Effect of row spacing and land preparation methods on yield of eight advanced bean lines

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The Brazilian Savannah becomes the most important region for bean producing with irrigation. During the winter period (April to July) of 1998 the cultivated area was 184,000 ha, producing 288,000 t with yield average of 1600 kg ha^{-1} equivalent to 2.5 fold of the national average of 660 kg ha^{-1}(IBGE 1998). Soil fertility of these areas has been improved in the last two decades by applying large quantity of chemical fertilizers and lime. The soil physical properties of this Oxisol is fragile and prone to soil degradation. The extensive use of disk harrow induces soil erosion and soil compaction, hence reducing the soil biological activities. To improve these soil characteristics and avoid soil erosion the no till farming was introduced and now becomes a standard cultural practice by many farmers. Deep plowing up to 0.30 m with moldboard plow is recommended to reduce the soil compaction. During the winter period the temperature is optimum for beans, and the incidence of pest and disease is generally low. Yield higher than 3t ha^{-1} is commonly obtained when recommended cultivars are utilized e.g. "Perola" and "Apore", both of carioca grain type. It is estimated that about sixty percent of bean production area is now planted with carioca grain type. Few information on other grain types e.g., cream, purple and black seeded for the intensive bean production with irrigation is available. In the intensive bean production system, farmers grow beans using one single standard row spacing and density, neglecting the growth habit of the cultivars. Growing beans with correct row spacing is important to suppress weed through rapidly covering the soil surface and to produce the maximum leaf area at flowering time for highest yield. Row spacing is also influenced by soil fertility and cultivars performance (Portes, 1996).

Two experiments were conducted on Oxisol at Santa Fe Farm in Santa Helena de Goias, where no till farming is being practiced for more than 13 years, during dry winter season of 1999 with irrigation. The soil is fertile with the following characteristics: 17.8 mg kg^{-1} of P; 128 mg kg^{-1} of K, 6.0 $mmol_c$ L^{-1} de Ca and 1,6 $mmol_c$ L^{-1} of Mg, and have sufficient content of micronutrients. Both experiments received 250 kg ha^{-1} of complete fertilizer type 4-20-20 and were planted with 15 seed m^{-1}, and thinned out to plant density at 12 plant m^{-1}. The objective of the first experiment was to evaluate the effect of spacing of 0.35 and 0.45 m on yield of 8 bean lines. The experimental design was split plot design in 5 repetitions, where the main plot was the row spacing and the subplot was the bean lines. The objective of the second experiment was to study the effect of no till and moldboard plow land preparation on the same 8 bean lines. The experimental design was split plot design in 5 repetitions, where the main plot was the land preparation methods and the subplot was the bean lines.

The results are shown in Table 1. There was no significant difference between the two row spacing in the yield and yield component of the 8 advanced lines, because all these advanced lines are of growth habit II and III. The growth habit II and III are assumed to have the plasticity for yield compensation within a certain range of row spacing. Significant difference was only

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obtained among the 8 advanced lines. A 774 and A 775 are the outstanding lines in this experiment. The higher yield was obtained through increasing the number of pod per plant.

Table 2 shows the results of the second experiment, where no till system gave higher bean yield than the plots plowed by moldboard plow. The difference was not statistically significant. The performance of the 8 advanced lines was similar to the first experiment where A 775, A 774 and AN 730116 were the outstanding lines.

These preliminary results suggest that outstanding lines with growth habit II and III will perform well under 0.35 or 0.45 m row spacing. Yield would increase significantly if narrow row spacing, bean with growth habit I and erect growth habit II had been used. The no-till land preparation method tends to increase yield, but statistically non significant. These experiments were conducted under minimum stress of soil fertility, water availability, and incidence of pests and diseases. These experiments will be repeated next year.

Table 1. Effect of row spacing on yield and yield components of eight advanced bean lines.

Identification	Pods plant^{-1}			Seeds pod^{-1}			Yield (kg ha^{-1})		
	0.35 m	0.45 m	Mean	0.35 m	0.45 m	Mean	0.35 m	0.45 m	Mean
A 775	16.0	17.4	16.7 a*	4.98	5.43	5.21ab*	3225	3001	3114ab*
MA 733327	13.8	12.4	13.1bc	5.09	5.54	5.31a	2176	2275	2225 d
LR 9115398	11.8	12.9	12.3 c	5.48	5.02	5.25ab	2119	2510	2314 d
AN 730116	17.9	14.2	16.0ab	4.76	4.78	4.77 ab	2763	2878	2820 bc
RAO 33	16.8	14.8	15.8ab	4.78	4.19	4.49 b	1930	2066	1998 d
A 774	16.2	20.3	18.3 a	5.02	5.91	5.47 a	3052	3542	3297 a
FEB 163	13.2	13.3	13.3bc	5.32	5.31	5.31 a	3272	2281	2777 bc
LM 93204217	6.8	9.1	8.0d d	4.33	5.19	4.76 ab	2622	2198	2410 cd
Mean	14.1	14.3	14.2	4.96	5.17	5.07-	2645	2594	2619
CV %	23			15			17		

* Means followed by the same letter in the same column are not significantly different by Tukey test at P=0.05.

Table 2. Yield of eight beans advanced lines as affected by two land preparation methods.

Identification	Growth habit	Seed color	Yield (kg ha^{-1})		
			No till	Mold board plow	Mean
A 775	II	Cream	3472	2952	3212 a*
MA 733327	II	Black	2128	1509	1819 c
LR 9115398	IIIa	Black	1671	1333	1502 c
AN 730116	II	Black	3048	2405	2727 ab
RAO 33	II	Purple	2551	2370	2461 b
A 774	II	Cream	2874	2707	2791 ab
FEB 163	II	Purple	2849	2130	2489 b
LM 93204217	II	Black	2602	2562	2582 b
Mean			2664	2246	
CV (%)			14		

Means follow by the same letter in the same column are not significantly different by Tukey tetst at 5% at P=0.05.

Reference

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