ASSOCIATION OF BEANS WITH MAIZE IN SIMULTANEOUS PLANTING SYSTEM: EFFECT OF SPATIAL ARRANGEMENTS

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Introduction: In Minas Gerais State, Brazil, approximately 40% of dry beans (*Phaseolus vulgaris* L.) are produced in association with other crops. The predominant association is maize with beans, which are planted simultaneously during the second half of spring when rains begin. At the end of summer beans can be planted again between maize rows when this crop is in maturation. Maize is usually planted in rows 1.0 m apart either in furrows or in hills with 20 to 47 thousand plants/ha (Vieira et al., 1975). Three spatial arrangements are used for this associated cropping: beans sown in the same maize rows or hills, bean rows alternated with maize rows, and beans sown in the same maize rows and also between maize rows. The objectives of this study were: (a) to evaluate the effect of three spatial arrangements of bean rows on maize-bean intercrop, (b) to determine if bean rows planted in alternative rows to either maize rows or maize plus bean rows should be fertilized, (c) to compare the effect of planting rows and hills on beans and maize yield, and (d) to verify if the use of higher monocropped maize population can increase its yield, compared to that recommended for maize-bean intercrop (40,000 plants/ha) (Vieira, 1989).

Materials and Methods: The experiment was installed in Coimbra, Minas Gerais State, on 24 Nov. (spring) 1993. The treatments tested are in Table 1. A randomized complete block design with six replications was used. Maize was planted in rows or hills 1.0 m apart, with about 41,000 plants/ha, except in one treatment of monocropped maize in which 47,000 plants/ha were used. Each plot contained four rows 6 m long. In hills, maize was planted at intra-row spacing of 0.4 m. Bean planting density was 12.5 seeds/m. Monocrop bean plots were planted outside the experiment. Maize (or maize plus beans) was fertilized with 20-70-40 kg/ha of N-P_2O_5-K_2O at planting plus 50 kg/ha of N as side dressing 40 days later. Monocropped beans and beans planted in alternative rows to maize rows (and fertilized) received the same amount of fertilizer/ha used for maize at planting, but only half the amount of N as side dressing.

Results and Discussion: The highest maize yield was obtained in treatment 7, maybe because the fertilizer applied for beans was also utilized by maize, as shown by Freire et al. (1985). The lowest maize yield was obtained in treatment 5, in which both crops were planted in the same hills. The other treatments did not differ significantly from treatments 5 and 7. Monocropped beans (treatment 3) yielded almost 1.5 MT/ha. Treatments 8 and 9 yielded about three times less than treatment 3, in spite of their high, similar bean population (about 200,000/ha), showing the high competitive ability of maize. When beans are either planted in the same maize row (or hill) or in between maize rows and fertilized (treatments 4, 5, and 7), the yields were almost the same (about 360 kg/ha). When no fertilizer is applied to the bean crop (treatment 6), its yield was the lowest. Monocropped beans provided the highest equivalent production (Table 2), but this system represents risk for the farmers, since beans are harvested during the rainy season. On the other hand, maize is a low risk crop. Treatments 7, 8, and 9 also permitted a high equivalent production, but they require more labor and inputs and impair weeding, when compared to treatment 4. Small farmers want both low production cost and little risk, conditions offered by treatment 4.

References:

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Table 1 - Plants per hectare and yield of maize and beans planted in monocrop and intercropped during rainy season (spring)*

Treatments	Maize		Beans	
	Plants/ha x 1000	Seed yield (kg/ha)	Plants/ha x 1000	Seed yield (kg/ha)
1. Monocropped maize	41.3 bc	4483 ab	-	-
2. Monocropped maize (higher population)	47.0 a	3977 ab	-	-
3. Monocropped beans	-	-	226 a	1470**
4. Maize and beans planted in the same rows	44.2 ab	4090 ab	91 c	364 b
5. Maize and beans planted in the same hills	39.0 c	3717 b	67 c	377 b
6. Beans (not fertilized) planted in alternative rows to maize rows	41.3 bc	4665 ab	136 bc	253 c
7. Beans (fertilized) planted in alternative rows to maize rows	40.5 c	4790 a	138 abc	358 b
8. Beans (not fertilized) in both alternative and same maize rows	40.8 bc	4123 ab	202 ab	538 a
9. Beans (fertilized) in both alternative and same maize rows	41.3 bc	4222 ab	197 ab	522 a

* Means within column followed by the same letter are not significantly different according to Tukey's test (5%).

** Data not included on statistical analysis, because plots were planted outside the experiment.

Table 2 - Equivalent production of maize (kg/ha), considering price of bean seeds 4.5 times higher than that of maize seeds

Treatment numbers	Maize	Beans*	Total
1	4483	-	4483
2	3977	-	3977
3	-	6615	6615
4	4090	1638	5728
5	3717	1696	5413
6	4665	1138	5803
7	4790	1611	6401
8	4123	2421	6544
9	4222	2349	6571

* Bean yields (Table 1) x 4.5.