Effect of Spacing and Number of Plants in the Row on Bean (*Phaseolus vulgaris L.*) Production in Tropical Lowland of Brazil

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Common bean is being planted practically in any cropping systems all over Brazil. Recently the bean production is being expanded to the tropical lowlands with high temperature regime. Bean production system has been studied extensively in the higher latitude of Brazil, but there is little information and production technology available for bean grown under lowlands tropic conditions. The low bean yield obtained by local farmers of the region reflects the lack of technology. There is still room for improvement by introducing the right cultural practices. The production technology commonly used in this region is brought from southern part of Brazil with no or little modification, e.g., row spacing of 0.45 a 0.50 m and plant density of 10 to 15 plants m^{-1}. It was observed that in the lowland tropics the border rows have significantly higher pod set and yield than the inner rows. The border row effect is less in traditional bean growing regions during the winter planting. This leads to the assumption that the spacing and plant density in the tropical lowlands are important parameter for improving bean yield. COBRAPE farm, State Tocantins (11° 26' 52,4" S e 49° 57' 36,9" W em 115 m a.s.l), was chosen as an experimental site during winter 2000 to study the optimum spacing, plant density and bean yield. The experiment of 3x4x2 factorial was conducted in completely randomized block design with four replications. The treatments were: 3 spacing (0.45, 0.60 and 0.75 m between rows), 4 plant densities (7, 10 , 13 e 16 plants m^{-1}) and 2 cultivares (Pérola, III and Jalo Precoce, II). The soil is classified as a hydromorphic and the chemical analysis of the soil shows the following results: pH (water) 5.5, Ca 38.7, Mg 14.5 , Al 5, e H + Al 112 ($mmol_c\ dm^{-3}$), P 66, K 162, Cu 2.3, Zn 3.7 , Fe 198 e Mn 30 ($mg\ dm^{-3}$) and organic matter 55 ($g\ dm^{-3}$). The planting was done at the highest density and thinned out to the determined densities at 10 days after emergence. The plot consisted of eight rows with 6 m length. At harvest 1 1/2 m head and two lateral borders were discarded. Basal fertilization was 450 kg ha^{-1} with 8-28-26 composition. Side dressing was applied at 20 days after emergence with 80 kg N ha^{-1} in form of Ammonium sulfate. Data of final plant population, yield and yield components were collected. Analysis of variance and regression analysis were carried out and response curves are shown in Figures 1 and 2. From the response curve the importance of spacing on bean yield was detected. In cultivar Pérola (growth habit III), spacing contributed 78% of bean production variation and only 5% due to density and 3% due to the interaction of spacing and density. For Jalo Precoce (growth habit II) the effect of spacing, density and its interaction was 54, 3 and 1%, respectively. The highest yield of Pérola was estimated as 3241 kg ha^{-1} with row spacing of 58 cm and plant density of 14 plants m^{-1}. For Jalo Precoce it was estimated the highest yield of 2272 kg ha^{-1} at 57 cm row spacing and 12 plants m^{-1}. These results suggests that by increasing the spacing from the traditional 45 to 60 cm it is possible to increase the bean yield and at the same time saving about 25% fuel energy and seed rate.

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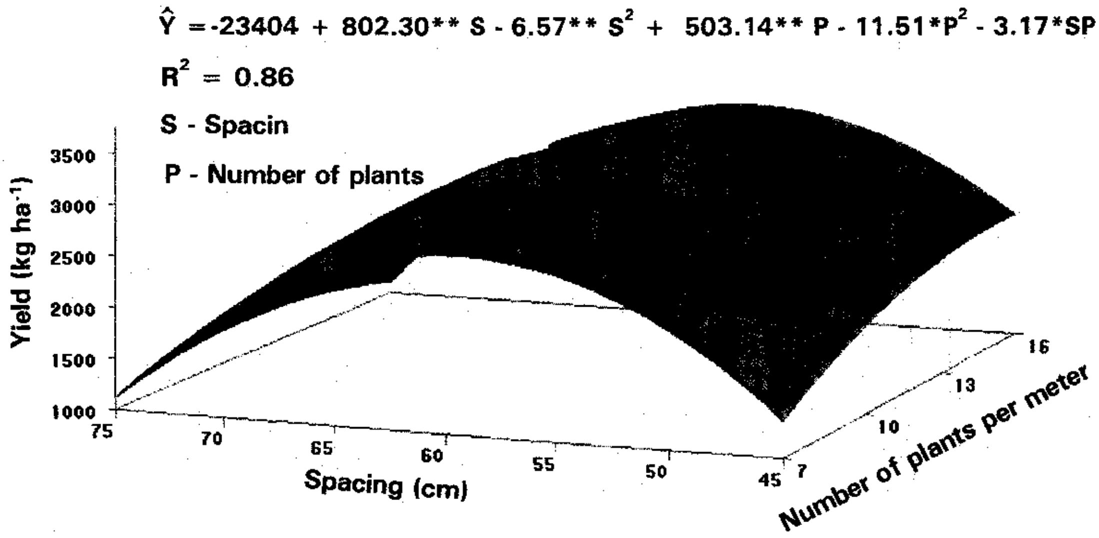

Figure 1. Yield of cv. Perola as affected by spacing and number of plants per meter at COBRAPE farm, State Tocantins during winter 2000.
*,** indicates significant difference at 1%

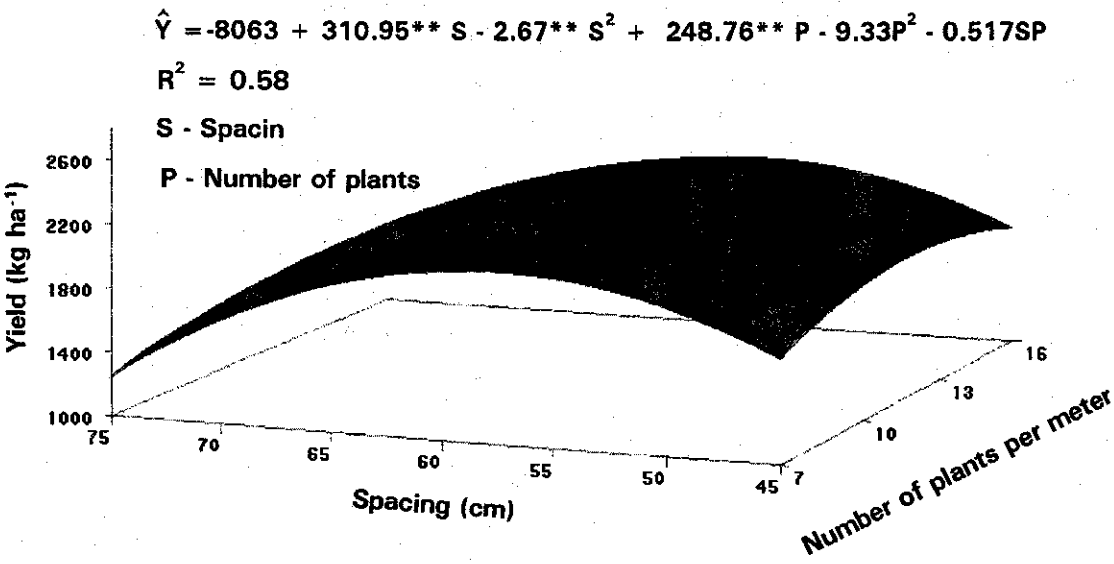

Figure 2. Yield of cv. Jalo as affected by spacing and number of plants per meter at COBRAPE farm, State Tocantins during winter 2000.
*,** indicates significant difference at 1%