

## **BEST USAGE OF NATURAL RESOURCES AND YIELD WITH HIGH POPULATION IN Phaseolus vulgaris L. UNDER RAINFED CONDITIONS**

J. Alberto Escalante Estrada and J. Kohashi Shibata. Programa de Botánica. Instituto de Recursos Naturales. Colegio de Postgraduados. Chapingo-Montecillo, Méx. 56230.

### Introduction

Economic Crop production is the conversion of three natural resources (light, water and nutrients) into usable products by the plant community. The efficiency by which these resources can be used is influenced in part by crop management. Three management decisions that might influence the production of a crop are cultivar selection, plant population and nitrogen fertilization. Moreover, high radiation interception is a prerequisite for maximal seed yield (Tanner and Hume, 1978) and it can be get with increase in the cover ground by high leaf area index and dense populations. In addition, in rainfed crops it is advantageous because it reduces the evaporation increasing the water availability for the crop (Escalante, 1992).

### Materials and Methods

The experiment was conducted in the field during the rainy season in Chapingo, Méx. Two varieties were employed: Michoacán 12-A-3 (M12), a type II indeterminate bush bean (56 days to flowering and 114 days to maturity) and Cacahuatate 72 (C72), a type I, determinate bush bean (45 days to flowering and 94 days to maturity). Nitrogen fertilization as urea at 100 kg N/ha (F) was applied before sowing. The population densities were: 83,000 (LD) (80 x 15 cm) and 166,000 (HD) (40 x 15 cm) plants per hectare. The treatments were allocated in a split-plot design with 4 replicates. Sowing date was 8th May 1992. The leaf area index (LAI) light interception (LI) and biomass were recorded at 38 and 48 days after sowing (das). At physiological maturity (PM) the biomass and yield (Y) components, N use efficiency (YHD-YLD/F) and water use efficiency (Y/R) were evaluated. The mean of YHD, YLD, F, Y were presented above, R is the rainfall during growth cycle and it was of 274 and 312 mm for C72 and M12, respectively.

### Results and Discussion

From early stages M12 and C72 showed higher LAI and LI in HD (Table 1) and consequently highest biomass and yield in PM (Table 2) than LD: Biomass and LI showed close relation ( $r= 0.83 **$ ). In PM the yield increase was related to a high seed and pod number per area obtained with HD. Moreover, the crop in HD showed higher N use efficiency, 4.1 kg/kg (C72) and 6.3 kg/kg (M12) than LD, and highest water use efficiency, 15.0 kg/ha/mm in HD against 10 kg/ha/mm in LD for both varieties. These results indicate that a

high efficiency in the use of natural resources can be obtained with crop management increasing bean yield in rainfed crops.

Table 1. Leaf area index (LAI) and light interception during the growth of bean. Chapingo. 1992.

Genotype	Population	das			
		38 LAI	LI(%)	48 LAI	LI(%)
C72	HD	0.75	32	1.00	46
	LD	0.43	21	0.70	24
M12	HD	0.38	21	0.95	25
	LD	0.17	16	0.42	20

Table 2. Biomass (B), Yield (Y), Seed (S) and pod number per m<sup>2</sup> in beans as related to population density. Chapingo. 1992.

Genotype (G)	Population (D)	B (g)	Y (g)	S	Pod
C72	HD	426	141	348	96
	LD	260	100	313	84
M12	HD	469	180	1007	262
	LD	373	117	670	176
PROB F.	G	NS	NS	**	**
	D	**	**	**	**
	G*D	*	*	**	*

NS= Non significant differences; \*P $\geq$ 0.05; \*\*P $\geq$ 0.01.

### References

Escalante, J.A. 1992. Tesis Doctoral. E.T.S.I.A. Universidad de Córdoba, España. 230 págs.

Tanner, J.W. and D.J. Hume. 1978. p. 157-217. In. A.G. Norman (ed). Soybean physiology, agronomy and utilization. Academic Press, New York.