RECONSTRUCTING PLANT ARCHITECTURE OF VEGETABLE BEAN (*PHASEOLUS VULGARIS* L.) FOR EFFICIENT AND COMPETITIVE PRODUCTION

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Strategies employed by bean breeders to improve yield include ideotype breeding, based on an ideal plant architecture that is expected to: (i) maximize yield trough enhanced morphological adaptation to specific cropping systems or environments; (ii) improve disease avoidance and (iii) adaptation to mechanical harvesting of bush beans in monoculture (1, 3). The wide range of variability for plant type in cultivated beans has been classified into four growth habits. Type I is the only determinate habit, whereas Types II, III and IV are indeterminate, differing in vine growth extension and climbing ability (2). Our bean breeding program earliest attempts of genetic modification of growth habit were successful in converting pole or climbing snap bean to determinate bush types. Study the architectural differences among 29 determinate bush types of garden bean suitable for mechanical harvest is the aim of the current investigation.

MATERIALS AND METHODS

There were used 29 genotypes from Maritsa Vegetable Crops Research Institute bean germplasm collection. Conventional equipment was used for planting bean accessions on the experimental plots of 3 m^2 of four replications. Samples of 12 plants in technical ripeness were evaluated for following architectural characters: plant height (PH), stem height (SH), number of branches per plant (NBP) and pods arrangement toward the stem (PA) both in vertical and horizontal line.

RESULTS AND DISCUSSION

A major focus of our bean breeding programs has been to (i) increase the space between the fresh pods to avoid disease infections and the ground and (ii) decrease pods concentration around the main plant stem in order to reduce losses from mechanical harvesting. Pods arrangement in vertical and horizontal direction depends on genotype. To demonstrate that we used architectural characters PH, SH, NBP and PA, and MS Excel program to build figures that correspond to three average plant habit models.

Habit model I (fig. 1). Bean plant is an upright 60 cm height bush. Vertical pods arrangement is between 10-15 and 50-55 cm in height with maximum concentration at about 20-35 cm. Horizontal pods arrangement is up to 20 cm sideward from the main stem, efficiently distributed. That habit model enables mechanical harvesting, monoculture growth of garden bean and may prove to be a valuable strategy in future diseases avoidance. It was possessed from 11 of all tested genotypes.

Habit model II (fig. 2). Bean plant is an upright 50 cm height bush. Vertical pods arrangement is between 5-10 and 40-45 cm in height with maximum concentration at about 15-25 cm. Pods distribution under 15 cm and over 25 cm is very unequal and asymmetrical. Horizontal pods arrangement is up to 10 cm sideward from the main stem with very high concentration. That plant habit model on one hand allows increasing crop density aiming to improve yield of fresh garden bean, but enables diseases epidemics and caused by them yield losses on the other hand. Highly concentrated pods amplify the risk of mechanical damage of the fresh pods. Ten of all tested genotypes possess that plant habit.

Habit model III (fig. 3). The plant is an upright 55-60 cm height bush. Vertical pods arrangement is between 5-10 and 50-55 cm in height with maximum concentration at about 25-35 cm. Pods

distribution along the whole length of the stem is very equal and symmetrical. Horizontal pods arrangement is up to 15 cm sideward from the main stem, non concentrated. Eight of all tested genotypes possess that plant habit, with pods that don't reach the ground. These are highly recommended for breeding garden bean varieties for mechanical harvesting in monoculture cropping.

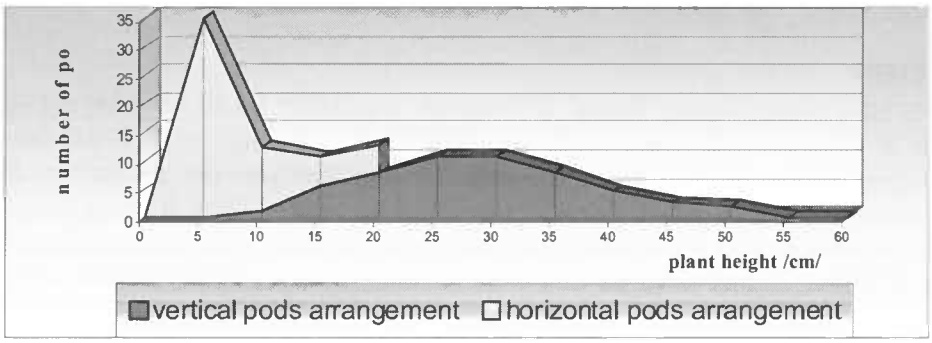

Figure 1. Plant habit model I

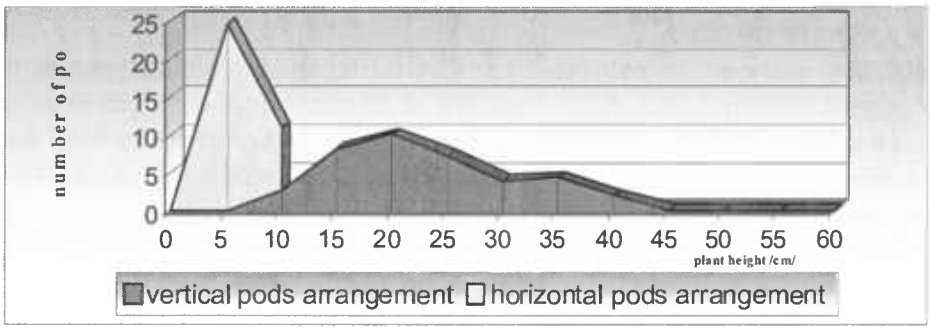

Figure 2. Plant habit model II

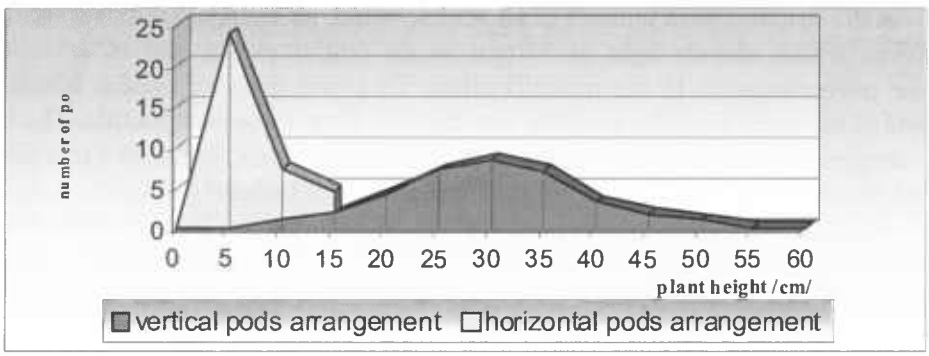

Figure 3. Plant habit model III

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