The flowering response of some tropicaly adapted cultivars of common bean (Phaseolus vulgaris L) to short days

The common bean, (Phaseolus vulgaris L) is grown in the tropics under moderately short or moderately long days (1) Beans are known to show either of two types of response to daylength, depending on the genotype Some genotypes are daylength insensitive, and because of this, early flowering Other genotypes show a quantitative delay of flowering when grown under long days (2, 7) The extent of quantitative response is modulated by the length of the dark period and magnified by warm temperature and or cool night temperature (relative to the day temperature) (8) It is known however, that the primary (or immediate) effect of long (non inductive) days is a change in partitioning of photosynthates (3, 5) See also the results on multiple effects of daylength on bean growth in this report

The concurrent changes in architecture and agronomic value that are brought about by daylength interacting with temperature have determined the adaptation of bean cultivars to the temperate zone of the world (4) Under tropical conditions, the response to daylength (moderately long days) and simultaneous high temperatures also determines the adaptation of bean cultivars to hot lowlands (4) Some bean genotypes of tropical origin, known to be daylength insensitive show a delay in flowering and occurrence of the first flower in upper nodes on the plant, when grown in high elevation mountains with mean temperatures below 23 C (4) A daylength-mediated delay of flowering also has been observed in bean accessions and improved varieties adapted to lowland tropics under greenhouse conditions (3) There is also evidence that under field conditions some bean accessions of the CIAT bean germplasm bank show a delay in flowering when grown under 12 5 hour natural daylength, compared to the same natural daylength when extended with artificial light to 18 hours The nature of this response to short days-low temperature has not been studied before

Materials and Methods

Five tropic adapted bean cultivars were grown under two daylength regimes in a growth room The five cultivars are described in Tab e ' The two daylengths were 11 and 15 hours and were meant to represent the e tremes in the range of daylengths occurring in tropical and sub tropica bea producing areas Six plants of each cultivar were grown under each of the daylengths, in 20 cm diameter plastic pots containing a 1 1 soi said r a fertilized with 2 grams of 10 30 10 commercial fertilizer The g owth roo was maintained at 23 C during the illumination period and at 20 C dur ng the dark period Light was supplied by M5° 400 w metal halide lamps positioned 120 cm above the top of the pots, yielding 35 h cm-2 sec 2 measured at the top of the pots

The number of days to, and the node number for the first opened flower was recorded for each plant A flower was considered opened at full refle ng of petals For node counting, the node of insertion of the cotyledons was considered number one, for a acropetal order

Results and Discussion

Short days delayed the opening of the first flowe in cultivars G 5474, JU 80-11, and DOR 44 G 2997 (Rabia de Gato), an early, insensitive and race, flowered in the same number of days, 33 8, under the two daylengt conditions (Table 2) On the contrary, G 17650 (San Martin) flowered days earlier under 11 hours as compared to under 15 hours The hasten of flowering in G 17650 was the expected response since it has a str sensitivity to long days (4)

The differences in time of flowering were coincident with differences in position of the first flower In cultivars G 5474, JU 80-11, and DOR 4 the first flower was on nodes positioned 1 2, 3 0, and 1 9 node units closer to the base of the plant (node number one) when grown under 15

hours-daylength as compared 11 hours Again, in G 2997, the early flowering, insensitive cultivar, the first opened flower appeared in nodes 3 2 and 3 5 (mean values from six plants) under 11 and 15 hours-daylength, respectively In G 17650 the first opened flower appeared in nodes values of 6 8 and 10 5 under 11 and 15 hours-daylength, respectively G 17650 flowered 4 7 days later with the first opened flower appearing in nodes 3 7 node-units upper in the stem, which is the typical response in flowering behavior for a long day sensitive, indeterminate plant (4, 7) G 2997 flowered earlier than any of the other four cultivars in this experiment under both daylengths It also had the first opened flower at a lower node than any other cultivar in the study, under both daylengths It flowered in the same number of days and essentially in the same node under both daylengths This is the typical response of a insensitive (day neutral) indeterminate cultivar (4, 7)

The flowering behavior of G 17650 and G 2997 as observed in this study is in agreement with their known behavior under field conditions (4) The behavior of G 17650 and G 2997 in this study indicates that the light and temperature conditions in the growth room were adequate for a normal growth and for inducing the known flowering responses of bean plants, to varying daylength

G 5474, JU 80-11 and DOR 44 flowered 3 5, 6 3 and 3 5 days later under 11 hours as compared to 15 hours, respectively, They also had the first flower opening in node positions 1 2, 3 0 and 1 9 node units upper in the plant (more distant from the base) when grown under 11 than under 15 hours-daylength These three bean cultivars had then a flower response that is a reversal of the known responses to daylength in beans

Beans have been classified as a short day plant (long day sensitive), that is, they flower earlier under short than under long days (9) The results in this study indicate, however, that the reverse type of response to daylength do exist in P vulgaris L , that is, a long day plant response The results also indicate that there is variability in the species and that

depending on the genotype, P. vulgaris L. can be classified as a day neutral, short day or long day plant. It also seems reasonable to expect that combinations of both responses, short day and long day can exist in the same plant.

Table 1 Some characterstics of five cultivars studied in groth room.

Cultivar	Reaction to Long Days	Flowering at 19 C	Area of Adapt
G 5474	Insensitive	Unknown	Unknown
JU 80-11	Insensitive	Delayed	Lowland
G 2997	Insensitive	Early	Lowland
G 17650	Sensitive	Early	Highland
DOR 44	Insensitive	Delayed	Lowland

Table 2 Days to first flower

	11 hours	15 hours	Delay
G 5474	44 0	40 5	-3 5
JU 80-11	47 0	41 7	-5 3
G 2997	33 8	33 8	0 0
G 17650	40 3	45 0	4 7
DDR 44	43 8	40 3	-3 5

Analysis of Variance

	F	Probability
Daylength	0 74	>0 10
Cultivars	4 32	0 10-0 05
Interaction	15 41	<0 005

Table 3 Node of first flower

	11 hours	15 hours	Change
G 5474	7 2	6 0	-1 2
JU 80-11	8 5	5 5	-3 0
G 2997	3 2	3 5	0 3
G 17650	6 8	10 5	3 7
DOR 44	8 7	6 8	-1 9

Analysis of Variance

	F	Probability
Daylength	0 12	
Cultivars	2 48	>0 10
Interaction	19 47	<0 005

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