Report to the Oregon Processed Vegetable Commission
1987

1. Title: Relation of maturity to yield and quality in supersweet (sh_2) corn varieties

2. Project Leaders: J. R. Baggett, Horticulture
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3. Project Status: Terminating June 30, 1988

4. Project Funding by Commission for this Period: $4,600.00

5. Justification:

Because interest in supersweet corn varieties is increasing rapidly among processors in the United States, it is important to determine if such varieties can be produced economically in Oregon. Up to this time, supersweet corn has been discouraging in trials because the inherent pericarp toughness of most varieties appears to require harvest at about 78% of moisture or higher to avoid poor texture of the processed product. At this maturity, ears of most varieties are poorly developed at the tip and many ears are too immature to use. Preliminary trials in 1985 and 1986 indicate that tip fill and ear uniformity, flavor, and color are greatly improved by allowing the moisture content to reach 77 or 76%. Pericarp toughness of tough varieties becomes more pronounced at 77 and 76% moisture, but several new varieties with greatly improved tenderness offer the possibilities of harvest at an even more mature stage. If this is possible, yields should increase significantly and the number of unusable immature ears in the crop should be reduced. A study is needed to determine the interactions of yield, quality and maturity of several supersweet varieties of differing levels of pericarp toughness. Such a study should provide a much better evaluation of the potential for economic production of a variety. Eventually, any variety considered for production should be studied in this manner to determine the highest maturity at which quality is acceptable.

6. Report of Progress:

Four supersweet varieties of current interest and having a range of pericarp toughness were grown in a 4-replication trial at the Vegetable Research Farm. Jubilee was also included, but was planted in a separate area where cross-pollination with the supersweet varieties could not occur. Supersweet varieties Pinnacle, Crisp 'N Sweet 710, 84-3376, and Stylesweet were planted May 20 in four replications, each consisting of 3 adjacent plots 50' long. Plants were thinned to stand 10" in the row where possible. Rows were 36" apart. Each variety was first harvested when the % moisture was 80-81, and on alternate days except that harvests were not made on Sunday. Harvests were thus separated by one or two days. Actual number of days from first harvest was used to plot the relation of change in various characteristics with time.

At each harvest, for each replication, about 25' of row was harvested. When the amount of row harvested varied from the standard, the data were adjusted to 25' during analyses. Each variety was harvested on seven dates. On each harvest date various field measurements were taken. Selected husked ears considered typical for that harvest date were taken to Food Science for processing and moisture determination. Tenderness was measured with a spring loaded puncture tester.

Figure 1 shows the % moisture obtained for the 7 harvest dates of each variety. Similar curves were obtained for all of the varieties except that the values for Jubilee were generally lower than for the super-sweet varieties and appeared to drop more abruptly. Jubilee harvests were started at 76.7, which was considered comparable to 80-81% for the supersweet varieties. Figure 1 shows actual values obtained; the irregularities in the curves are mostly caused by variation in sample selection rather than daily irregularities in the actual moisture content, or in the method of moisture determination.

Figures 2-11 show the changes in 10 characteristics as related to number of days from harvest. In these figures, a regression analysis was used to develop straight line expressions of changes, eliminating the irregularities caused by sample variation. The use of straight lines was based on an analysis that indicated these relationships were predominately linear.

The variety Stylesweet did not have a normal stand or uniformity of seedlings. Table 1 shows that number of plants in a 25' harvest plot was 27 for Stylesweet, compared to about 35 for the other varieties. Thus lower values for tons/acre and no/acre of good ears (Figures 2, 3) should not be considered typical of the variety when grown with a normal stand.

The increase in number of good ears per acre with days is an expression of reduced number of immature ears classified as culls and a corresponding reduction in weight of culls/acre. The increased weight of good ears/ acre with days is a result of increased ear size and kernel depth along with an increase in number of good ears because cull ears eventually become usable ears. Supersweet corn varieties often appear to have more of a problem with immature culls than Jubilee. Figures 4 and 5 show that the decline in number and weight of cull ears was less pronounced in Jubilee than in 3 of the supersweet varieties. The graphs for number and weight of good ears (Figures 2, 3) do not show a flatter line for Jubilee. Weight per ear (Figure 6) showed a much greater increase with time for Jubilee than for the supersweet varieties.

Ear length (Figure 7) changed very little with days. Our data actually showed a decrease in ear length in 3 varieties and it is not known if this is real or represents sampling error. Of concern to processors is the comparison of ear length of Jubilee with that of 84-3376 which is considered to be a supersweet version of Jubilee. The mean ear length was 7.8 inches for both of these varieties (Table 1) but the figures show a relationship that changes with maturity. Further trials are needed to determine if these varieties really have different ear length and a different effect of date.

Ear diameter showed a very consistent increase with days, though Jubilee increased at a faster rate (Figure 8), as was true for ear weight. Kernel depth showed a strong increase with days as did percent cutoff. The % cutoff for Jubilee was considerably higher than for 84-3376, assuming the ranges of % moisture for these two varieties was really comparable.

For tenderness, a key factor in this experiment, Jubilee, 84-3376, and Stylesweet show a clear superiority over Pinnacle and Crisp 'N Sweet 710. At the end of the harvest range used, these varieties were still more tender than Pinnacle was at date 1 and about the same as the starting point for Crisp 'N Sweet 710. Jubilee and 84-3376 increased in toughness more slowly than the other varieties. Assuming tenderness is the most important limiting factor developing with increased maturity, then the kind of differences shown in Figure 10 become very important. Changes in other quality factors, such as color, flavor, and appearance improve with maturity up to a point. The analyses of sensory qualities, pericarp content, and possible sugar content will be analyzed and included in a supplementary report.

7. Summary:

There was a linear relationship between harvest date and 10 measurable characteristics of supersweet and Jubilee corn. A shift of immature culls to the usable category resulted in a large reduction of number and weight of culls and contributed to an increase in weight and number of good ears. Ear diameter increased uniformly for all varieties except that Jubilee had a greater increase than the supersweets. Ear length decreased slightly with date in 3 of the 5 varieties. Varieties behaved similarly in changes of weight/ear, kernel depth, and percent cutoff, except that Jubilee had a much greater increase in weight per ear. Jubilee, Stylesweet, and 84-3376 were distinctly more tender than Pinnacle and Crisp 'N Sweet 710. Jubilee and 84-3376 increased in toughness more slowly than the remaining three varieties.

8. Signatures:

Submitted by:

Redacted for Privacy

Project Leader Date

Redacted for Privacy

Project Leader Date

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Approved by:

Redacted for Privacy

Department Head Date

Table 1

Relation of maturity to yield and quality in supersweet (sh_2) corn varieties, Corvallis, Oregon, 1987

Variety	Harvest Date	Av. Stand	% Moisture	No. 1000 Good Ears	T/A Good Ears	No. 1000 Culls	T/A Culls	Lbs/ Ear	Ear Length (in.)	Ear Diameter (in.)	Kernel Depth (mm)	% Cutoff	Tenderness[1]
Pinnacle	8-24	35	79.6	21.5	5.5	5.0	0.88	0.51	8.3	1.78	9.5	51.4	149
	8-26	35	79.3	22.4	6.1	0.9	0.16	0.55	8.7	1.88	10.5	51.7	128
	8-28	35	76.8	20.3	6.0	2.5	0.54	0.59	8.4	1.90	11.0	55.9	150
	8-31	36	76.3	19.9	6.7	0.4	0.08	0.68	8.4	2.00	12.0	55.2	132
	9-2	36	73.3	25.0	7.8	0.4	0.07	0.62	8.2	2.08	11.2	61.2	153
	9-4	36	74.6	22.7	7.3	0.1	0.02	0.64	8.4	2.10	10.8	64.7	160
	9-7	34	74.1	32.1	10.0	1.7	0.20	0.63	8.3	1.98	12.5	59.7	176
	Mean	35	----	23.4	7.1	1.6	0.28	0.60	8.4	1.96	11.1	57.1	150
C & S 710	8-26	37	81.1	17.6	4.9	4.1	1.05	0.56	8.1	1.95	10.5	48.4	121
	8-28	35	78.9	18.3	5.5	5.4	1.24	0.61	8.2	1.95	11.0	51.4	134
	8-31	36	77.5	20.6	6.5	2.5	0.48	0.64	8.2	2.05	11.8	63.6	134
	9-2	37	75.0	22.4	7.4	1.2	0.24	0.67	7.7	2.15	11.2	58.6	142
	9-4	33	75.6	23.0	7.5	1.6	0.29	0.66	7.9	2.25	11.8	61.6	147
	9-7	35	73.9	22.3	7.8	2.4	0.48	0.70	8.1	2.18	13.0	61.7	157
	9-9	36	73.6	22.8	8.5	0.2	0.50	0.75	8.1	2.20	12.5	58.3	159
	Mean	36	----	21.0	6.9	2.5	0.55	0.65	8.0	2.10	11.7	57.7	142
84-3376	8-25	35	80.9	12.7	3.1	12.7	2.47	0.49	7.7	1.83	10.8	49.3	103
	8-27	36	79.7	14.2	3.7	7.6	1.58	0.52	7.8	1.85	10.8	50.2	120
	8-29	34	78.3	20.2	5.5	7.3	1.47	0.54	7.8	2.08	9.5	58.4	107
	8-31	34	76.4	21.5	6.1	3.2	1.17	0.57	7.8	1.98	12.0	59.5	107
	9-2	37	75.1	27.4	8.0	1.9	0.31	0.58	7.8	2.10	10.2	62.5	115
	9-4	34	74.4	27.5	8.6	1.3	0.23	0.64	7.9	2.18	12.2	62.7	111
	9-7	39	74.5	31.4	10.2	5.0	0.90	0.65	7.6	2.05	13.5	63.8	121
	Mean	36	----	22.1	6.5	5.6	1.16	0.57	7.8	2.01	11.3	58.1	112
Stylesweet	8-29	26	81.8	7.4	2.1	9.4	2.06	0.57	8.8	1.88	9.5	51.1	103
	8-31	26	80.6	10.3	3.3	4.4	1.03	0.64	8.6	2.00	10.8	54.9	112
	9-2	29	80.1	12.6	4.1	4.4	0.99	0.65	8.7	2.10	10.2	51.8	110
	9-4	28	78.8	15.4	5.4	1.8	0.38	0.71	8.8	2.15	11.0	55.4	108
	9-7	25	78.6	13.8	4.8	1.0	0.14	0.73	8.7	2.08	12.0	57.2	117
	9-9	27	77.6	14.7	5.8	1.2	0.33	0.80	9.0	2.20	12.2	56.2	114
	9-11	30	77.1	19.1	7.3	0.3	0.58	0.77	8.9	2.18	13.5	56.2	141
	Mean	27	----	13.3	4.7	3.2	0.71	0.69	8.8	2.08	11.3	54.7	115
LSD, dates[2]			----	4.4	1.2	2.4	0.66	0.05	NS	0.09	1.2	----	9
LSD, var.			----	1.7	0.5	0.9	0.25	0.02	0.1	0.04	NS	----	3
LSD, var. x dates			----	3.3	0.9	1.8	0.50	0.04	0.2	0.07	0.9	----	7
Jubilee	8-26	27	76.7	17.6	4.4	3.4	0.66	0.51	7.8	1.92	10.5	55.9	101
	8-28	27	73.4	16.0	4.2	2.8	0.57	0.53	7.7	1.85	10.5	58.2	108
	8-31	35	71.6	23.8	6.7	1.2	0.20	0.56	7.8	2.00	11.8	----	96

Table 1 (cont.)

Relation of maturity to yield and quality in supersweet (sh_2) corn varieties, Corvallis, Oregon, 1987

Variety	Harvest Date	Av. Stand	% Moisture	No. 1000 Good Ears	T/A Good Ears	No. 1000 Culls	T/A Culls	Lbs/ Ear	Ear Length (in.)	Ear Diameter (in.)	Kernel Depth (mm)	% Cutoff	Tenderness[1]
Jubilee (cont.)	9-2	38	70.3	30.5	8.8	0.6	0.07	0.58	7.6	2.08	11.8	62.8	101
	9-4	35	70.1	25.1	8.0	2.0	0.35	0.64	7.8	2.20	11.8	63.9	108
	9-7	34	69.2	28.3	9.7	1.0	0.21	0.63	7.9	2.12	13.5	65.0	108
	9-9	34	67.9	30.3	10.8	0.5	0.06	0.71	8.0	2.20	13.2	----	116
	Mean	33	----	24.5	7.5	1.7	0.30	0.59	7.8	2.05	11.9	----	105
LSD, dates[2]			----	7.5	1.7	1.4	0.25	0.12	NS	0.11	1.1	----	7

[1]Comparative scale determined by a Chantillon spring gauge; average of 10 readings.

[2]Jubilee was analyzed separately.

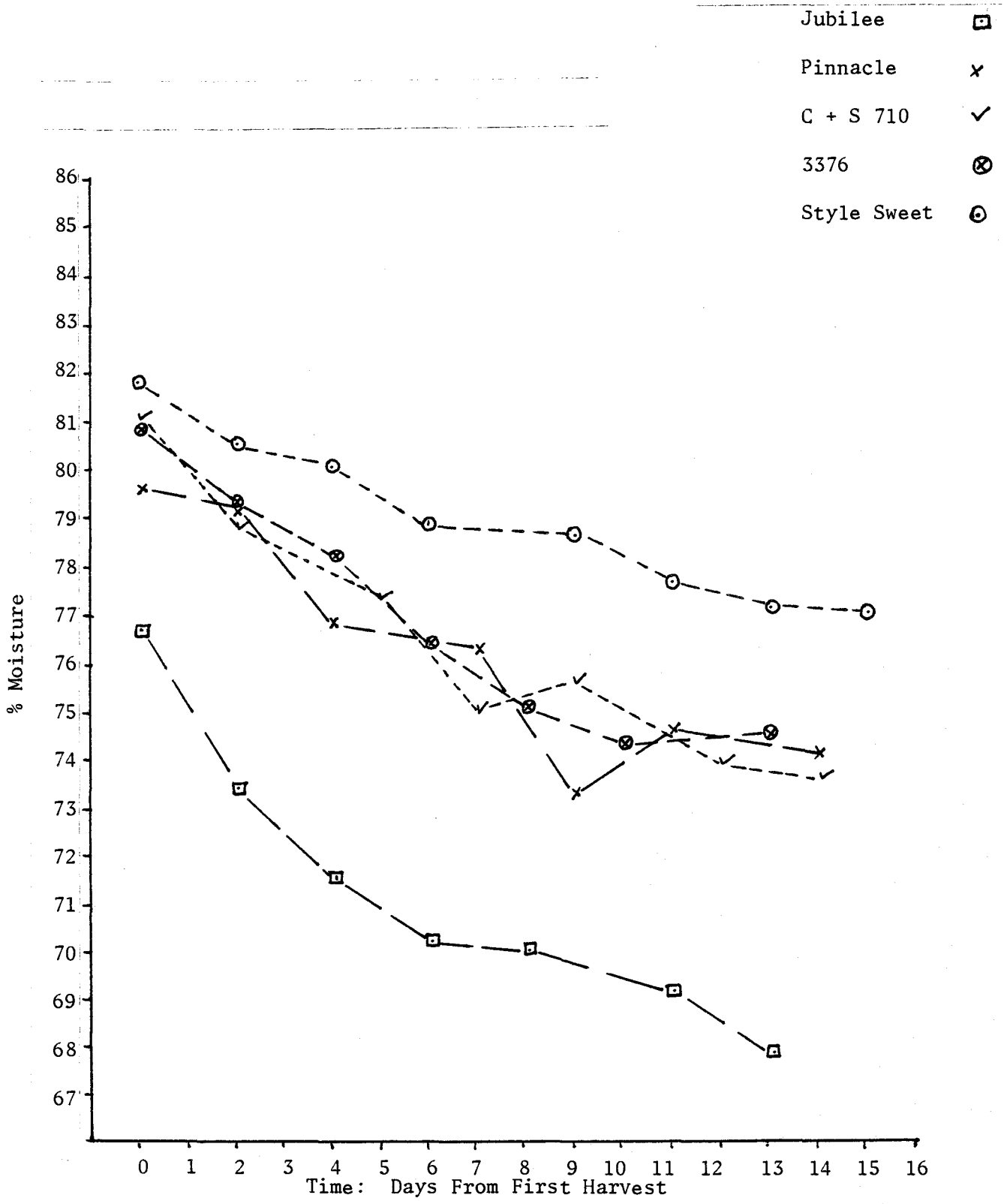

Fig. 1 Percent moisture vs. days from first harvest of supersweet corn varieties

Rates of Change by Variety:

Pinnacle	:	0.40% per day	slightly curvilinear
C & S 710	:	0.55% per day	curvilinear
3376	:	0.49% per day	curvilinear
Style Sweet	:	0.40% per day	linear
Jubilee	:	0.70% per day	curvilinear

Fig. 2

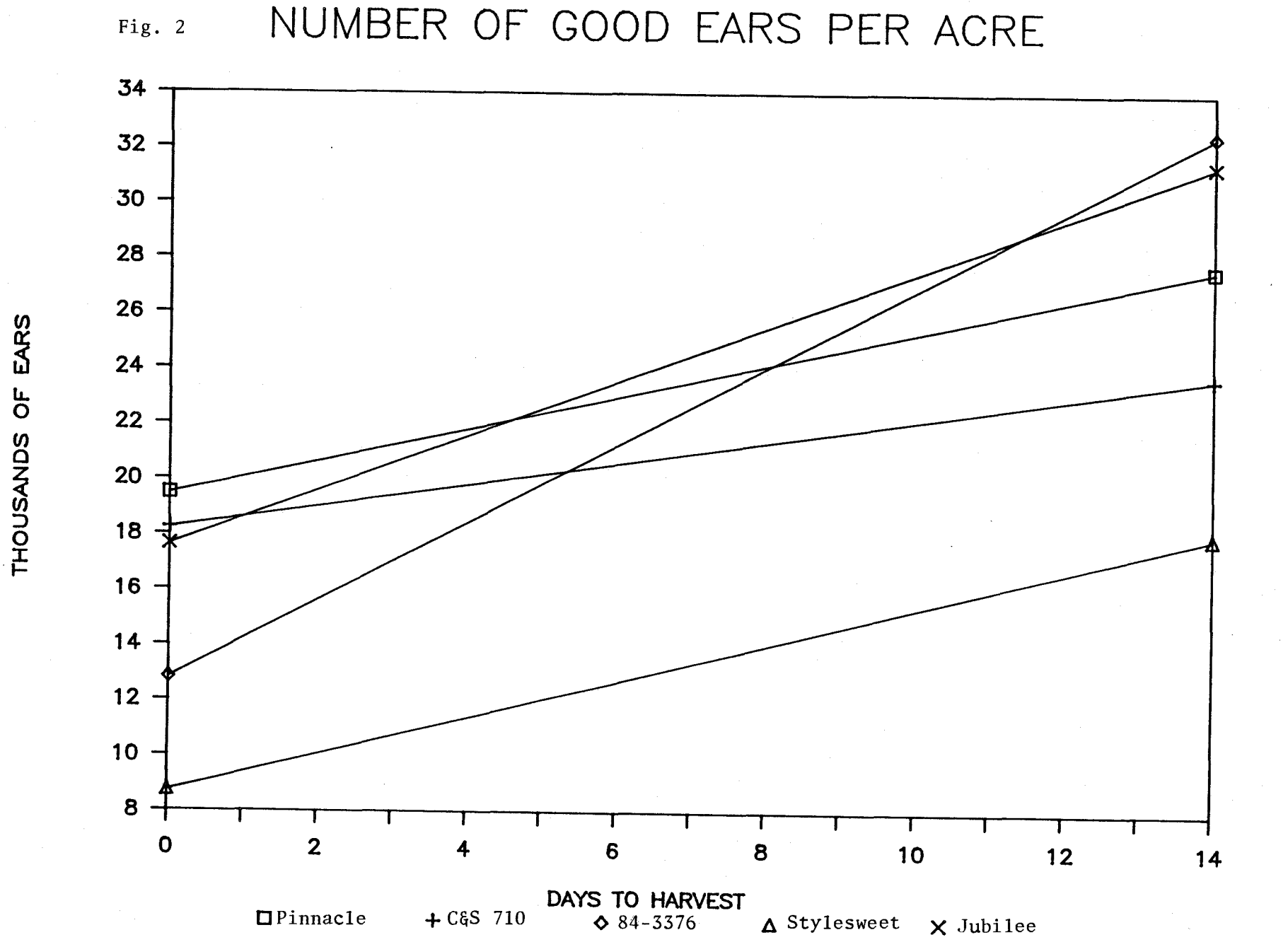
NUMBER OF GOOD EARS PER ACRE
THOUSANDS OF EARS
34
32
30
28
26
24
22
20
18
16
14
12
10
8
0
2
4
6
8
10
12
14
DAYS TO HARVEST
Pinnacle
C&S 710
84-3376
Stylesweet
Jubilee

Fig. 3

TONS OF GOOD EARS PER ACRE

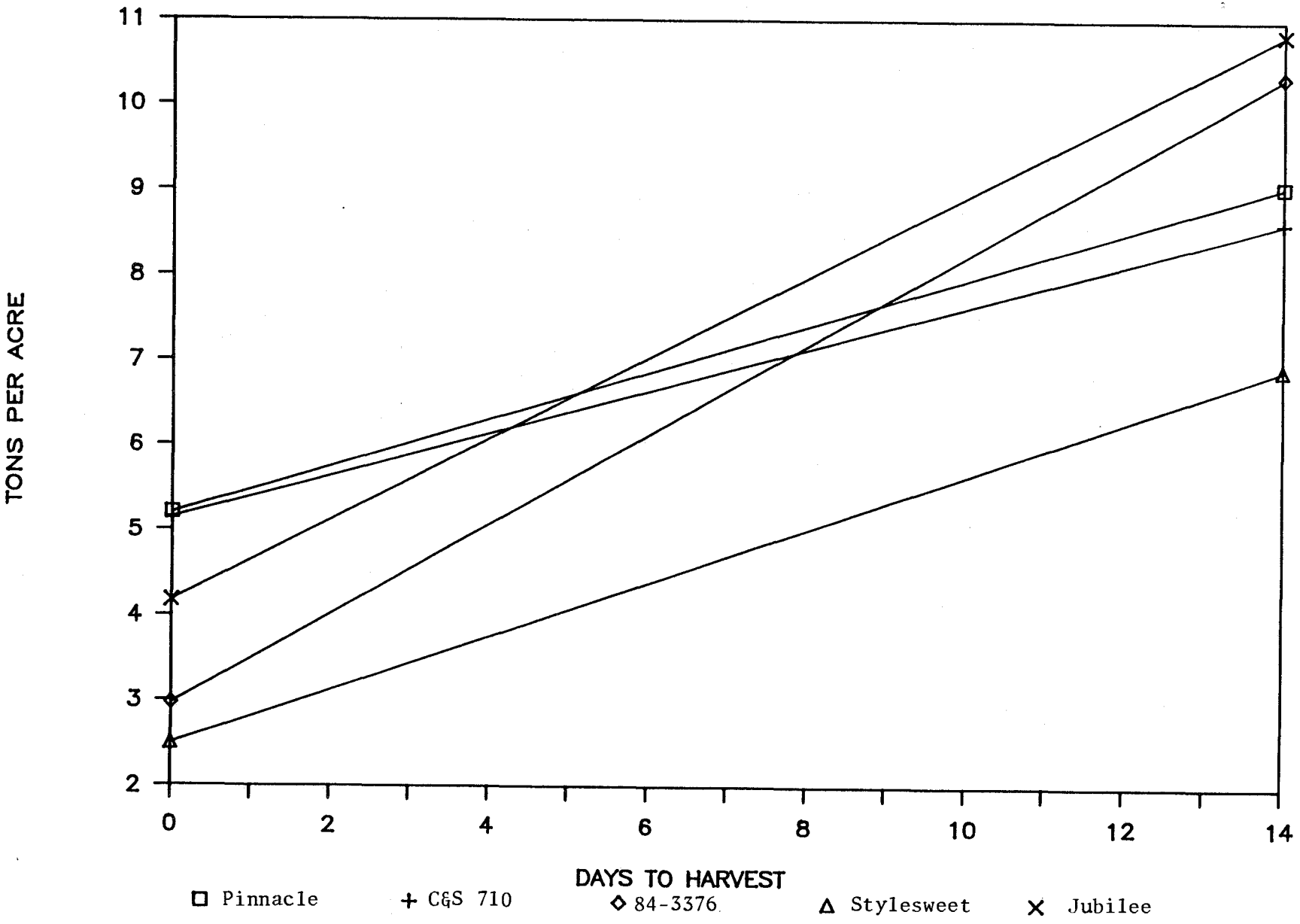

Fig. 4

NUMBER OF CULL EARS PER ACRE

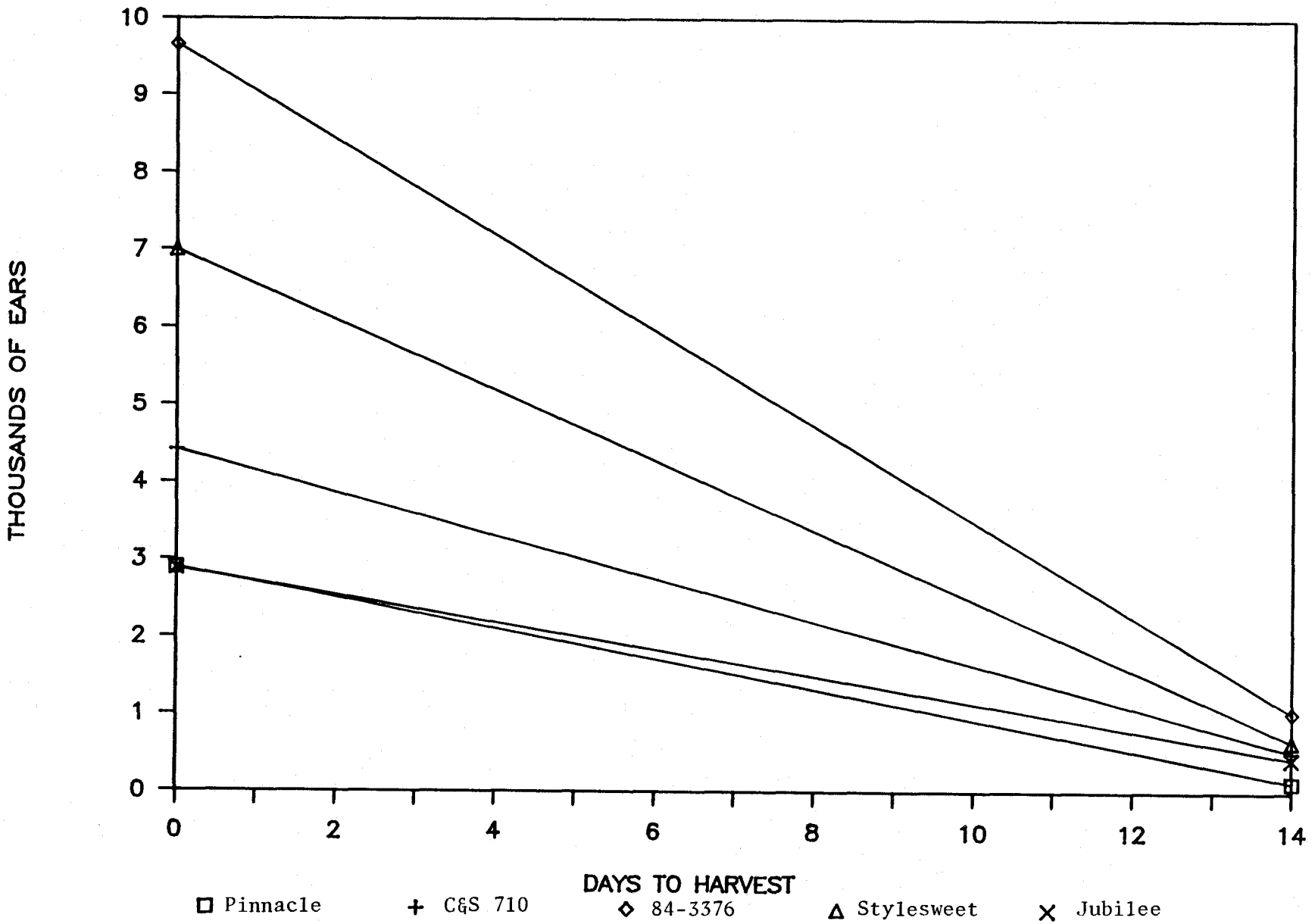

Fig. 5

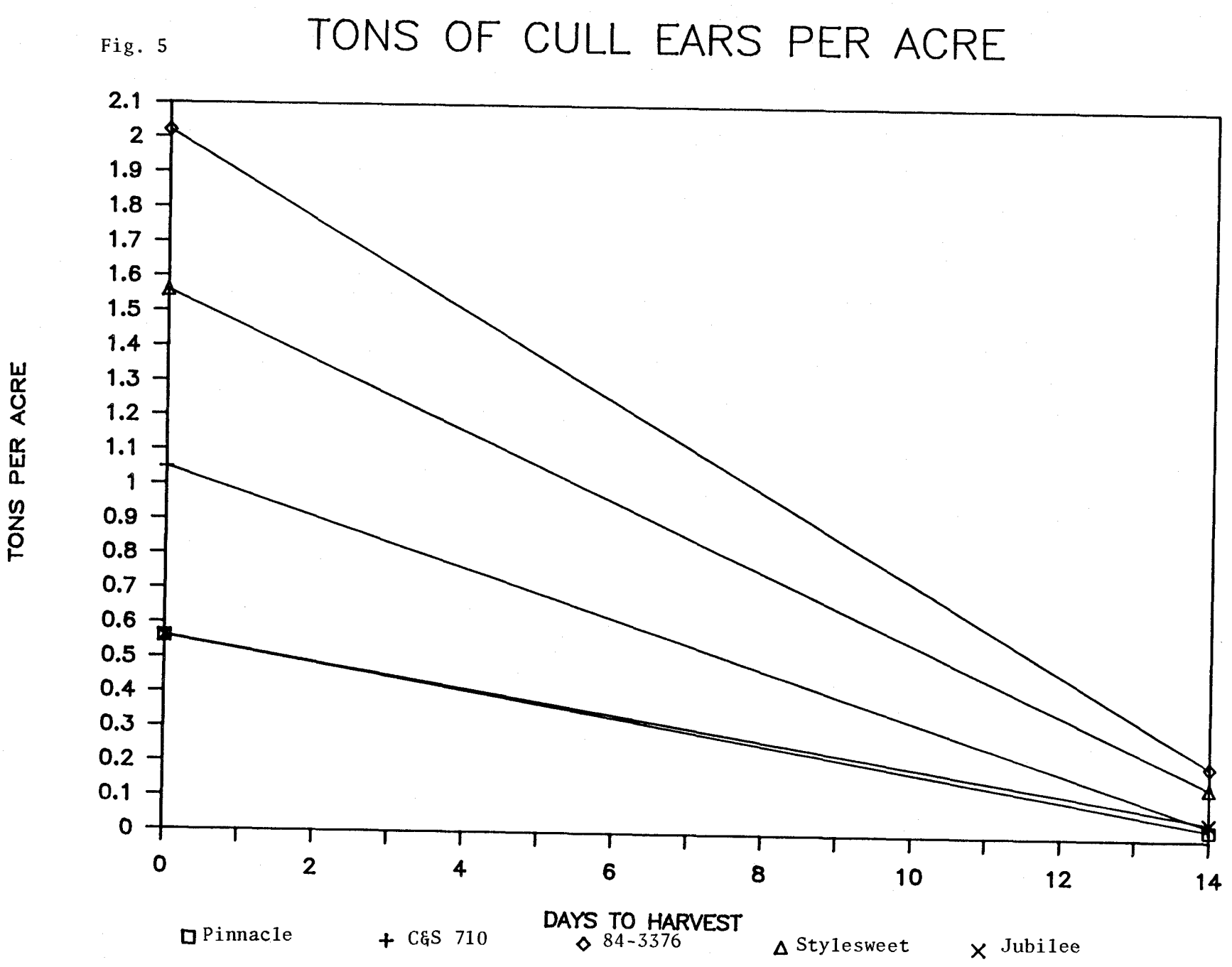
TONS OF CULL EARS PER ACRE
TONS PER ACRE
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
12
14
DAYS TO HARVEST
Pinnacle
C&S 710
84-3376
Stylesweet
Jubilee

Fig. 7

EAR LENGTH

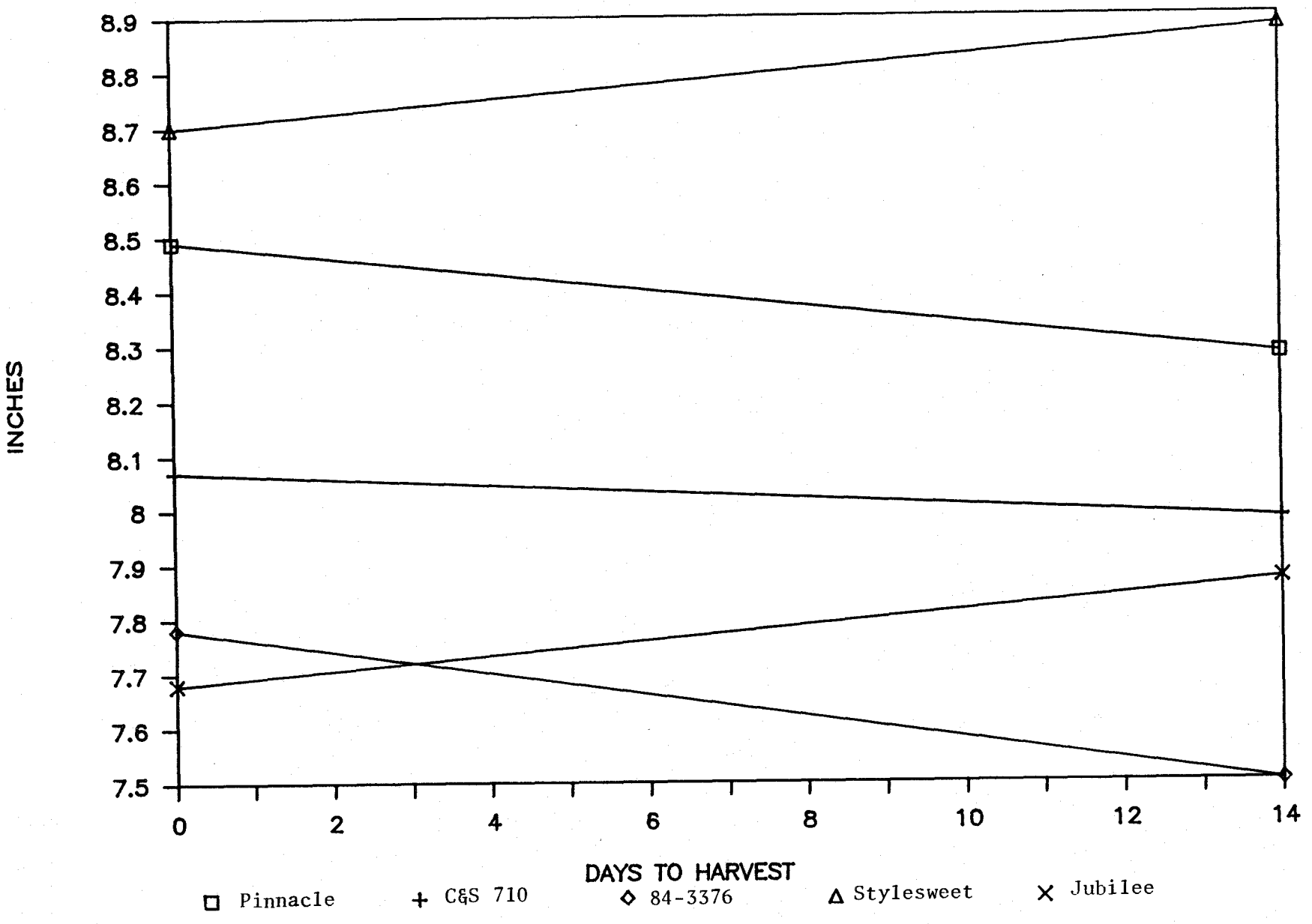

Fig. 6

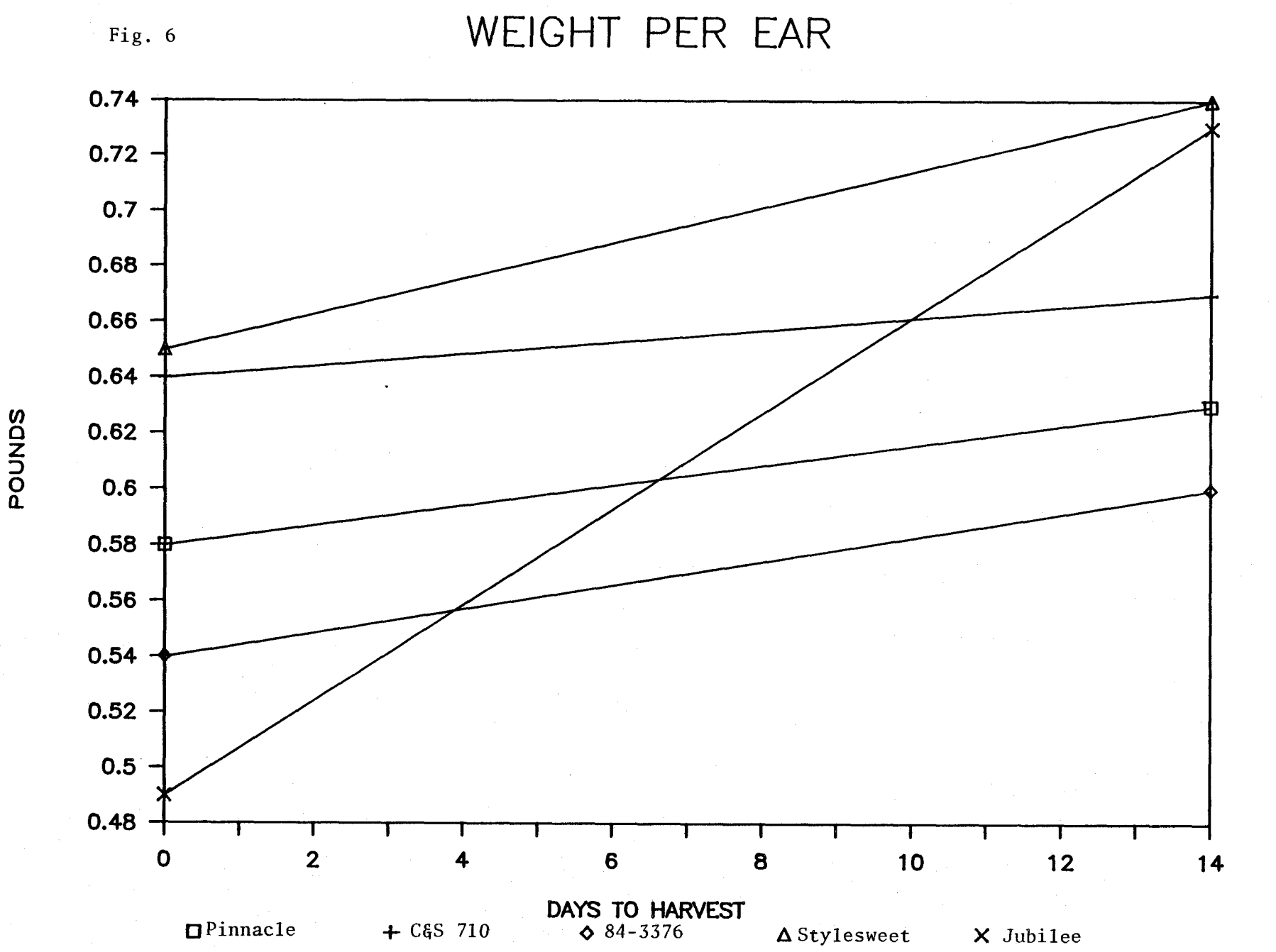
WEIGHT PER EAR
POUNDS
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0
2
4
6
8
10
12
14
DAYS TO HARVEST
Pinnacle
C&S 710
84-3376
Stylesweet
Jubilee

Fig. 8

EAR DIAMETER

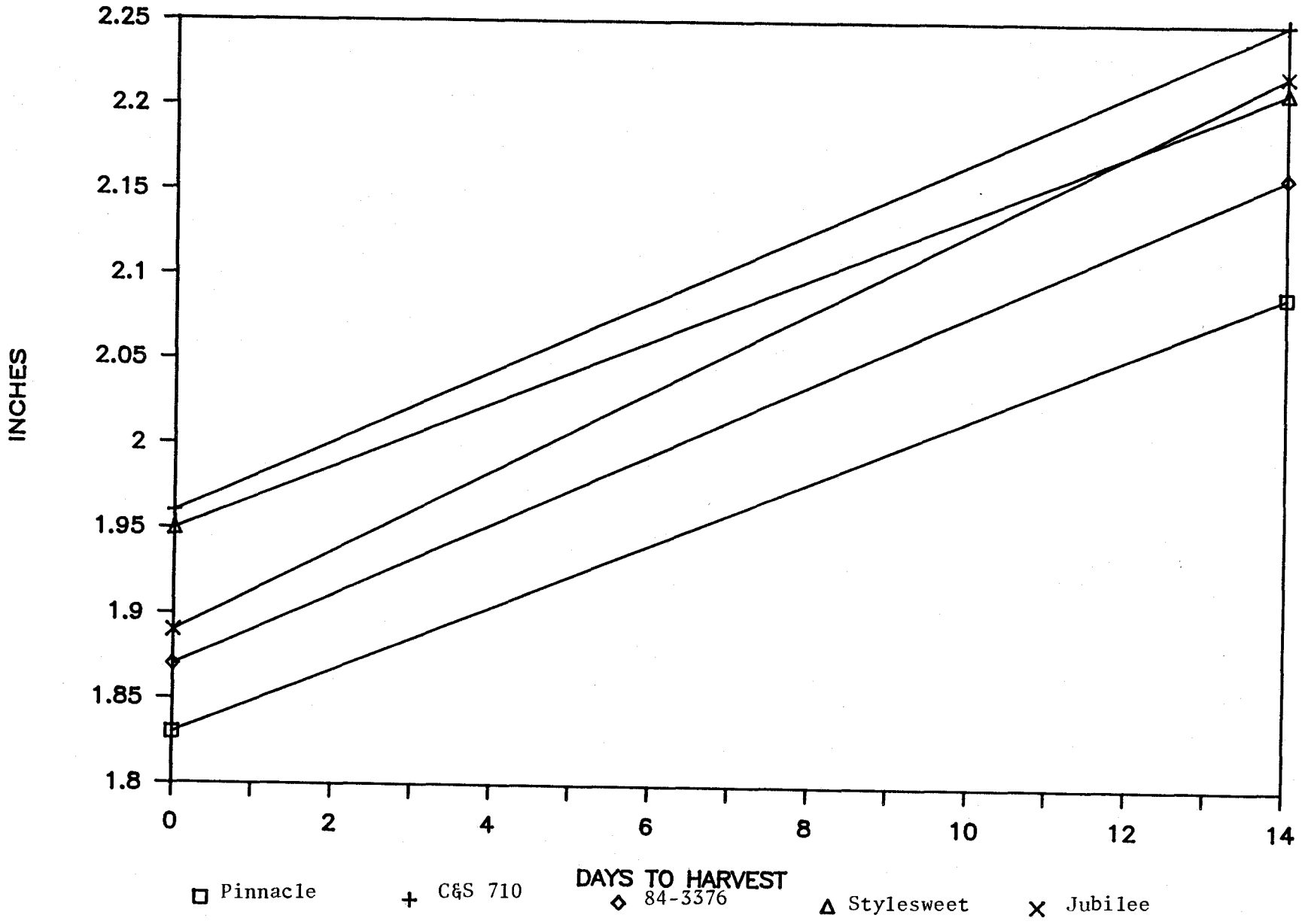

Fig. 9

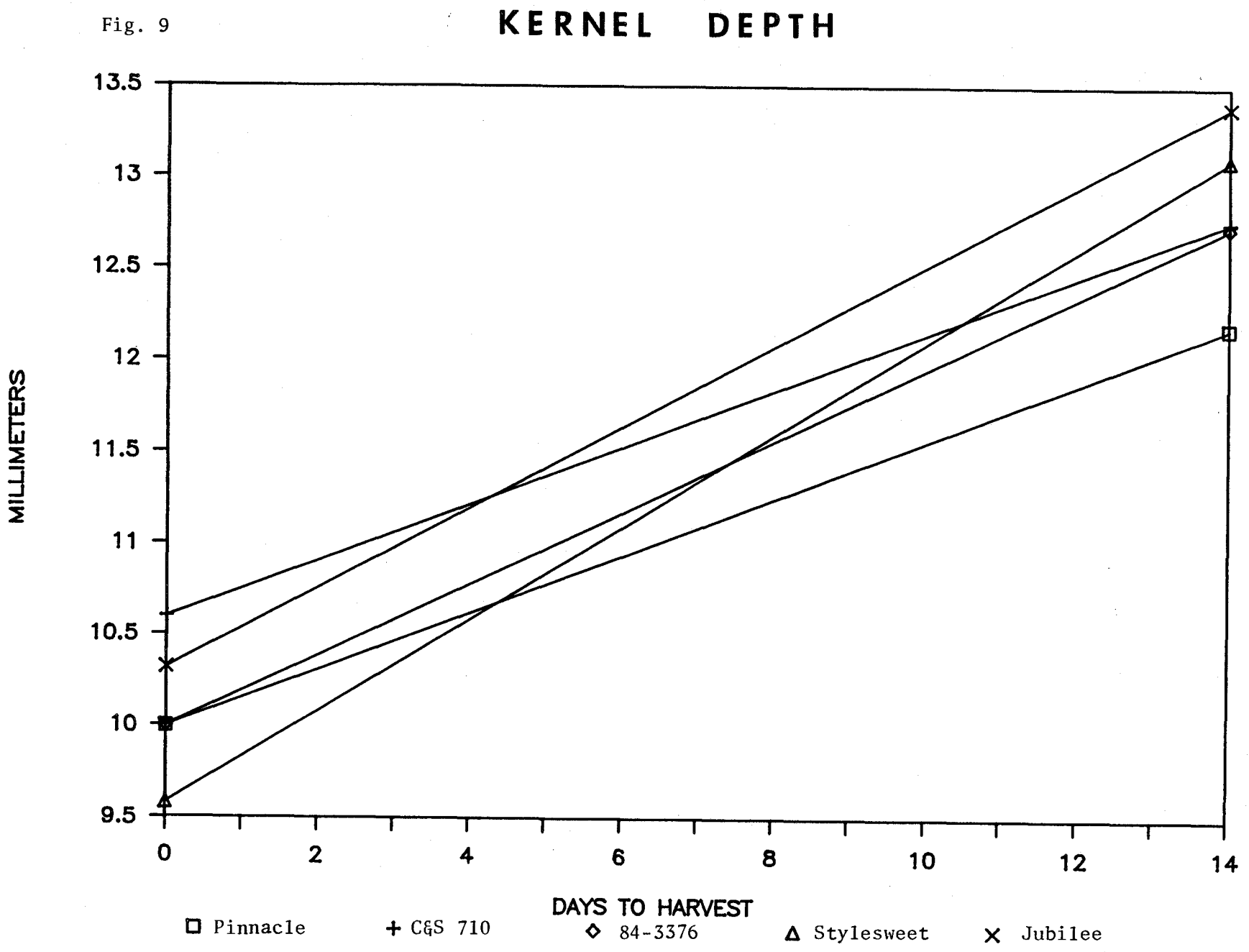
KERNEL DEPTH
MILLIMETERS
13.5
13
12.5
12
11.5
11
10.5
10
9.5
0
2
4
6
8
10
12
14
DAYS TO HARVEST
Pinnacle
C&S 710
84-3376
Stylesweet
Jubilee

Fig. 10

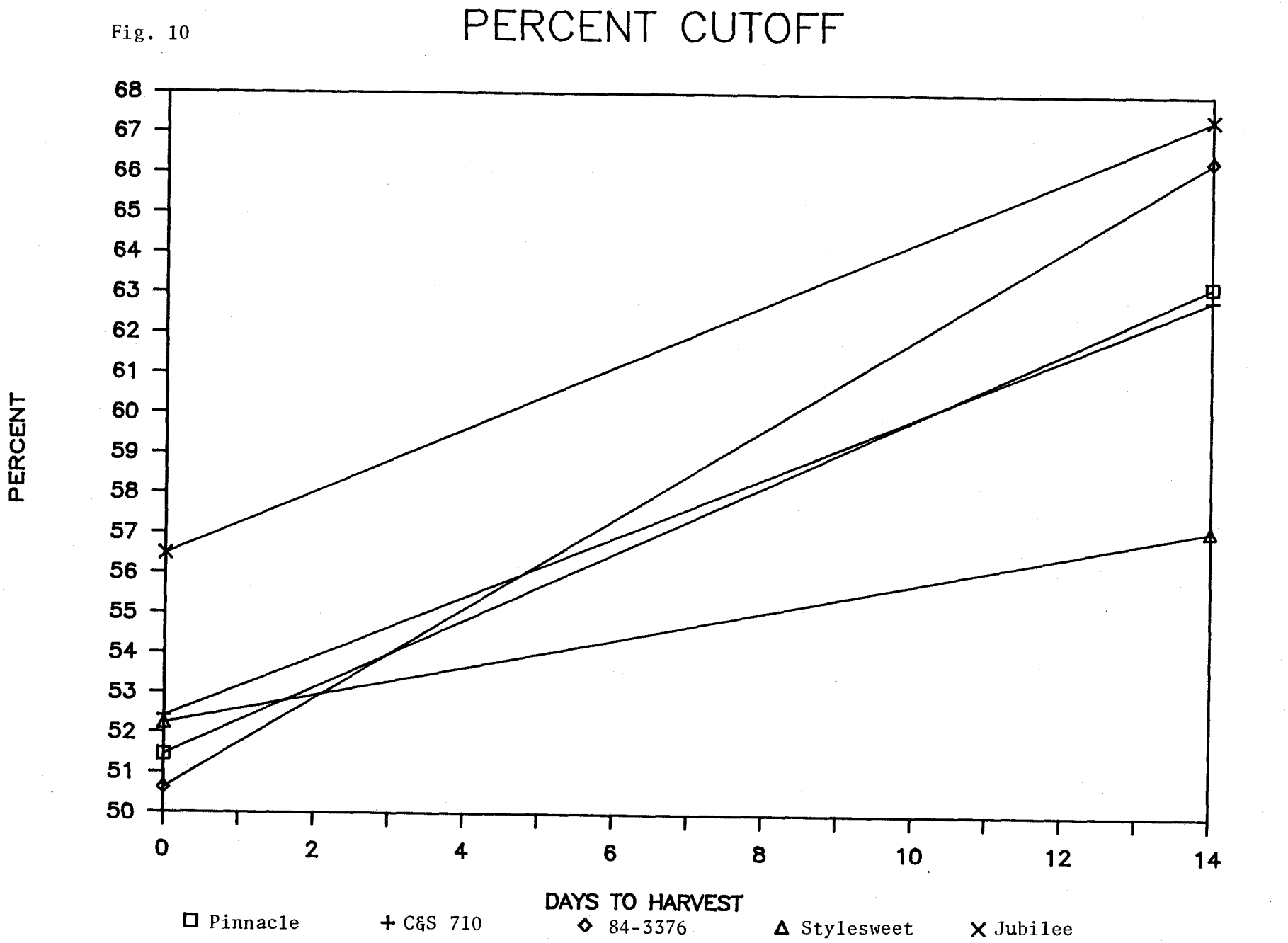
PERCENT CUTOFF
PERCENT
68
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
0
2
4
6
8
10
12
14
DAYS TO HARVEST
Pinnacle
C&S 710
84-3376
Stylesweet
Jubilee

Fig. 11

TENDERNESS