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Effect of Harvest Date on Yield and Grade Distribution Relationships for Pickling Cucumbers Harvested Once-over[1]

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Abstract. **Pickling cucumbers (*Cucumis sativus* L.) were harvested once-over at 24-hour intervals for periods of from 6-11 days over a 3-year period to study the effect of harvest date on yield, average crop value, and grade distributions, and to identify criteria that could be used to identify optimum harvest date in the field. The relationship between yield (MT/ha) and average crop value ($/MT) was linear ($R^2$>.90) indicating that average crop value would be a satisfactory criterion to indicate optimum harvest date. The relationships between yield and grade 1 and grade 5 cucumbers (% by number and by weight) and grade 4 cucumbers (% by number) were also linear (R^2>.68) indicating that these measures of grade distribution could also be used to indicate optimum harvest date. The relationship between yield and % by weight and by number of grade 2 and 3 cucumbers did not follow a consistent pattern and were not considered to be satisfactory indicators of optimum harvest date.**

Optimum harvest timing is a critical profit factor in once-over mechanical harvesting of pickling cucumbers because fruit can be set over a long time period (5). Growers are paid for cucumbers on a grading scheme based on cucumber cross sectional diameter with the higher prices per unit weight received for the smaller diameter cucumbers. It is therefore important to provide a criterion which the grower can use in the field to indicate the optimum time for harvesting the crop. A harvest criterion based on heat unit accumulation or on chronological dates has not proved satisfactory since growth and development of the cucumber crop is greatly influenced by many environmental factors (4). A criterion based on a measure of grade distribution would permit the grower to determine the optimum harvest date by examining a small field sample.

Maximum profit occurs when marginal cost = marginal revenue (3). As cucumber harvest is delayed by a few days, marginal revenue measured as crop sales per hectare, will change because of increased yield and declining crop value/MT (5). Delayed harvest will have a small effect on crop costs primarily because weight increases result in increased transport costs per hectare. Maximizing profit per hectare will be closely related to maximizing crop sales per hectare. Identification of a reliable harvest criterion, based on grade size distribution, requires the establishment of consistent high quality relationships between yield per ha and measures of grade distribution for several harvest dates, under a range of production conditions. This study examines the effect of delays in harvest on yield, average crop value and grade distribution of cucumber. Relationships between these factors are examined to identify variables which may be considered as possible harvest criteria.

Materials and Methods

Studies were conducted on sandy loam soils at the Horticultural Experiment Station, Simcoe, Ontario from 1976 to 1978. In order to get as wide a range of growing conditions as possible, cucumbers were seeded at different times during the growing season and at different plant densities. In addition, 2 different methods of cucumber production were used. In 5 of 8 experiments, the predominantly female cultivar 'Greenstar', with pollinator added, was used. In the other 3 experiments, gynoecious 'Femcap', without pollinator added, was used. Chlorflurenol was applied to this cultivar to promote parthenocarpic fruit set and the crop was grown isolated from other cucumbers by at least 600 m to prevent pollination (2).

'Greenstar' was seeded on June 28, 1976; June 25, 1977; and June 13, 1978. Plants were spaced 7.5 cm apart in rows 71 cm apart, giving a population equivalent to 188,000 plants per ha. In 1976, 2 additional populations of 270,000 and 450,000 plants per ha were included. This was achieved by spacing rows 50 cm and 30 cm apart, respectively, with the same in-row spacing of 7.5 cm. The rows were in beds 7.6 m long with 2.1 m centers and, depending on population, 3, 4, or 6 rows per bed. 'Femcap' was seeded on May 20, 1977 and on May 26 and May 30, 1978. Plants were spaced 15 cm apart in rows 71 cm apart giving a population equivalent of 94,000 plants per ha. In all cases cucumbers were overseeded and thinned by hand to get the required populations. There were 4 replications in all experiments with harvest dates (treatments) arranged in a randomized block design.

Recommended practices for cucumber production in Ontario were followed (1). Irrigation was supplied as required during fruit development. When about 6-8 flowers per plant had reached anthesis, chlorflurenol was applied to the 'Femcap' cultivar at a rate of 2 liters of chlorflurenol in 675 liters of water per ha.

The first harvest was made when the crop was considered to be about 2-3 days before reaching its maximum dollar return. Harvests were then made at 24-hr intervals for periods of 6-11 days, depending on growing season. At harvest, plots 2.1 × 6.1 m from the center of each bed were taken and all the fruit was stripped by hand from the plants. The fruit was then graded, counted and weighed. The grades based on maximum diameter and dollar values per tonne were: No. 1, less than 25 mm, $382.02 Canadian; No. 2, 25 to 32 mm, $275.83; No. 3, 32 to 41 mm, $154.57; No. 4, 41 to 51 mm, $65.97; No. 5, greater than 51 mm, no value.

Relationships between yield and grade distribution for each experiment were established using an IBM Call 360 curve fitting program involving an iteration procedure. Values and signs of the a and b co-efficients and the co-efficient of determination (R^2) were obtained for 6 equation forms (Table 5).

Results and Discussion

The yield and grade distributions indicate fruit development patterns over time. Data for yield, average crop value, crop sales per hectare and grade distributions are reported in Tables 1 and 2. Information on grades 2 and 3 have not

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Table 1. Effect of harvest date on yield, value and grade distributions for 'Greenstar' cucumbers harvested once-over in 1976 and 1978.

				Grades					
				1		4		5	
Harvest date	Yield (MT/ha)	Avg crop value ($/MT)	Crop sales ($/ha)	Weight (%)	No. (%)	Weight (%)	No. (%)	Weight (%)	No. (%)
			Experiment 1 (188,000 plants/ha) 1976						
Aug. 17	3.9	238.9	931.7	16.3	52.2	0	0	0	0
18	8.9	202.1	1798.7	14.3	53.9	5.3	1.9	0	0
19	9.6	188.5	1809.6	12.8	48.0	9.9	3.6	0.8	0.2
20	13.7	148.8	2038.6	11.4	56.4	35.5	12.1	3.1	0.8
21	16.8	152.1	2555.3	13.2	49.7	32.6	12.2	8.8	2.4
22	16.4	148.4	2433.8	10.7	43.1	30.0	11.5	12.5	3.6
23	20.7	121.8	2521.3	7.6	36.3	32.6	15.6	22.2	7.2
24	21.5	128.5	2762.8	7.7	40.6	30.3	12.2	18.6	5.3
25	25.4	107.1	2720.3	3.7	22.2	33.2	20.6	22.2	8.9
26	30.2	100.8	3044.2	3.9	25.6	33.0	20.4	25.3	9.7
27	35.1	84.5	2965.9	3.8	33.3	35.6	21.3	33.8	12.8
			Experiment 2 (270,000 plants/ha) 1976						
Aug. 17	5.1	260.4	1328.0	22.9	63.3	0	0	0	0
18	7.3	212.6	1552.0	15.1	52.6	2.5	0.8	0	0
19	6.1	234.4	1429.8	24.2	62.6	1.5	0.5	0	0
20	10.9	205.7	2242.1	17.6	61.8	6.5	1.9	0	0
21	10.1	212.7	2148.3	24.5	62.8	16.8	3.8	2.2	0.2
22	13.6	180.1	2449.4	15.9	48.5	23.4	7.5	6.2	1.5
23	18.5	145.4	2689.9	8.6	34.4	36.4	17.2	5.5	1.7
24	22.1	163.2	3606.7	10.4	37.7	20.5	7.4	11.2	3.1
25	23.3	147.2	3429.8	7.6	33.4	21.7	9.5	10.7	3.1
26	28.6	107.9	3085.9	4.0	21.3	35.8	20.9	19.2	7.2
27	28.5	91.4	2604.9	3.0	24.2	38.7	24.1	25.5	10.8
			Experiment 3 (450,000 plants/ha) 1976						
Aug. 17	3.2	281.3	900.2	32.7	71.0	0	0	0	0
18	7.6	222.9	1694.0	15.8	53.1	0.6	0.2	0	0
19	6.0	245.7	1474.2	26.8	66.6	0.5	0.2	0	0
20	11.1	194.9	2163.4	15.9	56.7	13.5	3.7	0	0
21	10.7	214.8	2298.4	25.9	67.2	16.5	4.2	0	0
22	12.2	187.9	2292.4	18.5	52.9	23.4	7.5	3.0	1.2
23	16.9	197.8	3342.8	17.4	50.1	17.3	5.2	3.1	0.7
24	20.7	178.7	3699.1	14.8	46.5	19.3	6.8	8.0	1.8
25	20.5	171.9	3524.0	10.9	37.8	19.9	7.8	5.6	1.4
26	23.9	128.7	3075.9	5.8	27.6	40.3	20.4	7.9	2.8
27	31.2	106.2	3313.4	3.2	25.0	42.7	24.5	15.9	6.3
			Experiment 5 (188,000 plants/ha) 1978						
July 29	2.8	269.1	753.5	43.7	82.3	14.7	1.8	0	0
30	5.2	236.1	1227.7	34.2	71.2	18.1	3.7	4.4	0.7
31	6.5	219.2	1424.8	23.8	60.0	9.1	2.0	6.6	1.1
Aug. 1	9.8	207.2	2030.6	21.3	58.8	7.9	1.8	6.3	0.8
2	10.3	179.6	1849.9	12.9	47.4	12.6	3.7	11.1	2.3
3	17.3	147.7	2555.2	4.7	20.4	18.7	8.5	11.2	3.6
4	22.7	105.0	2383.5	2.8	15.8	27.5	16.6	26.9	11.4
5	24.2	100.5	2432.1	3.2	21.4	27.5	16.3	28.5	11.4

been reported because of space limitations and because the relationships between yields and these 2 grades proved to be of limited usefulness. Data for 4 experiments using 'Greenstar' are reported in Table 1. Data for 'Femcap' are reported in Table 2. Data for 'Greenstar' in 1977 are not presented because low temperature-high soil moisture conditions in the latter part of the growing season resulted in less consistent data than for the other experiments. However the same general pattern of development is apparent. In general, as harvest date was delayed, crop yield (MT/ha) increased while average crop value ($/MT), a composite measure of the grade distribution, declined. For cucumbers treated with clorflurenol yield tended to increase very slowly or decline as harvest date was delayed (Table 2). In Experiment 6, yield initially increased slowly and then declined rapidly. The initial harvest on this crop was made at a more advanced stage of fruit development. Because fruit set in chlorflurenol treated crops takes place at one time and no new fruit develop as the season progresses, the yield of marketable fruit declines over time. Average daily yield increase for the 8 experiments varied from 1.28 MT/ha to 3.12 MT/ha with a mean value of 2.41 MT/ha. Mean daily fall in crop value due to delayed harvest for the eight experiments was $24.72/MT with a range from $14.44/MT to $36.28/MT (Table 3).

Examination of the effect of delayed harvest on grade size distribution indicates that as harvest was delayed the percentage of the smallest, highest priced cucumbers (grade 1) declined while the proportions of the large low priced cucumbers (grades 4 and 5) increased. No consistent pattern was apparent in the proportion of medium-sized cucumbers (grades 2 and 3).

Examination of the coefficients of determination for the

Table 2. Effect of harvest date on yield, value and grade distribution for 'Femcap' cucumbers harvested once-over in 1977 and 1978.

Harvest date	Yield (MT/ha)	Avg crop value ($/MT)	Crop sales ($/ha)	Grades 1 Weight (%)	Grades 1 No. (%)	Grades 4 Weight (%)	Grades 4 No. (%)	Grades 5 Weight (%)	Grades 5 No. (%)
Experiment 6, 1977									
July 19	7.2	256.7	1848.2	32.2	76.1	0	0	0	0
20	8.9	205.2	1826.3	20.2	65.0	0.6	1.3	0	0
21	9.8	173.7	1702.2	16.3	68.5	25.5	6.9	0	0
22	9.4	159.2	1496.5	10.7	53.7	28.9	11.1	0	0
23	10.6	106.1	1124.7	4.4	25.8	55.9	38.7	8.6	3.2
24	14.9	108.2	1612.2	8.0	28.9	59.3	42.1	11.6	7.9
25	10.9	54.3	591.9	3.9	16.0	52.1	44.0	41.5	28.0
26	7.9	54.3	429.0	1.8	13.0	31.5	39.1	50.1	21.7
27	9.2	70.3	646.8	1.2	15.0	47.2	45.0	36.4	20.0
Experiment 7, 1978									
July 24	5.7	370.4	2111.3	89.7	96.3	0	0	0	0
25	6.2	362.6	2248.1	83.1	93.3	0	0	0	0
26	10.9	326.1	3554.2	62.2	84.8	0	0	0	0
27	9.9	281.8	2789.8	43.7	74.1	1.3	0.3	0	0
28	11.5	265.2	3049.8	41.3	79.6	3.0	0.4	2.0	0.2
29	12.5	236.1	2951.3	32.5	70.9	6.8	1.4	3.9	0.5
30	17.2	212.6	3656.7	26.8	66.6	14.2	3.1	6.6	0.9
31	18.2	187.6	3414.3	20.9	63.3	28.4	6.8	3.5	0.7
Aug. 1	20.2	159.8	3228.0	16.9	59.9	36.4	10.6	9.3	1.9
Experiment 8, 1978									
July 26	7.4	300.8	2225.9	47.0	75.2	0	0	0	0
27	7.2	291.8	2101.0	43.5	70.9	0	0	0	0
28	10.0	230.7	2307.0	25.3	60.5	2.9	0.7	0	0
29	13.0	213.4	2774.2	23.5	60.5	8.9	1.4	3.4	0.4
30	16.3	152.9	2492.3	12.4	49.4	30.7	11.9	7.1	1.6
31	15.4	135.0	2079.0	8.5	37.4	37.9	17.3	9.0	2.8

Table 3. Average daily changes in yield[z] and crop value[y] for all experiments.

Average daily change	Experiment number 1	2	3	4	5	6	7	8	Mean
Yield (MT/ha)	3.12	2.61	2.80	1.28	3.05	1.54	1.82	3.03	2.41
Avg crop value ($/MT)	14.44	16.91	17.51	36.28	24.23	28.91	26.32	33.15	24.72

[z]Avg daily change in yield is calculated as: highest yield – lowest yield/duration between occurrence of lowest and highest yield (days).

[y]Avg daily change in crop value is calculated as: highest crop value – lowest crop value/duration between occurrence of lowest and highest crop values (days).

11 linear equations relating cucumber yield per hectare to average crop value and 10 measures of grade distribution provides an indication of the physical measures which could best be used as a basis for a harvest criterion. Linear relationships explaining more than 90% ($R^2 > .90$) of the variation between yield per hectare and average crop value, measured as $/MT, were obtained for 6 of the 8 experiments (Table 4). Lower coefficients of variation were obtained in experiments 4 and 6 which were conducted in 1977 probably for the previously discussed reasons. The proportion of variation explained by the linear equation exceeded 75% ($R^2 > .75$) with each of the 6 data sets for the relationships between yield per hectare and % by weight for grade 1 and grade 5 cucumbers. In addition, levels of explained variation exceeding 68% were found for each of 6 data sets relating yield per hectare and % by number for grades 1, 4 and 5. Very low and inconsistent levels of explained variation were obtained for the relationships between yield hectare and the proportion of grade 2 and 3 cucumbers.

When experiments 4 and 6 are excluded, the linear equation form had as high or higher predictability, as measured by the co-efficient of determination, than any other form in more than 75% of the considered relationships (Table 5). In addition, no single non-linear equation constantly provided the highest co-efficient of determination for all data sets analyzed in any one experiment. These results indicate that as harvest date was delayed the relationship between yield, measured as tons per hectare, and measures of average crop value or grade distribution are most likely to be linear.

Examination of the coefficients of the linear equations relating the dependent variable, yield (MT/ha) and the independent variable ($/MT) provided further evidence on the consistency of the yield and grade distributions and their adequacy for predictive purposes. The equation co-efficients and SE values are included in Table 6.

Table 4. Coefficients of determination (R^2) for linear relationships between yield (MT/ha), average crop value ($/MT) and size grade distribution (% by weight and % by number) for cucumbers harvested once-over on different harvest dates in 1976, 1977 and 1978.

Experiment no.	Avg crop value	Grade 1 Wt	Grade 1 No.	Grade 2 Wt	Grade 2 No.	Grade 3 Wt	Grade 3 No.	Grade 4 Wt	Grade 4 No.	Grade 5 Wt	Grade 5 No.
	Coefficient of determination (R^2)										
		Grade distribution									
1	.92	.90	.68	.47	.19	.56	.02	.61	.89	.93	.93
2	.93	.86	.95	.56	.17	.20	.62	.77	.81	.87	.77
3	.91	.79	.87	.51	.03	.06	.56	.83	.82	.88	.79
4	.60	.42	.68	.40	.03	.02	.43	.38	.31	.44	.56
5	.97	.84	.92	.96	.03	.17	.84	.62	.89	.91	.88
6	.12	.14	.11	.20	.16	.11	.03	.51	.24	.00	.01
7	.93	.85	.89	.05	.55	.45	.75	.81	.76	.77	.77
8	.94	.91	.81	.94	.74	.30	.84	.83	.69	.86	.68

There is an inverse linear relationship between yield (MT/ha) and average crop value ($/MT) for all 8 data sets indicating that as yield per hectare increased average crop value declined. Substantial variation occurred in the intercept and slope values for the various data sets reflecting inter-year and inter-experiment variations in overall yield levels. Data for 'Greenstar' and 'Femcap' also show differences in intercept and slope co-efficients. Those co-efficients are lower for data from experiments 6 to 8, which represent 'Femcap' than from experiments 1 to 5, inclusive, which used 'Greenstar'. This data indicates that the rate of decline in average crop value associated with rising yield per hectare values was lower for cucumber crops treated with chlorflurenol than for conventional "seeded" cultivars such as 'Greenstar'.

The value of the linear equations for predictive purposes is partially indicated by the relationships between the intercepts and regression co-efficients and their respective standard error terms. The error terms, with the exception of experiments 4 and 6, do not exceed 12% of the corresponding equation coefficients in all cases for the relationship between yield and average crop value.

Conclusions

The influence of delayed harvest upon fruit development patterns was to increase crop yield at an average daily rate of 2.41 MT/ha and to reduce average crop value by $24.72/MT per day. Linear equations of the form Y = a + bx provided higher R^2 values than any one of 5 curvilinear equations for the relationships between yield per ha and each of 11 independent variables consisting of average crop value and percentage of each of the 5 size grades by number or by weight. Linear equations, which explained more than 90% of the variation between yield per ha and average crop value and more than 68% of the variation between yield per ha and 5 measures of crop grade distribution, were obtained for 6 of the 8 experiments. The 5 measures of crop grade distribution were percent grade 1 cucumbers by weight and by number, percent grade 5 cucumbers by weight and by number and percent grade 4 cucumbers by number. These findings indicate the potential applications of any of these 5 grade distribution measures and average crop value as appropriate indicators for optimum harvest criterion in once-over harvesting of pickling cucumbers. Examination of the linear relationships between yield per hectare and average crop value showed that the error terms for all data set excluding

Table 5. Frequency of occurrence of specific equation forms with highest coefficient of determination for relationships between yield (MT/ha), average crop value ($/MT) and size grade distribution (% by weight and % by number) for grade 1, 4 and 5 cucumbers harvested once-over on different harvest dates in 1976 and 1978.

Equation type	Equation form[z]	Frequency of occurrence Number	Frequency of occurrence Percentage
Linear	$y = a + bx$	34	75.6
Simple exponential	$y = ae^{bx}$	3	6.7
Simple power	$y = ax^b$	2	4.4
Hyperbola (type 1)	$y = a + b/x$	4	8.9
Hyperbola (type 2)	$y = 1/(a + bx)$	2	4.4
Simple rational	$y = x/(b + a^x)$	0	0.0

[z]y = yield per hectare for each replicated harvest. x = average crop value or one of 10 grade distribution measures consisting of % by weight or % by number of cucumbers in each of 3 grades. Average crop values measured as $/MT were calculated by applying the appropriate prices/MT for each grade to the proportion of the yield occurring within that grade and summating the resulting values.

Table 6. Linear relationships between yield (MT/ha) and average crop value ($/MT).

Experiment no.	Equation		
1	Y =	46.85 – 0.193X**	
	(2.83)	(2.95)	(.019)
2	Y =	44.50 – 0.161X**	
	(2.40)	(2.67)	(.014)
3	Y =	46.76 – 0.164X**	
	(2.76)	(3.54)	(.018)
4	Y =	24.04 – 0.080X*	
	(1.84)	(5.16)	(.027)
5	Y =	36.22 – 0.130X**	
	(1.42)	(1.68)	(.009)
6	Y =	11.34 – 0.011X NS	
	(2.22)	(1.63)	(.011)
7	Y =	29.98 – 0.066X**	
	(1.48)	(1.92)	(.0069)
8	Y =	23.89 – 0.056X**	
	(1.05)	(1.56)	(.0068)

[z]All equations are of the linear form with subscripts as noted below:

Y = a + bx

(Standard error of estimate) (Standard error of intercept) (Standard error of regression coeff.)

where Y = yield (MT/ha), a = intercept, b = slope, X = average crop value ($/tonne).

*,**,[NS]F value significant at 5% (*), 1% (**) or nonsignificant (NS).

4 and 6, did not exceed 12% of the corresponding intercept or slope co-efficients. This supports the usefulness of average crop value as a potential predictor of optimal harvest timing.

This relationship could also be useful in measuring the true yielding potential, in dollars per ha, of cultivars or other experimental treatments. Since the relationship between yield (MT/ha) and dollar value/MT is linear, yield ($/ha) could be estimated from fruit weights alone, by taking small sub-samples at 2 different growth stages in the development of the crop.

Further analysis of the co-efficients of the linear equations together with examination of the data in Tables 1 and 2 indicate that criterion to indicate optimum harvest date for cucumbers, treated with growth regulators to induce parthenocarpic fruit set, differ substantially from those for pollinated cucumbers.

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Seasonal and Diurnal Variations in Abscisic Acid, Water Potential, and Diffusive Resistance in Leaves from Irrigated and Non-irrigated Peach Trees[1]

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Abstract. **Water potential, diffusive resistance, and abscisic acid (ABA) were measured at 10-12 day intervals from May to October in leaves from irrigated and non-irrigated peach (*Prunus persica* L. cv. Fay Elberta) trees, and measurements were taken at intervals from sunrise to sunset on September 8. Leaf water potential, before sunrise, was between −5 and −8 bars in irrigated trees during the entire season whether drip irrigated at 100% evapotranspiration (ET) or 50% ET. Non-irrigated trees showed a decrease in pre-dawn leaf water potential with time, following a pattern similar to that of decreasing soil moisture. Leaf water potential values taken during the afternoon were not associated with soil moisture and did not reflect the stressed condition of the trees. In non-irrigated trees stomatal resistance at mid-day increased rapidly after mid-summer as leaf water potential decreased. ABA concentration in leaves from irrigated trees ranged from 30 to 80 ng/g fresh wt during the entire season. In non-irrigated trees the ABA concentration increased sharply after mid-summer; this was associated with an increase in leaf diffusive resistance and a decrease in leaf water potential. Diurnal variations in leaf water potential were associated with changes in soil moisture, air temperature, relative humidity, and stomatal resistance. Leaf diffusive resistances were similar for all treatments until 1100 hr after which a notable increase occurred with increasing stress, ultimately leading to stomatal closure. ABA concentrations in leaves from irrigated and non-irrigated trees increased as leaf diffusive resistance increased; however in stressed trees, high levels of ABA in the morning were not associated with closed stomata.**

Soil moisture stress (10, 13, 18, 19) and other types of environmental stresses (2, 3, 6, 12, 15) affect the endogenous concentrations of different plant hormones. ABA concentration increased and stomata closed when leaf water potential in sorghum and maize dropped to −10 or −12 bars (19). In leaves of non-irrigated apple seedlings increases in ABA concentration were associated with changes in leaf turgor rather than water potential (4). ABA content of leaves of *Juglans* seedlings increased during waterlogging (18). In lettuce (*Lactuca sativa* L.) leaf ABA increased, while gibberellin and cytokinin declined, during desiccation (1).

Application of ABA or its esters to leaves of several species reduced water loss (1, 7, 8, 10, 11), while treatments with gibberellic acid or kinetin did not affect stomatal opening in non-stressed leaves of lettuce (1). Application of gibberellin and cytokinin retarded stomatal closure during water stress (1). Loveys (12) found that ABA synthesis in stressed broad bean leaves occurred in the chloroplasts and from there ABA migrated rapidly to other parts of the plant.

The experiments reported here on peach trees were designed to provide information on the seasonal and diurnal variations of leaf ABA, water potential, and diffusive resistance in relation to differences in soil moisture as affected by drip irrigation.

Materials and Methods

Uniform 9-year-old 'Fay Elberta' peach trees on Lovell rootstock were selected at the University of California Wolfskill Experimental Station in Winters, California. The soil is classified as Yolo loam and the trees were irrigated daily by drip irrigation at 100% ET and 50% ET and compared with a group of non-irrigated trees. Trees were hand thinned to the commercially accepted fruit load per tree. ET was estimated from a U.S. Weather Bureau Class A pan placed in a bare field nearby. A crop coefficient factor of 0.6 was used and corrected for approximately 45% ground cover of the trees. ET of the trees

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