Table 4. Effect of blending various proportions of 'G-21' (gynoecious) and 'M-12' (monoecious) seeds on yields of cucumbers, fall 1975.

Blend (%)		Cumulative returns ($/ha)[z]					Yield (T/ha)
		Harvests (5 total)					
gyn.	mon.	1/5	2/5	3/5	4/5	5/5	5/8
87.5	12.5	395	635	1032	1275	1647	25.0
75.0	25.0	319	561	961	1195	1620	23.2
62.5	37.5	336	588	993	1262	1761	24.9
50.0	50.0	333	566	1010	1262	1685	25.3
37.5	62.5	220	454	837	1072	1512	20.9
25.0	75.0	264	469	904	1166	1615	23.6
12.5	87.5	124	282	598	860	1499	21.6
0.0	100.0	121	333	647	902	1507	19.7
LSD 5%		151	245	356	401	NS	NS

[z] Values are for the first of 5 harvests (1/5), the first 2 of 5 harvests (2/5), through 5 of 5 harvests (5/5). Returns adjusted for grade.

dictate which blend should be purchased. In fact, depending upon the length and nature of the harvest season, completely monoecious seed might result in as many cucumbers as blends containing a high proportion of gynoecious hybrid seed.

From the point of view of flowering habit and sex-expression, the monoecious cucumber plant might be regarded as a compound inflorescence bearing staminate flowers at the base and pistillate flowers on the upper portion (4). Therefore, there is good reason to expect monoecious plants to eventually yield as much as gynoecious plants in multiple harvest systems. On the other hand, for once-over harvest systems, a high degree of gynoecious expression would be desirable.

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Photosynthetic Rate — Yield Component Relationships in Winter Greenhouse Tomatoes[1]

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Additional index words. Lycopersicon esculentum, light responses

Abstract. **The relationships between photosynthetic rate, yield, and yield components of forcing tomatoes (*Lycopersicon esculentum* Mill., cvs. Tuckcross V and Tuckcross 533) under variable lighting and spacing were studied during the dark winter of 1972-73. Yield and its components were all highly and positively correlated with both cloudy-day (90–110 W/m^2 light intensity) and sunny-day (200 W/m^2 or higher) photosynthetic rates. The rate-yield relationship remained nearly constant irrespective of the predictor variable. Better linear response of yield and its components to cloudy than to sunny-day photosynthetic rate was observed. Photosynthetic rate accounted for more than 60% of the yield variation.**

The importance of light for proper growth and fruiting of winter greenhouse tomatoes has been long recognized. Light has been found to be a dominant factor for increased growth (5, 15), normal development of ovules and fruits (14), earliness (13), and rapid fruit color development, higher yields and better quality fruits (1, 2, 7, 11, 14). Although photosynthetic activity is widely recognized as determining fruiting responses, the authors are not aware of other research relating photosynthetic rate with specific yield components. Knowledge of these quantitative relationships should provide a more objective basis for efficient management practices through better utilization of light energy.

'Tuckcross V' and 'Tuckcross 533' seeds were sown in vermiculite-filled seedflats on Oct. 2, 1972. Three-leafed seedlings were potted in 7.6-cm peat pots and transplanted in the media troughs (10) on Nov. 19, 1972.

Following the Cornell ring culture method (9), 20 × 30 cm rings were set in 7 × 1 m wooden troughs lined with polyethylene film. Rings and troughs were filled with Cornell peat-lite mix (9). One plant was transplanted to each ring. The plants were trained to overhanging wires set horizontally above the troughs.

The plants were subjected to different lighting and spacing treatments previously described (8) to create as varied an individual plant environment as possible.

Photosynthetic rate was measured by the $^{14}CO_2$ technique, which was principally that of Shimshi (12) with some modifications (8). Photosynthetic measurements were made twice each on a cloudy day (90–110 W/m^2 intensity) and a sunny day (200 W/m^2 or higher) starting when the first fruits were about 3 cm diam. Leaves of approximately the same chronological age as identified by tagging were sampled.

The relationship between flowering and fruiting variables and corresponding rates of photosynthesis under cloudy and sunny conditions was determined by correlation and regression analysis. The dependent variables included flower clusters/plant, flowers/cluster, flowers/plant, fruits set (fertilized ovaries)/plant and % fruit set, which were recorded as yield components. Mature fruits/plant and early and total fruit wt/plant were taken as measures of yield.

Yield and its components were all significantly ($P<1\%$) and positively correlated with photosynthetic rate for both cloudy and sunny conditions (Table 1). On a cloudy day, high r values ranging from 0.539 for % fruit set to 0.925 for flowers/plant were observed. Corresponding correlations on a sunny day were numerically lower. Particularly notable was the near-perfect correlation between yield and photosynthetic rate on a cloudy day, indicating that yield factors other than photosynthetic rate were either indirectly involved or of little significance.

Since all significant r-values were positive, a unit increase in photosynthetic rate was accompanied by unit increases in the dependent variables as defined by the slope b or regression coefficient. Thus, early and total fruit yields were increased 0.31 and 0.59 kg/plant, respectively, for each mg $CO_2dm^{-2}hr^{-1}$ fixed on a cloudy day. On a sunny day, the corresponding increases were 0.30 and 0.62 kg/plant. The similar yield slopes for sunny and cloudy conditions show the rate-yield

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Table 1. Correlation and regression of yield, yield components and maturity (Y) on apparent photosynthetic rate (X) (mg CO_2 $dm^{-2}hr^{-1}$) of 'Tuckcross' tomatoes on a cloudy and sunny day.

Plant characters	Correlation and regression matrices Cloudy day r	 r^2	 $\hat{Y} = a + bX$	 Sunny day r	 r^2	 $\hat{Y} = a + bX$
A. Yield components						
Flower cluster/plant	0.71**	0.51	$\hat{Y}$=8.44+0.67X	0.671**	0.450	$\hat{Y}$=5.33+0.74X
Flowers/cluster	0.87**	0.76	$\hat{Y}$=4.14+0.46X	0.614**	0.377	$\hat{Y}$=3.02+0.38X
Flowers/plant	0.92**	0.86	$\hat{Y}$=30.96+9.22X	0.760**	0.578	$\hat{Y}$=–1.65+8.90X
Fruits set/plant (fertilized ovaries)	0.89**	0.79	$\hat{Y}$=10.87+7.47X	0.785**	0.616	$\hat{Y}$=–19.93+7.76X
% Fruit set	0.54**	0.29	$\hat{Y}$=46.85+2.76X	0.529**	0.280	$\hat{Y}$=32.96+3.19X
Fruit size (g/fruit)	0.64**	0.42	$\hat{Y}$=63.23+4.49X	0.667**	0.445	$\hat{Y}$=38.42+5.46X
B. Yield						
Total mature fruits/plant	0.90**	0.81	$\hat{Y}$=7.00+5.47X	0.775**	0.600	$\hat{Y}$=–14.34+5.46X
Early yield (kg/plant)	0.93**	0.86	$\hat{Y}$=0.90+0.31X	0.781**	0.610	$\hat{Y}$=–1.16+0.30X
Total yield (kg/plant)	0.90*	0.81	$\hat{Y}$=0.12+0.59X	0.809**	0.654	$\hat{Y}$=–2.40+0.62X

**$P<1\%$.
*$P<5\%$.

relationship was almost constant irrespective of the predictor variable. However, the higher r values indicate better linear response to cloudy-day photosynthetic rate; this may have resulted from the confounded effects of lighting and spacing.

On a sunny day, these effects may have been masked by adequate sunlight in which case there would be little effect of supplementary lighting on photosynthetic rate. On a cloudy day, however, supplementary lighting likely increased plant-to-plant photosynthetic rate variation, thereby contributing to the higher r values. Furthermore, a preponderance of cloudy days during the flowering and fruiting period likely contributed to the better linear fit under cloudy-day conditions. Thus, in predicting light responses use of the cloudy-day photosynthetic rate as predictor variable may prove more meaningful, especially in winter months with short daylight duration and low light intensity.

The coefficient of determination (r^2) measured the contribution of photosynthetic rate to the variations observed for each flowering and fruiting trait. Photosynthetic rate on a cloudy day accounted for as low as 42% (fruit size) to as high as 86% (flowers/plant) of the observed variation (Table 1). Similarly, sunny-day rate contributed from 38% (flowers/cluster) to 65% (total yield) of the variation. Cloudy-day rate accounted for more than 80% of the yield variation, as compared with 60 to 65% for sunny conditions. The unaccounted-for variation was presumably due to differences in conditions between samplings.

The correlation coefficients between photosynthetic rate and flowers/cluster, flowers/plant, and fruit set/plant were notably high (0.89 to 0.92). Since these components contribute to yield, it is not surprising that the rate-yield r values as measured in fruits/plant, and fruit weights were as notably high (0.90 to 0.93). It should be emphasized that the controlled greenhouse environment minimized environmental fluctuations and doubtlessly contributed to high r values.

While establishing the quantitative relationships between photosynthetic rate and yield components reported above, these data support the essential role of light on tomato flowering and fruit setting previously reported. Optimum photosynthetic rate for good growth, blossom development, fruit setting and high yield requires adequate light (5, 8). Unfruitfulness is attributed to flower abscission (8). Relative vegetative growth to fruiting is encouraged under conditions of low light intensity (3) resulting in flower abscission (6). The adverse effect of low light intensity is manifested on the flower itself by stylar exsertion and non-viable pollen, which prevent pollination and fertilization (4). Fruits formed under low light intensity may lead to dormancy of fertilized flowers on the same cluster or the cluster above (3).

In addition to aiding in efficient energy management, using photosynthetic rate as predictor variable may be useful in evaluating yield potential of genotypes at early stages of development thus greatly facilitating screening and selection procedures.

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Ammonium Tolerance of Tobacco Cultivars with Different Nicotine Contents[1]

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Abstract. **Cultivars of *Nicotiana tabacum*, L. of high and low nicotine contents were grown in an unbuffered nutrient solution sand culture. All of the cultivars showed significant growth restriction on NH_4-N and formed brown stem lesions. The appearance of the lesions was delayed in 'Speight G-41' and 'Lizard Tail Orinoco', cultivars known to have high nicotine contents. Nicotine contents were reduced under NH_4 nutrition in 'Speight G-41' and 'Lizard Tail Orinoco' but not in 'Va. 724'.**

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