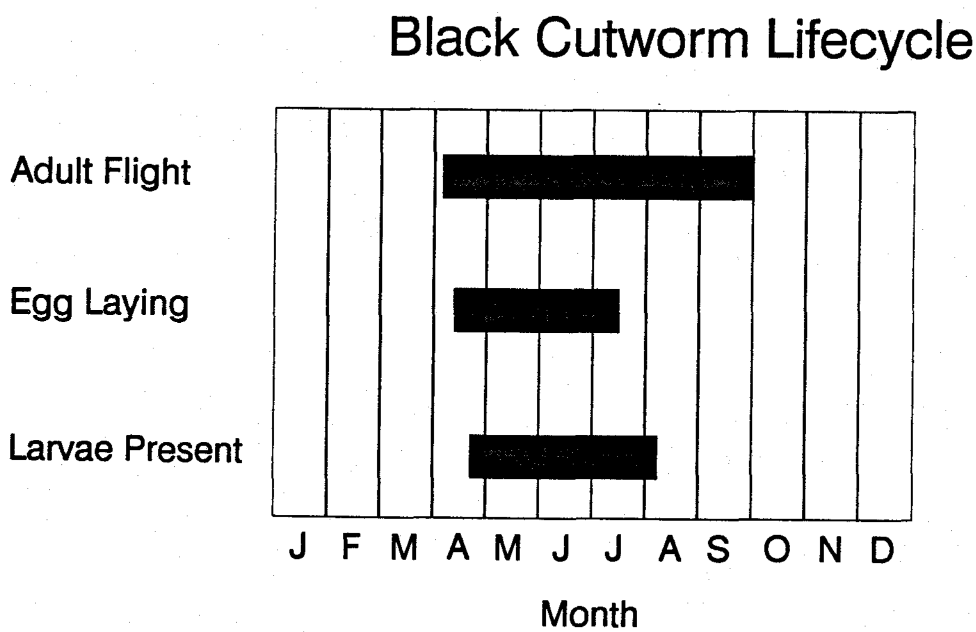

Table 1. Test of insecticides to control the black cutworm in table beets, results from trials conducted during 1988 and 1989.

Black Cutworm Control Trials

Chemical	Rate	# larvae 1988	# larvae 1989
Lannate	0.45 lbs ai/a	0.88a[1]	1.375a
Sevin	2.00 lbs ai/a	0.88a	2.0a
Javelin	1.25 lbs form.	*	4.25c
BioSafe	500./sq in	*	2.125ab
Check (water)	-	5.14b	2.75b

* not tested
[1] means followed by different letters are significantly different (FPLSD 0.05).

Redacted for Privacy

Project Leader

Redacted for Privacy

Additional Investigator

Redacted for Privacy

Additional Investigator

Redacted for Privacy

Department Head

RESEARCH REPORT TO
OREGON COMMODITY COMMISSION

TITLE: Control of Rust and Downey Mildew of Table Beets

PROEJCTS LEADERS: Ross Penhallegon, OSU Extension, Commercial Horticulture, Lane County

Dan McGrath, OSU Extension, Tri-County Area, Vegetable, Marion County

Paul Koepsell, Dept. of Botany and Plant Pathology, OSU

PROJECT STATUS: Continuing

PROJECT FUNDING by Commission for this report period was $1500. The funds were used to purchase plot materials, spray equipment, and hire labor to harvest the plots. Funds from the Lane County Extension Office budget ($300) also were used on this project.

OBJECTIVE: To evaluate the effectiveness of registered and unregistered chemical controls of Rust, Leaf Spot, and Downey Mildew in Table Beets (Uromyces betae, Cercospora beticola, and Peronospora schachtii.)

METHODS: Fungicide trials were replicated on two commercial plantings for control of foliar diseases on table beets near Junction City, Oregon. Eight fungicides were applied twice during the growing season at each site. The beets were sprayed 7/11-12/89 and 8/15-16/89. A 5 lb. aluminum CO2 cylinder, with three nozzle spray boom was used in the applications. The sites were visually evaluated for phytotoxicity, leaf spot, rust, downey and powdery mildew.

RESULTS: Significant disease occurred in both commercial plants. The planting of "Red Ace" sown in April developed severe rust (Uromyces spp.) and the "Detroit Dark Red" developed severe leaf spot (Cercopora spp.). Very little downy or powdery mildew were observed on 7/14/89 or 8/21/89.

Phytotoxicity ratings were made 3 to 5 days after each fungicide application. Both plots were sprayed 7/11-12/89 and 8/15-16/89. No phytotoxicity was observed on either 7/14/89 or 8/21/89. Yield data and disease severity ratings were obtained from each field.

Leaf spot and rust were noticed 6/20/89. Fungal diseases were noticed earlier in 1989 than 1988. By 7/10/89 there was significant infection of rust (Uromyces spp.). No significant yield differences occurred among the treatments.

Manex II, Rid/Bravo and Ridomil provided good to adequate control of Rust. Kocide provided good control of Leaf Spot, while Rid/Bravo, Bravo 500 and Ridomil provided adequate control for Leaf Spot. For over-all Rust and Leaf Spot control, Ridomil provided the best control.

This year the regrowth of new leaves was evaluated after the primary leaves died from Rust or Leaf Spot. Again, Ridomil provided the best regrowth. No significant powdery or downey mildew infections occurred in 1989.

Minor sightings of powdery mildew were seen in the control plots, and where Bravo 500, Kocide and Sulfur were used.

DATA SHEETS

Fields - Ron and Wallace Detering

Treatment and rate/A *	Yield lb/10ft row	Size** wt/beet (lb)	Size*** wt/beet (lb)
Control	30.43	0.1392	0.189
Bravo 500, 3 pt/A	30.54	0.1546	0.199
Ridomil, 2 EC, 2 pt/A	31.73	0.1591	0.210
Ridomil/Bravo, 81WP, 2 lb/A	30.67	0.1568	0.208
Manex II. 4 EC. 3 pt/A	30.56	0.1496	0.205
Ridomil MZ-58WP, 2 lb/A	31.45	0.1535	0.206
Aliette, 80WP, 4 lb/A	30.42	0.1566	0.213
Kocide 50WP, 4 lb/A and crop oil, 1 qt/A	32.1	0.1689	0.239
Super 6 /sulfur, 6EC, 1 gal/A	30.27	0.1491	0.201
LSD P = .05	NS	NS	NS

* Treatments were applied July 11-12, 1989 and August 15-16, 1989.
** Size/weight for "Total" beet weight.
*** Size/weight for "Marketable" beet weights.

Means in vertical columns followed by the same letter are not significantly different from one another (P = 0.05) by the Duncan's multiple range test.

Fields - Ron and Wallace Detering

Treatment and rate/A	Yield lb/10ft row	Number of Beets Marketable	Non*	Total
Control	30.43	161.3	57.5	218.6
Bravo 500, 3 pt/A	30.54	153.4	44.2	197.5
Ridomil, 2 EC, 2 pt/A	31.73	151.0	48.1	199.4
Ridomil/Bravo, 81WP, 2 lb/A	30.67	147.4	48.3	195.6
Manex II. 4 EC. 3 pt/A	30.56	149.2	55.2	204.3
Ridomil MZ-58WP, 2 lb/A	31.45	152.7	52.3	204.9
Aliette, 80WP, 4 lb/A	30.42	143.0	51.3	194.3
Kocide 50WP, 4 lb/A and crop oil, 1 qt/A	32.1	137.3	52.8	190.1
Super 6 /sulfur, 6EC, 1 gal/A	30.27	150.3	52.8	203.0
LSD P - 0.05	NS	NS	NS	NS

* Beets under 1 1/4 inch in diameter.

Means in vertical columns followed by the same letter are not significantly different from one another (P = 0.05) by the Duncan's multiple range test.

Fields - Ron and Wallace Detering

Treatment and Rate/A	% Rust	% Leaf Spot *	% 2nd Leaves **	Over-all Rating	% Mildew ***
Control	61.25	50.0 a	22.5abc	35.0	
Bravo 500, 3 pt/A	58.7	27.92 d	23.7abc	43.75	
Ridomil, 2 EC, 2 pt/A	54.17	30.83 cd	25.0abc	33.13	+
Ridomil/Bravo, 81WP, 2 lb/A	52.08	27.5 d	31.2ab	36.25	+
Manex II. 4 EC. 3 pt/A	45.42	44.17ab	32.5a	43.13	+
Ridomil MZ-58WP, 2 lb/A	57.08	44.17ab	26.2abc	38.75	+
Aliette, 80WP, 4 lb/A	69.17	37.08 bcd	18.7 c	35.0	+
Kocide 50WP, 4 lb/A and crop oil, 1 qt/A	60.67	23.33 d	20.0 bc	40.0	
Super 6 /sulfur, 6EC, 1 gal/A	62.92	40.42abc	18.7 c	38.13	
LSD P = 0.05	NS			NS	

* % of leaf covered with Leaf Spot
** % 2nd Leaves is a rating of the % of 2nd growth leaves.
*** Powdery mildew was present but in small amounts.

Means in vertical columns followed by the same letter are not significantly different from one another (P = 0.05) by the Duncan's multiple range test.

Fields - Ron and Wallace Detering

Treatment and Rate/A	Number of beets with percentage of Total				
	Marketable		Non		Total
Control	161.3	(73.8)	57.3	(26.2)	218.6
Bravo 500, 3 pt/A	153.4	(77.7)	44.2	(22.3)	197.5
Ridomil, 2 EC, 2 pt/A	151.0	(75.7)	48.1	(24.6)	199.4
Ridomil/Bravo, 81WP, 2 lb/A	147.4	(75.4)	48.1	(24.6)	195.6
Manex II. 4 EC. 3 pt/A	149.2	(73.0)	55.2	(27.0)	204.3
Ridomil MZ-58WP, 2 lb/A	152.7	(74.7)	52.3	(25.2)	204.9
Aliette, 80WP, 4 lb/A	143.0	(73.6)	51.3	(26.4)	204.9
Kocide 50WP, 4 lb/A and crop oil, 1 qt/A	137.3	(72.2)	52.8	(27.8)	190.1
Super 6 /sulfur, 6EC, 1 gal/A	150.3	(74.0)	52.8	(26.0)	203.0
LSD P = 0.05	NS	NS	NS	NS	NS

Means in vertical columns followed by the same letter are not significantly different from one another (P = 0.05) by the Duncan's multiple range test.

Over-All Disease Control Per Plot

Ridomil	33.13
Control	35.0
Aliette	35.0
Rid/Bravo	36.3
Sulfur	38.13
Ridomil MZ	38.75
Kocide	38.75
Manex	43.13
Bravo500	43.75

SIGNATURES

Project Leader(s) Redacted for Privacy

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Dept. Head ____________________

Report to the Oregon Processed Vegetable Commission
1989

1. Project Title: Broccoli breeding

2. Project Leader: J. R. Baggett

3. Project Status: Continuing, indefinite

4. Project Funding for Reporting Period: $6,000.00

5. Objectives:

Develop broccoli varieties for processing in western Oregon stressing:

a) Elongate habit with highly exserted heads easily accessible for harvest

b) Openly branched heads with heavy, clean stem for easy trimming and separation into spears or chunks

c) Medium fine, firm, uniform florets of good color and which are retained after freezing

d) Early to midseason maturity, concentrated high yield potential

e) Clubroot and downy mildew resistance

6. Report of Progress:

a) An early observation trial was planted April 14 to get a preliminary evaluation of the field crosses made in 1988. Some of the best field crosses and greenhouse crosses from previous years, and a number of commercial varieties, were also planted. Subjective notes and scores were taken for all material and the number of crosses versus selfs in the field grown hybrids were noted. Notes for commercial varieties are shown in Table 3.

89-1 (HS161-1 x S240-10) 86% crosses. Score 3.5. Tight segmented dome head, may not have adequate size and color. Very uniform.

89-2 (S240-10 x HS161-1) 100% crosses. Some notes as 89-1. A substantial number of selfs were found in the late trial. Good exsertion.

89-3 (HS161-1 x S240-11-2) 98% crosses. Score 3.5-4.0. Compact, little segmentation, yellow undercolor.

89-4 (S240-11-2 x HS161-1) 57% crosses. Same notes as 89-3 but too many selfs to be of use.

89-5 (S240-5 x S315A) 52% crosses. Score 3.0. Poor color, fair exsertion, no processing potential, and too many selfs.

89-6 (S366 x S364) Nearly 0% crosses. No potential because of large numbers of selfs. Plant and head very yellow in color.

b) A replicated yield trial was planted June 16 using 30 foot, two row plots with 20 inches between rows, and four replications. Some OSU hybrids included in this trial were not harvested because of excess selfed inbreds. Five OSU hybrids and six commercial hybrids were harvested weekly or more frequently, with yields expressed on a weekly basis in Table 2. Total yields in Table 1 show that the high exsertion-high color hybrids 87-3 and 87-4 produced about a ton/acre less than Gem. Yields of these hybrids was about the same in 1988, but Gem yields were higher in 1988. Highest yields were generally obtained from the varieties with heavy heads, poor exsertion, and poor color since these characteristics are highly associated. Broccoli plants with well exserted heads have long internodes and smaller heads in general. The highest yield was produced by Early Dawn, but this was in part due to overmaturity at harvest. Premium crop was very high in yield, but does not appear to have any potential for processing of quality broccoli in Oregon. Gem was higher in yield than OSU 87-3 and 87-5, but lower than most other commercial varieties. This trial indicates that the use of Gem and possibly 87-2 and 87-5 in preference to the low exsertion types, is dependent on higher processed quality.

OSU 88-3 and 88-4, HS161 x S240-5, yielded well and harvested very efficiently because of good head and plant form. These hybrids have been considered too light in color after processing.

c) The main planting of OSU inbreds, OSU hybrids, and commercial varieties was made June 27 in single rows 36" apart. Table 3 lists the best OSU hybrids evaluated and Table 4 includes notes from the commercial hybrids for both the early and late observation trials.

Fewer OSU greenhouse experimental hybrids than usual were available in 1989, but many of the best 1988 crosses were repeated. Those listed in Table 3 with a score of 3.5 to 4.0 are considered to have high potential and deserve repeating and further evaluation. Some of these, i.e. 88-5, 88-16, 88-36, 88-66, and 89-11, may have better potential than 87-3 and 87-5 for high exsertion along with bigger heads. However, as the overall size of these types increases, there is a potential problem with lodging when fertility is high. Several of the 1988 greenhouse hybrids listed above have already been produced as field crosses in the field in 1989. These will be evaluated in 1990.

A repeat evaluation of the 1989 experimental field crosses indicated a lower percent of crosses than was indicated in the early trial. For example, 89-2 and 89-3 had nearly 100% crosses in the early trial, but had nearly half selfs in the late trial. It is possible that the selfs were thinned out in the early trial, but not in the late trial. Thus, it is possible that our evaluation of percent crosses can be misleading.

New selections were made in new F_2 populations from the best 1988 crosses. These will be self-pollinated in the greenhouse for 1990 evaluation. F_4 families were planted in 1989 for continued selection in the development of new inbred parents.

<u>Commercial Varieties</u>: As in 1988, most of the commercial varieties observed in 1989 had large heads, short plants, poorly exserted heads, and bad color for processing. Some which should be reevaluated, based

on the scores and descriptions in Table 4 or based on the yield trial, are: FM-96, Tendergreen, 861268N, Pirate, and Early Dawn. None of these has good color and good exsertion combined.

7. Summary:

OSU 87-3 and 87-5, OSU hybrids with high head exsertion, continued to look good for quality, especially lack of fiber, good color, and good floret type. Yield of these hybrids was not as high as Gem, but was closer to Gem in 1989 than it was in 1988. High yields in commercial varieties was associated with large, poorly exserted heads, high fiber, and poor color. Breeding for better yielding, high exsertion types, by intercrossing existing OSU inbred lines and by developing new inbred lines, continued.

8. Signatures:

Submitted by:

Redacted for Privacy

Project Leader Date

Approved by:

Redacted for Privacy

Department Head Date

Table 1. Broccoli yield trial, Oregon State University, Corvallis, Oregon, 1989[1]

Variety	Source	Total No. Heads/Acre	Total Tons/Acre	Lbs./Head	No. Harvests	Avg. Tons/ Weekly Harvest	Tons Largest Weekly Harvest	Notes
87-3	OSU	22454	4.3	0.38	3	1.4	2.6	Highly exserted, good color, and floret type, size may not be adequate
87-5	OSU	16786	4.0	0.47	2	2.0	3.9	Similar to 87.3
88-1	OSU	21909	7.6	0.69	3	2.5	4.4	Very good yield, large heads, poor color
88-3	OSU	17222	6.1	0.72	2	3.0	3.1	Excellent plant and head form and yield; color moderately light
88-4	OSU	17876	6.3	0.71	2	3.1	3.4	Same notes as 88-3
Gem	Asgrow	19075	5.5	0.57	2	2.8	4.8	Tall plant, heads quite variable and rough, good color
Premium Crop		21255	8.7	0.82	2	4.4	6.1	Very poor exsertion, hard to pick; good wt., poor color; concentrated maturity
Pirate		18094	7.4	0.81	1	7.4	7.4	Very poor exsertion, hard to pick; stem color fair to good
Cruiser	Royal Sluis	21255	6.6	0.62	3	2.2	3.6	Poor color, poor exsertion
Early Dawn		22454	9.3	0.83	3	3.1	7.2	Possibly overmature at harvest, very early, poor exsertion, good color
Hi-Caliber		25179	6.9	0.55	3	2.3	3.4	Good exsertion, fair head color
LSD at 5%		3645	1.3	0.11				

[1]Direct-seeded June 16 in 30' plots, 20" between rows, two rows per plot, thinned to 10" between plants; 900 lbs/A 12-29-10 broadcast at planting time with 120 lbs. N side-dressed as urea on July 25.

Assessment of Value of Aqueous Nitrogen Fertilizer Solutions as Fertilizer and Herbicide Supplement in Broccoli

Garvin Crabtree
N.S. Mansour
Department of Horticulture
Oregon State University

STATUS: The research conducted in 1989 was for the second year of this two-year project.

FUNDING: The Oregon Processed Vegetable Commission provided $2680 to assist in paying for costs for the 1989 study. Approximately three-fourths of this funding has been used for personnel costs, the remainder for services and supplies.

OBJECTIVES of this project, remain as stated in the proposal, and are as follows:

1) Determine the potential selective herbicidal activity of three nitrogen-containing fertilizer solutions.

2) Compare broccoli response to nitrogen applied in these foliar sprays to equal amounts of nitrogen applied in the usual form of side-dressed fertilizer.

PROGRESS: Two plantings of broccoli 'Gem', seeded on April 12 and 28, 1989 were established on Chehalis sandy loam soil at the Horticulture Research Farm, Corvallis, OR. Fertilizer (18N, 44P, 15K and 10S - lbs. per acre) was broadcast and soil incorporated prior to planting. The early and late plantings of broccoli were thinned on May 5 and 24, 1989, respectively, to leave plants spaced at 9 inches in the rows (rows spaced 18 inches apart). On May 16, 1989 when the first planting was in the 5-leaf stage and the second planting had 1 to 3 leaves (designated as 2-leaf stage), liquid fertilizer sprays were applied. Treatments used are shown in the table. Sprays were either broadcast (BRO) to give complete, uniform coverage over appropriate test plots or applied as a directed (DIR) spray so that the fertilizer sprays covered the area between rows and the crop plant row was avoided. Plots were evaluated on May 19, 1989 (early rating) for weed control and crop response. Subsequently, all plots were uniformly cultivated and weeded check plots were hand weeded. Evaluations of general weed control (ALL WEEDS) and crop response were made on June 21 and June 28, 1989, prior to harvest, for the April 12 and April 28, 1989 plantings, respectively.

On June 26, 1989, various amounts of ammonium nitrate was applied as a side dressing fertilizer to result in a total N application of 208 lbs per acre. Cultivation following on the same day served to incorporate the fertilizer, as well as to control weeds between the broccoli rows. Plots were harvested (primarily center heads) on three separate dates for each planting. Harvest numbers and weights of each planting were combined for the total yield for each plot. Somewhat lower yields for the second planting reflect a slightly advanced harvest schedule as compared to the first planting.

Results, as shown in the table, confirm findings of the 1988 field study. Weed control is variable between species and incomplete, so that additional control measures are needed to supplement the effect of nitrogen fertilizer sprays. Application method (broadcast or directed) of the fertilizer sprays generally had little influence on their weed control effectiveness. Although this study was not designed for a precise comparison of timing of the sprays, this factor was important, with the earlier application (broccoli 2-leaf stage) often giving higher weed control ratings. With the considerable variability present in these data there is no clear preference among treatment materials or combinations. As was found in 1988, AN-20 appeared to have the most effect on weeds and crop when compared to equal gallonage applications of other materials. The combination of AN-20 and ammonium thiosulfate was essentially as effective in controlling weeds as AN-20 alone.

Broccoli injury ratings (leaf necrosis and growth reduction) were usually consistent between the early (soon after application of the fertilizer sprays) and late (just before first harvest) evaluation dates and even though crop injury was not readily apparent from a casual inspection at harvest, closer study showed evidence of leaf necrosis and reduced growth. There was also a strong inverse relationship between injury ratings and yield with the highest injury ratings and lowest yields resulting from the broadcast applications over the second planting.

In this study, there was no significant difference in broccoli production when part of the nitrogen fertilizer was applied as a directed spray as compared to an equal amount of N applied as a side dressing of ammonium nitrate.

SUMMARY: In a comparison of nitrogen fertilizer spray treatments, the best control of weed species was obtained when applications were made to small weeds (broccoli 2-leaf stage). Using a directed spray to minimize contact with the crop plants resulted in the least crop injury and the best broccoli yields. There was not much difference between the various materials used as fertilizer spray treatments but slightly more herbicidal activity was observed in the AN-20 plots. Crop response to this material was satisfactory if the applications were made as directed spray; in the broadcast spray treatments, more crop safety was exhibited if combinations of AN-20 and ammonium thiosulfate or AN-20 and Solution-32 were used.

Oregon broccoli growers should be able to incorporate information obtained from this project into their production practices. Use of fertilizer sprays as a supplementary weed control measure should result in lower production costs/greater broccoli yields/improved product quality.

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PROJECT LEADER: ______________________

Redacted for Privacy

PROJECT LEADER: ______________________

Redacted for Privacy

DEPARTMENT HEAD: ______________________

WEED CONTROL IN BROCCOLI - 1989

No.	Fertilizer	Appln Rate (Gal/Acre)	Type[1] of Appln	Broc Stage	Weed Control (%)[2] BRSRA/ RAPRA	SOLSA	SPRAR	MATMT/ ANTCO	CAPBP	ALL WEEDS	Broccoli Injury Rating (%) early	late	Yield No. of Heads	Tons/Acre
1	AN-20	60	BRO	5-LF	38	50	7	24	45	55	6	20	37	2.0
				2-LF		93	31			66	24	11	24	1.9
2	AN-20	90	BRO	5-LF	56	73	39	45	83	76	13	15	37	2.7
				2-LF		93	23			54	39	15	20	1.3
3	AN-20	60	DIR	5-LF	46	60	24	28	56	75	10	8	37	2.3
				2-LF		63	10			100	3	10	29	3.1
4	AN-20	90	DIR	5-LF	31	33	15	19	39	68	5	20	39	2.7
				2-LF		93	31			66	24	11	35	3.3
5	Ammonium thiosulfate	60	BRO	5-LF	43	49	15	18	65	60	6	11	36	2.4
				2-LF		70	8			63	16	8	19	1.3
6	Ammonium thiosulfate	90	BRO	5-LF	34	50	5	34	50	65	8	14	34	2.3
				2-LF		91	30			74	20	18	22	1.5
7	Ammonium thiosulfate	60	DIR	5-LF	36	45	9	18	55	45	8	13	34	2.4
				2-LF		58	5			100	1	16	30	2.7
8	Ammonium thiosulfate	90	DIR	5-LF	56	73	31	34	74	74	11	13	34	2.3
				2-LF		80	28			100	8	18	30	2.6
9	Solution-32	60	BRO	5-LF	29	50	20	26	58	60	9	8	38	2.5
				2-LF		71	8			51	11	18	22	1.7
10	Solution-32	90	BRO	5-LF	31	49	18	18	55	54	3	20	38	2.2
				2-LF		75	8			50	16	14	19	1.3
11	Solution-32	60	DIR	5-LF	35	60	17	35	64	73	6	11	37	2.5
				2-LF		39	1			96	6	14	27	2.4
12	Solution-32	90	DIR	5-LF	24	43	20	31	55	70	1	9	37	2.5
				2-LF		40	3			98	3	10	34	3.0
13	AN-20	30}	BRO	5-LF	35	63	19	30	50	64	4	19	31	1.9
	Amm-thio	30}		2-LF		83	6			71	18	10	27	2.2

14	AN-20	45)	BRO	5-LF	30	40	13	28	50	74	5	5	38	2.6
	Amm-thio	45)		2-LF		84	30			78	20	13	17	1.5
15	AN-20	30)	DIR	5-LF	35	63	19	30	50	64	4	5	39	2.7
	Amm-thio	30)		2-LF		63	3			79	5	9	25	2.4
16	AN-20	45)	DIR	5-LF	25	35	6	15	33	63	3	15	34	1.7
	Amm-thio	45)		2-LF		66	5			100	1	10	31	2.5
17	Soultion-32	30)	BRO	5-LF	28	40	18	23	47	74	4	8	35	2.7
	Amm-thio	30)		2-LF		76	5			76	14	5	24	2.3
18	Solution-32	45)	BRO	5-LF	38	53	27	28	55	64	6	13	38	2.5
	Amm-thio	45)		2-LF		48	1			58	6	13	23	1.6
19	Solution-32	30)	DIR	5-LF	48	64	12	30	69	66	1	14	33	2.3
	Amm-thio	30)		2-LF		55	0			98	4	6	30	2.8
20	Solution-32	45)	DIR	5-LF	30	50	11	20	45	44	3	16	37	2.1
	Amm-thio	45)		2-LF		61	1			95	6	11	29	2.2
21	Weeded Check	---	---	5-LF	8	13	4	9	20	53	0	6	32	2.1
				2-LF		3	0			81	1	13	28	2.7
22	Unweeded Check	---	---	5-LF	14	15	5	10	11	61	1	9	34	2.5
				2-LF		0	0			93	0	1	34	3.9
	LSD (0.05)			5-LF	27	35	22	25	34	26	9	14	7	0.8
				2-LF		25	29			23	14	14	7	1.2

[1] Type of Application: BRO = broadcast, uniform application over plot
DIR = directed, application between crop rows

[2] Weed Control Rating: Visual evaluation of % control (stand and growth), individual species - early, ALL WEEDS - late
Weed species abbreviations - BRSRA = birdsrape mustard
RAPRA = wild radish
SOLSA = nightshade
SPRAR = corn spurry
NATMT = pineapple weed
ANTCO = mayweed chamomile
CAPBP = shepherdspurse

Project Report to the Oregon Processed Vegetable Commission-1989

TITLE: Effect of Nitrogen Sources, Calcium Rates, and Bactericides on Yield and Head Rot of Broccoli

PROJECT LEADERS: Delbert D. Hemphill, Jr., No. Willamette R&E Center
Mary L. Powelson, Botany and Plant Pathology
N. S. Mansour, Horticulture

COOPERATOR: Dan McGrath, OSU Cooperative Extension

PROJECT STATUS: First year completed

FUNDING: $4850 from this source, $6732 other sources

OBJECTIVES:

1. To evaluate the effect of several nitrogen sources and calcium rates on yield, head rot, quality, and nitrogen content of broccoli.

2. To evaluate the efficacy of copper compounds and selected bacterial antagonists for control of broccoli head rot.

PROGRESS REPORT:

First N Source Experiment. 'Gem' was seeded on March 31 and transplanted on May 1. Treatments consisted of a factorial combination of six N sources (ammonium nitrate, calcium nitrate, urea, sodium nitrate, potassium nitrate, and sodium-potassium nitrate); two rates of total N (150 and 200 lb/A); and three rates of foliar-applied calcium chloride (0, 10, and 20 lb Ca/A). Each plot consisted of a four-row bed, 15 feet long, on 16 x 9 inch spacing. Treatments were replicated four times. Nitrogen sources were sidedressed on May 29 and again on June 13, with half the total rate applied on each date. The plots were immediately irrigated to carry the fertilizer into the soil. Calcium chloride was applied on June 13. An aqueous cell suspension of *Erwinia carotovora* (10^6 cells/ml) was sprayed onto the plants on June 17 and again on June 29. The plots were harvested on June 29 and July 7.

Neither head weight, head width, percent good heads, percent head rot, nor percent downy mildew-affected heads was significantly affected by N source (Table 1). However, the incidence of head rot tended to be lower on plots receiving either potassium or sodium nitrate. This trend, though not statistically significant, was particularly strong for the first harvest. Bead size was affected by N source, with the smallest bead size occurring with calcium nitrate as the N source, the largest with urea.

The higher rate of total N applied increased head size but also nearly doubled the incidence of head rot. At the first harvest there was a significant interaction of N rate and N source on head rot incidence: head rot increased at the high N rate for five of the six N sources, but rot incidence was lower at the high N rate with sodium nitrate as fertilizer. With potassium nitrate, the tendency for higher rot incidence at the high N rate was reduced (data not shown).

Rate of calcium chloride had no effect on head weight or quality. Leaves of plants grown with potassium or sodium in the fertilizer were noticeably darker green in color.

Second N Source Experiment. 'Gem' was direct-seeded on June 21 in 16-inch rows and thinned to an average in-row spacing of 9 inches. Treatments consisted of a factorial combination of the above N sources, with the addition of ammonium sulfate, and the same three rates of calcium chloride. Plot size was a four row bed, 20 feet in length. Treatments were replicated four times. Total N applied was split with 50 lb N/A applied on July 7, and 75 lb on both July 26 and August 21. The calcium chloride treatments were applied on August 21. Boron was applied at 2 lb/A on July 27. Cells of *Erwinia carotovora* were applied on August 21 and again on September 5. Plots were harvested on September 5 and 12.

Nitrogen source had no significant effect on mean head size, although there was a strong trend for heavier heads with urea as N source (Table 2). Yield on a ton/acre basis did vary with N source, with urea and potassium nitrate producing the highest yields. Head width also varied slightly with N source. Head rot incidence in this trial was extremely low due to the unusually warm, dry conditions during the maturation and harvest period. Neither head rot nor downy mildew incidence varied significantly with N source. Most favorable bead size occurred with sodium, potassium, and calcium nitrates. Rate of applied calcium chloride had no effect on yield or head rot.

Soil pH was affected by N source, with the potassium, sodium, and mixed sodium/potassium fertilizers increasing pH of the surface half-inch of soil and ammonium nitrate and ammonium sulfate reducing pH compared to the control value of 5.4. Sodium and potassium nitrates should reduce the amount of lime necessary to maintain adequate pH on heavily fertilized Willamette Valley soils. Leaf tissue N concentration did not vary significantly with N source or rate of Ca.

Chemical and Biological Control of Head Rot. One chemical and three biological control agents were applied in two grower fields on September 29 and October 6 (Table 3). Very little head rot developed until late in October. At this time, it was noted that the 4.0 lb/acre rate of Kocide caused phytotoxicity to the heads, expressed as a darkening and hardening of the florets. The only significant head rot development through two weeks of commercial harvests was on heads injured by the Kocide treatment.

SUMMARY:

Nitrogen source had little effect on broccoli yield at the N rates used in these trials. Differences due to N source would be expected only at rates of N less than necessary to obtain optimal yields. Calcium rate also had little effect on yield or quality. Higher rates of N, as in previous years, increased the incidence of head rot, the price one must pay for obtaining high yields. Because the amount of head rot was not high in these trials, it is hard to gauge the effect of the N sources on disease incidence. Previous work in Virginia indicated that sodium or potassium nitrates reduce head rot. The trend was the same in the first planting reported here. However, the overall head rot percentage was too low to permit definitive statements about N source effects on head rot under our conditions. Floret bead size was greatest with urea as N source, smallest with calcium and sodium nitrates.

The big surprise in the grower spray trials was the damage caused by the copper bactericide, Kocide. The floret damage caused by this material appeared to provide an entry into the plant tissue for the *Erwinia* bacterium, which was reflected in a higher incidence of head rot.

Table 1. Main effects of N source, N rate, and Ca rate on yield and quality of broccoli, July, 1989.

Treatment	Yield (T/A)	Mean head wt. (g)	Head width (in.)	Good heads (%)	Head rot (%)	Downy mildew (%)	Bead[z] size
N source							
NH_4NO_3	5.1	162	3.9	92.7	8.1	1.5	3.6
$Ca(NO_3)_2$	5.4	171	4.0	90.6	8.3	2.5	3.2
KNO_3	5.0	164	4.0	92.5	4.5	3.1	3.7
$NaNO_3$	5.4	168	4.0	92.6	5.4	1.5	3.6
$K/NaNO_3$	5.1	169	3.9	91.1	7.1	1.5	3.5
Urea	5.4	169	4.1	93.0	6.8	1.0	3.9
LSD(0.05)	NS[y]	NS	NS	NS	NS	NS	0.3
N rate, lb/A							
150	5.0	160	3.9	93.4	4.8	1.8	3.6
200	5.5	174	4.0	90.8	8.6	1.9	3.6
	**	**	**	NS	**	NS	NS
Ca rate, lb/A							
0	5.4	173	4.1	91.1	7.8	2.1	3.6
10	5.1	161	3.9	93.2	5.9	1.7	3.5
20	5.2	166	4.0	91.9	6.5	1.7	3.6
LSD(0.05)	NS	8	0.1	NS	NS	NS	NS

Notes: No significant differences in stem color or hollow stem incidence.
[z]Bead size rated on a five point scale, with 1=very fine bead, 5=very open bead, some open flowers.
[y]NS,*,**: No significant differences, significant at the 5% and 1% levels, respectively.

Table 2. Main effects of N source and Ca rate on yield and quality of broccoli, September, 1989.

Treatment	Yield (T/A)	Mean head wt. (g)	Head width (in.)	Good heads (%)	Head rot (%)	Downy mildew (%)	Bead size	Soil[z] pH	Leaf N (%)
N Source									
NH_4NO_3	4.8	166	3.6	96.1	1.3	2.6	3.3	4.8	5.41
$(NH_4)_2SO_4$	4.6	161	3.6	88.7	0.0	11.3	3.3	4.5	5.38
$Ca(NO_3)_2$	4.9	167	3.5	90.4	1.7	7.9	3.1	5.4	5.81
KNO_3	5.2	176	3.7	92.4	0.4	7.2	3.0	6.0	5.69
$NaNO_3$	4.6	162	3.6	89.9	1.7	8.6	2.9	6.2	6.16
$K/NaNO_3$	5.0	173	3.8	89.9	0.5	9.6	3.1	6.1	5.72
Urea	5.8	184	3.8	85.8	0.4	13.8	3.4	5.4	5.85
LSD(0.05)	0.5	NS[y]	0.2	NS	NS	NS	0.3	0.3	NS
Ca rate, lb/A									
0	5.0	174	3.7	88.4	1.2	10.5	3.3	5.5	5.69
10	5.0	166	3.6	90.8	1.1	8.1	3.0	NM[x]	NM
20	4.9	170	3.7	92.1	0.4	7.6	3.2	5.4	5.74
LSD(0.05)	NS	NS	NS	NS	NS	NS	0.2	NS	NS

[z]pH of the surface half-inch of the soil, September, 1989. Unfertilized soil had a pH of 5.4.
[y]NS: No significant differences among means within the column.
[x]NM: Not measured.

Table 3. Effect of Kocide and biological antagonists on head rot incidence in broccoli, October, 1989.

Treatment	Rate	Rot incidence (%) on October 20	October 26
Nontreated control	--	1.0	0.5
Erwinia carotovora	10^6 cells/ml	2.0	0.0
Kocide	4.0 lb/A	4.5	14.3
3832	10^7 cells/ml	0.0	1.0
3871	10^7 cells/ml	0.0	1.0
WAR60	10^7 cells/ml	2.2	5.0
LSD (0.05)		2.4	4.7

SIGNATURES:

Project Leaders: Redacted for Privacy

Redacted for Privacy

Redacted for Privacy

Department Heads: Redacted for Privacy

Redacted for Privacy

Report to the Oregon Processed Vegetable Commission
1989

1. Title: Supersweet corn variety evaluations

2. Project Leaders: J. R. Baggett, Horticulture
G. W. Varseveld, Food Science and Technology

3. Project Status: Terminating June 30, 1990

4. Project Funding by Commission for this Period:

Field trials (Baggett) - $3,000.00
Processing (Varseveld) - $3,630.00

5. Objectives:

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

6. Report of Progress:

a) Multiple Harvest Date Trial

Five varieties of supersweet corn, considered promising for processing in Oregon, were grown in a replicated trial at Corvallis. These were Showcase (Rogers Brothers), GSS 3548 (Rogers Brothers), XPH 2659 (Asgrow), Supersweet Jubilee (Rogers Brothers), and Crisp 'n Sweet 710 (Crookham). Each variety was planted on May 31 in about 170 feet of row in each replication. Plants were thinned to approximately 10" apart. On six harvest dates (Table 1), 25 feet of each plot was harvested for field yield data and ear measurements.

Harvests were made once every two days, except that on weekends two days intervened between pickings for each variety. Thus, varieties picked on Friday were not picked Saturday and Sunday, and varieties picked on Saturday were not picked Sunday and Monday. First harvests were made as close to 78% moisture as could be achieved by early observation and preliminary moisture determinations. All moisture determinations were made by use of a microwave oven for sample drying.

Twenty ears from each replication, carefully selected for a uniform maturity typical for that harvest, were used for the field measurements, which included a measure of tenderness by means of a spring puncture gauge. The 20 ears were then delivered to the Food Science and Technology pilot plant for moisture and percent cut off determination and processing. All data on the processed samples will be presented in a supplementary report at a later date.

Patterns of moisture change for the five varieties are shown in Figure 1. Variations from the expected uniformly decreasing percent moisture can probably be attributed in part to changes in environmental conditions. Variation in selection of samples could also be involved even though there was great emphasis on selecting uniform samples representing typical maturity for the harvest day.

Although percent moisture generally decreased uniformly during the harvest period, most other factors were very erratic in the observed pattern of changes (Table 1). Sampling error, caused in part by variation in stands and other field conditions, was probably responsible for most deviation from expected patterns. Data for tons/acre, ear diameter, wt. per ear, percent cut off, and tenderness are graphically related to days from first harvest in natural form in Figures 2-6, and as regression lines which show general trends in Figures 7-11. Table 1 shows that good number of ears per acre increased through the harvest period in all varieties. At 78% moisture, there are usually some ears of supersweet corn varieties that are not mature enough to include as good ears. These ears become usable at lower moisture levels. Tip fill generally improves rapidly as moisture changes from 78% or above to about 76%. Yields increased by 2-4 tons/acre over the six harvests and the range of about 78% down to about 75% moisture.

Ear weight increased about .05 to .1 lb. except in Crisp 'n Sweet 710, which showed no increase at all over the six harvest dates. As in previous years, there was little or no increase in ear length, but ear diameter increased about 0.2 in. over the harvest period. Percent cut off typically increased by about 5%.

Tenderness measurements were quite inconsistent, showing distinct ups and downs. For example, varieties tended to have a peak of high readings (tougher pericarp) early in the harvest period and then show more tenderness later. This was probably due to changes in stress related to weather and/or irrigation. It has been observed that puncture test readings are higher in the afternoons than they are early in the morning.

<u>Variety Behavior</u>

Supersweet Jubilee was the highest yielding variety due to a large number of usable ears/acre. Individual ear weight was average, but percent cut off was highest in the trial. Tenderness readings were lower than those of Crisp 'n Sweet 710, but were not exceptional and were higher than in previous years.

Crisp 'n Sweet 710 had the heaviest ears and a percent cut off slightly lower than Supersweet Jubilee. Number of good ears/acre was lowest in the trial and this apparently resulted in some reduction in yield. Crisp 'n Sweet 710 had the highest pericarp puncture test readings.

XPH 2659 had the longest ears, good ear weight, percent cut off, and yield. Tenderness was fair. The long slender ears tended to be curved. In general performance, this variety appeared to deserve further trial unless the curved ears are considered to be a limiting factor.

Showcase appeared to be a variety which should be tried further. Yields were good at about 76% moisture (mean yield was lowered by the first harvest which was high in % moisture). Ear weight, ear diameter, and cut off percent were similar to Supersweet Jubilee, but ear length was slightly less. Tenderness scores were better than those of Supersweet Jubilee.

GSS 3548 did not perform as expected from 1988 preliminary observations. Although yield was acceptable, ear length appeared to be reduced by the cool season and is considered too short for processing use.

b) Observation Variety Trial

Two replications, 30 feet long, were planted for each of 37 supersweet varieties. At an estimated maturity of about 76% moisture, 22 feet of row was picked from each plot. In some cases, the two replications were picked on different days to better assure observation of the variety in the mid-maturity condition. Notes, yield estimates, and ear measurements are shown in Table 2. Ten of the varieties were processed for observation and panel evaluation. These are discussed below.

Only three of the processed varieties were yellow. These were FMX 280, FMX 284, and Sweet Season. FMX 280 had good tip fill and lacked taper but had only fair yield. FMX 284 yielded well, had good tip fill, and ear shape. FMX 284 and FMX 280 were both fairly tender. Sweet Season was fair in yield, not outstanding in appearance, and was tough.

Of the varieties observed, many of the best for ear type and yield were white or bicolor types. Seven of these were processed because of the possibility that their types may eventually be commercially canned or frozen in Oregon. Eating quality of some white and bicolors is known to be outstanding. For example, Honey 'n Pearl is now reputed to be the leading fresh market corn in Japan. Other promising bicolors were BSS 3378 (good yield, tender, good flavor and ear type), Sunre 2629 (average yield, tender, good ear type), and XPH 2687 (good yield, slightly coarse but otherwise good type, somewhat tough). Promising white varieties included How Sweet It Is (good yield, tender, good refinement, good flavor), WSS 3686 (better than average yield, variable type and maturity, good flavor, fairly tender), and WSS 3680 (late maturity, large ears, tender, good yield, good flavor). Most other varieties observed generally lacked refinement, yield, or uniformity.

7. Summary

Five supersweet corn varieties were compared in a replicated trial harvested five times over a period of 12 days. Yield in ears/acre and tons/acre, ear weight, ear diameter, cut off percent, and pericarp toughness increased steadily over the harvest period, but ear length remained constant. Supersweet Jubilee was the best overall variety. Performance of a new variety, Showcase, should justify further trial and XPH 2659 should be further trialed, with reservations because the long ears are frequently curved. Most of 37 lines grown in observation plots were poor prospects for processing because of low yield, poor ear type, or apparent poor quality. Ten varieties, including several white and bicolor types, were procesesed for panel evaluation.

8. Signatures:

Submitted by:

Redacted for Privacy

Project Leader Date

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Project Leader Date

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Department Head Date

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Department Head Date

Table 1. Yield and ear measurements of supersweet (sh_2) corn varieties on six harvest dates, Corvallis, Oregon, 1989[1].

Variety	Harvest date	Plants/ 25 ft.	Percent moisture	No.[2] good ears	T/A good ears	T/A culls	Lbs./ good ear	Ear length (in.)	Ear diameter (in.)	Percent cut-off	Tender-ness[3]
Crisp 'n Sweet 710	9-8	28	77.5	16.4	6.0	0.2	0.73	8.4	2.08	62.9	152
	9-11	28	75.4	19.2	6.9	0.5	0.73	8.6	2.08	63.5	162
	9-13	28	76.2	21.9	7.8	0.6	0.72	8.7	2.20	63.6	162
	9-15	28	76.0	21.2	7.8	0.5	0.74	8.5	2.15	65.1	154
	9-18	29	75.0	26.1	9.5	0.7	0.73	8.4	2.20	66.9	205
	9-20	28	74.4	21.1	7.7	0.8	0.73	8.5	2.20	67.2	188
	mean	28	75.7	21.0	7.6	0.5	0.73	8.5	2.15	64.9	171
Super-sweet Jubilee	9-9	28	77.2	26.6	7.1	0.4	0.54	7.7	1.88	62.8	123
	9-12	28	75.9	32.0	9.2	0.1	0.57	7.7	2.00	64.2	150
	9-14	29	75.1	34.0	8.8	0.4	0.52	7.7	2.00	67.5	121
	9-16	28	75.7	36.5	10.6	0.3	0.58	7.7	2.08	68.1	116
	9-19	28	75.0	33.8	10.5	0.7	0.62	7.9	2.10	68.7	144
	9-21	29	75.4	31.8	10.2	0.7	0.64	8.0	2.12	68.3	144
	mean	28	75.7	32.4	9.4	0.4	0.58	7.8	2.03	66.6	132
Showcase	9-9	28	78.9	19.8	5.6	0.9	0.57	7.6	1.92	62.1	109
	9-12	26	77.4	24.4	7.3	0.4	0.60	7.4	2.00	62.5	146
	9-14	31	77.1	25.3	7.7	0.8	0.61	7.5	2.05	63.9	108
	9-16	28	76.7	28.5	8.9	0.5	0.62	7.6	2.05	67.2	116
	9-19	28	76.3	27.7	9.2	1.3	0.66	7.7	2.12	67.0	130
	9-21	29	75.4	28.6	9.7	1.1	0.68	7.5	2.15	69.4	128
	mean	28	76.9	25.7	8.0	0.8	0.62	7.6	2.05	65.3	123
GSS 3548	9-7	29	78.1	18.6	4.5	0.1	0.48	7.1	1.90	49.3	133
	9-9	28	77.6	22.2	5.4	0.4	0.49	6.9	1.88	62.0	146
	9-12	28	75.8	28.6	7.3	0.3	0.51	6.9	2.00	60.6	145
	9-14	28	75.3	32.7	8.4	0.5	0.51	7.0	1.98	65.8	130
	9-16	28	75.2	36.9	9.6	0.2	0.52	6.9	2.02	66.9	136
	9-18	28	74.9	32.6	9.1	0.6	0.57	7.0	2.00	68.0	179
	mean	28	76.1	28.6	7.4	0.4	0.52	7.0	1.96	62.1	145
XPH-2659	9-11	30	78.5	25.3	6.6	1.0	0.52	8.8	1.82	58.8	145
	9-13	30	77.4	23.5	7.0	1.2	0.60	8.8	1.90	61.0	135
	9-15	30	76.5	26.9	8.0	0.4	0.60	8.6	1.90	64.8	143
	9-18	28	76.4	29.9	9.1	1.3	0.61	8.7	1.70	67.6	150
	9-20	28	75.9	30.4	9.6	1.3	0.62	8.5	2.00	69.9	161
	9-22	30	75.8	32.1	10.2	0.9	0.64	8.8	2.00	69.3	146
	mean	29	76.7	28.0	8.4	1.0	0.60	8.7	1.89	65.2	147
LSD 5% for variety means				2.4	0.6	0.2	0.03	0.1	0.03	0.4	2

[1]All values except % moisture are average of four replications; for ear length, ear diameter, and tenderness, the value used for each replication was the mean of 20 individual ear measurements.

[2]Number of ears/acre divided by 1,000.

[3]Comparative scale, determined by a Chantillion spring puncture gauge.

RESEARCH REPORT - OREGON PROCESSED VEGETABLE COMMISSION

Title:

Evaluation of Sweet Corn Varieties for Production in the Columbia Basin

Project Leader:

George H. Clough, Horticulturist

Department:

Hermiston Agricultural Research and Extension Center

Status:

Continuing, projected completion date - Aug. 1991

Funding:

Approximately 2/3 of the $1,500.00 allotted to this project for 1989 was expended for labor, with the remainder utilized for services and supplies. Additional funding for laboratory equipment to support corn research was received from the Agricultural Research Foundation.

Objectives:

Determine yield and quality characteristics of sweet corn cultivars which may be appropriate for climate and cultural practices in the Columbia basin.

Progress:

Several varieties of supersweet (sh_2) and regular (se, su) sweet corn were grown in replicated trials to evaluate their potential for early sweet corn for processing in the Columbia Basin. Data recorded included tasseling and silking dates, harvest date, yield (number and weight) of marketable and cull ears, per cent moisture, ear weight, ear length, ear diameter, kernel depth and number of kernel rows.

Summary:

Measured characteristics varied significantly among the 8 cultivars evaluated (see Tables 1-3). With a late April planting, time to harvest ranged from 86 to 99 days. Earlier planting dates probably would not produce an earlier crop due to cool soil temperatures. Acceptable yields were obtained with 6 of the 8 varieties evaluated. Due to variations in climatic conditions from year to year, the trials will be repeated, with additional varieties included, over a 3-year period.

Table 1. Sweet corn maturity, Hermiston, Oregon, 1989.

Variety	Type	Time to Tassel	Silk	Harvest	Moisture
			Days[z]		%
HMX7345E	se	65.0ab[y]	68.0b	90	70.0b
Horizon	su	61.8b	64.0b	86	74.9ab
Jubilee	su	72.0ab	75.0ab	93	78.9a
Seneca Star	su	64.0ab	67.0b	86	76.8a
HMX7348S	sh_2	71.5ab	75.3ab	93	77.1a
Landmark	sh_2	66.5ab	72.5ab	93	77.5a
Supersweet Jubilee	sh_2	76.5a	81.5a	99	79.8a
Upmost	sh_2	67.0ab	71.5ab	93	74.9ab

[z] From Apr 23 planting date.
[y] Means followed by different letters are significantly different at alpha = 0.05 (DMRT).

Table 2. Sweet corn yield, Hermiston, Oregon, 1989.

Variety	Type	Yield (Husked) Marketable	Cull	Ear Weight
		Tons/acre		Pounds
HMX7345E	se	5.6ab[z]	0.6	0.53ab
Horizon	su	5.8a	0.7	0.58a
Jubilee	su	5.3abc	0.3	0.49ab
Seneca Star	su	4.4bc	0.1	0.47b
HMX7348S	sh_2	5.4abc	0.7	0.57a
Landmark	sh_2	4.2c	0.9	0.53ab
Supersweet Jubilee	sh_2	5.2abc	0.1	0.53ab
Upmost	sh_2	5.0abc	0.5	0.53ab

[z] Means followed by different letters are significantly different at alpha = 0.05 (DMRT).

Table 3. Sweet corn ear characteristics, Hermiston, Oregon, 1989.

		Ear[z]		Kernel	
Variety	Type	Length	Diameter	Depth	Rows
			Inches		No.
HMX7345E	se	7.23b[y]	1.91ab	0.36	16.6ab
Horizon	su	7.17b	2.02a	0.38	15.4ab
Jubilee	su	7.83ab	1.83ab	0.35	16.0ab
Seneca Star	su	7.61a	1.73b	0.37	14.5ab
HMX7348S	sh_2	7.73ab	1.89ab	0.38	15.4ab
Landmark	sh_2	8.15a	1.81b	0.37	12.6b
Supersweet Jubilee	sh_2	7.93ab	1.88ab	0.37	17.6a
Upmost	sh_2	8.09a	1.81b	0.38	12.6b

[z] Average of 8 ears/replication, 4 replications.
[y] Means followed by different letters are significantly different at alpha = 0.05 (DMRT).

Signatures:

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Project Leader Date

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Department Head Date

Report to the
Oregon Processed Vegetable Commission
December 1, 1989

Title: Corn Earworm Control in Sweet Corn

Project Leaders: Brian Croft, Glenn Fisher, Leonard Coop, Ray Drapek

Entomology Department
Oregon State University
Corvallis, Oregon 97331-2907
(503) 737-3151

Status: Continuing until June 30, 1990

Funding: $9,500

Objectives:

1. Continue the cooperative pheromone trapping program to validate management models and to maintain necessary standards.

2. Continue developing the earworm management model to aid in determining if and when fields should be protected from corn earworm using insecticides.

3. Establish criteria for defining economics of earworm losses so that the management models developed can be based on economic threshold values for earworm control.

Report of Progress:

The material presented below summarizes the work completed as of December 1, 1989. Work is continuing on the project and further results are anticipated.

Pheromone Trapping Results

In 1989, 26 fields in the Willamette Valley, 8 fields near Hermiston, 1 field in Medford, and 4 fields near Ontario. Trap monitoring began in mid May and continued until mid October. Traps usually were checked twice a week during this period. Willamette Valley trap catches in 1989 were considerably lower than 1988 throughout the trapping season (Fig. 1). Because of the low trap catches, we were able to predict early in 1989 that it would be a relatively earworm-free year. By placing traps in the field over a month earlier than last year, we were able to detect an early season moth flight that we had not observed before. This moth flight had decreased to extremely low levels by early July (the time when the earliest traps were placed last year). Though that early flight was high compared to subsequent July flight levels, note that it was still only slightly higher than the lowest flight levels detected in 1988. Trap catch data from other regions within the state still need to be collected from cooperators and analyzed.

Note that the pheromone trap used in this study is the Texas Trap and the pheromone lure used is the PVC lure distributed by Scentry Inc. All trapping results indicated in this paper assume the use of these products.

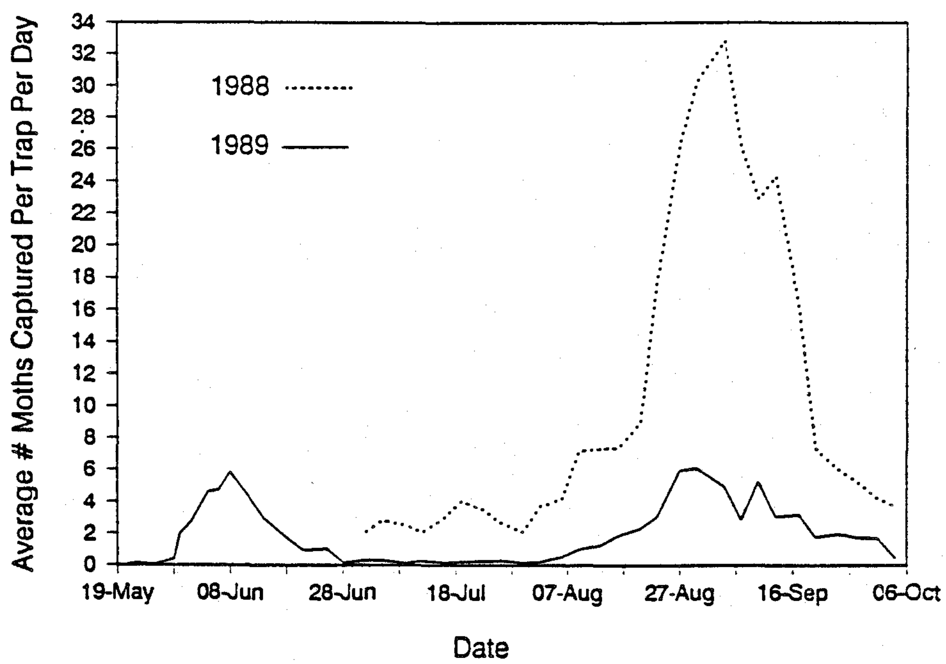


Figure 1. Average earworm moth trap catch results for 1988 and 1989 pheromone traps in the Willamette Valley.

Corn Ear Damage Levels

Ear damage levels for later planted corn fields are generally higher than for early planted corn fields. Damage levels observed in samples taken from fields in the years 1986 to 1989 are shown in Figure 2. Each dot in this figure represents data from one field. Lines are included to show least square fits of damage versus silking date for each of the four years. Damage in this figure is indicated as a natural log of damage because this transformation best fits the damage trends of any tested. As we would expect from the trapping data, 1989 had significantly lower damage than 1988. This figure also shows that 1989 damage levels generally were the lowest of all years for which we have sample data.

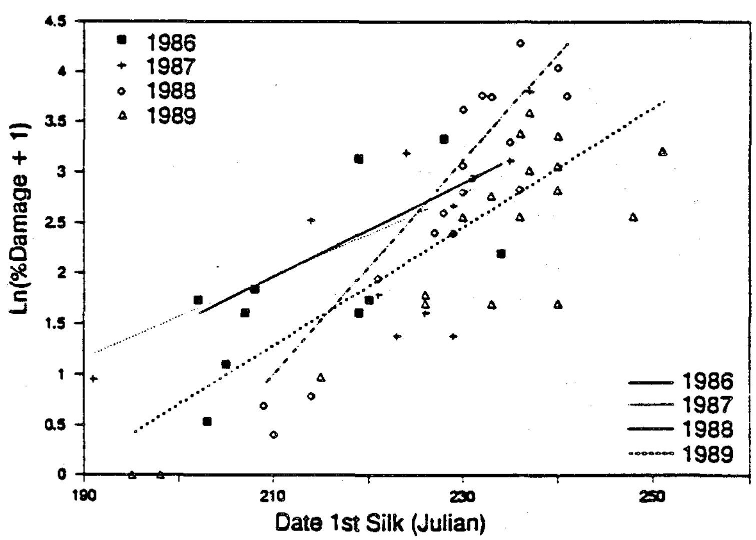


Figure 2. Plot of damage versus silking date for individual sites over all four years for which samples were taken. Lines of least square error are also shown for each year to show yearly damage trends.

Predicting Percent Damage Using Pheromone Traps

In 1988, we came up with an equation relating the date of first silking and trap catch from first tassel to first silk to subsequent percent damage. This equation was based on silking date versus percent damage data for the years 1986-1988 and on trap catch data from 1988. The equation was:

PERCENT DAMAGE = -255.527 + (1.197 X DATE) + (0.089 X CATCH).

This model predicted 73% of the variation of damage levels for the data set used to create it. We tested this model this year to see how well it would predict 1989 damage levels (Figure 3). In general, predicted damage levels proved to be higher than actual damage levels.

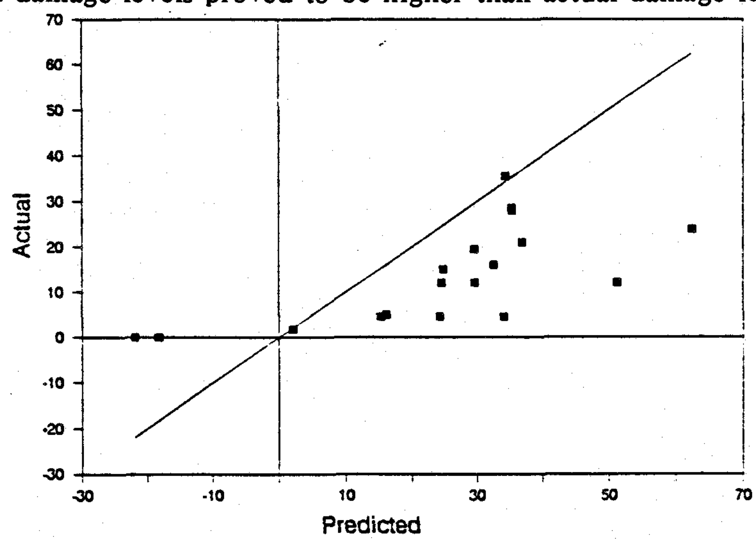


Figure 3. Predicted percent damage levels from last year's damage prediction model versus actual damage levels for 1989 corn fields.

Several alternative models for predicting damage were tested in 1989. The best model to date was based on 1988 and 1989 trap catch data and damage data. This model is:

$$\mathrm{Ln}(\%\mathrm{Damage} + 1) = 0.0666(\mathrm{Date}) + 0.002216(\mathrm{Catch}) - 12.994$$

For this model DATE date is the Julian date (Jan. 1 = 1, Jan. 2 = 2 etc.) of the first date in which any corn is silking within the planting of interest. CATCH is the cumulative trap catch from the day when the tasseling is first observed in the planting to the day when 50% of the corn ears are silking. This model explains 74% of the variation in damage for both 1988 and 1989 and thus is a better model for damage prediction in both low damage years and in high damage years. Figure 4 shows the damage levels predicted by this model for fields monitored in 1988 and 1989 versus the actual damage levels observed. The line in this figure shows where points should cluster if observed values agree with the model.

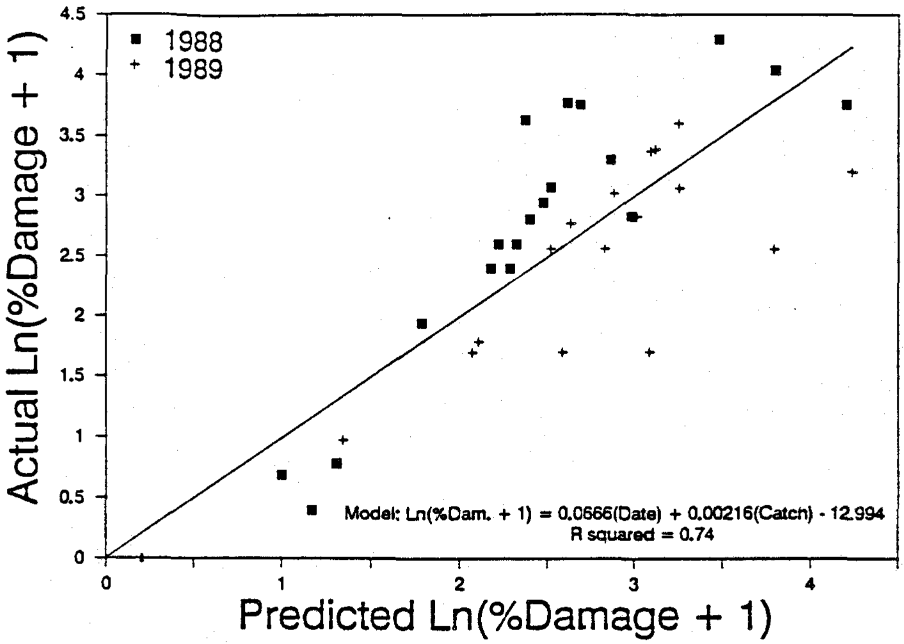


Figure 4. Damage levels predicted by 1989 version of the multiple regression damage prediction model. Each point represents predicted and actual damage levels for one field. The line represents locations where predicted and actual damage levels agree.

The new damage prediction model provides a better overall agreement with the observed data, but a closer examination of figure 4 shows that for 1988 (a year of relatively high earworm damage levels) the model tends to under-predict damage, and for 1989 the model still tends somewhat to overpredict damage. Future research efforts should go towards refining the model to fit yearly variability better. Methods of determining early in the season whether a year will have high, moderate, or low earworm damage levels need to be refined. Trap catch already has proven itself to be a useful indicator.

As we continue to work on improving our damage prediction abilities we will probably find that a multiple regression model such as the one shown above will produce the best predictions. Future models of this type, though, may include other factors besides trap catch and silking date. Because the model above tends to average out damage levels for both a high damage year and a low damage year, we might decrease the error of our prediction if we use separate damage prediction models for low damage years and high damage years.

If we were to base such a model on data collected to date, the high damage year model would have to be based solely on 1988 data and the low damage year model on 1989 data. From our experience over those two years we feel that an average catch of 1 or more moths per day over the last week of July can be used as a threshold separating high damage years from low damage years. Our high damage year model then would be:

$$\text{Ln}(\%\text{Damage} + 1) = 0.116(\text{Date}) - 23.810$$

For this model date once again is the Julian date in which silking is first observed. This model explains 88% of the variation in damage levels for 1988 and would probably do a better job of predicting damage for high damage years than the general multiple regression model. Analysis of data for our low damage model year (1989) shows that inclusion of trap catch significantly improves model predictability. Therefore our low damage year model is:

$$\text{Ln}(\%\text{Damage} + 1) = 0.00353(\text{Trap Catch}) + 0.0550(\text{Date}) - 10.704$$

Date again is the Julian date of 1st silk and trap catch is again the cumulative trap catch from first tassel to 50% silk. This model explains 83% of the variability of damage in 1989, and would probably do a better job for low damage years than the general multiple regression model.

Status and Review of CEWSIM Model

Version 1.1 of the corn earworm damage simulation model, or CEWSIM, is under preparation and should be ready by mid December. Version 1.0 was made available last August. The program is intended to provide assistance in determining the need for treatment in processed sweet corn in Oregon.

The model may be used by growers, processors, and extension personnel knowledgeable in the use of IBM PC computers. It consists of familiar menus and data input screens and graphics output displays. Corn silking and harvest times are predicted by a growing degree day submodel which uses daily maximum and minimum temperature data. Percent ears infested by corn earworm is predicted by a regression equation that is a function of corn silking date and earworm moth catch in pheromone traps. This regression equation (reviewed previously) is a critical element in the program, and is now undergoing further refinement. Earworm development is predicted by a degree-day model which also uses daily maximum and minimum temperature data. Effect of insecticide treatment on earworm survival is simulated to provide estimates of benefits of treatment for one or more applications.

At harvest, the model converts the final stages of earworms into damage distributions according to damage samples from processed corn fields. Damage distributions are converted to cullage estimates according to the % weight of the damaged portion of corn ears. The difference between damage estimates for treated and untreated earworm populations provides an estimate of the benefit of treatment.

Changes made to the model since version 1.0 include:

1) Temperature data for 1989 (Corvallis Oregon Hyslop farm) have been entered. Data from other weather stations can be made available for use with CEWSIM upon request.

2) New ear samples were taken for data relating ear lengths to % weights. The results of these measurements are presented in Fig. 5. These results produce lower damage estimates than did the original values used.

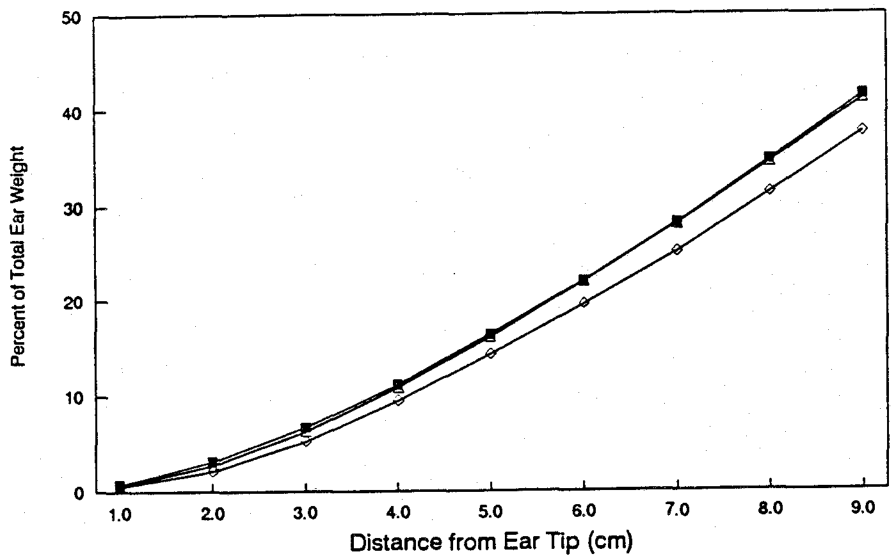


Figure 5. Relationship between distance from ear tips and ear percent weight sampled from three Jubilee corn fields, 1989.

3) An average damage index is also computed as a standard way of comparing damage severity.

4) Greater efforts were made to use the 1986-1988 spray trial data to calibrate and validate the model.

5) A more accurate corn earworm development submodel has been incorporated into CEWSIM. The improved method of representing earworm growth is based on the entire distribution of earworm development rates (Fig. 6), rather than using the mean development rate as was formerly done.

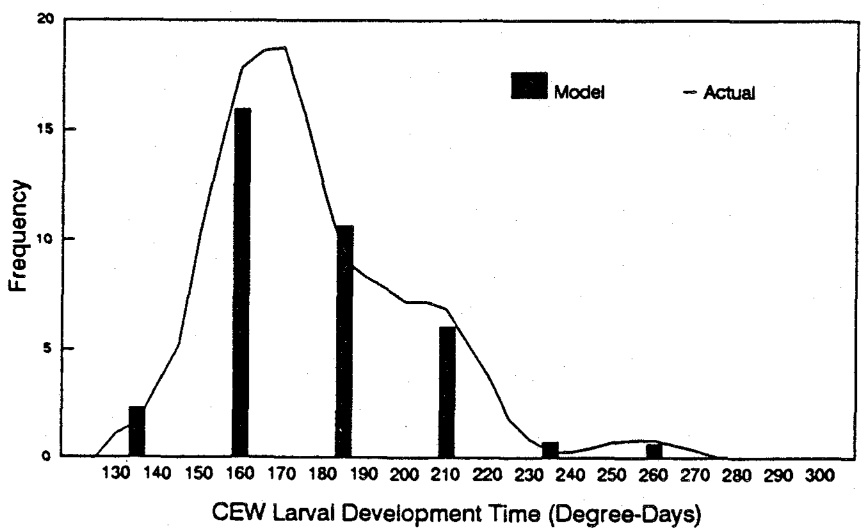


Fig. 6. Corn earworm development times. From five replications of earworms inoculated on corn ears. Conducted in Jubilee corn fields, near Corvallis, Oregon. With six bars summarizing development times as used in CEWSIM version 1.1.

Economic Analysis of 1988 Pheromone Trapping Sites

CEWSIM was used to compute damage estimates from the sites monitored during the 1988 trapping program. This analysis was not conducted for 1989 sites because the regression model tended to overpredict damage in 1989, indicating that more work on the model is required. The date of first silk, pheromone trap moth catch from first tassel to first silk, actual sampled percent infestation and model outputs are presented in Table 1. The predicted percent infestation was highly correlated to actual sampled infestation rates. The estimated losses are based on the assumptions of a yield of 9.10 tons/acre and corn price of $71.30/ton. The treatment simulated in the analysis was made 11 days after first silk at a cost of $11/acre.

Table 1. Preliminary economic analysis of 1988 fields surveyed during the pheromone trapping program.

Date First Silk	Moth Catch	Actual % Infestd	Predicted % Infestd	Damage Cost	Trtmnt %Infestd(1)	Trtmnt B/C
Jul 27	22	1	1	0	0	0.02
Jul 28	17	1	1	0	0	0.03
Aug 1	9	1	0	0	0	0.00
Aug 8	14	6	9	7	3	0.47
Aug 14	12	10	16	13	5	0.83
Aug 15	30	13	19	15	6	0.97
Aug 15	6	13	17	13	5	0.86
Aug 16	4	10	18	14	6	0.88
Aug 17	10	37	20	15	7	0.93
Aug 17	23	16	21	16	7	0.99
Aug 17	37	21	22	17	7	1.05
Aug 18	14	18	21	16	8	0.95
Aug 19	39	42	25	19	9	1.06
Aug 22	34	42	29	20	10	1.12
Aug 24	79	26	35	22	12	1.15
Aug 25	354	72	62	37	22	1.84
Aug 25	56	16	34	20	13	1.02
Aug 29	256	56	54	21	21	1.16
Aug 30	318	42	60	21	22	1.26

1 The percentage ears infested for the treated simulation

Estimated earworm damage costs ranged from 0 to $37/acre, and averaged $15/acre. The damage costs from worm/bird dockage reports available for three of the fields above ranged from $7 to $15/acre. More of these dockage reports are required to check the validity of model results. The insecticide treatment reduced earworm infestations (in fields with predicted infestations at 20% or greater) by an average of 64%. In no field did the estimated damage reach a level where the treatment benefit/cost ratio exceeded 2.0, indicating that the risk of severe damage was relatively low for these sites. We tentatively conclude from the analysis that, although several of the fields monitored in 1988 could have economically benefitted from an insecticide application, the economic benefits would have exceeded costs by a fairly small margin.

Treatment Guideline Tables

In the June 15, 1989 CEW Report newsletter, we presented a table of predicted earworm-induced losses based on trap catch, silking date, and average earworm damage lengths. An update of that table, using CEWSIM version 1.0, is presented below in Table 2. In Table 3, benefit/cost ratios for a treatment costing $11.00/acre are presented.

Table 2. Value of potential earworm damage ($/acre) for combinations of pheromone trap counts (first tassle to first silk, Texas trap with Scentry lure) and date of first silk (1988 regression model, CEWSIM 1.0 used).

Silk	Cumulative Trap Catch				
Date	10	30	70	150	300
7/29	0.40	0.40	1.60	7.50	18.60
8/5	4.00	5.50	8.40	14.30	25.30
8/12	10.60	12.00	14.80	20.50	31.20
8/19	16.30	17.60	20.30	25.70	35.70
8/26	16.40	17.30	19.30	23.20	30.40
9/2	7.50	7.90	8.60	9.90	12.60

The damage estimates in Table 2 are much higher than the values presented last summer, principly because damage distributions were used instead of average damage lengths. Highest estimated damage is $35.70/acre, for a trap catch of 300 and silking date of 8/19. These damage estimates indicate that (in 1988) treatment may have been justified for some fields. Damage begins to fall off for silking dates after 8/19, due to a lack of heat units needed by earworms to reach the more damaging, later instars. The regression model, when used alone, will predict greater infestation levels for later silking fields, whereas the development model in CEWSIM will reflect the effects of cooler temperatures in Sept-Oct. The highest benefit/cost ratio obtained (one insecticide treatment) was 2.3 (Table 3), meaning that the return would be $2.30 for each dollar spent on control. For most trap catch and silk date combinations, the benefit/cost ratio is not great enough to justify treatment. Considerable damage from earworms is tolerated in processed sweet corn, and treatments so far have not been made due to the relatively low risk of heavy damage. When benefit/cost ratios can be reliably predicted to exceed 1.0, then treatments may be recommended.

Table 3. CEWSIM predicted benefit/cost ratios for an insecticide treatment made 7 days after first silk.

Silk	Cumulative Trap Catch				
Date	10	30	70	150	300
7/29	0.0	0.0	0.1	0.5	1.2
8/5	0.2	0.3	0.5	0.9	1.5
8/12	0.6	0.7	0.8	1.2	1.8
8/19	1.0	1.1	1.3	1.7	2.3
8/26	1.1	1.2	1.3	1.6	2.1
9/2	0.5	0.5	0.6	0.7	0.9

Example CEWSIM Model Output

In order to give a more comprehensive view of the CEWSIM model outputs, and to further encourage feedback for later improvements, an example output report is provided below. If any omissions or confusing items are noted, please let us know so we can make corrections for the next version of the program.

CEWSIM Report File

TRAP :
Trap Type (1-4) : 1
Cum. Trap Catch From Tasseling to 1st Silk: 150

CROP :
Planting Date : Jun 10
Approximate Date of 1st Silk : Aug 19
Earworm 50% eggs laid on : Aug 27
Estimated Harvest Date : Sep 23
Crop Variety Name : Jubilee
Days in Season (Plant to Harv) : 105
Processed or Fresh Market (P or F) : P

HARVEST/ECONOMIC:
Growing Degree Days from 1st silk to harvest: 550
Expected Yield : 9.00 tons/acre
Corn Price : $70.00/ton
Cullage expression method (1-2) : 2
2. Direct with tolerance to : 2.4 cm from tip
Field Name and Description : Example Run

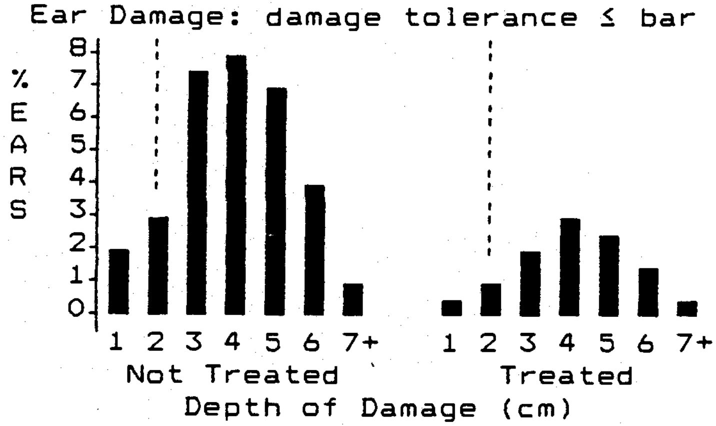
APPLICATION SCHEDULE:

Compound	Application Timing after 1st Silk	Maximum Efficacy	Residual Half-Life (1day = 16 GDD avg)
Permethrin	11 Days	95%	125 GDDs

RESULTS:
Earworm densities present at harvest (per 100 ears):

Stage:	1	2	3	4	5	6	prepupa
Not Treated:	0.0	1.9	4.6	5.5	9.7	11.8	1.2
Treated:	0.0	0.9	1.9	1.9	2.3	4.5	1.2

Damage distributions: % ears with feeding damage from tip of ear.
Ear Damage: damage tolerance ≤ bar



DAMAGE SUMMARY:

	Not Treated	Treated
Ears Damaged:	34.97%	12.83%
Avg Dam Index:	2.09	0.78
% Wt Culled:	4.07%	1.55%
Value of Damage:	25.65/acre	9.77/acre

Dam Index: 1=no damage, 2=silk, 3=1 cm, 4=2 cm, etc.

FINAL ECONOMIC REPORT:
Crop Value : $ 630.00/acre
Cost of Treatment : $ 11.00/acre
Benefit of Treatment:$ 15.87/acre
Benefit/Cost Ratio : 1.44
(If > 1.0 then benefits of treatment measures exceed costs)
Estimate of Error : 27% (regression model only)

Signatures

Project Leaders Redacted for Privacy

Redacted for Privacy

Redacted for Privacy

Redacted for Privacy

Department He Redacted for Privacy

Control of wild proso millet in 'Jubilee' sweet corn, 1989.

Dan Curtis / Ray D. William, Horticulture Department
Oregon State University

Initiated 1985
[ ] Continue for one more year

Commission Funding	$2,500.00
Company Funding	$2,000.00
Grower Contributions	0.5 Acres of corn

Objectives: To identify weed management strategies that suppress wild proso millet below thresholds that ensure harvestability.

Results: See table 1.

Narrative: Results confirm previous research conducted in the midwest and in Oregon regarding the need for nearly perfect control of wild proso millet during early stages of corn growth, followed by a selective postemergence treatment that eliminates survivors and seedlings germinating later in the season. Surpass herbicide continued to provide superior control, whereas Eradicane-Extra controlled 10-15% less millet. Dual preplant incorporated provided better control than preemergence. Combinations with Dual (preemergence) plus Tandem/Aatrex/crop oil enhanced control. Other treatments were unacceptable. No injury to the corn was observed with any treatment.

Three experimental postemergence herbicides were evaluated to determine efficacy in millet control. The DPX (DuPont) materials were effective in stunting millet from the time of application to the end of the season, but a preplant treatment was needed to reduce crop-weed competition until the corn reached the six-leaf stage which was necessary for crop safety with the materials. Beacon herbicide (Ciba-Geigy) provided no millet control.

Current decisions regarding herbicide reregistration (loss of registrations) suggest the following practices will aid millet suppression in 'Jubilee' sweet corn:

1. Rotate with crops where a postemergence grass herbicide is registered for use to reduce viable seed in the soil.

2. Decrease between-row spacing to increase competition against millet.

3. Plant late to ensure maximum activity of preplant incorporated herbicides.

4. Apply a preplant incorporated herbicide such as Surpass or Eradicane Extra (pending registration). Addition of Dual will enhance control slightly, but requires economic evaluation by grower.

5. Postemergence treatments consist of directed sprays aimed at bottom 12 inches of the stalk and must occur after the corn whorl has grown past this height. Currently, Gramoxone Super (ICI) and Evik (Ciba-Geigy) are registered for this purpose.

*Note: Eradicane-Extra contains a new safener for corn which may provide adequate safety for 'Jubilee' sweet corn west of the Cascades. Previously, the initial safener leached faster than the EPTC resulting in unprotected corn seed.

O R E G O N   S T A T E   U N I V E R S I T Y

WILD PROSO MILLET CONTROL IN SWEET CORN PRODUCTION 1989

Results: table 1

			wild proso millet		corn harvest		
			% control		ears/20ft	Quality	Tons/A
NO.	NAME	date:	6/15/89	8/11/89		9/12/89	
01	CHECK		0	0	12	2.1	1.65
02	PROWL A* AATREX	PRE PRE	44	41	22	2.8	4.56
03	PROWL A AATREX TANDEM CROP OIL	PRE POST POST POST	33	56	25	3.6	5.09
04	PROWL B AATREX TANDEM CROP OIL	PRE POST POST POST	35	83	36	4.0	7.99
05	ERADICAN AATREX	PPI PPI	79	24	26	3.5	4.36
06	ERADICAN AATREX DUAL	PPI PPI PRE	86	39	29	4.0	6.20
07	ERADICAN AATREX GRAMOXON	PPI PPI POSTD	73	43	27	3.5	4.27
08	ERADICAN AATREX TANDEM CROP OIL	PPI POST POST POST	83	79	34	3.8	7.31
09	ERAD-EX AATREX	PPI PPI	83	35	26	3.1	4.29

O R E G O N   S T A T E   U N I V E R S I T Y

WILD PROSO MILLET CONTROL IN SWEET CORN PRODUCTION 1989

Results(table 1 continued)

NO.	NAME	date:	wild proso millet % control 6/15/89	8/11/89	corn harvest ears/20ft	Quality 9/12/89	Tons/A
10	ERAD-EX	PPI	84	74	37	3.8	7.95
	AATREX	POST					
	TANDEM	POST					
	CROP OIL	POST					
11	ERAD-EX	PPI	88	74	29	3.6	5.59
	AATREX	PPI					
	GRAMOXON	POSTD					
12	ERAD-EX	PPI	86	63	32	3.9	6.37
	AATREX	PPI					
	DUAL	PRE					
13	ERAD-EX	PPI	86	93	36	4.3	8.36
	DUAL	PRE					
	AATREX	POST					
	TANDEM	POST					
	CROP OIL	POST					
14	DUAL	PRE	31	10	11	2.0	1.34
	AATREX	PRE					
15	DUAL	PRE	24	59	26	3.6	5.68
	AATREX	POST					
	TANDEM	POST					
	CROP OIL	POST					
16	DUAL	PPI	71	78	33	3.9	7.18
	AATREX	POST					
	TANDEM	POST					
	CROP OIL	POST					
17	EPTAM	PPI	89	35	25	3.9	5.00
18	AATREX	PRE	28	10	12	2.1	1.74
19	SURPASS	PPI	93	89	42	4.4	9.37
	AATREX	POST					
	TANDEM	POST					
	CROP OIL	POST					
20	LASSO	PRE	38	40	31	3.8	6.06
	AATREX	POST					
	TANDEM	POST					
	CROP OIL	POST					

O R E G O N   S T A T E   U N I V E R S I T Y

WILD PROSO MILLET CONTROL IN SWEET CORN PRODUCTION 1989

Results(table 1 continued)

NO.	NAME		wild proso millet % control date: 6/15/89	8/11/89	corn harvest ears/20ft	Quality 9/12/89	Tons/A
21	DPX9360 X-77	POST1 POST1	18	55	25	3.4	4.47
22	DPX79406 X-77	POST1 POST1	5	61	26	3.0	4.30
23	DPX79406 AATREX X-77	POST1 POST1 POST1	19	64	27	3.1	4.53
24	BEACON X-77	POST1 POST1	8	5	5	1.5	.58
	LSD(0.05) =		26	26	2	11	2.55
	STD DEV =		18	18	1	8	1.77
	C.V. =		34	35	20	29	34.17

* Two rates of Prowl were used, A and B.

% control = percent control, 0 = no control,
100 = complete control

\# ears/20ft = the aveage number of corn ears harvested in 20 feet within each treatment

Quality = an indication of average tip fill by treatment
1 = very poor tip fill, 5 = all ears filled

Tons/acre = average projected gross yield from each treatment

WILD PROSO MILLET CONTROL IN SWEET CORN PRODUCTION 1989

** SET 1 OF 1 ** GEN. APPLIC. TYPE	APPLIC. 1 PPI	APPLIC. 2 PRE	APPLIC. 3 POST	APPLIC. 4 POST 1	APPLIC. 5 POSTD
APPLICATION DATE	05/30/89	06/02/89	06/15/89	06/28/89	07/25/89
JULIAN DATE/YEAR	J150/89	J153/89	J166/89	J179/89	J206/89
START HR / END HR	15:00/16:30	09:00/10:20	14:45/16:00	02:15/03:15	04:00/04:30
APPLIC. METHOD	BRDCST	BRDCST	BRDCST	BRDCST	DSPRAY
AIR/SOIL TEMP (F)	73 / 74	79 / 74	64 / 70	71 / 74	0 / 0
% REL. HUMIDITY	0	62	50	47	0
WIND DIR. / VELOC	N / 03	-- / 00	SW / 05	-- / 0	/ 0
SKY / SOIL COND.	CLEAR/FN+RK	/FN+RK	CLDY /FN+RK	/	/
SOIL/LEAF MOIST.	DRY / -0-	DRY / -0-	WET / WET	DRY / DRY	DRY / DRY
INCORP. EQUIPMENT	ROTOTILLER	-0-	-0-	-0-	-
INCORP. DEPTH(in)	3	0	0	0	0
SPRAYER TYPE	UNI/COMPAIR	UNI/COMPAIR	UNI/COMPAIR	UNI/COMPAIR	UNI/CO2
SPRAYER GPA / PSI	22.68 / 30	22.68 / 30	22.68 / 30	22.68 / 30	30.25 / 30
MIX SIZE (Gallon)	0.125	0.125	0.125	0.125	0.125
NOZZLE TYPE /NUM.	8003/5 @18"	8003/5 @18"	8003/5 @18"	8003/5 @18"	8003/2 @18"
RAINFALL/IRRIG.in					
0-24 HR/1-3 DAYS	/	/	/	/	/
4-7 DAYS/2ND WEEK	/	/	/	/	/
3RD WEEK/4TH WEEK	/	/	/	/	/

	SPECIE CODE	SPECIES	APPLIC. 1 DEN./STG.	APPLIC. 2 DEN./STG.	APPLIC. 3 DEN./STG.	APPLIC. 4 DEN./STG.	APPLIC. 5 DEN./STG.
	*******	****** CROP ******	*********	*********	*********	*********	*********
		SWEET CORN	/Planted	5/31/89	/0-6LF	/	/
	*******	****** PEST ******	*********	*********	*********	*********	*********
1		WILD PROSO MILLET	/	/	/1-5LF	/	/
2			/	/	/	/	/
3			/	/	/	/	/
4			/	/	/	/	/
5			/	/	/	/	/
6			/	/	/	/	/
7			/	/	/	/	/
8			/	/	/	/	/
9			/	/	/	/	/

UNIFORM STANDARD TREATMENT UNIFORM TRT. RATE AND UNIT					

Signatures:

Project Leader Redacted for Privacy

Department Head Redacted for Privacy

PROGRESS REPORT TO THE OREGON PROCESSED VEGETABLE COMMISSION

1. **Title:** Dependable Stand Establishment for Super Sweet Corn

2. **Project Leaders:** Clinton C. Shock and Charles Burnett

   Cooperators: Dale Wilson and Krishna Mohan, University of Idaho
   Bob Trent, Crookham Company
   Lee Schweitzer, Asgrow
   Mark Hughes, Germains

3. **Project Status:** Continuing project 304 of Oregon State University, Agricultural Experiment Station

4. **Funding for 1989**: $4,500 from the Oregon Processed Vegetable Commission, initiated in 1987

5. **Objectives:**

   Evaluate the effects upon seedling emergence and die back of:

   A. combinations of fungicides and reputed plant growth regulating agents.

   B. interactions of seed sizes and seed densities.

   C. seed coatings and enhancements.

   D. early season nitrogen applications.

6. **Progress:**

   A. Effects of fungicides and insecticides: This trial was coordinated with personnel from the Southwest Idaho Research and Extension Center for a multi-location test. Thirty eight fungicide combinations were tested along with an untreated check. Individual fungicides included Captan, Thiram, Benlate, Imazalil, Apron (Metalaxyl), Nusan (TCMTB), PCNB, Epic (Iprodione), Mertect (Thiabendazol), and Vitavax. Magnum and Loresban insecticides were also added to some mixtures.

   All fungicides and insecticides were added to the same lot of Abbot and Cobb Summer Sweet Brand 8701 W seed by the Gustafon Seed Technology Laboratory. Seed was planted on May 2 at the Malheur Experiment Station. Live and dead counts were made six times over a four week period between May 15 and June 2. The effects of individual chemicals and chemical mixtures were interpreted.

Plant establishment ranged from 59 to 83 percent, a fairly broad range for a seed lot with a low index of seed borne disease. Fungicide mixtures produced very highly significant improvements in plant stand compared to the check. By component analysis, only Thiram, Benlate, and Apron and their combinations produced emergence and stand improvements at Ontario in 1989. Neither the fungicides Captan, Metalaxyl, Vitavax, Nusam, PCNB, Epic and Mertect nor the insecticides Magnum and Loresban had any significant effect. Imazalil decreased plant emergence and final plant stands.

The best fungicide mixtures included Thiram, Benlate and Apron. The activity of these three fungicides was additive, except that the action of Thiram plus Apron added little to the individual effects.

B. Effects of seed size and seed density interactions: Seed sizes and densities were sorted by industry. The resulting variation in size and weight was judged to be too small to justify field trials in 1989. No progress was made on this objective.

C. Effects of seed coatings and enhancements: Three seed companies prepared a total of eight different seed coats using the same lot of super sweet corn seed, Abbot and Cobb Summer Sweet Brand 8701 W. Seed had been previously treated with Captam + Thiram + Benlate.

Seed were planted and counted on the same dates and in the same ways as the fungicide trial above. Final stand establishment ranged from 78 to 84 percent, without significant seed coat treatment effects.

D. Effects of early season nitrogen: Extra nitrogen was sidedressed or waterrun at 35 lbs N/acre in the form of ammonium nitrate. Sidedressed nitrogen improved final plant stands from 80 to 84 percent, but the difference was not statistically significant at the 95 percent confidence level.

7. **Summary:**

A. Effective fungicide treatments were Thiram, Benlate and Apron alone or in combination. Effective rates of seed treatment in 1989 were:

Thiram	4 fl oz per cwt
Benlate 50 WP	4 oz per cwt
Apron FL (N)	0.75 fl oz per cwt

Although Captan has been used extensively as a corn seed treatment, it had no beneficial effect when added to or omitted from a mixture of these other fungicides.

Imazalil has been touted as an effective seed treatment for improving emergence and reducing seedling blight of super sweet corn. Imazalil at 0.5

fl oz per cwt had no significant effect and Imazalil at 1.0 fl oz per cwt reduced both seed emergence and final plant stands.

B. Seed coats can be of practical benefit in planting uniform stands of super sweet corn given the irregular shapes of the shrunken seed. Seed coats from three companies did not interfere with seed emergence or stand estalishment. The seed coats appear to be practical alternatives to planting raw seed.

C. Extra sidedressed nitrogen (35 lbs/acre) may have helped super sweet corn seedling emergence and survival in 1989, but the stand improvement did not reach the 95% confidence level. Unless negative effects are proven, it appears wise to sidedress part of the super sweet corn seed nitrogen requirement at planting.

Research Report to Oregon Processed Vegetable Commission (1989-90)

Title of Project: Effects of irrigation (water stress), timing of N application, boron rates and transplant characteristics on growth and development, maturity and yield of cauliflower.

Project Leaders: H. J. Mack and J. R. Stang, Horticulture

Project Status: Request will be made for continuation.

Project Funding: By Commission (89-90) $9,930.

Objectives: (1) To evaluate the effects of varying the amount of water stress (irrigation) during early stages of growth of cauliflower plants, and/or before and during the time of curd initiation, or subsequent growth, maturity, and yield.

(2) To measure the effects of varying the time of application of four nitrogen fertilizer sources (solution 32, urea, ammonium nitrate, and calcium nitrate) on growth, maturity, nutrient composition, and yield of cauliflower grown with adequate and uniform irrigation applications.

(3) To determine the effects of varying the nitrogen rates on growth and yield of cauliflower.

(4) To study the effects of rates of boron to the soil on growth and yield of cauliflower grown with differential total amounts of water (line-source irrigation).

Report of Progress:

The following results were obtained from various experiments conducted at the Oregon State University Vegetable Research Farm, Corvallis. Total yields and distribution of yields at the various harvest dates are the major emphasis here but additional analyses are yet to be completed on effects of treatments on head quality (hollowness, boron deficiency, etc.) as well as analysis of leaf samples for nutrient concentrations.

Nitrogen sources and timing (Table 1): Total yield of cauliflower from calcium nitrate was slightly higher than from the other three nitrogen sources--solution 32, urea, and ammonium nitrate (timings of 5 and 7 weeks after transplanting averaged). There was no difference in yield from timing of application at five or seven weeks after transplanting (4 sources averaged). Percentage of total yield in the first two harvests was lower from the ammonium nitrate source than others and N application seven weeks after transplanting delayed maturity slightly when compared to application five weeks after transplanting. Transplants were from a commercial grower. An initial rate of 50 lbs. N/A was banded at transplanting. The various sources of N were applied at one application of 150 lbs. N/A.

Timing of water stress in relation to curd initiation (Table 2): Data in Table 2 indicate that water stress before and during curd initiation (Treat. 2) was most detrimental to total yield of cauliflower as well as causing the greatest delay in maturity. Water stress was not as great as desired in the treatment designated to receive stress before curd initiation (Treat. 1) because of rainfall patterns; however, yield was similar to plants that had no early water stress (?), but maturity was delayed compared to plants with no water stress (Treat. 4). Stress after curd initiation (Treat. 3) reduced yield slightly compared to the no water-stress treatment and also caused some delay in maturity. All plots were irrigated uniformly on August 17 and at 7-10 day intervals thereafter when needed. Curd initiation occurred during July 26-August 3 for this trial that was direct-seeded on June 8.

Soil tillage treatments and nitrogen rates (Table 3): Four nitrogen rates were applied on plots which had previously received different soil tillage treatments--wet plow, rototill, conventional and subsoil/conventional. All plots were irrigated uniformly and received about 14 inches of water from transplanting (July 19) through harvest. Highest yields were at the 200 and 300 lbs. N/A rates with no difference between these two rates. When all N rates are averaged, there were no large differences in tillage treatments, with the wet plow tillage producing a slightly higher yield than others. Average yield (T/A) for the treatments were: wet plow-15.4, rototill-14.1, conventional-14.2, and subsoil/conventional-14.8. Transplants were from a commercial grower.

Differential irrigation and nitrogen rates(Table 4): Five nitrogen rates were applied in conjunction with differential irrigation levels that were established by a line-source system on transplanted cauliflower (transplants from a commercial grower). Average yields (T/A) for the three levels of applied water were (all N rates combined): wet-10.4, intermediate-9.8, and dry-4.2. In this experiment there was no increase in yield when N rates were 150 lbs. N/A and higher. Average total yields (T/A) for the five N rates were (the wet and intermediate water levels combined): 50 lbs. N-7.7 T/A, 100 N-9.6, 150 N-11.4, 200 N-11.4 and 250 N-10.5.

Irrigation of water-stressed and non-water-stressed transplants (Table 5): Transplants were grown at the OSU VRF under two different irrigation levels, stressed and non-stressed, before transplanting to four irrigation treatments. The transplant bed was direct-seeded on June 9 and the plants under water stress and the "wet" plants received 2.5 inches of water (irrigation plus rainfall). Then only the "wet" plants received an additional 1.2 inches of water during the 14 days before transplanting. Average total yields were increased from 8.6 T/A from application of 8.2 inches of water after transplanting to harvest to 18.1 T/A from 20.1 inches of applied water. When yields from the four irrigation levels are averaged, transplants grown under water stress produced 13.1 T/A while transplants grown without stress (wet) produced 13.8 T/A. Yield at first harvest averaged 23% of the total for water-stress transplants compared to 33% for "wet" transplants. Jack Stang will be making an additional report on effects of transplant characteristics.

<u>Differential irrigation and boron rates (Table 6)</u>: Preplant soil application of boron was made on cauliflower that was direct-seeded on June 8. Differential irrigation levels were established by a line-source sprinkler in which all plants were irrigated at 7-10 day intervals. Total applied water (including irrigation for establishment and rainfall) varied from 4.8 to 17.5 inches from seeding through harvest. Boron rates were 0, 1, 3, 6 and 9 kg/ha (0-8 lbs. B/A--multiply kg/ha by .9 to convert to lbs./A), and resulted in only small differences in yield (all irrigation levels averaged). Total yields varied from 4.5 to 16.9 T/A from the lowest to highest amounts of applied water (all B rates averaged). Data regarding amount of hollow heads and internal blackening of tissue, plant and soil analyses are yet to be completed.

<u>Summary</u>: In the above experiments there was usually no increase in total yield when nitrogen rates were 150-200 lbs./A or higher. There were no differences in yield from four N sources although yield from calcium nitrate was slightly higher. Additionally there was no difference in yield from application at five or seven weeks after transplanting. There was no difference in yield from soil applications of 1-9 kg boron/ha. Water stress before and during curd initiation resulted in lowest yields and also had the greatest effect on delay of maturity compared to plants with no water stress. Yields were increased as amounts of applied water increased from 4 to 20 inches. However, in two experiments (Tables 5 and 6), reducing the water application by 27% from the highest amount resulted in only 17% reduction in yield. Water stress imposed on transplants during the last 14 days before transplanting resulted in no difference in yield compared to transplants grown without water stress ("wet"), although maturity was delayed in plants that were water-stressed. (Part of the research reported here are results from thesis studies by Tony Bratsch and Bill Grealish).

<u>Signatures</u>:

Project Leaders Redacted for Privacy

Redacted for Privacy

Department Head Redacted for Privacy

Table 1. Effects of nitrogen sources and timing of application on cauliflower, 1989.

Treatment: N Source	Application time-Weeks After Transpl.	Total Yield T/A	% of Yield at Harvest Date 10/6	10/12	10/24	10/31	11/14
1) Solution 32	4	13.7	13	26	39	11	11
2) Solution 32	5	13.4	43	17	15	16	9
3) Solution 32	6	15.9	42	15	24	13	6
4) Solution 32	7	13.9	23	17	30	14	16
5) Urea	5	14.4	33	14	28	12	13
6) Urea	6	13.1	18	11	33	14	24
7) Urea	7	12.4	26	21	25	11	17
8) Ammon. Nitrate	5	12.9	18	12	31	14	26
9) Ammon. Nitrate	7	14.0	24	15	30	14	17
10) Calcium Nitrate	5	14.0	40	15	30	8	7
11) Calcium Nitrate	7	14.3	36	9	26	17	12

All N sources at one rate--150 lbs. N/A; Transplanted July 19; 4 replications; yield averages (4 sources combined); 5 weeks-13.7, 7 weeks-13.6; yield averages (5 and 7 weeks combined); solution 32-13.6, urea-13.4, ammonium nitrate-13.4, calcium nitrate-14.1.

Table 2. Effects of timing of water stress on yield of cauliflower, 1989.

Treatment (Water Stress)	Total Yield T/A	% of Yield at Harvest Date 9/21	9/30	10/10	10/17
1) Stress before curd initiation	13.6	21	32	36	11
2) Stress before and during curd initiation	8.0	8	38	32	22
3) Stress after curd initiation	12.1	41	37	16	6
4) No water stress	13.0	62	34	4	0

Direct seeded June 8; curd initiation July 26-August 3. All plots irrigated to establish planting and then on August 17 and later; interim irrigations; Treat 1-August 8; Treat 2-none; Treat 3-July 24; Treat 4-July 21, 28, August 8.

Table 3. Effects of soil tillage treatments and nitrogen rates on cauliflower, 1989 (Tony Bratsch).

Tillage treatment	N Rate (lb/A)	Total Yield T/A	% Yield at Harvest Date 1	2	3	4
Wet Plow	50	12.7	32	49	16	3
	100	14.3	33	50	14	3
	200	15.9	31	40	24	5
	300	15.6	26	43	23	8
Rototill	50	10.7	44	40	13	3
	100	15.0	26	41	28	5
	200	15.4	22	46	24	8
	300	15.2	20	47	25	8
Conventional tillage	50	11.0	29	44	24	3
	100	14.2	28	46	25	1
	200	15.8	23	50	22	5
	300	15.8	29	47	19	5
Subsoil/ conventional tillage	50	11.8	25	55	17	3
	100	16.2	32	48	17	3
	200	15.7	33	42	17	8
	300	15.6	28	44	23	5

Transplanted July 10-11; tillage treatments for curent year and for two previous years (sweet corn and bush beans); N rate yield means: 50-11.6; 100-14.9; 200-15.7; 300-15.6 T/A.

Table 4. Effects of differential amounts of irrigation (line source) and nitrogen rates on cauliflower, 1989 (Tony Bratsch).

N Rate (lbs/A)	Irrigation Level	Total Yield T/A	% of Yield at Harvests 1	2	3	4
N 50	Wet	7.5	52	9	29	10
	Intermediate	7.9	32	19	43	6
	Dry	4.0	47	8	38	7
N 100	Wet	10.2	33	15	34	18
	Intermediate	9.0	44	15	35	6
	Dry	2.5	28	23	37	12
N 150	Wet	12.6	37	9	36	18
	Intermediate	10.2	55	11	26	8
	Dry	5.3	31	10	46	13
N 200	Wet	11.3	28	14	34	24
	Intermediate	11.5	46	9	28	17
	Dry	4.5	60	2	29	9
N 250	Wet	10.6	26	25	37	12
	Intermediate	10.4	42	14	35	9
	Dry	4.8	55	14	17	14

Transplanted July 19; Total water applied: wet-18.6"; intermediate-12.8"; dry-8.0".

Table 5. Effects of irrigation timing and amounts of water application (special irrigation) and transplant growing condition on cauliflower, 1989 (Tony Bratsch).

Irrigation Treatment	Transplant Growing Conditions	Total Yield T/A	% of Yield at Harvest Date 1	2	3	4
M 1	Water stress	8.9	33	32	22	13
	Wet	8.4	48	29	12	11
M 2	Water stress	11.0	20	37	21	22
	Wet	12.8	34	30	26	10
M 3	Water stress	14.3	17	40	37	6
	Wet	15.8	27	39	18	16
M 4	Water stress	18.1	22	45	23	10
	Wet	18.1	24	51	19	6

Transplanted July 13; No. irrigations and total amount of water applied (inches) M1:1, 8.2"; M2:2, 11.6"; M3:4, 14.6"; M4:7, 20.1"; All treatments received 4.8 inches of irrigation earlier (included in above amounts) before differential irrigation was started at about two weeks after transplanting; yield means (T/A): M1-8.6, M2-11.9, M3-15.0, M4-18.1).

Table 6. Effects of differential amounts of irrigation (line source) and boron rates on cauliflower, 1989 (Bill Grealish).

Water applied (in.)	Total Yield - T/A B0	B1	B3	B6	B9	Avg.
17.5	17.2	16.0	17.3	17.1	17.2	16.9
16.4	16.0	14.0	15.9	15.8	15.1	15.4
14.3	15.5	14.2	14.5	14.5	15.1	14.8
12.7	14.4	12.1	15.6	15.2	12.7	14.0
12.3	13.0	12.0	11.1	12.6	12.0	12.1
8.0	10.1	8.1	7.5	10.2	8.2	8.8
4.8	4.9	6.0	3.3	3.9	4.6	4.5
B average	13.0	11.8	12.2	12.8	12.1	

Water Applied (in.)	Total Yield T/A	% of Yield at Harvest dates 9/22	10/3	10/10	10/19
17.5	16.9	50	29	17	4
16.4	15.4	55	25	18	2
14.3	14.8	55	11	32	2
12.7	14.0	56	13	30	1
12.3	12.1	58	18	22	2
8.0	8.8	56	14	22	8
4.8	4.5	20	23	6	20

Direct seeded June 8; Water amounts include 1.5 inches of uniform irrigation for establishment plus 2.0 inches of rain from planting to last harvest.

Research Report to Oregon Processed Vegetable Commission (1989-90)

Title of Project: Effects of irrigation (water stress), timing of N application, boron rates and transplant characteristics on growth and development, maturity and yield of cauliflower.

Effects of transplant bed moisture regime, transplant size and planting date

Project Leaders: H.J. Mack and J.R. Stang, Horticulture

Project Status: Request will be made for continuation

Project Funding: By Commission (89-90) $9,930

Objectives:

(1) To evaluate the effects of varying the amount of water stress (irrigation) during early stages of growth of cauliflower plants, and/or before and during the time of curd initiation, or subsequent growth, maturity, and yield.

(2) To measure the effects of varying the time of application of four nitrogen fertilizer sources (solution 32, urea, ammonium nitrate, and calcium nitrate) on growth, maturity, nutrient composition, and yield of cauliflower grown with adequate and uniform irrigation applications.

(3) To determine the effects of varying the nitrogen rates on growth and yield of cauliflower.

(4) To study the effects of rates of boron to the soil on growth and yield of cauliflower grown with differential total amounts of water (line-source irrigation).

Report of Progress:

Transplants were grown at the OSU VRF under two different irrigation levels: stressed and non-stressed. Plants were harvested from these beds and transplanted at 33 days from seeding and at 41 days. At each transplanting date, the plants were divided into four size groupings: large, mid-sized, small, and a mixture of plant sizes.

For a given transplant date, transplant size and transplant bed moisture regime affected the time of 50% head maturity (Table 1). Whether they were stressed or unstressed, the larger transplants matured earlier. Furthermore, the larger and middle-sized transplant grown under the high transplant bed moisture regime matured earlier than the larger and middle-sized plants grown under the low moisture regime. The transplant size grouping and the transplant bed moisture regime did not appear to affect the spread in maturity.

The effect of age of the transplants (transplant date) on head maturity depended on the size and transplant bed moisture regime. The later planting of large, unstressed transplants (grown under the high moisture regime) reached 50% maturity at the same time as the early planting of large, unstressed transplants. However, the later plantings of smaller and/or stressed transplants matured later.

Transplant size and transplant bed moisture did not appear to affect average head size of the earlier planting. However, for the later planting, the larger the transplants the lower the average head size.

Once again this year, the differences among treatments in time of head maturity could be predicted by the effects of these treatments on the timing of curd initiation (Table 2).

Signatures:

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Project Leaders __________

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Department Head __________

Table 1. Effects of transplant bed moisture level, transplant age and transplant size on the maturity and head weight of 'Snowball Y Improved' cauliflower. 1989.

Transplant Date	Transplant bed moisture	Transplant Size	Date of 50% head maturity	Spread (Days) 10-90% head maturity	kg/ head
12 July	High	Large	22 Sep	20	1.44
		Mid	28 Sep	22	1.41
(33 days)		Small	10 Oct	27	1.49
		Mix	25 Sep	25	1.33
	Low	Large	26 Sep	26	1.35
		Mid	3 Oct	23	1.39
		Small	9 Oct	24	1.45
		Mix	27 Sep	24	1.38
20 July	High	Large	22 Sep	25	1.10
		Mid	2 Oct	27	1.22
(41 days)		Small	20 Oct	28	1.34
		Mix	3 Oct	31	1.24
	Low	Large	1 Oct	23	1.27
		Mid	11 Oct	30	1.42
		Small	21 Oct	24	1.43
		Mix	10 Oct	29	1.38

Table 2. Effects of transplant bed moisture level, transplant age and transplant size on the timing of curd initiation of 'Snowball Y Improved' cauliflower. 1989

Transplant Date	Transplant bed moisture	Transplant Size	% Plants with Curds 26 Jul	3 Aug	10 Aug	18 Aug
12 July	High	Large	0	67	100	---
(33 days)		Mid	0	25	58	---
		Small	0	0	17	---
	Low	Large	0	55	100	---
		Mid	0	17	92	---
		Small	0	0	33	---
20 July	High	Large	--	42	91	100
(41 days)		Mid	--	8	25	100
		Small	--	0	8	45
	Low	Large	--	17	67	100
		Mid	--	0	20	100
		Small	--	0	0	18

WEED CONTROL IN CARROTS

Garvin Crabtree
Department of Horticulture
Oregon State University

STATUS: This project was initiated in 1988 with a plan for the field research to be completed in three years. At the present time, we expect to follow the planned schedule.

FUNDING by the Commission has been $2000 for each of the 1988 and 1989 growing seasons. These funds have been used mostly for personnel costs (technical support and labor), farm service activities, and other services and supplies.

OBJECTIVES of this study are, in general, to look for alternatives to the use of linuron (Lorox) in anticipation of the possible loss of the registration for its use on carrots and to seek more effective weed control programs for this crop. Specific objectives as listed initially remain as follows:

1) Identify herbicides with characteristics of good crop tolerance in carrots and effective control of weeds, especially certain broadleaf species which continue to be problem weeds in carrots grown in Oregon.

2) Develop a data base to be used in the pursuance of registrations for alternative herbicides

PROGRESS: Herbicide treatments showing promise in 1988 and combinations of herbicides suggested by that test were included in the 1989 field study. This work was carried out at the Oregon State University Horticulture Research Farm on a silty clay loam soil. Carrots, cv. Royal Chantenay, were seeded on May 10, 1989 immediately following application and soil incorporation of preplant (PPI) herbicide treatments. The schedule for other herbicide applications are as follows:

Preemergence (PRE) - May 11, 1989
Early postemergence (POST-1) - June 7, 1989, when carrots were in the 3-leaf stage
Mid postemergence (POST-2) - June 20, 1989, when carrots were in the 5-leaf stage
Late postemergence (POST-3) - July 6, 1989

Effectiveness of weed control was evaluated on July 13, 1989 and on October 10, 1989 the plots were harvested (10 ft. of row from each plot). The list of treatments and results are shown in the table.

SUMMARY: Much of the interference with carrot growth and the consequent low yields in some treatments can be attributed to the lack of control of a heavy weed infestation, rather than to direct injury to the crop by herbicides. Failure to maintain a clean weeded check also

shows the low tolerance for weeds by this crop.

Treatments providing the best selective weed control with the weed species present in this study were combinations of trifluralin (Treflan)/ clomazone (Command), clomazone/metribuzin (Sencore), and clomazone/etiozin (Tycor). The other herbicide showing promise in this trial was pendimethalin (Prowl).

Further efforts to expand the options of growers for the use of herbicides on this crop should include 1) the evaluation of environmental interactions of the most promising treatments in this study, and 2) the pursuit of registrations for the use of one or more of these new herbicides (Command. Prowl. Tycor).

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PROJECT LEADER

Redacted for Privacy

DEPARTMENT HEAD

WEED CONTROL IN CARROTS - 1989

Treatment				Weed Control (%)				Yield	
No.	Herbicide	Rate (lbs ai/A)	Timing	Nightshade	Pigweed	Groundsel	Lambsquarters	No. of Roots	Tons/A
1	clomazone	0.25	PPI	79	0	99	48	112	14.5
2	clomazone	0.50	PPI	95	15	100	90	115	25.7
3	clomazone	1.00	PPI	97	70	100	100	84	21.5
4	trifluralin	0.75	PPI	40	90	13	88	122	9.3
5	trifluralin/ clomazone	0.75 0.50	PPI PPI	80	100	100	100	112	32.4
6	pendimethalin	1.00	PRE	75	95	0	100	104	24.6
7	pendimethalin	2.00	PRE	88	100	13	100	113	29.9
8	pendimethalin/ clomazone	1.00 0.50	PRE PPI	95	99	99	100	123	36.6
9	metribuzin	0.25	POST-1	0	100	96	100	102	8.4
10	metribuzin	0.25	POST-2	22	51	59	69	112	6.7
11	metribuzin	0.50	POST-2	0	70	81	80	104	3.7
12	metribuzin/ metribuzin	0.25 0.25	POST-2 POST-3	20	93	80	83	140	7.0
13	metribuzin/ clomazone	0.25 0.50	POST-2 PPI	90	66	100	100	108	31.7
14	etizon (Tycor)	1.00	PRE	15	100	56	100	118	16.2
15	etizon	2.00	PRE	50	100	99	100	122	24.2
16	etizon/ clomazone	1.00 0.50	PRE PPI	100	100	100	100	83	34.6
17	linuron/ linuron	0.75 0.75	POST-1 POST-2	71	100	25	98	138	18.8
18	Weeded check			75	75	75	75	116	9.8
19	Unweeded check			0	0	0	0	107	3.7
	LSD (0.05)			29	30	22	27	33	8.7

Weed Control Alternatives in Drilled Peas

Dan Curtis / Ray D. William, Horticulture Department
Robert L. Rackham, Benton County Extension
Oregon State University

Initiated 1989
[ ] Continue with Federal Grant

Funding: CSRS-USDA Special Grant

Results: See table 1

Narrative: Peas tolerated most herbicides evaluated in three field trials conducted with grower-cooperaters in 1989. The exception was trifluralin (Treflan) which reduced early growth and vigor by 10 to 40%. By harvest, the remaining plants in trifluralin treatments compensated and yields were similar to other treatments. Clomazone (Command) caused white leaves on young seedlings, especially following rainfall or irrigation. Symptoms disappeared within several days. Growth and yields were not suppressed, although observations from previous trials at higher rates suggest that soil persistance can be a serious threat to subsequant crops including fall-planted wheat.

Lambsquarter infested only one trial where trifluralin provided optimum control. Other acceptable treatments included clomazone at 0.25 to 0.33 lbs. ai/acre. Bentazon (Basagran) applied postemergence failed to control lambsquarter, probably due to excessive size.

Year-round weed management strategies were demonstrated in at least two of the trial sites where weed interference failed to depress yields in the non-treated controls. Both growers had practiced some sort of postharvest weed control that prevents increases in the seed bank.

Weed Control Alternatives in Drilled Peas

Results: table 1

			Peas % injury trial 1	Peas % injury trial 2	Weed Control lambsquarter trial 3	Peas ave. yield Tons/Acre trial 1	Peas ave. yield Tons/Acre trial 2	Peas ave. yield Tons/Acre trial 3
Check			6	0	0	4.79	2.98	1.85
Command	PPI	0.25	10	5	73	4.76	2.87	2.49
Command	PPI	0.33	1	3	74	5.05	2.85	2.55
Command	PPI	0.50	9	3	83	4.65	2.71	2.98
Command Sencor	PPI PRE	0.50 0.18	9	0	91	4.98	2.34	2.57
Command Basagran	PPI POST	0.50 0.50	4	2	75	4.80	2.59	2.51
Sencor Basagran	PRE POST	0.18 0.50	6	1	40	4.00	2.62	2.47
Treflan Basagran	PPI POST	0.50 0.50	11	46	86	4.69	2.44	2.79
Ramrod Basagran	PRE POST	5.00 0.50	4	1	70	4.32	2.60	2.30
Ramrod Treflan	PRE PPI	5.00 0.50	8	48	96	3.68	2.54	2.76
Dual Treflan	PRE PPI	2.00 0.50	26	48	98	3.85	2.58	2.93
Dual Basagran	PRE POST	2.00 0.50	13	0	70	3.48	2.80	2.57
	LSD (0.05)		= 19	1.0	17	1.54	.43	.74
	STD. DEV.		= 13	6.8	12	1.07	.29	.51
	CV.		=152	43.1	17	24.17	11.08	19.90

Signatures:

Project Leader Redacted for Privacy

Department Head Redacted for Privacy

JUL 19 1991

DEPARTMENT OF
FOOD SCIENCE AND TECHNOLOGY

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July 15, 1991

John McCulley, Administrator
Oregon Processed Vegetable Commission
1270 Chemeketa Street NE
Salem, OR 97301

Dear John:

Enclosed please find the 1989-90 reports for processed beans and corn. I apologize for the extreme lateness of these reports--they are a year overdue! The main cause has been change in personnel (Varseveld to Barrett), incompletion of 1989 evaluations by Varseveld, and re-evaluating the data analysis and whole evaluation scheme.

I had a very good planning session with Frank McKay, Mike Shelby and Jim Baggett last month. We will be doing a major revamping of the bean and corn evaluation research for this 1991 season. A lot of the decisions made in that meeting resulted from an intensive examination of the 1989/90 data. I hope to have the 1990/91 reports to you by the end of August 1991! Hope your summer is going well.

Sincerely,

Redacted for Privacy

Diane M. Barrett
Assistant Professor

cc: Dr. Jim Baggett
Brian Yorgey

DMB/rm

Enclosures

Supplemental Report
to Oregon Processed Vegetable Commission
1989/90 Project period (Submitted July 1991)

TITLE: Green Bean Breeding and Evaluation

PROJECT LEADERS: J.R. Baggett, Horticulture
G.W. Varseveld, Food Science & Technology
D.M. Barrett, Food Science & Technology

PROJECT STATUS: Continuing, indefinite

PROJECT FUNDING: Breeding $39,000.
Processing $11,450.

Funds allocated to the processing portion of this project were used for labor; purchase of supplies for processing, laboratory and sensory evaluation; secretarial and accounting and for travel.

I. Objectives:

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

II. Processing Quality Evaluation:

Single harvest lines were harvested once and both canned (3 whole, 4 cut, 5 cut, 6 cut) and frozen (4+5 cut). Multi-harvest lines were harvested three to five times. Plantings I and V were canned (3,4,5, and 6 whole and 3+4, 5 and 6 cut) and Planting III was frozen (1+2, 3+4, and 5+6 whole and 1+2, 3+4 and 5+6 cut). Maturity was measured in all lines as the % of 1 to 4 sieve pods by weight in the size-graded field sample. Percent seed and fiber analyses were carried out on 5 or 6 sieve size beans of all samples.

Sensory analysis of the single harvest lines consisted of ratings by members of the industry during a cutting in February 1990. The industry evaluated the entire set of single and multi-harvest samples during one session. Multi-harvest lines were evaluated for sensory quality by both a trained OSU panel (August 1990) and an untrained industry panel (industry cutting, February 1990). The quality factors rated by the panels included the following: appearance, color, texture, flavor, overall liking and fleshing. Beans were rated on a nine point hedonic scale, with zero being dislike extremely and nine being like extremely. Sample preparation for both OSU and industry panels consisted of serving the canned samples at room temperature while the frozen samples were blanched prior to serving.

III. Single Harvest Bean Lines

Twenty new round pod lines from Planting II were harvested and processed into both canned and frozen products. In addition, four standards or check varieties (including 2 flat Italian pod selections) were harvested once and processed for comparison. The lines were the following:

Numbered lines			Standards
5408	5394	5073	Hystyle
5412	5405	5411	91G
5403	5386	5090B	Roma II
5417	5420	5404	Roma 350
5402	5408	5421	
5456	5163	5433	
5437	5416		

A. Canned Beans

The results for the industry panel evaluation of the canned pack appear in Table 1 and Figure 5. Overall quality scores ranged from 4.2 to 6.5 with the standard 91G rating 5.4. Most lines in fact rated higher than 91 G in overall quality, with 5402 and 5403 scoring significantly higher. The industry panel also scored these two lines higher than 91G in terms of appearance, color, texture and flavor. Line 5433 scored high in appearance and overall quality. Lines 5417 and Hystyle both scored poorly in appearance and overall quality. Hystyle was rated down for color and flavor, while 5417 was judged poorly for texture. Overall quality of flat Italian line Roma II was judged to be slightly better than Roma 350, but differences were not significant.

B. Frozen Beans

Table 2 and Figure 6 include results of the industry panel evaluation of frozen green beans. Overall quality scores ranged from 4.9 to 6.2, a narrower range than that seen in canned beans. The standard, 91G, received a score of 5.4 for overall quality, while 5402 and 5403 were rated 5.8 and 6.2, respectively. These two lines were rated higher in appearance, color, texture and flavor than 91G, which was also the case in the canned samples. Line 5433 received very low scores for appearance, color, flavor and overall quality. It is surprising that this line, which was scored high in the canned sample, did so poorly in the frozen product. The evaluation may have been affected by the fact that the sample contained 92% 1 to 4 sieves.

IV. Multi-Harvest Bean Lines

Five advanced bean lines and six industry standards were harvested three to five times, with Plantings I and V canned and Planting III frozen. Processed quality over the range of planting dates and crop maturities was assessed by the OSU panel, the industry panel and by analysis of seed and fiber in the iarger sieved pods. The following were included in the multi-harvest evaluation study:

Numbered lines			Standards
5411	5256	5163	Hystyle
5417	5402		Blue Lake Pole
			Primo
			Roma II
			Roma 350
			91G

Sensory quality results for canned beans from Plantings I (July harvest) and V (August harvest), as evaluated by both the industry and OSU panel, are presented in Table 3. Results for frozen beans from Planting III are presented in Table 4. In order to simplify the discussion of results, the information in Tables 3 and 4 has been summarized into Tables 5 and 6. Table 5 lists only the highest and lowest scoring lines, and the quality attributes for which these bean lines scored either well or poorly. Table 6 summarizes this information even further, and lists those bean lines which scored either high or low in more than two quality attributes.

The same sensory information listed in Tables 3 and 4 (industry panels only) is displayed graphically in Figures 1 through 4. Because of the need for brevity, only five of the most interesting graphs of sensory quality attributes are displayed for canned and frozen round and flat Italian bean types. Beans were canned from both Planting I and V, and in order to represent this, a space has been left between harvests 1-3 (Planting I) and 4-6 (Planting V). The industry standard, 91G, was plotted in heavy type to emphasize its scores, but it is actually incorrect to compare this standard with the Italian type beans. In these graphs, 91G should be ignored.

Analytical results appear in Tables 7,8 and 9. Percent seeds and fiber are reported for all three plantings. These analyses were carried out on sieve 5 or 6 canned and frozen beans in August, 1990.

A. General Comments

1. OSU panel scores were, in general, higher than those of the industry panel for canned beans and lower than the industry panel for frozen.
2. OSU and industry panels did not agree on highest rated samples in most cases. As shown in Table 6, the only time when both panels concurred on the highest rated line was in the case of frozen samples of 5402.

C. <u>Frozen Beans</u>

The industry rated 5402, 5256 and Roma II as the top-ranking frozen beans (Table 4). All three were rated consistently high in all quality attributes, with values being slightly higher overall for the round than the flat bean types. The lowest scoring lines in both canned and frozen products, as rated by the industry, were 5417 and Hystyle (Table 6). Figure 3 illustrates that 5402 was rated much higher than other lines at all maturities. Variety 91G was rated very poorly for appearance, but scored fairly well in all other attributes. Hystyle was obviously rated poorly in many attributes, including color, flavor and overall quality (Figure 3). The patterns shown with Italian beans (Figure 4) are not that clear, but it appears that Roma 350 was rated much higher at late harvest than early or mid. Primo, on the other hand, declined in quality with time (Figure 4).

The OSU panel rated 91G, 5402 and Roma 350 as the best frozen beans (Table 5), however quality attributes were not consistently good in these lines. Variety 91G scored well on texture and flavor in the 5 sieve cut beans, and in appearance, color, texture and fleshing in 3 whole beans. Line 5402 was rated high in terms of appearance, color and flavor in the 5 sieve cut and high in color, texture, flavor and fleshing in the 3 whole sieve bean. Roma 350 rated high in color, texture and flavor, while Primo was also desirable for appearance and fleshing.

V. Conclusions

Results from the industry panel indicate that single harvest bean lines 5402, 5403 and 5433 received the highest sensory scores in the canned product. Sensory scores for frozen 5433 beans were very low, however. In the frozen product, lines 5402 and 5403 were top-rated, followed by 5405, 5412 and 5437.

Multi-harvest sensory results differed greatly between industry and OSU panels and future evaluations should address these differences. In general, 5402 and Roma II were the highest rated beans by the industry panel, in both canned and frozen products. The OSU panel, on the other hand, rated 5163, 5417 and Roma II highest in the canned product and 91G, 5402 and Roma 350 highest in the frozen product. Percent seed was lowest in Hystyle and Roma 350, and highest in 5402 in both plantings. Fiber content was highest in 5417 and lowest in 5411 from both plantings.

Table 1. 1989 Canned Green Beans - Industry Panel, single harvest. Data for sample code, % 1-4 sieve, average and standard deviation (in parenthesis) for appearance, color, texture, flavor and overall quality.

Line	% 1-4 sieve	Appearance	Color	Texture	Flavor	Overall Quality
5073	41	5.6 (1.2)	5.8 (1.1)	5.9 (1.5)	5.8 (1.4)	5.7 (1.3)
5090	38	5.7 (1.2)	5.6 (1.1)	5.9 (1.5)	5.8 (1.4)	5.7 (1.2)
5163	59	5.3 (1.6)	5.4 (1.4)	5.3 (1.9)	5.8 (1.5)	5.3 (1.2)
5256	62	5.8 (1.7)	5.8 (1.3)	5.6 (1.7)	5.9 (1.7)	5.6 (1.7)
5386	42	5.2 (1.1)	5.6 (1.4)	6.1 (1.5)	6.0 (1.5)	5.8 (1.6)
5394	47	6.2 (0.8)	5.7 (0.9)	5.9 (1.2)	5.8 (1.3)	5.7 (0.9)
5402	57	6.7 (0.9)	6.7 (0.8)	6.2 (1.3)	6.2 (1.5)	6.5 (1.1)
5403	56	6.6 (1.3)	6.6 (1.3)	6.3 (1.3)	6.2 (1.7)	6.4 (1.2)
5404	57	5.4 (1.3)	6.1 (1.0)	5.4 (1.5)	5.8 (1.4)	5.6 (1.3)
5405	54	5.8 (1.5)	5.9 (1.4)	6.0 (1.2)	5.9 (1.2)	5.8 (1.1)
5408	56	5.4 (1.4)	5.4 (1.6)	5.4 (1.6)	5.8 (1.1)	5.3 (1.5)
5411	45	5.6 (1.3)	5.4 (1.6)	5.8 (1.3)	5.9 (1.1)	5.9 (1.2)
5412	56	5.2 (1.2)	5.5 (1.6)	5.5 (1.3)	5.6 (1.3)	5.1 (1.2)
5416	46	5.4 (1.0)	5.7 (0.9)	5.6 (1.3)	5.2 (1.8)	5.2 (1.0)
5417	54	4.9 (1.6)	5.8 (1.6)	4.4 (2.4)	5.0 (2.0)	4.2 (1.6)
5420	57	5.7 (1.6)	5.6 (1.4)	4.9 (1.9)	5.6 (1.5)	5.1 (1.5)
5421	55	5.8 (1.5)	5.4 (1.6)	5.7 (1.3)	5.7 (1.3)	5.4 (1.1)
5433	92	6.6 (1.2)	6.2 (1.2)	5.9 (1.6)	5.7 (1.4)	5.9 (1.0)
5437	89	5.3 (1.0)	5.6 (1.5)	6.0 (1.2)	5.3 (1.9)	5.4 (1.2)
Hystyle	46	4.9 (1.7)	3.9 (1.7)	5.4 (1.4)	4.6 (1.1)	4.2 (1.2)
91G	56	5.3 (1.6)	5.9 (1.4)	5.6 (1.1)	5.7 (1.1)	5.4 (1.0)
Roma II	77	5.7 (1.2)	5.5 (1.2)	5.7 (1.2)	5.4 (1.7)	5.4 (1.1)
Roma 350	70	5.5 (1.6)	5.0 (1.4)	5.0 (1.8)	5.4 (1.7)	5.2 (1.5)

Table 3. 1989 Canned Green Beans - Industry & OSU Panels. Multi-harvest, 5c Data for sample code, harvest date, % 1-4 sieve, average for appearance, color, texture, flavor, overall quality (industry panel) and fleshing (OSU panel).

			Industry Panel Average scores						OSU Panel Average Scores				
Line	Harvest date	% 1-4 sieve	Appear.	Color	Texture	Flavor	Overall Quality		Appear.	Color	Texture	Flavor	Fleshing
5163	17-Jul	61.0	5.5	5.6	5.5	5.7	5.7	17-Jul	6.4	6.1	6.4	6.7	5.7
	19-Jul	42.0	5.8	6.1	5.9	6.0	5.9	19-Jul	6.7	5.8	5.8	6.7	5.7
	21-Jul	38.0	5.7	5.0	5.3	5.2	6.2	21-Jul	6.7	5.9	5.2	5.6	5.7
	21-Aug	60.0	6.1	5.7	6.1	5.9	6.0	21-Aug	6.7	6.8	6.0	6.4	5.7
	23-Aug	34.0	6.3	5.8	6.1	5.5	5.7	23-Aug	7.2	7.0	6.0	6.3	6.4
	25-Aug	29.0	5.6	5.4	5.2	5.1	5.2	25-Aug	6.9	7.4	5.8	6.0	6.3
5256	17-Jul	69.0	5.8	6.1	5.7	5.6	6.0	17-Jul	7.2	6.3	5.3	3.2	4.8
	19-Jul	57.0	5.6	6.0	5.3	5.7	5.9	19-Jul	5.9	5.4	5.7	5.2	4.9
	21-Jul	48.0	5.4	5.9	5.6	5.9	5.8	21-Jul	6.1	6.3	5.9	5.5	5.1
	21-Aug	63.0	6.0	5.9	5.8	5.8	5.9	21-Aug	7.1	6.3	6.8	6.4	6.8
	24-Aug	42.0	5.6	5.8	5.8	5.6	6.0	24-Aug	7.0	6.1	6.6	6.1	5.9
	26-Aug	33.0	5.4	5.6	5.5	5.4	5.5	26-Aug	6.7	6.3	6.2	5.9	5.8
5402	18-Jul	63.0	5.5	5.6	6.0	6.1	5.6	18-Jul	5.9	5.7	6.3	5.9	5.2
	20-Jul	53.0	5.9	5.9	6.0	6.3	6.0	20-Jul	6.3	6.2	6.2	5.8	5.2
	22-Jul	40.0	5.8	5.9	5.9	5.9	6.0	22-Jul	6.0	6.3	5.6	6.3	6.6
	22-Aug	57.0	5.9	5.9	6.0	6.1	6.0	22-Aug	6.6	5.8	6.3	5.8	6.9
	24-Aug	38.0	5.9	5.9	5.8	5.9	6.0	24-Aug	7.0	6.2	5.8	5.3	6.2
	26-Aug	30.0	5.8	5.6	5.9	5.9	6.0	26-Aug	6.4	5.9	6.2	5.9	6.9
5411	14-Jul	63.0	5.4	5.8	5.6	5.8	5.6						
	17-Jul	28.0	5.3	5.8	5.8	5.8	5.5	17-Jul	5.8	6.5	5.4	6.4	5.3
	19-Jul	21.0	4.9	5.6	5.9	5.8	5.4	19-Jul	6.0	6.2	6.1	6.0	4.8
	21-Aug	41.0	5.1	5.6	5.4	5.9	5.1	21-Aug	6.8	7.0	6.6	6.6	5.8
	23-Aug	22.0	5.1	5.5	5.8	5.8	5.1	23-Aug	6.7	6.5	6.5	5.9	5.8
	25-Aug	15.0	4.9	5.4	5.5	5.5	5.3	25-Aug	5.7	6.7	5.8	5.7	6.1
5417	17-Jul	66.0	4.5	5.2	4.7	4.7	4.7	17-Jul	5.9	6.9	6.7	6.1	5.9
	19-Jul	52.0	4.5	5.2	4.8	4.8	4.7	19-Jul	6.2	6.7	6.6	6.0	5.1
	21-Jul	43.0	4.7	5.0	4.8	4.8	4.8	21-Jul	5.7	6.6	5.4	5.8	5.4
	22-Aug	48.0	5.3	5.4	5.9	5.4	5.2	22-Aug	6.4	6.8	5.9	6.5	5.7
	24-Aug	32.0	5.1	5.7	5.9	5.6	5.4	24-Aug	6.8	6.9	5.5	5.9	5.6
	26-Aug	25.0	5.3	5.9	5.7	5.7	5.4	26-Aug	6.4	6.6	5.6	5.7	6.1
Hystyle	13-Jul	58.0	5.7	3.9	5.7	5.0	5.2	13-Jul	5.7	5.6	5.6	5.9	5.0
	15-Jul	49.0	5.4	4.0	5.7	5.3	5.4	15-Jul	5.9	5.4	5.8	5.3	4.4
	17-Jul	30.0	5.7	4.1	5.6	5.1	5.2	17-Jul	6.2	5.0	5.9	6.0	5.9
	21-Aug	36.0	5.6	4.0	5.6	5.6	5.4	21-Aug	7.4	5.0	6.3	6.2	6.8
	23-Aug	24.0	5.6	4.0	5.4	5.4	5.2	23-Aug	7.4	5.1	6.5	5.9	5.7
	25-Aug	17.0	5.6	4.1	5.6	5.0	5.2	25-Aug	7.2	4.9	5.7	5.3	6.5
91 G	15-Jul	71.0	5.4	6.0	5.6	6.0	5.8	15-Jul	5.8	5.8	6.1	6.4	4.7
	17-Jul	41.0	5.6	6.1	5.6	6.1	6.2	17-Jul	5.4	6.1	5.7	6.2	4.8
	19-Jul	33.0	5.6	6.4	5.7	6.1	6.4	19-Jul	5.3	5.6	5.6	5.8	4.8
	21-Aug	44.0	5.9	6.3	5.6	6.1	6.4	21-Aug	5.2	6.0	6.1	6.6	5.4
	23-Aug	29.0	6.0	6.3	6.0	6.1	6.4	23-Aug	5.7	6.4	6.1	6.4	6.3
	25-Aug	20.0	5.7	6.3	5.7	6.1	6.1	25-Aug	6.0	6.0	6.3	6.1	5.1
Primo	13-Jul	86.0	5.7	5.4	5.7	5.6	6.2						
	15-Jul	76.0	5.6	5.6	5.7	5.3	6.0	15-Jul	7.0	6.3	5.5	5.8	6.3
	17-Jul	47.0	-1.6	5.4	5.6	5.4	5.8	17-Jul	6.7	6.2	6.1	6.9	7.0
	24-Jul	59.0	5.6	5.4	5.7	5.3	6.2						
	21-Aug	46.0	5.8	5.8	5.8	5.7	6.3	21-Aug	7.4	5.3	6.1	5.8	6.0
	23-Aug	27.0	6.0	5.7	6.0	5.5	6.5	23-Aug	6.6	5.2	5.8	6.3	6.3
	25-Aug	22.0	5.3	5.7	5.8	5.5	6.3	25-Aug	7.0	5.6	5.7	5.7	6.2
Roma II	17-Jul	71.0	5.8	6.2	6.2	6.3	6.5	17-Jul	6.7	5.7	6.0	5.7	5.5
	19-Jul	66.0	6.0	6.0	6.3	6.2	6.5	19-Jul	6.5	5.5	5.8	5.9	6.3
	21-Jul	50.0	5.8	7.0	6.8	6.8	7.5	21-Jul	6.3	5.4	5.7	5.3	6.5
	21-Aug	78.0	6.0	6.0	6.3	6.3	6.5	21-Aug	6.5	4.6	6.7	6.1	6.2
	23-Aug	56.0	5.7	5.8	6.0	6.0	6.5	23-Aug	6.3	4.6	6.1	6.1	6.4
	25-Aug	43.0	5.7	5.7	6.0	6.0	6.5	25-Aug	6.5	4.2	6.1	6.1	6.1
Roma 350	17-Jul	79.0	6.2	6.7	6.2	6.2	6.8						
	19-Jul	76.0	6.0	6.5	6.0	6.2	6.5	19-Jul	6.5	5.1	5.5	3.8	5.7
	21-Jul	91.0	5.6	6.7	5.8	6.0	6.5	21-Jul	6.3	5.9	5.8	6.4	5.4
	21-Aug	81.0	5.7	6.7	6.0	6.0	6.8	21-Aug	6.5	4.7	5.3	5.8	5.4
	23-Aug	71.0	5.8	6.8	6.0	6.0	6.5	23-Aug	6.2	4.4	5.8	5.6	5.6
	25-Aug	60.0	5.8	6.7	5.8	5.8	6.8	25-Aug	5.9	4.1	4.7	5.7	5.2
Blue L.P.	14-Aug	•	6.8	7.4	7.0	6.8	7.3						
	21-Aug	•	7.2	7.4	7.2	7.0	7.7	21-Aug	5.6	5.9	6.9	6.2	6.8

Table 4. 1989 Frozen Green Beans - Industry & OSU Panels. Multi-harvest, 5c Data for sample code, harvest date, % 1-4 sieve, average for appearance, color, texture, flavor, overall quality (industry panel) and fleshing (OSU panel).

Line	Harvest date	% 1-4 sieve	Industry Panel Average Scores: Appear.	Color	Texture	Flavor	Overall Quality	Harvest date	OSU Panel Average Scores: Appear.	Color	Texture	Flavor	Fleshing
5163	5-Aug	70	5.3	5.5	5.4	5.2	5.5	5-Aug	6.8	6.4	6.3	5.9	5.4
	7-Aug	37	5.2	5.5	5.2	5.3	5.3	7-Aug	7.0	6.3	6.3	6.3	5.4
	9-Aug	45	5.3	5.5	5.3	5.3	5.3	9-Aug	6.2	5.6	6.5	6.2	5.1
5256	5-Aug	76	6.0	6.1	5.4	5.9	6.1	5-Aug	6.9	7.6	6.3	6.0	5.8
	7-Aug	67	6.0	5.9	5.2	5.3	6.1	7-Aug	7.1	7.2	6.3	6.4	5.7
	9-Aug	54	5.6	5.7	5.3	5.4	5.5	9-Aug	7.3	7.4	6.0	6.6	6.0
5402	7-Aug	68	6.3	6.5	6.1	5.5	6.2	7-Aug	7.2	7.2	6.0	6.6	5.3
	9-Aug	41	6.3	6.4	5.9	5.4	6.2	9-Aug	6.9	7.3	6.6	6.3	5.6
	11-Aug	35	6.1	6.0	5.7	5.3	5.8	11-Aug	7.7	7.7	6.2	6.6	6.0
5411	4-Aug	66	5.2	5.3	5.1	5.0	5.1	4-Aug	6.2	6.1	6.1	5.7	4.6
	7-Aug	•	•	•	•	•	•	7-Aug	6.0	6.4	6.4	6.2	5.2
	11-Aug	37	4.9	5.0	5.2	5.1	5.1	11-Aug	•	•	•	•	•
5417	7-Aug	50	5.4	5.0	4.9	4.9	5.0	7-Aug	6.1	6.0	5.9	6.0	4.5
	9-Aug	34	5.3	5.4	4.9	4.9	4.9	9-Aug	5.6	6.1	5.9	6.0	5.5
	11-Aug	33	5.0	5.0	4.6	5.0	4.8	11-Aug	6.1	6.3	6.0	5.4	5.4
Hystyle	4-Aug	54	4.6	3.7	4.5	4.0	4.1	4-Aug	6.5	5.0	6.3	5.5	5.8
	7-Aug	47	4.8	3.7	4.5	3.9	4.2	7-Aug	6.5	4.4	6.1	5.6	6.0
	9-Aug	41	4.7	3.7	4.7	4.2	4.2	9-Aug	7.0	4.7	6.2	6.0	6.9
91 G	5-Aug	52	4.6	5.7	5.3	5.6	5.7	5-Aug	6.8	6.9	6.3	6.0	5.7
	7-Aug	42	4.8	5.7	5.7	5.5	5.7	7-Aug	6.9	6.8	6.7	6.8	5.2
	9-Aug	25	4.7	5.3	5.3	5.2	5.3	9-Aug	7.3	7.2	6.2	6.9	5.9
Blue L.P.	11-Aug	•	7.1	6.9	6.6	6.5	6.9	11-Aug	•	•	•	•	•
Primo	2-Aug	73	5.4	5.7	5.4	5.3	5.6	2-Aug	5.9	5.8	5.8	5.9	5.3
	4-Aug	62	5.3	5.3	5.3	5.1	5.2	4-Aug	6.1	6.4	6.0	5.8	5.7
	7-Aug	55	5.3	5.3	5.4	5.1	5.3	7-Aug	5.8	5.6	6.4	6.4	4.8
Roma II	2-Aug	84	5.6	5.7	5.6	5.6	5.6	2-Aug	6.0	5.3	5.8	5.8	5.3
	4-Aug	78	5.9	5.8	5.7	5.7	5.8	4-Aug	6.3	5.2	5.9	5.9	5.2
	7-Aug	62	5.7	5.5	5.4	5.5	5.5	7-Aug	6.0	5.2	6.1	5.9	5.9
Roma 350	2-Aug	85	5.0	5.3	5.0	5.2	5.0	2-Aug	•	•	•	•	•
	4-Aug	77	5.7	5.4	5.5	5.6	5.6	4-Aug	5.8	6.4	6.0	6.0	5.1
	7-Aug	73	5.4	5.5	5.6	5.5	5.3	7-Aug	6.0	5.7	6.3	5.9	6.0

Table 5. Sensory quality attributes of highest ranking OSU bean lines, 1989.

Commodity	Processing Style	Size	Panel	Highest Scoring Lines				
				Appear	Color	Texture	Flavor	Overall
Beans	Canned	5c	Industry	5402, 91G	91G, 5402	5402, 5163	91G, 5402	91G, 5402
		5c	OSU	5163, 5256	5417, 5163	5256, 5411	5163, 91G	---
		5c Italian	Industry	---	Roma 350	Roma II	Roma II	Roma 350
		5c Italian	OSU	Primo	Primo	Roma II	Primo	---
		3W	OSU	5163, Hystyle	5417, 5163	5417 5163	5411, 5417	---
		3W Italian	OSU	Primo	Primo	Roma II	Roma II	---
	Frozen	5c	Industry	5402, 5256	5402, 5256	5402	5256, 5402	5402, 5256
		5c	OSU	5402, 5256	5402, 5163	91G, 5163	91G, 5402	Hystyle, 5256
		5c Italian	Industry	Roma II	Primo	Roma 350	Roma 350	---
		5c Italian	OSU	Primo	Roma 350	Roma 350	Roma 350	---
		3W	OSU	Hystyle, 91G	5256, 5402, 91G	91G, 5256, 5402	5256, 5402	---
		3W Italian	OSU	Primo	Roma 350	Roma 350	Roma 350	---

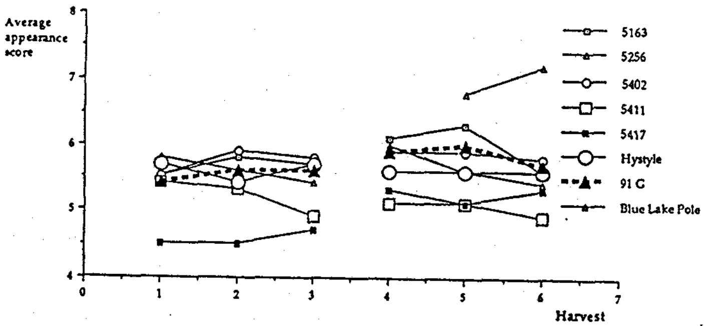
Table 6. Highest and lowest sensory scores for OSU green bean lines, 1989.

Processing Style	Type of Panel	Highest Scoring Lines	Lowest Scoring Lines
Canned	Industry	5402, 91G/Roma II	5417,Hystyle/Roma 350
	OSU	5163, 5417 (3W)/Roma II	91G,Hystyle (3W)/Roma 350
Frozen	Industry	5402, 5256/Roma II	5417,Hystyle/Primo
	OSU	91G, 5402/Roma 350	5417, 5411/Roma II

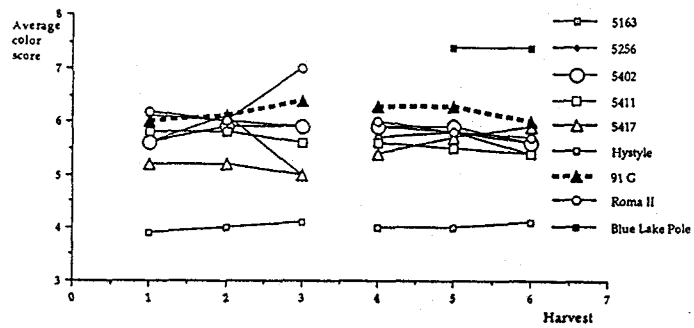
Table 9. Frozen green bean analytical results, sives 5 + 6. (Planting III)

Sample Code	Harvest Date	% 1-4 Sieve	n	Average % Seed	Average % Fiber
Primo	8/2	73	2	1.4	0.008
Primo	8/4	62	2	1.6	0.008
Primo	8/7	55	2	3.4	0.011
Roma 2	8/2	84	2	1.6	0.008
Roma 2	8/4	78	2	1.9	0.008
Roma 2	8/7	62	2	5.2	0.010
Roma 350	8/2	85	2	1.0	0.009
Roma 350	8/4	77	2	1.3	0.010
Roma 350	8/7	73	2	2.4	0.011
Hystyle	8/4	54	2	1.9	0.010
Hystyle	8/7	47	2	4.0	0.011
Hystyle	8/9	31	2	6.7	0.015
5411	8/4	66	2	3.4	0.008
5411	8/7	37	2	5.8	0.009
5163*	8/5	70	2	4.4	0.008
5163*	8/7	61	2	6.9	0.011
5163	8/9	45	2	10.7	0.013
5256*	8/5	76	2	4.3	0.009
5256*	8/7	67	2	6.7	0.012
5256	8/9	54	2	9.3	0.016
91G	8/5	52	2	4.7	0.009
91G	8/7	42	2	7.5	0.011
91G	8/9	25	2	8.9	0.017
5402*	8/7	68	2	6.0	0.011
5402*	8/9	41	2	7.8	0.013
5402	8/11	35	2	11.3	0.013
5417*	8/7	50	2	5.1	0.015
5417	8/9	34	2	8.1	0.022
5417	8/11	33	2	9.6	0.029
Blue* Lake Pole	8/11	?	2	6.0	0.009

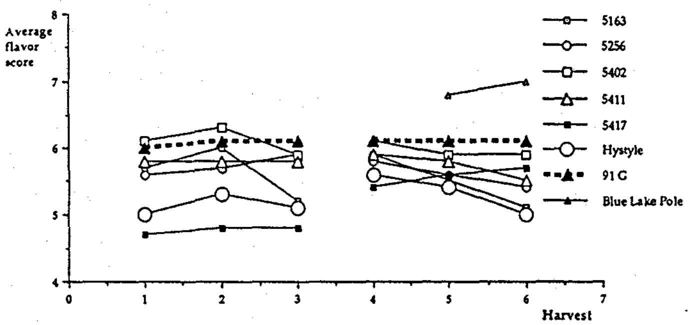
* 5 sieves



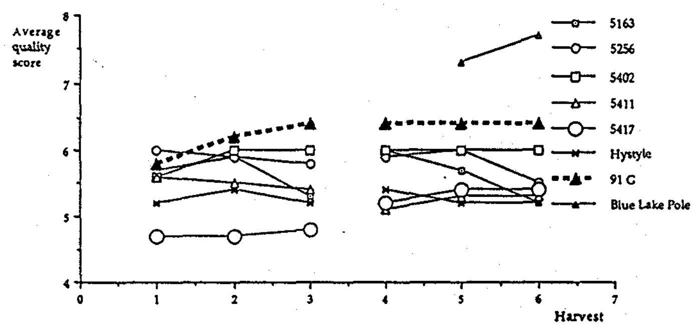
1989 Canned Green Beans - Industry Panel, 5c. Average appearance score.



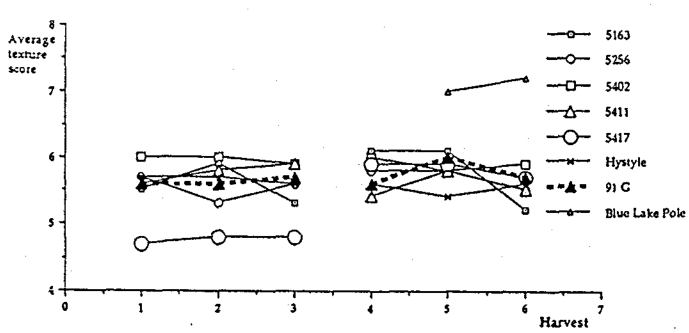
1989 Canned Green Beans - Industry Panel, 5c. Average color score.



1989 Canned Green Beans - Industry Panel, 5c. Average flavor score.



1989 Canned Green Beans - Industry Panel, 5c. Average quality score.



1989 Canned Green Beans - Industry Panel, 5c. Average texture score.

Figure 1. Sensory results for 1989 canned green beans, industry panel, 5 sieve cut.

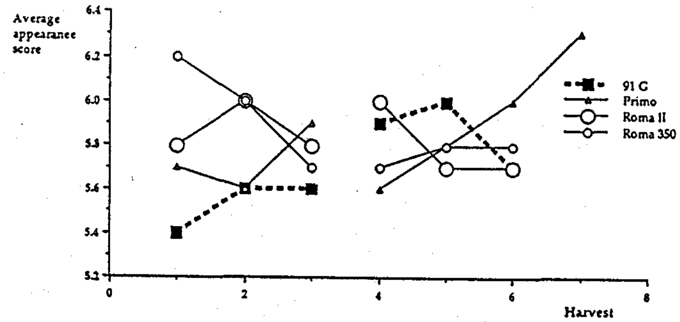


Figure 2. 1989 Canned Italian Green Beans - Industry Panel, 5c. Average appearance score

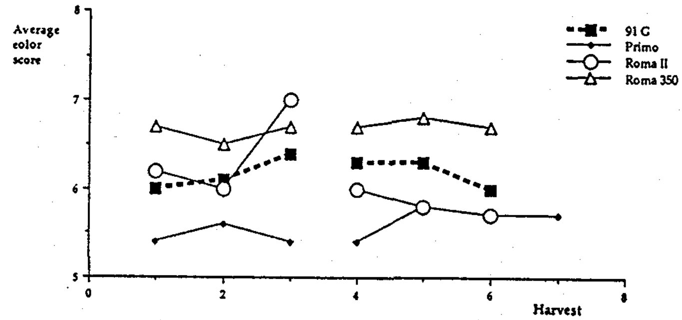


Figure 4. 1989 Canned Italian Green Beans - Industry Panel, 5c. Average color score.

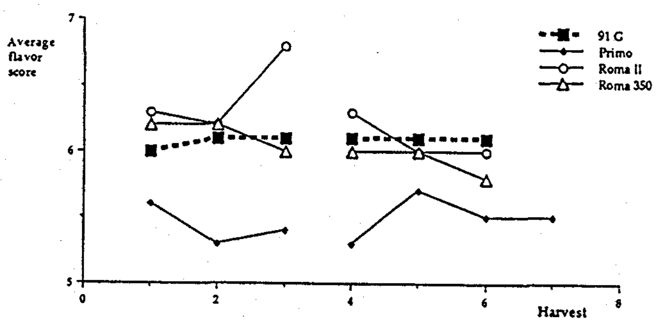


Figure 6. 1989 Canned Italian Green Beans - Industry Panel, 5c. Average flavor score.

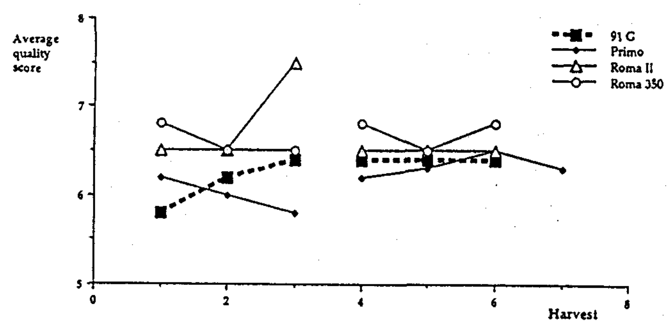


Figure 8. 1989 Canned Italian Green Beans - Industry Panel, 5c. Average quality score.

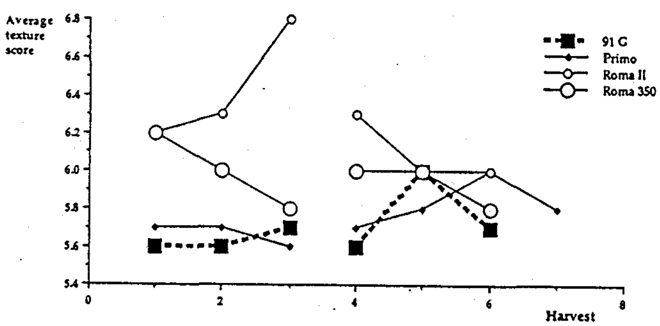


Figure 10. 1989 Canned Italian Green Beans - Industry Panel, 5c. Average texture score.

Figure 2. Sensory results for 1989 canned Italian green beans, industry panel, 5 sieve cut.

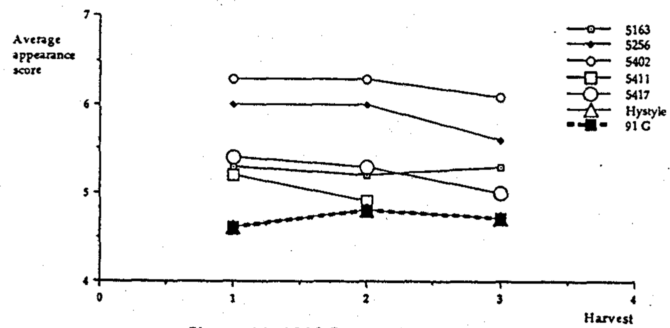


Figure 11. 1989 Frozen Green Beans - Industry Panel, 5c. Average appearance score.

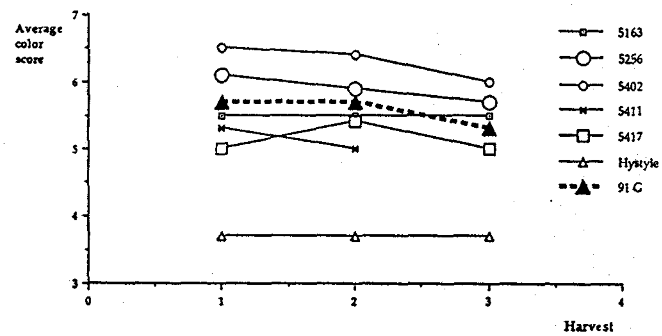


Figure 13. 1989 Frozen Green Beans - Industry Panel, 5c. Average color score.

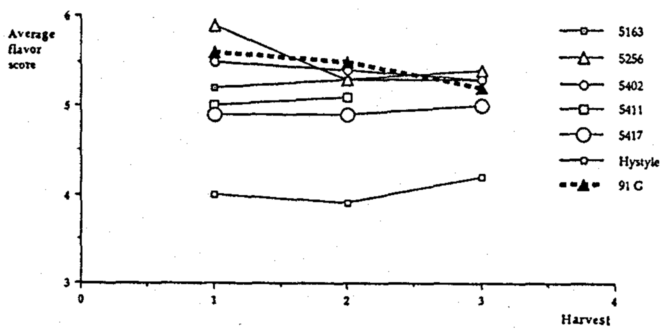


Figure 15. 1989 Frozen Green Beans - Industry Panel, 5c. Average flavor score.

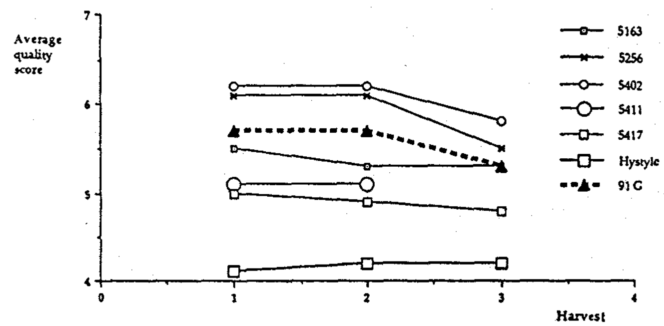


Figure 17. 1989 Frozen Green Beans - Industry Panel, 5c. Average quality score.

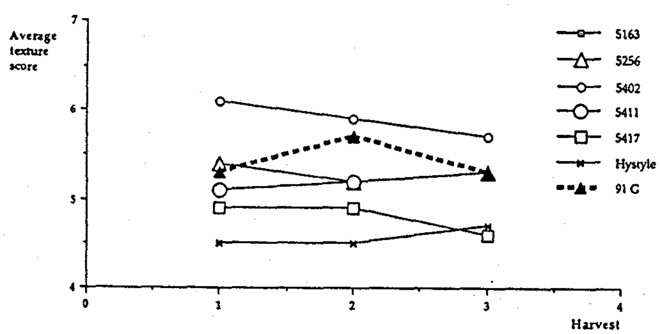


Figure 19. 1989 Frozen Green Beans - Industry Panel, 5c. Average texture score.

Figure 3. Sensory results for 1989 frozen green beans, industry panel, 5 sieve cut.

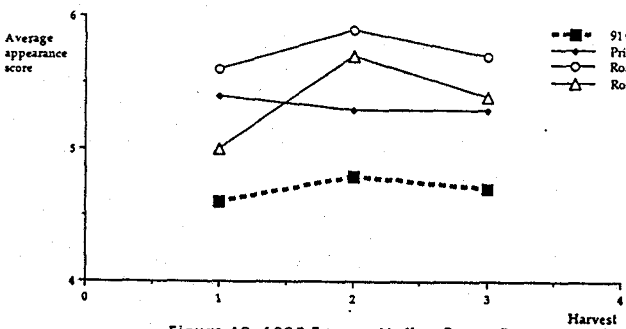


Figure 12. 1989 Frozen Italian Green Beans - Industry Panel, 5c. Average appearance score.

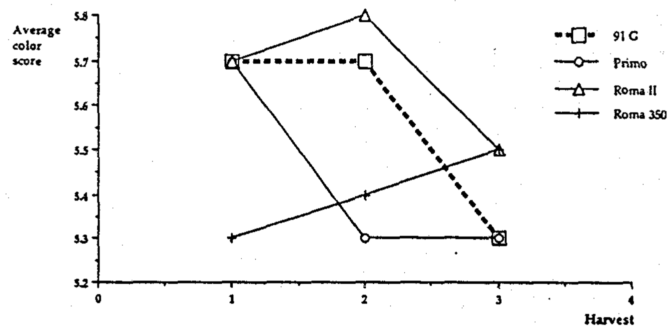


Figure 14. 1989 Frozen Italian Green Beans - Industry Panel, 5c. Average color score.

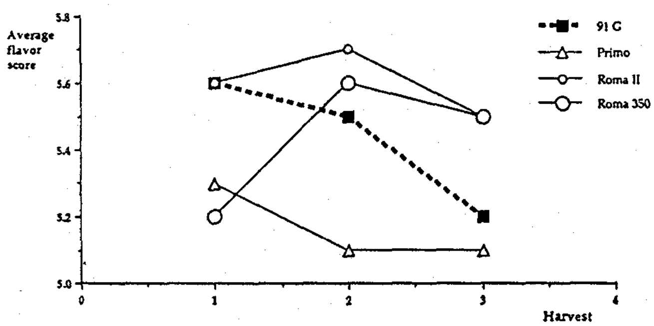


Figure 16. 1989 Frozen Italian Green Beans - Industry Panel, 5c. Average flavor score.

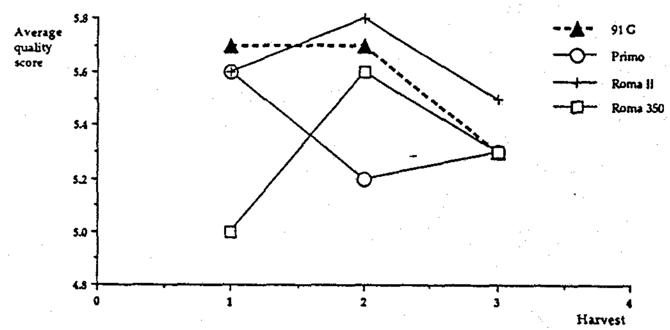


Figure 18. 1989 Frozen Italian Green Beans - Industry Panel, 5c. Average quality score.

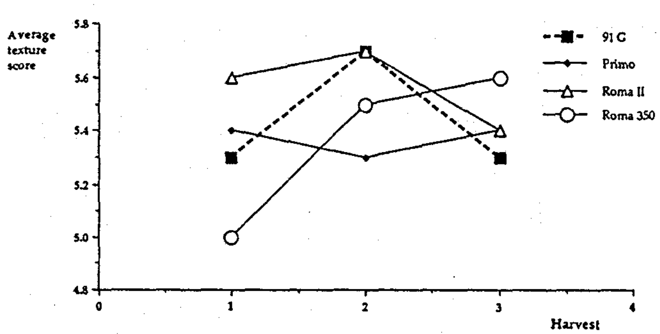


Figure 20. 1989 Frozen Italian Green Beans - Industry Panel, 5c. Average texture score.

Figure 4. Sensory results for 1989 frozen Italian green beans, industry panel, 5 sieve cut.

LEGEND

Sample Code	Line
1	5073
2	5090
3	5163
4	5256
5	5386
6	5394
7	5402
8	5403
9	5404
10	5405
11	5408
12	5411
13	5412
14	5416
15	5417
16	5420
17	5421
18	5433
19	5437
20	Hystyle
21	91G
22	Roma II
23	Roma 350

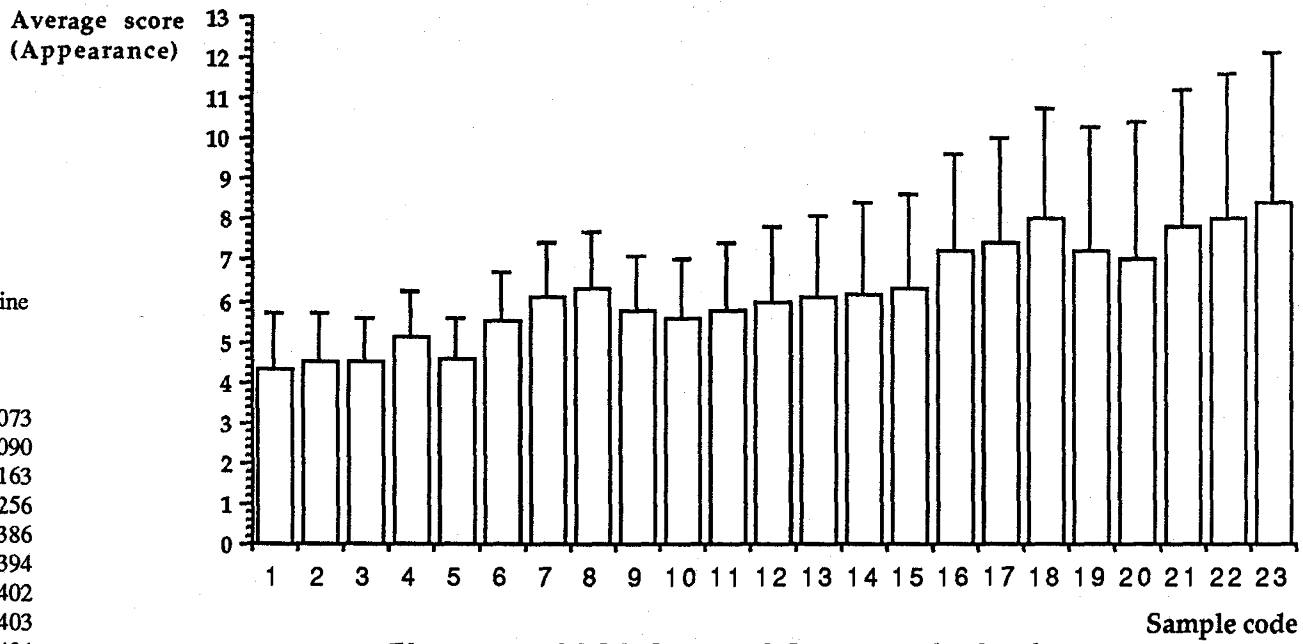


Figure 5. 1989 Canned Beans - Industry Panel, single harvest. Average and standard deviation for appearance.

LEGEND

Sample Code	Line
1	5073
2	5090B
3	5163
4	5256
5	5386
6	5394
7	5402
8	5403
9	5404
10	5405
11	5408
12	5411
13	5412
14	5416
15	5417
16	5420
17	5421
18	5433
19	5437
20	Hystyle
21	91G

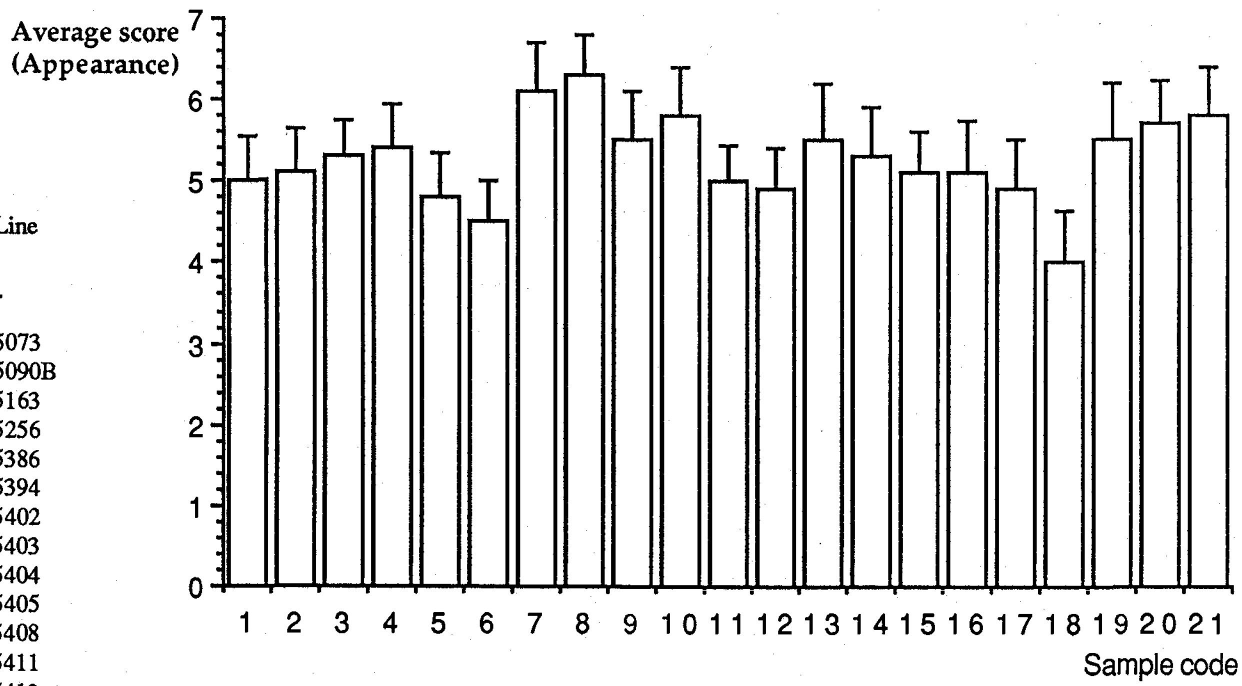


Figure 6. 1989 Frozen Beans - Industry Panel, single harvest. Average and standard deviation for appearance.

Supplemental Report
to the Oregon Processed Vegetable Commission
1989/90 Project Period (Submitted July 1991)

Title: Supersweet corn variety evaluation

Project Leaders: J. R. Baggett, Horticulture
Diane Barrett, Food Science and Technology

Project Status: Terminated June 30, 1990

Project Funding: $3,000 field trials
$3,630 processing evaluation

Funds allocated to the processing portion were used for labor; purchase of supplies for processing, laboratory and sensory evaluation, secretarial and accounting and travel. Four tables and six graphs containing 1989 OSU sensory panel results for canned and frozen corn were compiled by G. W. Varseveld and submitted with Baggett's 1989/90 production report. The present report includes results of both OSU and industry panels.

I. Objectives

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

II. Processing Quality Evaluation

Five varieties of supersweet corn, considered promising for processing in Oregon, were grown during the 1989 season in a replicated trial in Corvallis. These were: Showcase (Rogers Brothers), GSS 3548 (Rogers Brothers), XPH 2659 (Asgrow), Supersweet Jubilee (Rogers Brothers), and Crisp'n Sweet 710 (Crookham). Harvests were made once every 2 days, as close to 78% moisture as could be achieved by field observation and preliminary moisture determinations. All moisture determinations were made using a microwave oven method. Ears were evaluated for percent moisture and cut-off, and then canned or frozen in the Food Science and Technology pilot plant.

Sensory analysis of the single harvest "observation" corn lines and the multiple harvest lines was carried out by both 10-member OSU panels and a larger industry panel. The OSU panel was run in the fall of 1989, and results were submitted in December 1989, while the industry cutting was held in February 1990. The quality factors rated by both panels included appearance, color, flavor, texture and overall quality. Corn was rated on a nine point hedonic scale, with zero being dislike extremely and nine being like extremely. Sample preparation for both panels consisted of serving canned corn at room temperature and blanching frozen samples prior to serving.

III. Single Harvest Supersweet Corn Lines

Eight to twelve observation lines were canned and/or frozen and evaluated by either OSU or industry panels, or both. The supersweet corn observed in this trial included:

	Industry Panel		OSU Panel	
	Canned	Frozen	Canned	Frozen
FMX 280		X	X	X
FMX 284		X	X	X
BSS 3378	X	X	X	X
WSS 3680	X	X	X	X
WSS 3686	X	X	X	X
XPH 2687	X	X	X	X
Honey'n Pearl	X	X	X	X
How Sweet It Is	X	X	X	
Supersweet Jubilee				X
Crisp'n Sweet 710			X	
Sunre 2626	X	X		
Sweet Season	X	X		

Sensory and analytical results for canned and frozen samples evaluated by the industry panel and OSU panel are presented in Tables 1 and 2 (industry) and 3 and 4 (OSU). In some instances, the two panels agreed, but in many they did not. In general, the sensory results were as follows (attributes which were significantly better are identified in parentheses):

A. Canned corn

Industry panel ranked Honey'n Pearl highest (for appearance, flavor and texture), followed by sweet season (appear, color, overall quality). The OSU panel found FMX 284 (all attributes) to be of the highest quality, followed by XPH 2687 (appearance, color) and Crisp'n Sweet 710 (appearance, color).

The OSU and industry panels agreed on the lowest-ranking lines, e.g.: How Sweet It Is (appearance, color; high scores in flavor and texture) and WSS 3686 (appearance, color; high scores in texture). Both of these lines appear to look good, but taste poorly and have undesirable texture.

B. Frozen corn

Both the industry and OSU panels rated FMX 284 very high in almost all sensory attributes. The OSU panel ranked FMX 280 high also, while the industry panel found Sweet Season to be good on appearance, color and overall quality, but poor texture.

Both panels agreed that WSS 3686 was one of the lowest ranking samples, in terms of appearance, color and overall quality. The industry panel also ranked How Sweet It Is poorly, while the OSU panel found Supersweet Jubilee to be of poor appearance, color and flavor. Although the appearance and color of WSS 3686 and How Sweet It Is were poor, the flavor and texture were good.

In summary, there was agreement between both panels that FMX 284 performed well in frozen products, and the OSU panel found this line to do well in a canned product also. There was also agreement between panels that WSS 3686 did not perform well as a frozen or canned product, and that How Sweet It Is was a poor frozen product. The industry panel also rated this variety poorly in the canned product.

IV. Multiple Harvest Supersweet Corn Lines

Industry and OSU sensory panel results for multi-harvested and frozen supersweet corn are presented in Tables 5 and 6. Selected results from the industry panel are represented graphically in Figures 3 and 4 and from the OSU panel in Figures 5, 6, and 7. This information has been summarized as highest and lowest scoring lines in Table 7, and lines which scored high or low in more than two quality attributes are listed in Table 8. Analytical results for percent moisture and percent cutoff are presented in Tables 5 and 6 and Figures 1 and 2.

A. General Comments

1. Sensory scores for frozen corn were much higher than canned corn from both industry and OSU panels.
2. Industry and OSU panels agreed that:
   - Supersweet Jubilee was one of the highest ranking lines in both canned and frozen products
   - Showcase ranked high in canned products
   - Crisp'n Sweet 710 ranked poorly in canned and frozen products
   - Showcase ranked poorly in frozen products
3. Percent moisture (Tables 3 and 4, Figure 1) declined with time and was relatively high in XPH 2659 and Showcase.
4. Percent cutoff (Figure 2) generally increased, and was similar for all corn lines. GSS 3548 had low values in immature samples.

B. Canned corn

The industry and OSU panels both rated Showcase and Supersweet Jubilee highest in the canned product (Tables 7 and 8).

In addition, the industry rated GSS 3548 well for appearance, color and overall quality. Figure 3 illustrates that, according to industry panel results, most canned corn quality attributes remain fairly constant or decline only slightly until after the third harvest, after which more severe declines occur. OSU panel results are more difficult to interpret (Figures 6, 7, 8), however it appears that color and flavor may improve to about mid-maturity, then decline; and texture tended to decrease with maturity.

Both industry and OSU panels rated Crisp'n Sweet 710 poorly in the canned product (Tables 7 and 8). Figure 3, 6, 7 and 8 all illustrate that Crisp'n Sweet 710 sensory values are relatively lower than other corn lines throughout the season. One additional note, Supersweet Jubilee color was rated poorly in immature samples by both panels.

C. Frozen corn

In the frozen product, the industry panel rated Supersweet Jubilee and GSS 3548 high, while the OSU panel ranked Supersweet Jubilee and XPH 2659 as most desirable (Tables 7 and 8). The industry gave Supersweet Jubilee high scores for all quality attributes, while the OSU panel scored this variety highest for flavor, overall quality and texture only. According to industry panel results (Figure 4), most frozen corn quality attributes remained fairly constant or declined slightly until after the third harvest, after which declines were more dramatic. Overall, quality attributes in frozen corn were higher and more constant throughout the season than they were for canned corn (Figures 3 and 4). OSU panel results showed that frozen corn color, flavor and texture (Figures 5, 6 and 7) either remained constant or declined slightly with maturity. Declines in flavor and texture of both Crisp'n Sweet 710 and GSS 3548 were relatively greater than other lines with increasing harvest date.

Both panels ranked Crisp'n Sweet 710 and Showcase poorly in the frozen product (Tables 7 and 8). Although Crisp'n Sweet 710 rated average values in appearance and color, the flavor, overall quality and texture were poor. Showcase on the other hand, was rated low in almost all quality attributes. It is interesting that the OSU panel rated GSS 3548 low for color and texture, while the industry panel rated this line relatively high for appearance, flavor and overall quality. Figures 4 and 5 illustrate that the color of frozen Showcase is poor throughout the season. Figures 4, 6 and 7 illustrate that Crisp'n Sweet 710 scores for flavor and texture are lower than other lines and decline with maturity.

V. Summary

FMX 284 performed well in frozen and (OSU panel only) canned product observed in the single harvest trial. WSS 3686 did <u>not</u> process well, as either a canned or frozen product, and How Sweet It Is was not a high quality frozen or (industry panel only) canned product.

In the multiple harvest trial, industry and OSU panels agreed that:

- Supersweet Jubilee was one of the highest ranking lines in both canned and frozen products
- Showcase ranked high in canned products
- Crisp'n Sweet 710 ranked poorly in canned and frozen products
- Showcase ranked poorly in frozen products

In general, percent moisture and all quality attributes declined with maturity, while percent cut off increased. Quality attributes did not decline dramatically until after the third harvest, therefore it may be best to harvest at this time to maximize yields.

Table 1. 1989 Canned Corn - Industry Panel, single harvest. Data for sample code, % moisture, average and standard deviation (in parenthesis) for appearance, color, texture, flavor and overall quality.

Line	% moisture	Appearance	Color	Flavor	Quality	Texture
Honey'n Pearl	76.7	5.4 (1.4)	4.6 (1.6)	5.7 (1.3)	5.3 (1.4)	6.1 (1.2)
How Sweet It Is	77.2	3.9 (1.7)	2.9 (1.4)	5.5 (1.1)	4.3 (1.4)	5.9 (1.0)
WSS 3686	76.1	4.3 (1.3)	3.8 (1.4)	4.9 (1.4)	4.6 (1.4)	5.7 (1.2)
Sunre 2626	75.9	4.7 (1.2)	4.4 (1.5)	4.6 (1.8)	4.5 (1.5)	5.4 (1.0)
Sweet Season	77.1	5.3 (0.9)	5.2 (1.1)	4.7 (1.3)	5.2 (0.8)	4.9 (1.4)
BSS 3378	75.6	4.6 (1.3)	4.0 (1.5)	4.6 (1.3)	4.7 (1.2)	5.1 (1.1)
XPH 2687	75.0	4.8 (1.1)	4.6 (1.2)	4.8 (1.5)	4.7 (1.3)	4.8 (1.5)
WSS 3680	*	4.5 (1.5)	4.3 (1.5)	5.3 (1.3)	4.8 (1.6)	5.5 (1.0)

Table 2. 1989 Frozen Corn - Industry Panel, single harvest. Data for sample code, % moisture, average and standard deviation (in parenthesis) for appearance, color, flavor, quality, texture and whole appearance.

Line	% moisture	Appearance	Color	Flavor	Quality	Texture	Whole Appearance
FM 280	78.3	5.7 (1.5)	5.8 (1.6)	5.0 (1.8)	5.3 (1.5)	5.6 (1.5)	5.2 (0.8)
Honey'n Pearl	76.7	5.0 (1.4)	4.9 (1.7)	5.5 (1.4)	5.4 (1.3)	5.7 (1.5)	5.9 (1.5)
How Sweet It Is	77.2	3.7 (1.6)	3.3 (1.6)	5.2 (1.9)	4.3 (1.2)	5.6 (1.3)	4.2 (1.5)
WSS 3686	76.1	4.7 (1.8)	3.8 (1.6)	5.7 (1.8)	4.9 (1.6)	5.8 (1.4)	5.7 (1.6)
Sunre 2626	75.9	5.5 (1.5)	5.2 (1.7)	5.2 (1.8)	5.4 (1.3)	5.6 (1.6)	5.6 (1.7)
Sweet Season	77.1	6.1 (1.5)	6.3 (1.5)	5.5 (1.7)	5.6 (1.1)	4.9 (1.8)	6.0 (1.3)
FMX 284	77.1	6.3 (1.2)	6.7 (1.1)	5.6 (1.9)	6.2 (1.2)	5.7 (1.8)	6.8 (1.4)
BSS 3378	75.6	5.0 (1.6)	4.8 (1.6)	5.8 (1.8)	5.3 (1.6)	5.4 (1.6)	5.6 (1.8)
XPH 2687	75.0	5.0 (1.4)	5.0 (1.8)	5.7 (1.4)	5.3 (1.2)	5.2 (1.5)	6.0 (1.2)
WSS 3680	*	5.0 (1.4)	4.8 (1.5)	5.6 (1.5)	5.1 (1.2)	5.5 (1.4)	5.7 (1.6)

Table 3. Sensory Quality of Whole Kernel Supersweet Corn After Canning: Newer Varietal Lines, 1989.

SELECTION	HARV. DATE	% MOIST.[1]	COLOR TYPE	SENSORY PANEL MEAN SCORES[2]				
				COLOR	APPEAR.	TEXT.	FLAVOR	OVERALL QUALITY
FM 280	9/7	78.3	Yellow	5.0	5.1	5.5	4.3	4.9
FM 284	9/13	77.1	Yellow	6.5	6.3	5.9	5.4	5.9
BSS 3378	9/13	75.6	Bi-color	5.0	5.1	5.7	5.7	5.4
WSS 3680	9/15	--	Bi-color	4.5	4.7	5.0	5.1	4.8
WSS 3686	9/8	76.1	Bi-color	3.7	4.2	5.0	4.7	4.4
XPH 2687	9/13	75.0	Bi-color	5.7	5.2	4.6	4.6	4.9
Honey & Pearl	9/8	76.7	Bi-color	4.5	4.6	4.8	4.3	4.5
How Sweet It Is	9/8	77.2	White	2.8	4.4	5.3	4.7	3.5
Crisp 'n Sweet 710 (REF)	9/8	77.5	Yellow	5.3	5.2	4.8	4.7	4.9
LSD (0.05)				0.7	0.7	0.8	0.9	0.7

NOTES: [1] Moisture determined by microwave oven method.

[2] Panel of 10 members using a 9 point scale where 9 = outstanding, 5 = average acceptable, 1 = very poor.

Table 4. Sensory Quality of Whole Kernel Supersweet Corn After Freezing: Newer Varietal Lines, 1989.

SELECTION	HARV. DATE	% MOIST.[1]	COLOR TYPE	SENSORY PANEL MEAN SCORES[2] COLOR	APPEAR.	TEXT.	FLAVOR	OVERALL QUALITY
FM 280	9/7	78.3	Yellow	6.0	5.8	5.7	5.8	5.7
FM 284	9/13	77.1	Yellow	5.7	6.0	5.7	5.8	5.7
BSS 3378	9/13	75.6	Bi-color	5.0	4.4	5.5	5.3	5.1
WSS 3680	9/15	--	Bi-color	5.0	4.9	5.6	5.5	5.3
WSS 3686	9/8	76.1	Bi-color	3.0	3.9	5.2	5.0	3.9
XPH 2687	9/13	75.0	Bi-color	5.2	4.5	4.6	5.4	4.7
Honey & Pearl	9/8	76.7	Bi-color	5.7	4.9	5.4	5.4	5.2
Supersweet Jubille (REF)	9/21	75.4	Yellow	4.8	3.9	4.6	5.2	4.7
LSD (0.05)				0.8	0.8	0.7	N.S.	0.7

NOTES: [1] Moisture determined by microwave oven method.

[2] Panel of 10 members using a 9 point scale where 9 = outstanding, 5 = average acceptable, 1 = very poor.

Table 5. 1989 Canned Corn - Industry & OSU Panels multi-harvest. Data for sample code, harvest date, % moisture, average for appearance, color, flavor, quality and texture.

Line	Harvest date	% moist.	Industry Panel Average Scores Appear.	Color	Flavor	Quality	Texture	Harvest date	OSU Panel Average Scores Appear.	Color	Flavor	Quality	Texture
GSS 3548	7-Sep	77.6	5.9	5.7	5.2	5.7	5.4	7-Sep	5.6	5.2	5.1	5.5	6.1
	9-Sep	77.6	5.5	5.5	5.2	5.6	5.3	9-Sep	5.5	4.9	5.4	5.3	5.6
	12-Sep	75.8	5.6	5.6	5.2	5.5	5.1	12-Sep	5.8	5.6	5.8	5.9	6.2
	16-Sep	75.2	5.2	5.4	4.6	5.2	4.5	16-Sep	5.6	5.6	4.9	5.0	4.9
	18-Sep	74.9	5.2	5.2	4.4	5.0	4.1	18-Sep	5.3	5.7	5.3	5.2	4.7
C & S 710	8-Sep	77.5	5.2	5.7	4.6	5.2	4.9	8-Sep	4.4	4.2	4.6	4.4	4.8
	11-Sep	76.6	5.1	5.7	4.6	5.2	5.0	11-Sep	5.1	5.2	4.8	5.0	5.0
	13-Sep	76.2	5.1	5.7	4.5	5.2	4.7	13-Sep	5.2	4.9	5.3	5.2	5.3
	15-Sep	76.0	4.9	5.4	4.4	4.9	4.4	15-Sep	4.9	5.4	5.0	5.0	5.0
	18-Sep	75.0	4.7	5.0	4.3	4.5	3.7	18-Sep	5.0	5.3	4.7	4.5	4.4
	20-Sep	74.5	4.3	4.6	3.8	4.1	3.3	20-Sep	4.7	4.7	4.3	4.4	4.3
Showcase	9-Sep	78.9	5.7	5.5	5.3	5.7	5.5	9-Sep	4.7	4.3	5.3	4.8	5.5
	12-Sep	77.7	5.6	5.6	5.5	5.7	5.9	12-Sep	5.1	5.0	5.2	5.3	5.5
	16-Sep	76.7	5.8	5.7	5.1	5.7	5.5	16-Sep	5.5	6.2	5.8	5.8	6.0
	19-Sep	76.3	5.0	5.4	4.7	5.0	5.1	19-Sep	5.2	6.2	6.0	5.7	6.1
	21-Sep	75.5	4.7	5.1	4.8	4.9	4.8	21-Sep	5.0	6.3	5.5	5.2	5.4
Supersweet Jubilee	9-Sep	77.2	5.5	5.0	5.4	5.3	5.4	9-Sep	4.5	4.4	4.1	4.2	5.0
	12-Sep	75.9	5.7	5.4	5.6	5.7	5.8	12-Sep	5.0	5.5	5.4	5.3	5.5
	16-Sep	75.7	5.5	5.5	5.4	5.4	5.5	16-Sep	5.4	5.9	5.5	5.5	5.2
	19-Sep	75.0	5.2	5.4	5.0	5.2	5.0	19-Sep	5.4	6.3	5.7	5.5	5.5
	21-Sep	75.4	5.0	5.1	4.9	4.9	4.7	21-Sep	5.4	6.2	5.5	5.3	5.5
XPH 2659	11-Sep	78.5	6.1	5.6	5.1	5.5	5.1	11-Sep	5.8	5.6	4.8	5.2	5.7
	13-Sep	77.4	5.8	5.5	4.9	5.3	4.9	13-Sep	5.0	5.5	4.3	4.6	5.3
	15-Sep	76.6	5.7	5.5	4.6	5.0	4.6	15-Sep	5.8	6.2	5.3	5.3	5.0
	18-Sep	76.4	5.4	5.4	4.7	4.9	4.6	18-Sep	5.5	6.3	5.0	5.2	5.2
	20-Sep	75.9	5.2	5.3	4.5	4.9	4.4	20-Sep	4.9	5.3	5.3	5.1	5.0
	22-Sep	75.8	5.1	5.0	4.3	4.8	4.5	22-Sep	5.1	5.9	4.7	4.7	4.6

Table 6. 1989 Frozen Corn - Industry & OSU Panels multi-harvest. Data for sample code, harvest date, % moisture, average for appearance, color, flavor, quality, texture and whole appearance (industry panel).

Line	Harvest date	% moist.	Industry Panel Average Scores: Appear.	Color	Flavor	Quality	Texture	Whole appear	Harvest date	OSU Panel Average Scores: Appear.	Color	Flavor	Quality	Texture
GSS 3548	7-Sep	78	6.2	6.6	5.4	6.0	5.7	7.0	7-Sep	5.8	6.2	6.5	6.1	5.7
	9-Sep	78	6.1	6.2	5.8	6.0	5.7	6.5	9-Sep	5.9	6.5	6.1	6.0	5.5
	12-Sep	76	6.4	6.3	5.8	6.2	5.5	6.4	12-Sep	4.8	5.6	5.9	5.6	5.6
	14-Sep	75	5.8	5.8	5.4	5.5	4.7	6.5	14-Sep	•	•	•	•	•
	16-Sep	75	5.6	5.5	5.0	5.2	4.5	6.0	16-Sep	5.4	5.5	5.3	5.2	4.7
	18-Sep	75	5.2	5.1	4.9	4.9	4.3	6.2	18-Sep	5.0	5.6	5.0	5.1	4.5
C & S 710	8-Sep	77.5	6.4	6.8	5.1	6.1	5.6	6.2	8-Sep	6.3	7.4	5.8	6.3	5.6
	11-Sep	76.6	6.1	6.1	4.9	5.6	5.1	6.0	11-Sep	6.3	6.8	5.6	5.5	5.1
	13-Sep	76.2	5.9	6.4	4.8	5.4	4.8	5.9	13-Sep	6.3	6.6	5.7	5.8	4.9
	15-Sep	76.0	5.5	6.0	4.0	5.1	4.3	5.5	15-Sep	5.8	5.8	5.3	5.1	4.8
	18-Sep	75.0	5.0	5.3	4.3	4.6	4.2	5.2	18-Sep	5.8	6.1	5.0	5.2	4.5
	20-Sep	74.5	4.7	5.1	3.7	4.2	3.7	4.7	20-Sep	5.4	5.8	4.9	4.6	4.5
Showcase	9-Sep	78.9	6.4	5.5	5.1	5.9	5.8	6.7	9-Sep	4.8	4.7	5.4	5.2	5.7
	12-Sep	77.7	6.1	5.8	5.2	5.7	5.5	6.6	12-Sep	5.1	5.4	6.1	5.6	5.8
	14-Sep	77.1	5.9	5.8	5.1	5.4	5.1	5.7	14-Sep	•	•	•	•	•
	16-Sep	76.7	5.5	5.5	4.9	5.5	5.0	5.9	16-Sep	5.2	5.3	5.1	5.1	5.1
	19-Sep	76.3	5.0	5.3	4.8	5.2	4.7	5.6	19-Sep	5.4	5.8	6.1	5.8	5.7
	21-Sep	75.5	4.7	5.2	4.3	4.9	4.9	5.4	21-Sep	5.1	5.4	5.4	5.2	5.2
Supersweet Jubilee	9-Sep	77.2	5.9	6.1	6.0	6.0	6.4	6.7	9-Sep	5.7	6.5	6.0	5.9	5.9
	12-Sep	75.9	6.2	6.2	6.2	6.5	6.5	7.2	12-Sep	5.8	6.4	6.5	6.5	6.4
	14-Sep	75.1	6.0	6.1	5.9	6.1	6.0	6.6	14-Sep	•	•	•	•	•
	16-Sep	75.7	6.0	6.1	5.8	6.1	5.8	6.9	16-Sep	5.5	6.2	6.1	5.9	5.8
	19-Sep	75.0	5.5	5.7	5.5	5.6	5.4	6.4	19-Sep	5.8	6.2	6.1	6.1	6.0
	21-Sep	75.4	5.4	5.3	5.3	5.5	5.2	6.3	21-Sep	5.4	6.4	5.6	5.7	5.5
XPH 2659	11-Sep	78.5	6.5	6.8	5.0	6.0	5.7	6.1	11-Sep	6.9	6.7	5.9	6.2	5.9
	13-Sep	77.4	5.5	5.5	5.3	5.4	5.2	6.0	13-Sep	6.8	7.0	6.3	6.6	6.0
	15-Sep	76.6	5.9	5.9	5.2	5.7	5.0	5.9	15-Sep	6.8	6.7	6.1	6.3	5.8
	18-Sep	76.4	5.9	5.9	5.0	5.3	4.7	5.3	18-Sep	6.6	6.9	6.2	6.3	5.6
	20-Sep	75.9	5.4	5.4	4.8	5.0	4.5	5.5	20-Sep	6.5	6.6	6.2	6.3	5.8
	22-Sep	75.8	5.2	5.0	4.5	4.6	4.4	5.3	22-Sep	5.9	6.1	5.4	5.4	5.1

Table 7. Sensory quality attributes of highest ranking corn lines, 1989.

Commodity	Processing Style	Panel	Highest Scoring Lines						
			Appear	Color	Flavor	Quality	Texture	Appear	
Corn	Canned	Industry	XPH 2659 GSS 3548	GSS 3548 Showcase	SS Jub Showcase	GSS 3548 SS JUB	Showcase SS Jub	C+S 710	
		OSU	GSS 3548 XPH 2659	XPH 2659 SS Jub	Showcase SS Jub	Showcase SS Jub	Showcase SS Jub	C+S 710 SS Jub	(
	Frozen	Industry	GSS 3548 SS Jub	SS Jub C+S 710	SS Jub GSS 3548	SS Jub GSS 3548	SS Jub	Showcase	S X
		OSU	XPH 2659 C+S 710	XPH 2659	XPH 2659 SS Jub	XPH 2659 SS Jub	SS Jub XPH 2659	Showcase	S G

Table 8. Highest and lowest sensory scores for OSU corn lines, 1989.

Processing Style	Type of Panel	Highest Scoring Lines	Lowest Scoring Lines
Canned	Industry	GSS 3548, Showcase, SS Jub	C+S 710
	OSU	Showcase, SS Jub	C+S 710
Frozen	Industry	SS Jub, GSS 3548	C+S 710, Showcase
	OSU	XPH 2659, SS Jub	Showcase, C+S 710

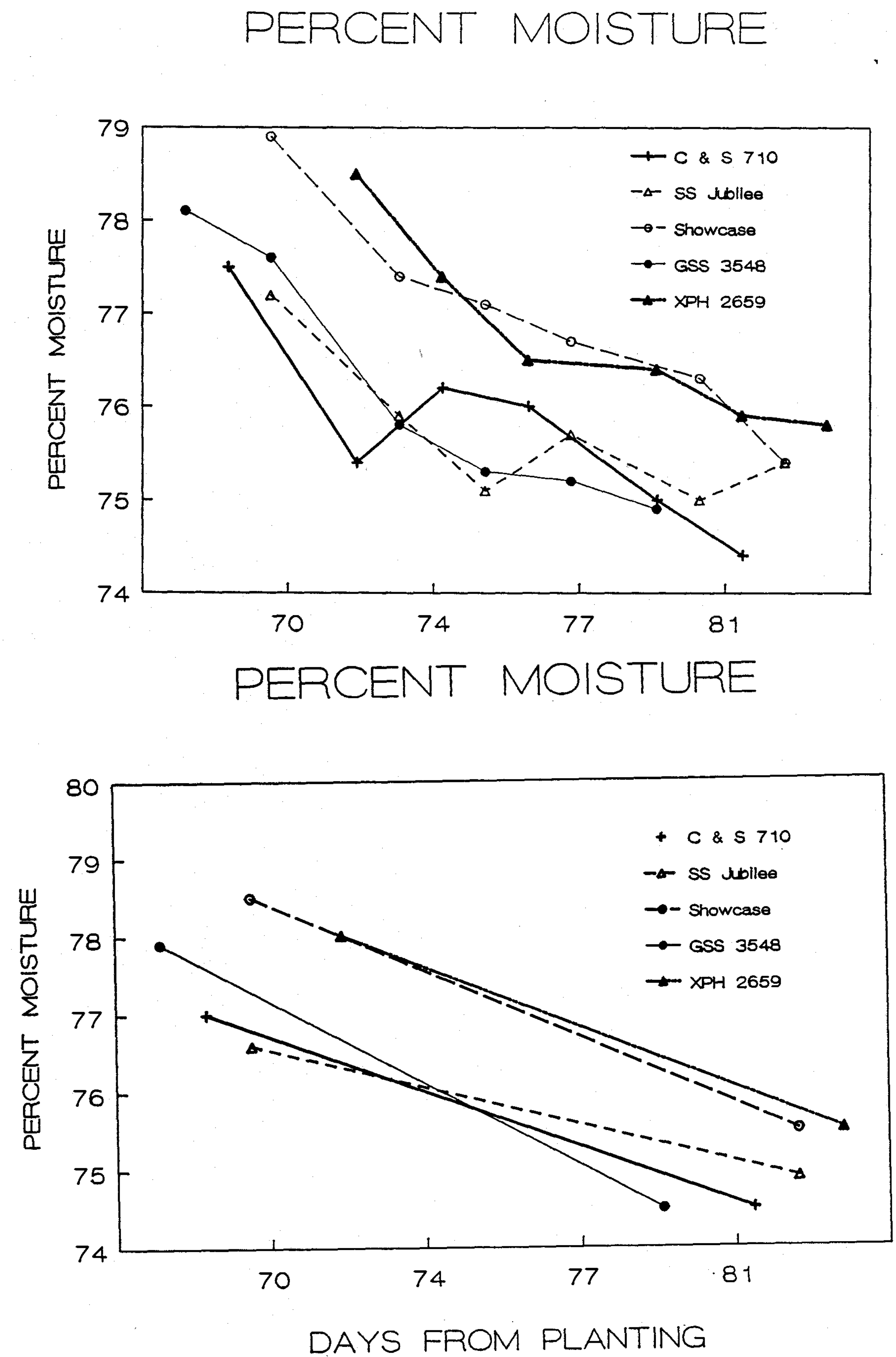
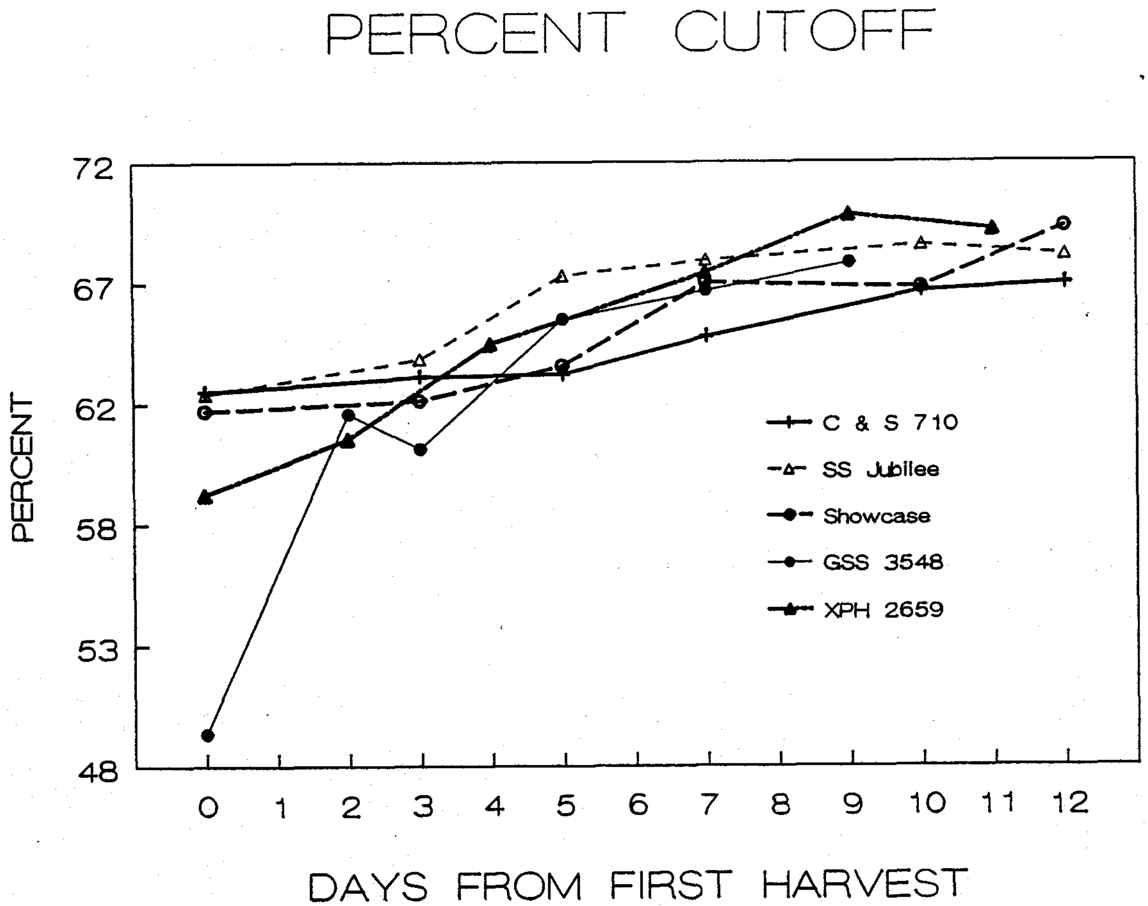


Figure 1. Percent moisture in fresh supersweet corn.



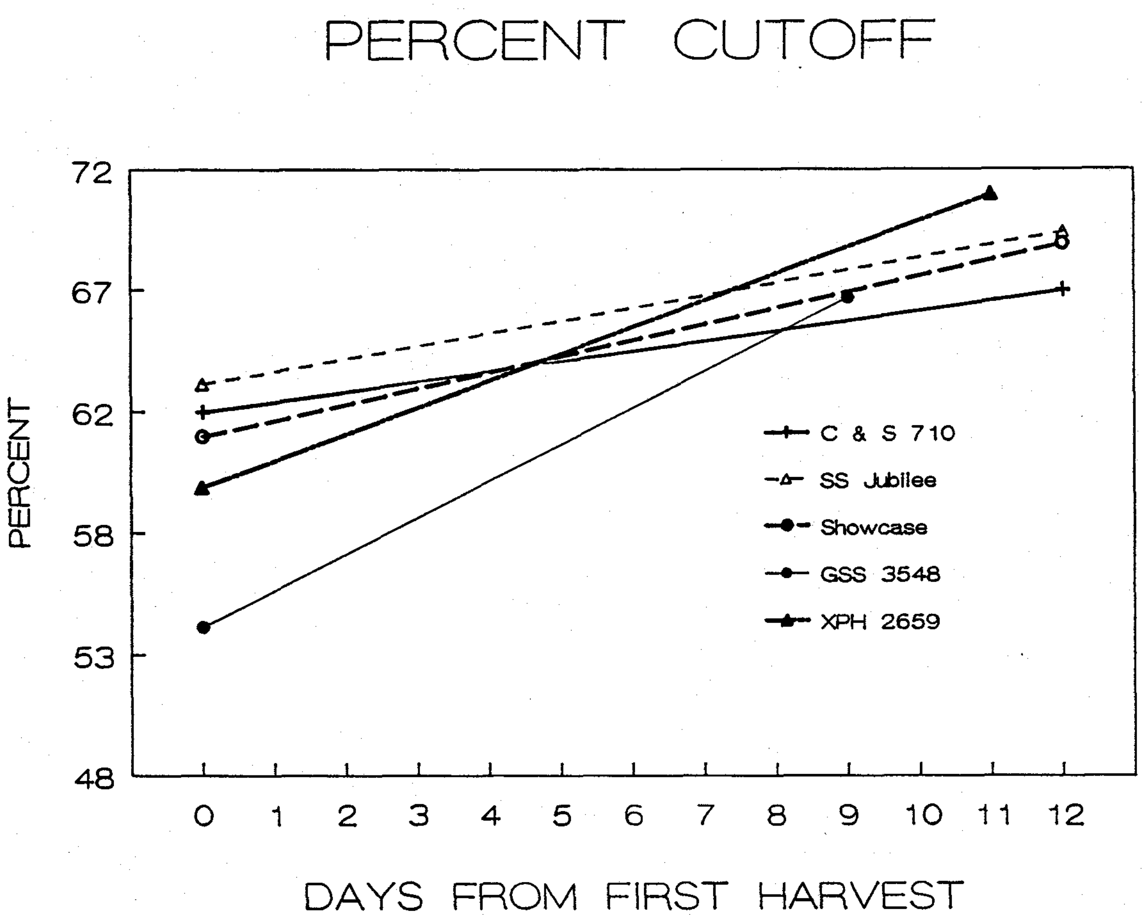


Figure 2. Percent cutoff in fresh supersweet corn.

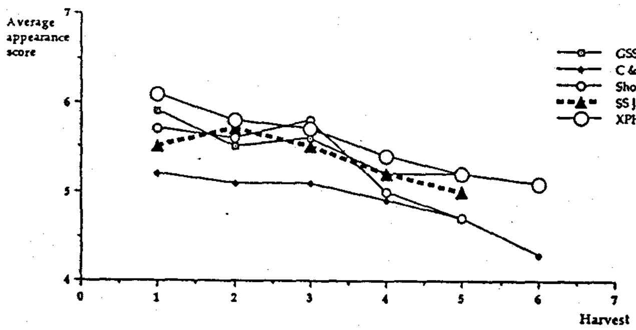


Figure 21. 1989 Canned Corn - Industry Panel. Average appearance score.

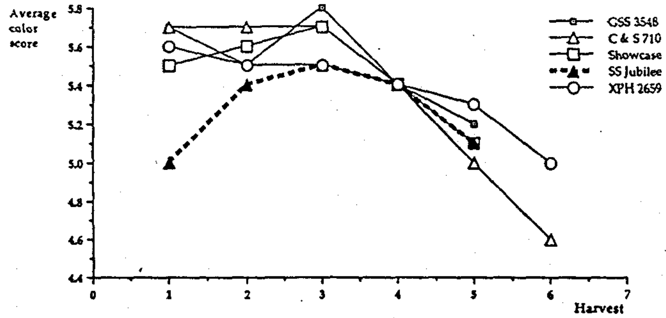


Figure 22. 1989 Canned Corn - Industry Panel. Average color score.

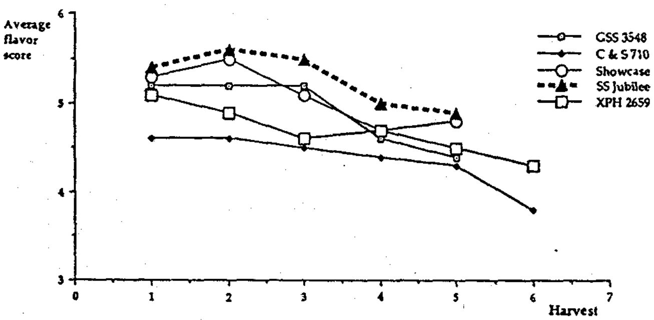


Figure 23. 1989 Canned Corn - Industry Panel. Average flavor score.

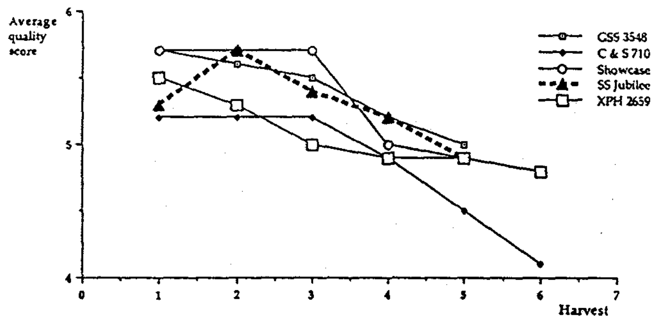


Figure 24. 1989 Canned Corn - Industry Panel. Average quality score.

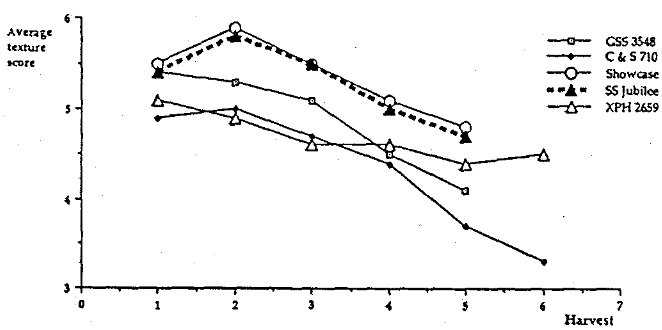


Figure 25. 1989 Canned Corn - Industry Panel. Average texture score.

Figure 3. Sensory results for 1989 canned supersweet corn, industry panel.

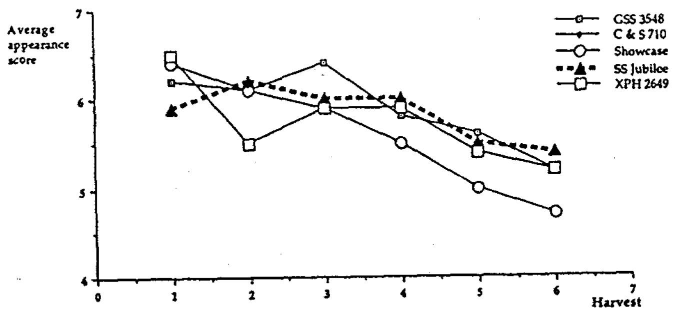


Figure 26. 1989 Frozen Corn - Industry Panel. Average appearance core.

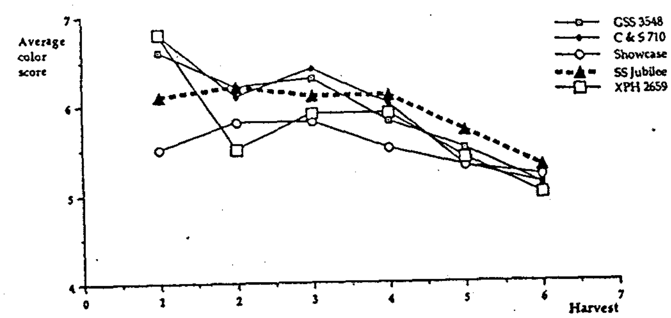


Figure 27. 1989 Frozen Corn - Industry Panel. Average color score.

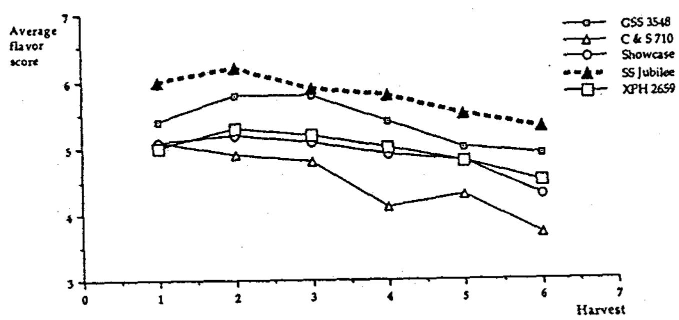


Figure 28. 1989 Frozen Corn - Industry Panel. Average flavor score.

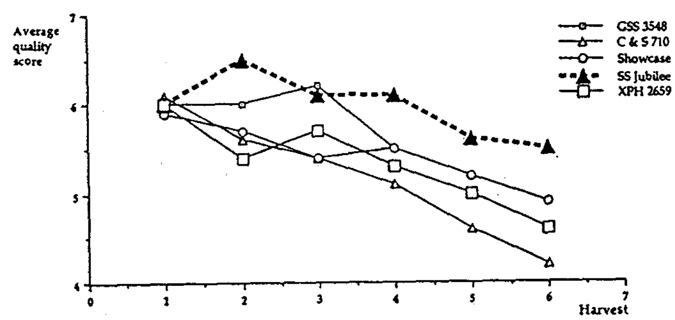


Figure 29. 1989 Frozen Corn - Industry Panel. Average quality score.

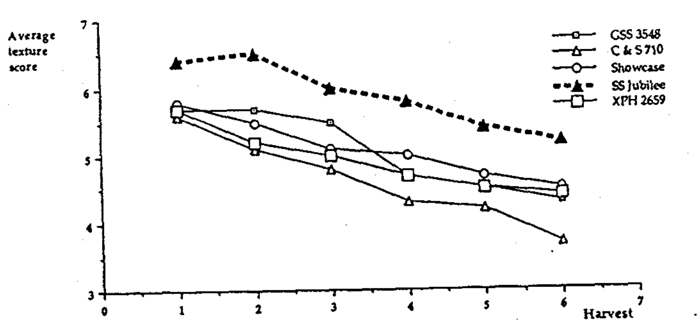


Figure 30. 1989 Frozen Corn - Industry Panel. Average texture score.

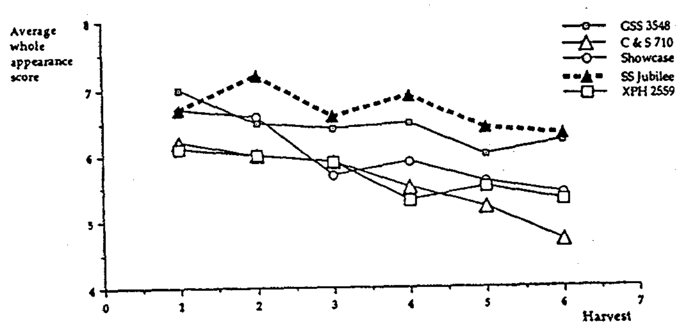
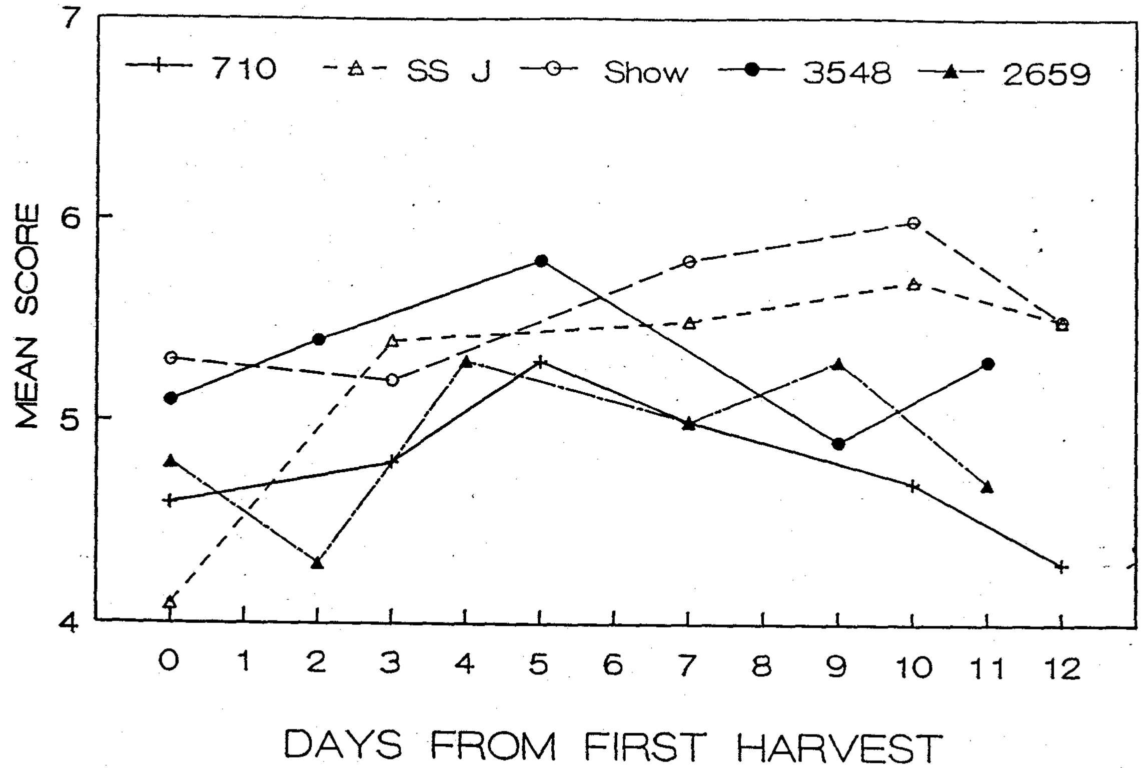


Figure 31. 1989 Frozen Corn - Industry Panel. Average whole appearance score.

Figure 4. Sensory results for 1989 frozen supersweet corn, industry results.

FLAVOR, CANNED SAMPLES
OSU PANEL 1989



FLAVOR, FROZEN SAMPLES
OSU PANEL 1989

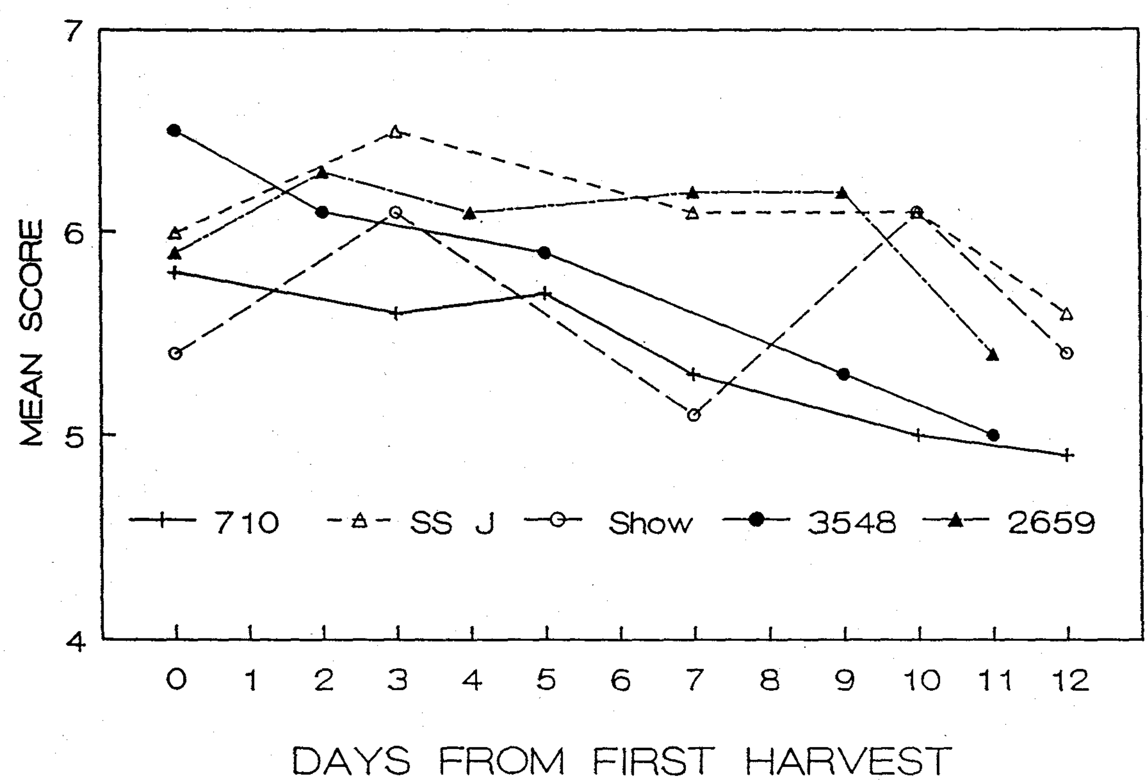
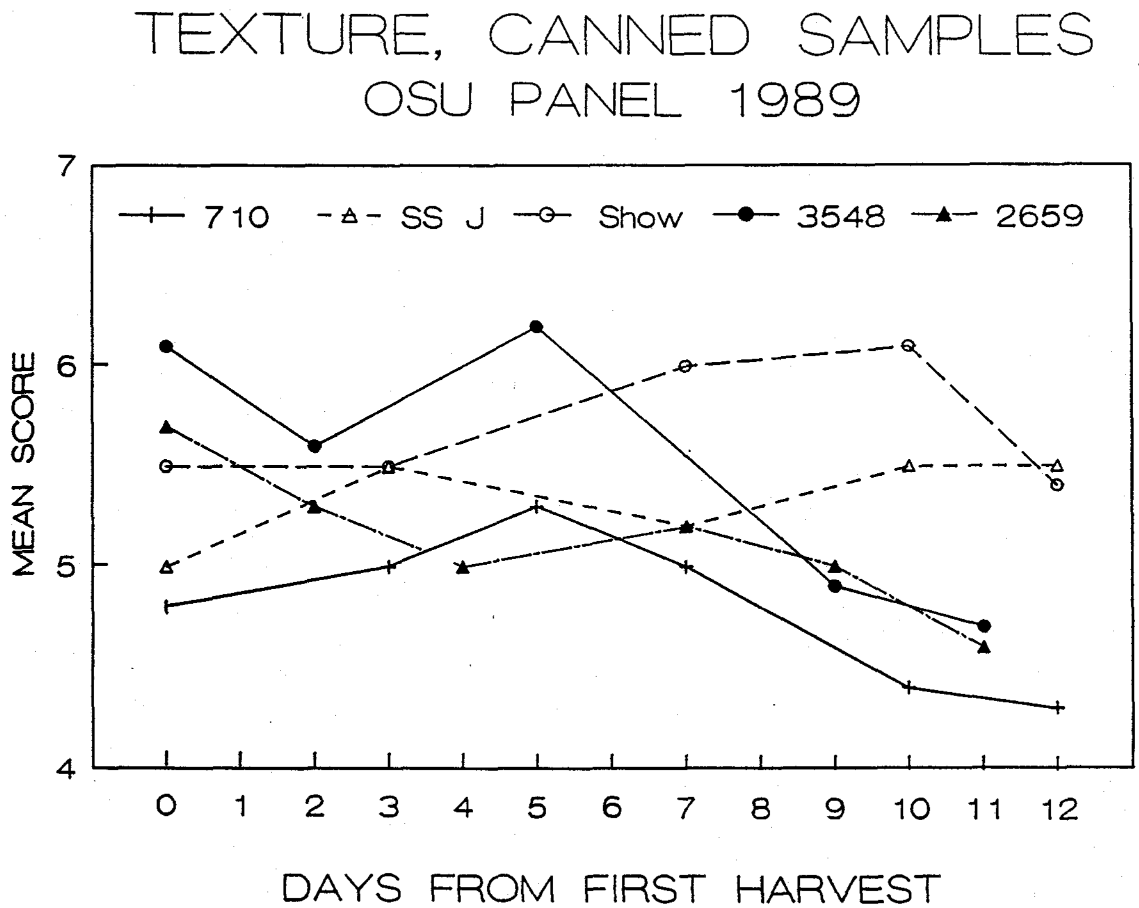


Figure 6. Flavor scores for 1989 canned and frozen supersweet corn, OSU panel.



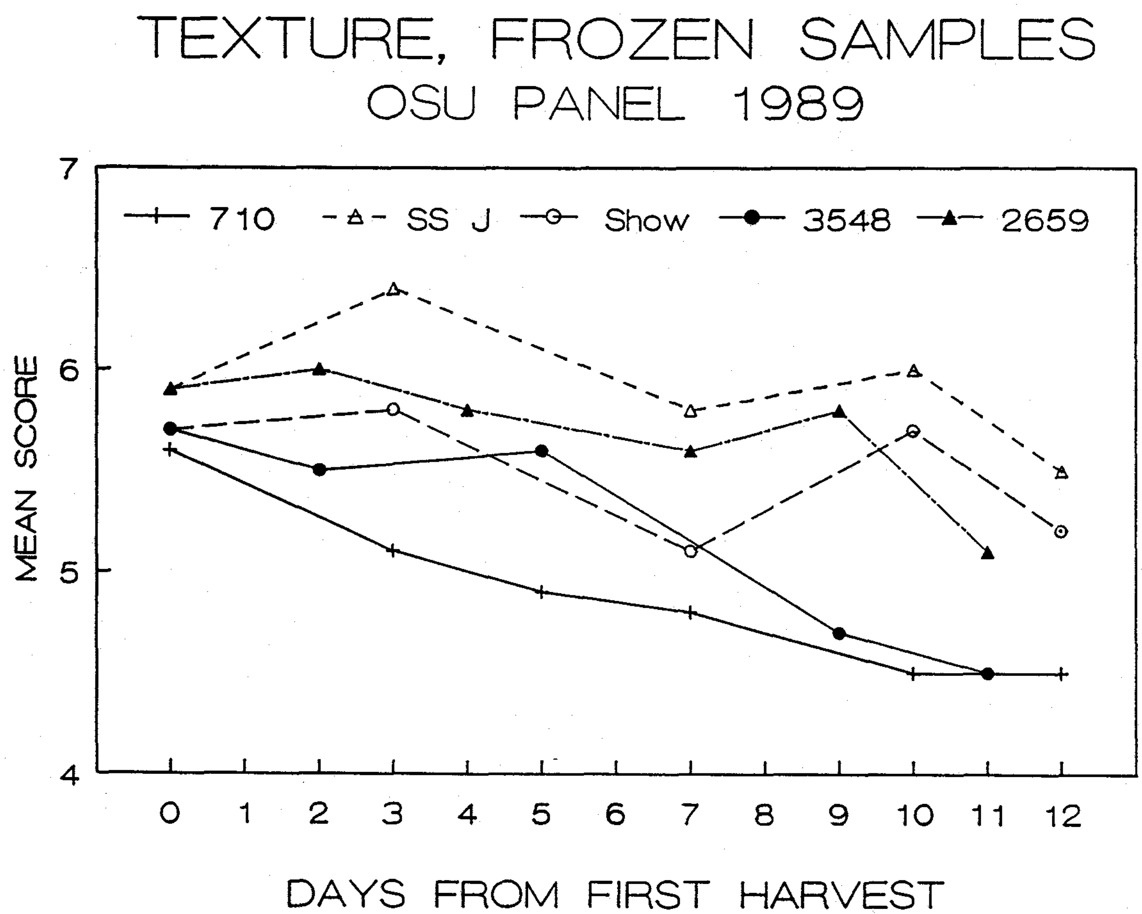


Figure 7. Texture scores for 1989 canned and frozen supersweet corn, OSU panel.