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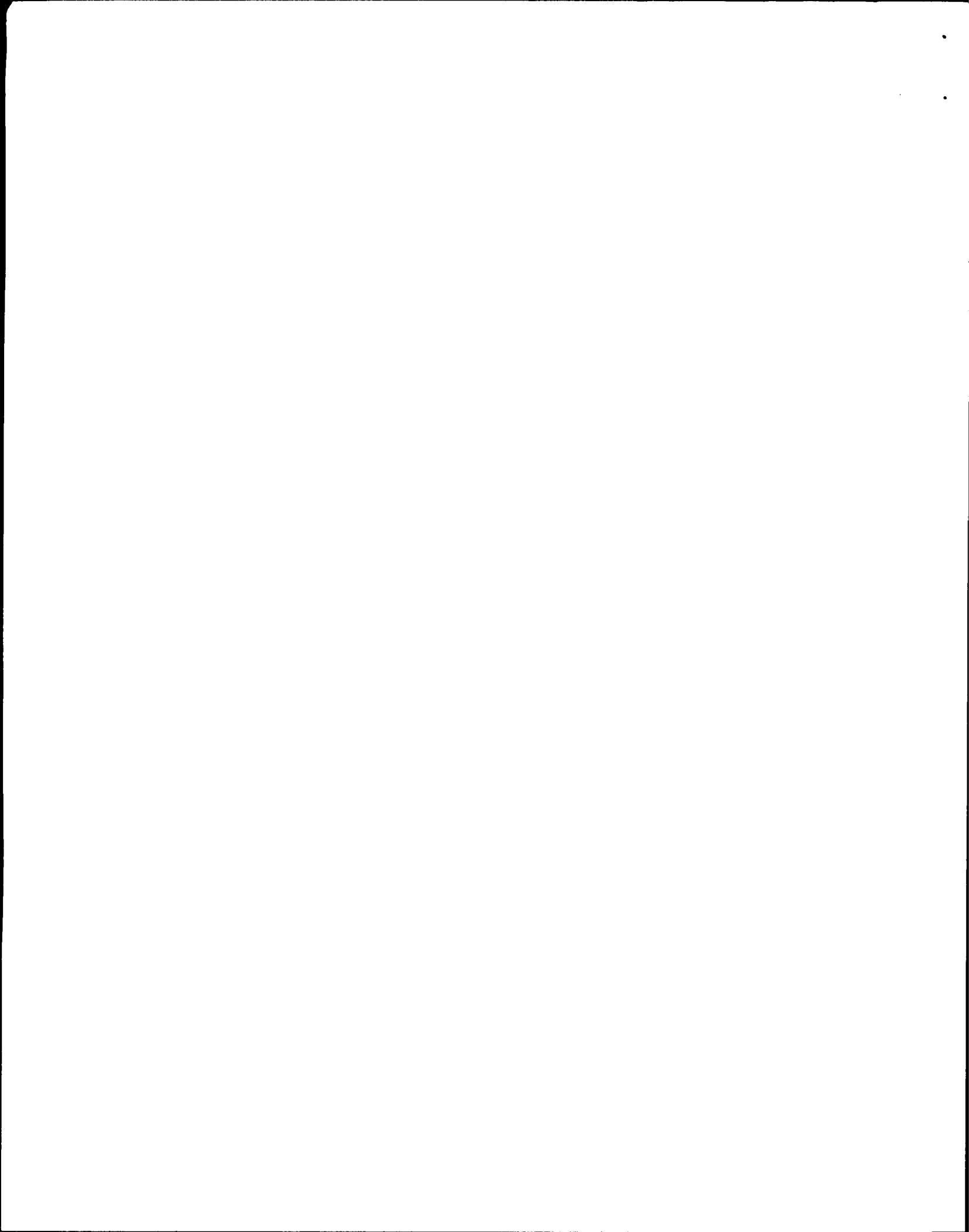
*J. Beattie*

ASPARAGUS RESEARCH REPORT, OCTOBER 31, 1980

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*Asparagus ♀ flower abortion -*



## INTRODUCTION

The 1980 asparagus research was a continuation and expansion of the 1979 program.

In addition to this, new variety trials were set out in Bow Island, Alberta, Creston, B.C., Fredericton, New Brunswick, Simcoe, Harrow and Guelph, Ontario. In addition to this, seedlings from plant crosses made in 1979 were set out in Kendal in E. Ontario. Other studies were nutrition, insect and weed control and mycorrhizae studies with asparagus. Insect and weed control studies were also initiated in B.C.

### University of Guelph

The Guelph weather conditions in early spring were cool again in 1980, but harvest began about 4 days sooner than in 1979.

The asparagus fern was rotary mowed in early April after which it received about 10 tons of barnyard manure and 800 pounds of 10-10-10 fertilizer per acre. The soil was tilled about 5 centimeters deep, which was followed by a pre-emergence herbicide. Harvest commenced May 5, 1980, and continued till June 5 to June 20, 1980, the length of harvest time depending on the age of the planting.

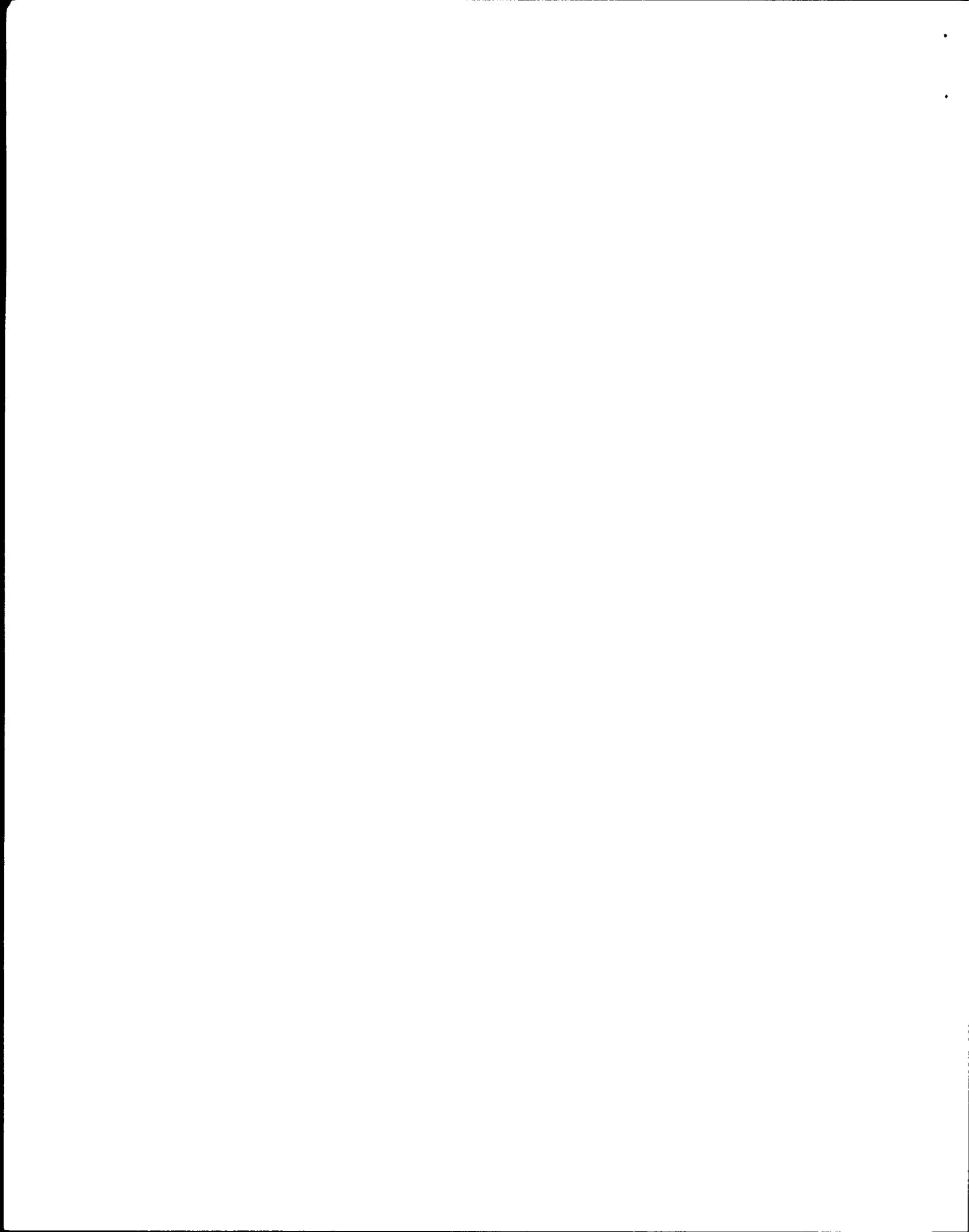
The crop was sprayed with an insecticide for asparagus beetle control. In spite of the spray program, there was a heavy beetle infection in the Viking seed field. This resulted in a heavy shelling of the seed pods and no seed was harvested in 1980.

Asparagus rust was severe at the end of the growing season but especially in some of the commercial fields in W. Ontario.

The 1979 yield at Guelph was slightly lower than in 1979 in the oldest planting.

### 1. Variety Trials

This investigation was to assess the different sources of asparagus varieties for Ontario conditions. We have 3 different plantings of asparagus (1973, 1975, 1977) with varieties originating from France, Germany, Holland, New Jersey, Washington, Canadian Cannors and our Canadian Selected Viking. In Lot A the 22 varieties were planted out in 1973, in Lot B the 7 varieties were planted out in 1974, and in Lot C the 21 varieties were planted out in 1977. All plants in the 3



lots of variety trials were started in the greenhouse and planted out as 12-week old transplants. They were grown at the Cambridge Horticultural Research Station on a Fox Sandy soil. Some of the varieties or lines look quite promising for Ontario conditions.

Lot A - 22 Varieties Established in 1973.

This was the fifth cutting season for these plots. Of the 22 varieties and lines assessed, Viking 2K and Viking Selected ranked from 13 to 20 over the 5 year harvest period. Of the 22 lines assessed 8, 3, 3, 4 and 2 of the French lines ranked in the top 10 for yields in 1976, 1977, 1978, 1979, and 1980 (Table 1). The 2 French lines yielding in the top 10 for 5 consecutive years are 105-106 and 106-105. These data indicate that the French lines yielded high in the early years but the yields dropped down by 1980. On the other hand, a number of asparagus lines from Rutgers yielding in the top 10 were 2, 5, 7, 5, and 8 in 1976, 1977, 1978, 1979, and 1980 respectively. The 5 Rutgers lines V15x14-4, 27x14-4, 15x14-4, RR1x14-4, and 16x14-4 were 1, 2, 3, 6, and 5 in 1980. (Table 1)

For cumulative yield, over 5 years, the Rutgers variety V15x14-4 had the highest yield in 1979 and 1980 and the highest total yield. (Table 2) The cumulative yield of this variety was followed closely by the two French lines 106-105 and 105-106.

The data suggests that the French lines produced higher yields in the early stages, however, some of the Rutgers lines improved and passed them in the 4th and 5th years. The yield reductions in the French lines could be due to growth setback from susceptibility to rust infection.

Lot B - 7 Varieties Established in 1974.

This is the fourth harvest season for this plot. In these trials Viking 2K ranks 4 to 6 of the 7 varieties tested. The Meisterschus line (22-25-75) has shown up best for ranking 1st or 2nd in the 4 years of harvest and with the highest cumulative yield (Table 3). Lucullus ranked 2nd in last 2 years and in the total cumulative yield. The two Dutch varieties Limbras I and II are the two poorest varieties to date which is probably due, in part, to their susceptibility to rust.

The Meisterschus lines and Lucullus have quite vigorous growth and show some tolerance to rust.



Table 1 Asparagus Variety Trials 1976, 1977, 1978, 1979 and 1980

<u>Lot A - 22 Varieties planted in 1973</u>			Cambridge Research Station								
<u>Name</u>	<u>Source</u>	<u>Total Marketable Asparagus Yield<sup>1</sup> (Kgm/ha)</u>									
		<u>1976</u>	<u>(R)<sup>2</sup></u>	<u>1977</u>	<u>(R)</u>	<u>1978</u>	<u>(R)</u>	<u>1979</u>	<u>(R)</u>	<u>1980</u>	<u>(R)</u>
Viking (Sel.)	Vineland	1323	16	1001	20	1909	19	2289	18	1984	17
Viking 2K	Kerr	1358	13	1093	17	2007	18	2183	20	2072	15
N.J. 106	NJAC	1331	15	1309**	9	2476	11	2890**	11	2816	8
25-46	France	1694**	10	1016	19	1810	20	2192	19	1459	21
53-36	France	2201**	5	1567**	2	3116**	2	3113**	9	2169	12
58-53	France	2170**	6	1181*	12	2389*	14	3069**	10	2073	14
105-106	France	2331**	2	1549**	3	3239**	3	3377**	6	2688	9
116-115	France	1971**	7	911	22	1723	21	1987	22	1268	22
106-105	France	2284**	3	1544**	4	3163**	4	3526**	4	2839	7
36-53	France	1680**	11	1094	16	2367*	15	2534	17	1513	20
108-107	France	2380**	1	1267**	11	2454**	12	3260**	8	2094	13
46-109	France	2214**	4	1084	18	2050	17	2755*	14	1801	18
46-25	France	1589*	12	962	21	1723	22	2034	21	1621	19
27x14-4	Rutgers	1171	19	1364**	6	3414**	1	3658**	2	3431	2
51x14-4	Rutgers	1239	18	1334**	7	2847**	8	3422**	5	3307	3
27x14-3	Rutgers	1056	20	1330**	8	2650**	9	2793**	13	2606	10
V15x14-4	Rutgers	1732**	8	1422**	5	3098**	5	3793**	1	3653	1
RR1x14-4	Rutgers	1040	22	1107	15	2607**	10	2812**	12	3135	4
16x14-4	Rutgers	1269	17	1307**	10	2967**	6	3590**	3	3107	5
51x14-3	Rutgers	1347	14	1616**	1	2834**	7	3307**	7	3059	6
56x14MM	Rutgers	1696**	9	1177**	13	2443***	13	2630	15	2045	16
VLGZx14MM	Rutgers	1056	21	1117	14	2181	16	2614	16	2450	11
		247		137		293		374		354	
		330		182		389		498		471	

Spacing - Plants set 30 centimeters apart in rows  
 - Rows 137 centimeters apart

Plants - 10 centimeters deep

Field Planted - June 1973 as 12 week old plants  
 (started in greenhouse in Jiffy Seven pots)

<sup>1</sup>Total Yield: 11-18 cm spears harvested:  
 1976 from April 23 to May 18  
 1977 from April 25 to June 3  
 1978 from May 10 to June 16  
 1979 from May 9 to June 22  
 1980 from May 5 to June 20

<sup>2</sup>Ratings in Marketable Yield of the different varieties  
 for each year



Table 2      Asparagus Variety Trials (1976-1980)      Cambridge Research Station

Lot A - 22 Varieties Planted in 1973

Variety Name (Source)	Marketable Yield 1980 (Kg/ha)	(R)	Cumulative Mkt Yield 1976-1980 (Kg/ha)	(R)
Viking (Sel) (Vineland)	1984	17	8506	19
Viking 2K (Kerr)	2072	15	8713	18
NJ 106 (NJAC)	2816	8	10822	11
25-46 (France)	1459	21	8171	20
53-36 (France)	2169	12	12166	7
58-53 (France)	2073	14	10882	10
105-106 (France)	2688	9	13184	3
116-115 (France)	1268	22	7860	22
106-105 (France)	2839	7	13356	2
36-53 (France)	1513	20	9188	17
108-107 (France)	2094	13	11455	9
46-109 (France)	1801	18	9904	15
46-25 (France)	1621	19	7929	21
27x14-4 (Rutgers)	3431	2	13039	4
51x14-4 (Rutgers)	3307	3	12149	8
27x14-4 (Rutgers)	2606	10	10435	13
V15x14-4 (Rutgers)	3653	1	13698	1
RR1x14-4 (Rutgers)	3135	4	10701	12
16x14-4 (Rutgers)	3107	5	12240	6
51x14-3 (Rutgers)	3059	6	12263	5
56x14MM (Rutgers)	2045	16	9991	14
VLGZx14MM (Rutgers)	2450	11	9418	16



Table 3 Asparagus Variety Trials 1977, 1978, 1979, 1980 Cambridge Research Station

Lot B - 7 Varieties planted in 1974

<u>Code No.</u>	<u>Variety</u>	<u>Source</u>	<u>Total Marketable Yield Kg/ha</u>								<u>Cumulative Mkt. Yield</u>	
			<u>1977</u>	<u>(R)</u>	<u>1978</u>	<u>(R)</u>	<u>1979</u>	<u>(R)</u>	<u>1980</u>	<u>(R)</u>	<u>1976-1980</u>	<u>(R)</u>
1	Viking 2K	Kerr	226	4	1309	2	1757	6	1322	4	4614	4
2	Meisterschus (22-25-75)	Germany	380*	2	1747	1	2026	2	1587	1	5740	1
3	Lucullus	"	335	3	1036	5	2480	1	1465	2	5316	2
4	Meisterschus	"	206	5	1206	3	1852	5	1393	3	4657	3
5	Meisterschus (94-55-74)	"	419	1	1048	4	1884	3	1058	5	4409	5
6	Limbras II	Holland	206	5	873	6	1857	4	670	6	3606	6
7	Limbras I	"	168	7	726	7	1633	7	587	7	3114	7
	LSD .05		120		252		399		365			
	.01		165		345		547		501			

Spacing - plants set 30 cm apart in rows  
rows 137 cm apart

Field planted - June 1974 as 12 week old plants from Jiffy Seven Pots

Total Yield Harvested - 1977, April 25 to May 19  
1978, May 10 to June 16  
1979, May 9 to June 23  
1980, May 5 to June 20



Lot C - 21 Varieties Established in 1977.

This lot was harvested for 2 weeks in 1979 and 4 to 5 weeks in 1980. Of the 21 lines assessed, 3 lines, namely, P66A H10, P11xT, and P66A FF, ranked in the top 10 for 2 years in a row. (Table 4) Although these yield trends are not too reliable, it is of interest to note that P66A FF ranked 1st and 2nd, 2 years in a row. Viking 2K was 8th and 12th in 1979 and 1980. (Table 4).

2. Effect of Different Seeding Depth on Yield of Direct Seeded Asparagus

The planting was direct seeded in 1974. The variety Viking 2K was sown at 5, 10, 15, and 20 cm. deep. The 1977, 1979, and 1980 results indicate an increase in yield with an increase in planting depth. (Table 5) This trend is more obvious in the cumulative yield over 4 years where the 20 cm. depth produced 2697 Kg more asparagus than at the 5 cm. depth. (Table 5)

3. Direct Seeding of Asparagus at Different Plant Populations

The variety Viking 2K was direct seeded 5 cm deep, at different plant populations. The planting consisted of 1, 2, 4, 6, 8, or 24 row beds, with plants 30 cm. apart in the beds. Rows in the 24 row plot were 45 cm. apart in the beds.

The plants were sown 8 cm. deep.

After 4 years of harvest there appeared to be no definite pattern in yield with the different plant populations in either marketable or total yield. (Tables 6 and 7). The yield varied from year to year for the different plant populations. There was only a spread of 550 and 474 Kg/hr for marketable and total cumulative yields between the lowest and highest yielding plots respectively over the 4 years. The highest cumulative yields were the 6 row and multiple 24 row blocks for marketable and total yield respectively.

4. Seed Stock Improvement (Improved Viking) 1973.

The object of this investigation was to obtain desirable plants from Improved Viking for establishment of seedbed for commercial seed production.

The seedling bed was direct seeded in June 1973 in single rows with plants 4 inches apart in rows 24 inches apart.

A one acre permanent seedbed was established from this planting, in the summer of 1975 and 1976 at a ratio of 4 females to one male plant. This field now harvested for seed is rogued for poor plants. Due to heavy insect damage this field was not harvested for seed in 1980.



Table 4 Asparagus Variety Trials 1979, 1980

Lot C - 21 Varieties - 1977

Variety	Source	<u>Total Marketable Yield Kg/Ha</u>				Cumulative Mkt. Yield (1979-80)	
		1979	(R)	1980	(R)	Kg/ha	(R)
Viking 2K	Canada	306	8	851	13	1157	13
8016 02-09		274	15	907	8	1181	10
8013 020120A		298	12	1065	3	1363	3
1018 02-W6		271	16	902	10	1173	11
9008 02-85		301	10	833	15	1134	14
8005-6 02-08		198	19	1009	5	1207	8
P66A H10	USA (W)	336	5	1115	1	1451	2
P11 XT	USA (W)	382*	2	912	6	1294	4
P12 x T	USA (W)	312	7	778	17	1090	17
P5 x T		298	13	911	7	1209	7
P13x11		308	11	713	18	1021	18
P12x5	USA (W)	347	3	667	19	1014	19
P12x13		260	17	836	14	1096	16
P2xT		108	20	391	21	499	21
P11xP11		95	21	415	20	510	20
P12x3	USA (W)	336	4	886	11	1222	6
POPS		306	9	863	12	1169	12
P5xP5	USA (W)	317	6	815	16	1132	15
P5x9		293	14	905	9	1198	9
P66A FF	USA (W)	458*	1	1091	2	1549	1
P11x5		249	18	1012	4	1261	5
	LSD	70.25		141			
		93.4		187			

Field Planted June 1977

Spacing - Plants 30 cm apart  
Rows 137 cm apartHarvest - 1979 May 13 - May 26  
- 1980 May 5 - June 6

(R) - Rating of variety



Table 5 Asparagus Seeding Depth

Seedling Depth (cm)	Total Marketable Yield Kg/ha				Cumulative Mkt. Yield (Kg/ha)
	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	
5	667	1475	1791	1335	5268
10	946*	1770	1894	2232	6842
15	1177**	1707	2228*	2362	7474
20	1411**	1533	2441**	2580	7965
LSD .05				334	
.01				480	

Variety - Viking 2K

Spacing - plants 30 cm apart in row  
rows 150 cm apart  
field sown - June 1974

Harvesting - 1977 - April 25 to May 31  
1978 - May 10 to June 16 (20 harvests)  
1979 - May 9 to June 22  
1980 - May 5 to June 20



Table 6 Asparagus Plant Population Study

Number of Rows	Plant Spacing in Row (cm)	Marketable Yield Kg/ha								Cumulative Total Yield (1977-1980)	
		<u>1977</u>	(R)	<u>1978</u>	(R)	<u>1979</u>	(R)	<u>1980</u>	(R)	(R)	(R)
1	30	281	6	1414	7	2084	2	2170	3	5949	6
1	45	279	7	1796	2	2177	1	2027	6	6279	2
2	30	329	4	1567	3	2055	4	2061	4	6012	4
4	30	365	1	1522	6	2022	5	2061	4	5970	5
6	30	347	2	1929	1	2078	3	2023	7	6377	1
8	30	286	5	1556	2	1799	7	2186	2	5827	7
24	45	338	3	1552	5	2001	6	2191	1	6082	3
	L.S.D. .05	51		NS		NS		NS			
	.01	71									

Variety - Viking 2K

Spacing - 1, 2, 4, 6, 8, 24 row bed

- beds 2,4, 6, 8 rows - rows in bed 30 cm apart

- 24 row bed - rows 45 cm apart

Field established in 1974

Harvest - 1977 - April 25 to May 19

1978 - May 10 to June 16

1979 - May 9 to June 19

1980 - May 5 to June 20 (33 harvests)



Table 7 Asparagus Plant Population Study

Total Yield (Kg/ha)

<u>Number of Rows</u>	<u>Plant Spacing in Row</u>	<u>1977</u>	<u>(R)</u>	<u>1978</u>	<u>(R)</u>	<u>1979</u>	<u>(R)</u>	<u>1980</u>	<u>(R)</u>	<u>Cumulative Total Yield (1977-1980)</u>	<u>(R)</u>
1	30	407	5	1988	7	3271	5	2640	2	8306	6
1	45	392	7	2306	1	3315	4	2458	5	8471	2
2	30	455	4	2159	2	3266	5	2491	4	8371	3
4	30	551	1	2086	4	3332	3	2361	7	8330	5
6	30	494	2	2007	6	3403	2	2380	6	8284	7
8	30	407	5	2074	5	3070	7	2804	1	8355	4
24	34	475	3	2129	3	3516	1	2638	3	8758	1
	L.S.D. .05	75		NS		342					
	.01	102				470					

Variety - Viking 2K

Spacing - 1, 2, 4, 6, 8, 24 row bed

- beds 2, 4, 6, 8 rows - rows in bed 30 cm apart

- 24 row bed - rows 45 cm apart

Field Established in 1974

Harvest - 1977 - April 25 to May 19

1978 - May 10 to June 16

1979 - May 9 to June 19

1980 - May 5 to June 20



5. Viking Plant Improvement 1973

A total of 4000 seedlings grown from Selected Viking seed were inoculated twice with Fusarium wilt from which about 50 plants survived and were field planted in 1974. Plants from this selection are being used for tissue culture work as well as variety improvement. These plants are growing in the greenhouse and are being used for breeding.

6. Variety Improvement Program

A number of Viking and plants of other varieties were selected from old asparagus plantings in Ontario, Quebec, and British Columbia and are being used in our breeding work. Also plants from our cultivar trials are being used as parents in our crop improvement program. Some of this material has been or will be increased through tissue culture. Plants from some of these crosses were set out for assessment in 1980 in the Kendal area (E. Ontario). Also a plot of genetic material is being established, through tissue culture, at the Cambridge Research Station. This field of genetic material, will be continually increased as new plant selections are made.

7. Asparagus Breeding and Tissue Culture Program

The most important aspect of the program this year was an extensive study of individual plant yields during harvest season. It was found that an individual mature plant could yield as many as 40 medium-sized or larger spears, with the average for our selected plants being about 22 spears. The high yielding plants begin producing early and maintain a steady production throughout the season. This study also confirmed that more males than females are high yielders and that neither summer fern growth nor earliness alone is an accurate indicator of high yield.

From this study, 60 individual plants were selected for use in the breeding program, and most have been introduced into tissue culture. Also cultured this summer were 15 Viking 2G selections to be used for a new seedbed and 31 selections from Kerr Farms, possibly to be used in the breeding program. The total number of spears cultured this summer was 97.

The calendar for tissue culture from field material is roughly as follows:

June - initial culture from spear in test tubes.

September - stem segment culture (branching nodes) in test tubes.



November - transfer of potential crowns to rooting medium in test tubes.

January - transfer of unrooted crowns to fresh rooting medium in bottles.

January to April - potting up of rooted plantlets in soil, to be grown in the greenhouse.

May to June - plants repotted or planted in the field.

Following this schedule, approximately 250 clones of an individual plant can be produced in a year, ready for field planting in the spring. The actual number depends on the vigour of the plant in tissue culture.

So far in the program about 1000 tissue culture plants have been potted in soil with about 75% survival. The value of these plants was reassessed after the spring harvest and many were discarded as poor yielders. The better plants are to be used for breeding and have been planted out in the genetic material lot at Cambridge, with one clone of each kept in the greenhouse. The plants in the field established themselves quickly and produced vigorous new growth.

Three experiments in tissue culture were undertaken this past year. In the first, it was found that stem segment cultures with more than one branch at the node were three times more likely to produce shoots than those with only one branch. In the second experiment concerning root growth in the first rooting medium, it was found that after eight weeks 8% of the cultures showed root growth sufficient for transfer to soil, and an additional 15% showed some root growth. For the third experiment, not yet completed, stem segments of one clone were cultured for varying lengths of time in colchicine in the hope of obtaining some tetraploid plants. Root tip samples have been taken from some of the cultures and cells have been observed which appear to have double the normal number 20 chromosomes. The plants suspected of being tetraploid will be grown on for observation.

Seeds for this summer's plantings were sown in March. They were treated with Javex, pregerminated 5 days, sown in styrofoam speedling flats and planted out in the field in June.

Seedlings from the crosses made in the field and the greenhouse last summer were planted out at Kendal. Germination was extremely poor for the field-crossed seed, but good for that from the greenhouse. Survival rate in the field was quite good for both groups. The hybrids show excellent growth, obviously exceeding the Viking seedlings in the same lot.



The 1980 greenhouse crosses from last winter were seeded in May and planted out at Kendal in July. Their survival rate was very good, but there has been little new fern growth this summer.

In July, 37 different crosses were made in the field at Cambridge, using as parents those plants selected in the spring harvest study. However, the set was again poor with only 19% of the crosses made producing healthy berries. (Compare this to an average of 65% for crosses made in the greenhouse.) The asparagus beetle caused some damage to the berries this year, even though the fields were sprayed regularly.

Throughout the summer, evaluations were made of the 1979 and 1980 plantings at Cambridge. Notes were made on survival rate, fern size, stalk number, uniformity, and sex ratio for each variety and replicate. After a slow start in the spring, the two 1979 lots are doing very well, with the Observation Trial showing somewhat more vigorous growth than the Variety Trial. The 27-variety 1980 Observation Trial was planted in June and most of the varieties show good first year growth.

An acre seedbed for the production of hybrid seed was planted at Kendal. The German variety Lucullus was planted as the male parent and Viking was planted for the female parent. The bed got off to a bad start because of damage from the late June frost and the July cloudburst. Some large gaps in the rows will have to be filled in next summer. Some of the Viking males bloomed this summer and were dug out, the remainder of the male will be rogued next summer. Any large gaps left by this male-elimination program will be filled with cloned Viking female transplants. Some of the Lucullus flowered this summer, all were males as expected. We should have a small harvest of hybrid seed next year.

The 17 crosses made in the field in 1979 were transplanted to Kendal in June and did very well. Most of the hybrids were 50% taller and had twice as many spears as the Viking and Lucullus in the adjacent rows. Very few flowers were produced on these hybrids which may indicate that they are slower maturing than the Viking and Lucullus varieties. The main parent varieties were French, Rutgers, and selected Viking. The growth of the individual plants will be assessed next summer, and any outstanding individuals will be cloned and used for breeding or production. Ten crosses were made in the greenhouse last winter and seeded in May and



planted out at Kendal in July. These plants survived well but there were no other late plantings with which to compare them. We will assess these next summer to find out if the late planting had any adverse effect. The seed germination and survival have been excellent and we will compare it with Viking next year. We are checking the hybrids for germination and survival as well as plant growth.

Little progress has been made in the production of a super-male. There are a number of tubes containing growth from pollen grains but so far this is all callus material and no entire plants have developed. Next summer we will be examining a large field of Lucullus to locate hermaphrodite plants. These will be cloned and selfed and should prove to be an alternate source of super males.

The major work this winter will be the production of cloned transplants from the better Viking males and females to produce the Cruikshank seed plot.

#### VARIETY TRIAL ESTABLISHMENT

##### ONTARIO

##### University of Guelph - H. Tiessen

In 1979 extensive variety trials were set out in Ontario.

At the University of Guelph, 27 replicated varieties and lines were set out. Also 81 varieties and lines were set out in single 80 plants per plot, variety observation trial. This is a total of 108 varieties which were set out at Guelph. These varieties continued to grow well in 1979 and 1980.

In 1980 a new Observation Trial was set out as 12 week old transplants. These consisted of 27 lines of varieties from Guelph, Germany, Rutgers and Washington State. The first year of growth was satisfactory.

##### Horticulture Research Station - Simcoe - A. Loughton

In 1979, 15 lines and varieties were set out as 12 week old transplants in 3 replications. Growth was very good in both 1979 and 1980.

In 1980 another asparagus variety trial of 17 varieties and lines were set out as 12 week old transplants. These consisted of 8



lines from Germany, 8 from France, and Viking 2K from Ontario.

Harrow Research Station - A Liptay

In 1980, 16 varieties and lines were set out as 12 week old transplants. These cultivars come from Canada, U.S.A., Germany, France, and Holland.

Other Research at the University of Guelph

(1) Effect of Spear Scarring on Growth and Development of Asparagus Spear and Fern

The objective was to determine the symptoms that appear on asparagus spear fern damage when the young spears are damaged in the early stages of their development. Spears were scarred above, below, or at the soil surface with a nail either as a single or continuous pierce.

As asparagus spears and ferns are affected by scarring. Spears damage is evident 2 to 3 days after scarring. There is generally a presence of bending, arching or angling of the spear and a reduction in growth rate. Symptoms are most severe in early stage of growth which affects marketability of the product. As the spear continues to grow, many scarring symptoms are less evident and often disappear at the fern stage. A small percentage of scarring severely damaged or killed the spears. Spears are generally affected shortly after scarring by bending, angling or arching and the number of marketable spears may be reduced. As the fern grows, scarring symptoms are often not readily evident.

(2) Spear Emergence After Cultivation

The object was to determine the effect of rotary mowing of fern above the soil or deeper tilling methods of cultivation, on spear emergence and growth of asparagus.

The asparagus field was rotary mowed, or disced 4 inches deep. Rotary mowing the asparagus bed cut off the fern at soil level. This promoted new spear growth - many of these were bent or angled because of obstruction from stubble and debris, however, they eventually straightened out and grew into normal ferns. Discing 4 inches



- (2) continued

deep in field where the seed was sown 3 inches deep, cut off existing ferns below the soil level. There was also some crown damage and the new spears that emerged were bent or twisted but these usually straightened out by the time the fern developed.

- (3) Effect of Temperature and pH on Seed Germination of Asparagus

- S. Khosla and H. Tiessen

The object of this study was to determine the effect of germination temperature and pH on the germination of asparagus seed. Seed of the variety Viking 2K was grown at 2 temperatures - 24°C and 18°C and 7 pH levels - 4.0, 5.0, 5.5, 6.0, 6.5, 7.0, 8.0. The seedling emergence rate was 19.30 to 20.3 days at all the pH levels at the higher temperature of 24°C. The percent germination was highest at a pH range of 6 to 7 (86 to 90%) and lowest at the pH 4 (70%).

At the lower temperature 18°C the percent germination was again the highest at pH 5.0 to 6.5 (49 to 60%) but considerably less than at the higher temperature. The low temperature also had a great influence on the germination rate at the different pH levels. It was found to be faster 24.8 to 25.3 days at a pH of 5.0 to 6.0 as compared to 27.2, 27.5, 29.1 and 27.6 days at the pH of 4.0, 6.5, 7.0, and 8 respectively.

The data would suggest that if the soil has a pH of 5 or below asparagus germination will be less than at a pH above 5 at both soil temperatures, but more so at a pH of 5.0 or below and at soil temperature below 18°C. Thus when direct seeding of asparagus in cool early spring, it would be necessary to adjust for a 30 to 50% germination rate.

- (4) Asparagus Nutritional Studies Are Underway in the Greenhouse and in the Field. Results are not available as yet. This study is being conducted by a graduate student.

- (5) Anther Culture of Asparagus is underway by a graduate student and will be discussed by Dr. P.M. Harney.

- (6) Effect of Low Temperature on Winter Killing and Hardiness Studies were initiated by H. Tiessen, in the winter of 1980. The plant material was killed by an unforeseen cold spell and new material is



- (6) continued  
being developed for this project.

New Proposed Research at Guelph

- (a) Studies on aborting female flowers to prevent berry production.  
(b) Tissue culture clones versus seed produced plants.

B.C. Asparagus Research Program

Mr. A.R. Maurer, Asparagus Research Co-ordinator, Agassiz, B.C.  
Co-operators - Mrs. M. James-Thomson, Summerland, B.C.  
Dr. J. Hogue, Summerland, B.C.

The 1980 Asparagus results from B.C. have not been received as yet and copies will be sent out as soon as they are available.

Variety Trials - Two asparagus variety trials were set out in B.C. in 1979, one plot in Agassiz, B.C. and the other in Summerland.

Both trials grew well, however, the Summerland plots were damaged by aphids in 1979. Hopefully they will recover by 1980.

Other research conducted in the Summerland, B.C. areas were herbicide, entomological and pathological studies.

Mr. P.D. Hollman, Department of Agriculture, Creston, B.C. initiated asparagus trials with 15 varieties in 1980.

Alberta

Mr. Schaupmeyer, from the Horticulture Research Station at Brooks, initiated asparagus variety trials in 1980 on Bow Island, Alberta, with 17 varieties.

New Brunswick

Mr. R. Cormier, New Brunswick Department of Agriculture, set out 10 asparagus varieties in trials in Fredericton, New Brunswick. The growth the first year was very good. Also, asparagus seedlings were grown in 1980 to establish a 40 to 50 acre commercial planting of asparagus, about 50 miles north of Fredericton.

General

This past summer I visited asparagus plots in Quebec and British Columbia (separate reports distributed).

Both these trips were informative and interesting.



Quebec intends to establish two asparagus variety trials in 2 locations, Deschambault, and L'Assumption. We will assist them to procure the varieties for their trials. I will also take part in an asparagus meeting in 1981.

The trip to B.C. revealed the severe problem they have in the Okanagan Valley with aphid damage. Even the variety trials at Summerland were damaged. Washington State has quite an extensive research project in this regard, hopefully they will come up with a control. They also had some cutworm problems in the Valley in commercial asparagus fields.

The asparagus variety trials at Agassiz, B.C. looked very promising and will probably be harvested for the first time in 1981. It would appear that a potential for commercial asparagus acreage might be possible on the Indian Reservation close to the Agassiz Station.

In 1980 the Ontario Ministry of Agriculture and Food, the Honorable Mr. Hendersen, formed an Action Committee to study the Asparagus Industry in Ontario and to make recommendations on its improvement. This committee submitted the report in July and various recommendations are now being considered for submission to the provincial cabinet. Hopefully some incentive will be forthcoming to the Ontario Asparagus Industry which will result in a considerable increase in acreage.

I have been in touch with Dr. Ellison re obtaining the parents of several New Jersey Hybrids so we can propagate them for a seedbed. I was assured that we could probably get them when the legal aspect of licensing has been completed. When this occurs, we hope to obtain this genetic material and begin to propagate it in order to establish a seedbed. In the meantime, we are continuing with our own breeding program which we hope will result in better lines or varieties.



ANTHER CULTURE

The ideal asparagus field would be composed of male plants as they produce more spears per plant, hence, a higher yield, than do the female plants. The sex of asparagus plants is determined by one gene, with homozygous recessives, mm, being female and the remainder, Mm and MM, being male. A few of the male plants (0 to 2% in a large population) are hermaphrodites; these can be selfed and will produce a population consisting of two-thirds male and one-third female. One-third of these male plants will be MM and two-thirds Mm. The progeny of mm x Mm will be half male and half female; that of mm x MM will be all male. Because of the advantages of having a field of producing asparagus which is made up of all male plants, males of the genotype MM are particularly desirable. Although it is not always possible to determine which of the phenotypically male plants are heterozygous or homozygous, many, perhaps all, so-called super-males are very poor looking specimens. Only a very few plants in a field of asparagus will be hermaphrodites with a genotype Mm and it is only through selfing of hermaphrodites that super-males can be produced. The frequency of super-males in an asparagus population is very low indeed; hence, they must be produced through the breeding program or some other method. Theoretically it should be possible to find hermaphrodite plants in a large population, self these and obtain super-males. It has proven, however, to be very difficult indeed to find hermaphrodites and therefore the possibility of using the technique of in vitro culture to produce haploids from pollen has been used successfully in France. About a year ago similar work was started at the University of Guelph. By taking anthers from phenotypically male plants, the haploids will be either M or m, which when the chromosome number is doubled with colchicine will give rise to MM or mm plants, super-males and females. These will also be homozygous for a number of other characters which may or may not be advantageous horticulturally.

Since last winter some 2000 to 3000 anthers from the cultivar 'Viking' have been cultured in vitro in the hope of producing plants. If the plants have developed from pollen grains, at the right stage of their development, they will be haploids. If they have arisen from the anther wall, as they can unfortunately, they will be Mm plants like the parent from which they



came. It is possible that during the development of haploids that the chromosomes will double spontaneously in which case the plants will be diploids, super-males or females. The only way of differentiating between diploids that may have arisen from the anther wall and diploid male plants from the pollen will be by crossing to a female plant. The diploid male plants from the pollen will have the genotype MM and their offspring will all be male. The offspring of the diploid males from the anther wall will be 50:50 male and female.

From the 2000 to 3000 anthers cultured, approximately 200 clumps of callus have developed. The callus is green in color and its ploidy is not yet known. The anthers were cultured on five different media, one of which contained no growth regulators and the other four contained varying concentrations of benzyladenine (BA), a cytokinin, and two auxins, naphthalene acetic acid (NAA) and 2,4-dichlorophenoxyacetic acid (2,4-D). When the callus was about 5 mm in diameter it was cut up and transferred to three other media. Two contained varying concentrations of kinetin (K), a cytokinin, NAA and B vitamins whereas the other contained BA instead of K and no B vitamins. Less than 10 of the calli are producing more concentrated green areas which may be the forerunners of true differentiation into shoots. These are now on new media which may encourage this differentiation. Although the technique of Dore in France has been followed to some degree media developed by other workers in asparagus propagation has also been used. Unfortunately Dore gives few details of the actual differentiation medium she used in the production of asparagus haploids.

During the winter this work will be expanded to include as many anthers as possible. It would seem that the best time to get anthers would be from the field during the natural flowering time. Anthers were collected from the field this summer but, as is so often the case with plant material growing outdoors, it was very high. It is much safer using greenhouse grown plants. A number of different media will also be used and the environmental conditions under which the anthers are being cultured will also be changed. Some species have responded very well to increases or decreases in temperature for example. This will be tried in asparagus.

The production of haploids in any plant species is usually frustrating and time consuming. However, in the case of asparagus particularly, will be well worth the effort.



RECOMMENDATIONS AND GENERAL COMMENTS

H. Tiessen

1. Continue to assess new asparagus varieties and lines in different potential production areas of the country, as they become available. Possibly in Manitoba, P.E.I., and 2 locations in Quebec.
2. Increase genetic and clonal material through tissue culture, in order to increase plant numbers, so crosses can be made and seed produced.
3. Grow seed from these plant crosses in the various producing areas and assess them for disease resistance, yield, and quality characteristics. If some of these crosses indicate considerable improvement over existing lines or varieties, the parents will be increased by tissue culture and seedbed will be developed for commercial seed production.
4. Continue anther and tissue culture at Guelph to obtain super males for breeding purposes.
5. Continue production research such as weed control, nutrition, pH, and frost damage, planting depth, etc.
6. Initiate mycorrhizae studies to determine their influence on asparagus growth, yield and incidence of Fusarium sp. diseases.
7. Procure, using whatever arrangements necessary, parent material of presently assessed exceptional hybrids, and increase plants by tissue culture, in order to develop a seedbed as a source of seed for the Canadian asparagus industry.
8. Consideration should be given to developing an asparagus seedbed in the Okanagan Valley of the Mary Washington (Old Ben Smith) variety. The field would be rogued for poor plants so that seed would only be collected from the best plants, adapted to the area. This seed would be available to growers for establishment of commercial asparagus plantings in the Okanagan Valley.

ACKNOWLEDGEMENTS

Appreciation for support of this research program are extended to Mr. W. Damand, C.H.C. for his guidance to the program.

To Members of the National Asparagus Research Committee.

To the Canadian Food Processors Associates, Agriculture Canada, Ontario Ministry of Agriculture and Food, the Ontario Asparagus Marketing Board and the University of Guelph for financial support of this program.

