Regression coefficients for computing leaf area in kiwifruit plants (*Actinidia chinensis* PLANCH.) grown under different daylength and temperature conditions.

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COEFFICIENTS DE REGRESSION POUR L'ESTIMATION DE LA SURFACE FOLIAIRE DES KIWIS (*ACTINIDIA CHINENSIS* PLANCH.) CULTIVES SOUS DIFFERENTES CONDITIONS DE LONGUEUR DE JOUR ET DE TEMPERATURE.

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RESUME - Les coefficients de régression de chaque variable de la surface d'une feuille : la longueur, la largeur, le produit longueur x largeur et le rapport longueur/largeur ont été calculés pour des plants de Kiwi ayant poussé sous différentes conditions de photopériode et de température. Seule le produit longueur x largeur donne la meilleure corrélation avec la surface de la feuille dans tous les cas.

INTRODUCTION

In a recent study on the effect of temperature and daylength on vegetative growth in kiwifruit plant (LIONAKIS and SCHWABE, in press), it was attempted to measure leaf area per plant throughout the growing season. For this purpose a nondestructive method of computing leaf area was required. Such methods have been reported for many plants (SESTAK et al., 1971), where coefficients are developed converting linear measurements of length and width of leaves to leaf area. Since such a method has not been published for kiwifruit plant, the objective of the present study was to establish a relationship between leaf dimensions and actual leaf area.

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MATERIALS AND METHODS

One year old plants of the 'Bruno' cultivar, obtained from cuttings, were used in all the measurements. Four plants were allocated randomly to each one of the following six daylenght/temperature treatments : SD/15°C, SD/20°C, SD/25°C, LD/15°C, LD/20°C, LD/25°C ; where, SD = 8 hours light (natural light), LD = 16 hours light (8 hours natural + 8 hours artificial given by Tungsten lamps supplying 320 Lux illumination).

The daylight growth cabinets described by SCHWABE (1957) were used for applying the six treatments. The plants were placed in the growth cabinets early in April - at that time the single bud which had been left on each plant had just burst - and continued growing there for 150 days. During this period the average length of the current season's growth per treatment varied from 250 to 520 cms in the different treatments.

The length and width of the youngest leaf (i.e appro-

TABLE 1 - Regression coefficients (b) of leaf area (A) on either one of the independant variates (X) : leaf length (L), leaf width (W), leaf length x leaf width (LW), leaf length/leaf width (L/W), calculated for the base and top of shoot in kiwifruit plants grown under different daylength/temperature conditions. Equation A = bX.

Treatments	Place of shoot sampled	Independent variate							
		L		W		LW		L/W	
		b	Variance accounted for regression %	b	Variance accounted for regression %	b	Variance accounted for regression %	b	Variance accounted for regression %
SD/15°C	Base	98.97	94.9	98.44	94.3	0.797	99.6	7358.38	55.5
	Top	61.44	90.2	67.02	93.6	0.789	99.9	3081.34	56.4
LD/15°C	Base	88.46	94.7	85.46	95.5	0.818	99.9	6525.58	63.4
	Top	68.24	92.7	66.71	94.8	0.813	99.9	3512.11	54.9
SD/20°C	Base	93.54	96.5	98.25	97.1	0.785	99.7	7467.02	63.3
	Top	68.59	89.4	72.60	92.4	0.757	95.6	4118.24	58.2
LD/20°C	Base	90.29	95.1	90.82	95.9	0.800	100	6612.84	59.8
	Top	88.20	91.8	81.53	94.2	0.858	99.9	5745.61	56.4
SD/25°C	Base	87.25	97.4	98.16	97.4	0.754	99.9	7231.35	68.6
	Top	72.06	93.2	84.08	95.5	0.763	99.8	4839.98	64.7
LD/25°C	Base	92.22	95.5	99.77	96.7	0.779	99.9	8027.97	68.9
	Top	76.21	95.2	74.57	96.5	0.805	99.6	5586.66	72.9

TABLE 2 - Daylength/temperature treatments for which a common, for base and top of shoot, regression coefficient (b) of leaf area (A) on leaf length x leaf width (X) was calculated. Type of equation : A = bX.

Treatments	Coefficients for base and top of shoot		Test for equality of two regression coefficients (b_1 and b_2)			Common coefficient of base and top of shoot	
	b_1 (base)	b_2 (top)	D.F.	T (calculated)	T 5 % (tables)	b	Variance accounted for regression %
SD/15°C	0.797	0.789	57	0.734	2.003	0.796	99.6
LD/15°C	0.818	0.813	59	1.093	2.001	0.817	99.9
SD/20°C	0.785	0.757	47	0.706	2.014	0.778	98.7
LD/20°C	0.800	0.858	49	- 6.649	2.012		
SD/25°C	0.754	0.763	46	0.782	2.015	0.757	99.9
LD/25°C	0.779	0.805	61	- 2.918	2.000		

ximately 4 to 5 mm long and 3 to 4 mm wide) of each replicate plant was measured 50 days after the application of treatments, while its outline was traced on a sheet of paper for measuring the leaf area. The distance in mm between the tip and base of the leaf blade was recorded as leaf length ; width (in mm) was taken as the maximum leaf dimension perpendicular to the length. Area was measured by means of a planimeter to the nearest hundreth of a square centimeter.

Measurements of leaf length and width and of leaf area were repeated every five days for the same leaf until leaf maturity. About 6 to 8 measurements were carried out per leaf. The total number of measurements from the four replicate plants of each treatment produced one sample (24 to 32 measurements) representative of leaves near the base of shoot. A second sample, representative of leaves near the top of shoot, was collected in the same way 95 days after the application of treatments.

RESULTS AND DISCUSSION

For each sample of data there were calculated regression equations of leaf area on : leaf length, leaf width, leaf length x leaf width, or on the ratio leaf length/leaf width. By assessing the goodness of fit of each equation, it was found that the product leaf length x leaf width gave the best correlation with the measured area (Table 1).

Since two regression coefficients for length x width of leaves on area had been determined for each treatment, it was thought desirable to find out whether one coefficient should be recalculated to fit all the leaves along the length of the shoot. For treatments SD/15°C, SD/20°C, SD/25°C and LD/15°C it was found that this procedure was justified since the two coefficients, for top and bottom leaves, did not differ significantly and thus a common coefficient was estimated for each one of these treatments (Table 2). For treatments LD/20°C and LD/25°C, however, this was not the case and the two coefficients were both used for calculating the leaf area of leaves on the lower and upper halves of shoot respectively.

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