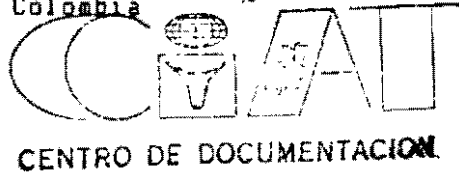


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Effects of short days on stem elongation in some indeterminate dry bean cultivars adapted to the tropics

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Dry beans are grown in the tropics under daylengths that vary from 11 to 15 hours. Daylength modulates the expression of several morphological characters in beans. Stem elongation is one of them. In subtropical areas beans are often planted as days become shorter in relay cropping, using stalks of the preceding crop, maize or sorghum, as physical support for the long and flexible bean stems. Some bean cultivars that do not elongate do not yield well under relay cropping.

Stem elongation has been shown to be promoted by long days (2), and by the ratio of red and far-red light reaching the plant at the end of a short day (1).

Five small, black seeded indeterminate bean cultivars were grown under two daylength treatments, 11 and 15 hour, both including a night break with red light. The cultivars represent the types currently grown in Central America. The plants were grown in 25 cm pots in a growth room at 23 C during the light period and 20 C during the dark period. Light was supplied by metal halide lamps positioned 120 cm above the top of the pots, yielding 35 Watt cm⁻² sec⁻¹. For each of the two daylength treatments, six plants of each of the five cultivars received the night break treatment with red light and six plants were grown without the night break. Stem elongation was measured as the length of the stem in cms from the cotyledons insertation to the tip of the stem.

Stem length was decreased in four cultivars under the long daylength, compared to the short one (Table 1). The exception was G 5474 which had the opposite behavior. Under the long daylength four cultivars, G 2997, DOR 44, G 5474, and JU 80-11 had the same plant height as indicated by the absence of significant differences. Under the short daylength, on the contrary, significant differences occurred. G 17650, a viny indeterminate variety adapted to tropical highlands showed the longest stem under all conditions. It is significant that G 2997 is a land variety widely distributed in Guatemala and DOR 44 is the commercial standard variety in eastern Guatemala. Both yield well in relay cropping and both show the highest degree of stem elongation under short days, compared to long days. It has been shown before that stem elongation is a phytochrome-mediated response, both, under long day and short day situations (1,2). In our case, the observed responses to short days in stem elongation is phytochrome mediated as indicated by the stem length reduction by the night break with red light (Table 2).

The fact that the varieties used currently in Central America in relay cropping show the most of the stem elongation suggest that indeed, this trait is beneficial for relay cropping. JU 80-11 represents the type of plant the breeders have been selecting for high yield under monoculture. This cultivar shows the lowest degree of response to short days and exhibits the shortest stem under both short and long days. It may well be that in selecting for erect architecture for monoculture, breeders have selected for a type of plant that is not adapted to the relay cropping, because of a decreased sensitivity to short days in stem elongation.

Table 1. Stem length (in cms) of five cultivars under two daylengths.
Plants were 29 days old.

Cultivar	11 hour	15 hour	Length Change	
			cms	%
G 17650	112.3a	105.2a	- 7.1	- 6.7
G 2997	87.8 b	57.0 b	-30.8	-54.0
DOR 44	63.3 c	46.2 b	-17.1	-37.0
G 5474	40.2 d	46.7 b	+ 6.5	+13.9
JU 80-11	32.2 d	26.5 b	- 5.8	-21.9

Table 2. Stem length (in cms) of five cultivars under two light treatments. Plants were 44 days old.

Cultivar	11 hour	11 hour + 1/2 h red	Length Change	
			cms	%
G 17650	199.3a	176.7a	-22.6	-11.3
DOR 44	149.2 b	100.8 b	-48.4	-32.4
G 2997	138.2 b	88.0 bc	-50.2	-39.1
JU 80-11	101.2 c	76.8 bc	-26.9	-26.6
G 5474	77.7 d	74.3 c	- 0.9	- 1.1

Means with the same letter do not differ statistically at 5% level.

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