

The Effect of Fertilizer Placement on Bean Yield in Tropical Lowland with Sub-Irrigation

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The region of lowland tropic of Brazil is appropriated for rice production during the rainy season. During the dry season, which coincides with the winter period in the Southern Hemisphere, the temperatures are lower and several annual crops such as maize and soybean can be grown. Water is supplied through sub-irrigation that carries the water from below by raising the water table and/or capillary water movement. In some spots water can raise to the soil surface, causing severe damage to the root development. There is no downward water movement as in the conventional overhead sprinkler irrigation or rainfall. Dissolved fertilizer solution concentrates around the fertilizer pelets, hence it is in the proximity of the roots and caused root injury. This type of injury has been reported by Vieira, 1966 and Kluthcouski, et al. 1999. In this region it is a common practice to place the fertilizer 3 to 5 cm below the seed as it were under the conventional irrigation system or in rainfed production. The correct positioning of the fertilizer in sub-irrigation system may reduce the young root injury. On the other hand placing the fertilizer too far away or too deep from the seed will starve the seedling from the needed nutrients. Therefore the study of fertilizer placement in this sub-irrigation system is essential before the begin of large bean production.

The experiments were conducted at two locations COBRAPE (hydromorphic soil) and Lagoa da Confusão (Oxisol) with sub-irrigation system. The fertilizer doses was 500 kg ha⁻¹ of complete fertilizer having 4-25-20 composition. Five placements were arranged in a completely randomized design with 6 replications and the net plot size was 10 m². The treatments are: a. No fertilizer applied, b. 2 cm deep adjacent to the seed row, c. 2 cm deep but 10 cm away from the seed row, d. 2 cm below the seed and e. 10 cm below the seed. The soil characteristics of the two experimental sites are presented in Table 1. Bean cv. Pérola was planted in 60 cm row distance with 18 seed m⁻¹. Plant protection was carried out according to the local practice.

The results in the Table 2 showed the importance of fertilization at both locations for improving yield. Yield in the control plot was quite. At Cobrape the mean yield was higher than in Lagoa da Confusão, this may be related to better soil fertility of this location. The best fertilizer placement at Cobrape was 10 cm adjacent to the bean row. This provided an ample space for the young root to develop without facing a high concentration of nutrient dissolved from fertilizer and close enough to be reached by root at later growth stages. Any other fertilizer placement gave similar results. At Lagoa da Confusão with lower soil fertility, the fertilizer placement 2 cm below the seed gave the highest yield but not significantly different with other treatments. This agrees with the common practice that in Oxisols the fertilizer must be placed as closed as possible to the seed. Further studies are needed to confirm whether placing the fertilizer 10 cm adjacent

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to the bean row is superior to other treatments in fertile soil of the region with sub-irrigation system and close fertilizer placement for soils with low fertility.

Table 1. Chemical characteristics of the two experimental sites.

Site	Depth (cm)	pH water	Ca Mg Al H+Al				P K Cu Zn Fe Mn						O.M. g dm ³
			mmol _c dm ⁻³				mg dm ⁻³						
Lagoa da Confusão	0 - 10	5.5	18.0	4.7	3	86	5.5	197	1.6	2.0	341	28	32
	10 - 20	5.5	21.6	5.8	2	85	3.3	95	1.6	1.4	253	31	28
Cobrape	0 - 10	5.5	38.7	14.5	5	112	66.0	162	2.3	3.7	198	30	55
	10 - 20	5.5	42.3	15.8	5	115	64.6	86	2.6	3.8	231	38	51

Table 2. Bean yield as affected by different placement of fertilizer in Cobrape and Lagoa da Confusão-TO, Brazil.

Site	Cobrape	Lagoa da Confusão	Mean (kg ha ⁻¹)
Fertilizer placement			
No fertilizer	1608 a	757 b	1202
10 cm adjacent the row	1909 a	1306 a	1608
2 cm adjacent to the row	1573 a	1176 ab	1375
2 cm below the seed	1588 a	1401 a	1495
10 cm below the seed	1506 a	1263 a	1385
Mean	1637	1188	
CV (%)	20.6	20.5	
LSD 5%	572	413	

Literature:

Kluthcouski, J.; I. P. de Oliveira, H. Aidar, T. Cobucci, J. G. T. Silva. 1999. Efeito salino causado por fertilizantes no sistema de plantio direto sobre as culturas do feijão, milho, soja e arroz. In: Reuniao Nacional de Pesquisa de Feijao, 6., 1999, Salvador, BA. **Resumo expandido**. Santo Antônio de Goiás: Embrapa - Arroz e Feijão, 1999, p.797-800. (Embrapa - Arroz e Feijão. Documentos, 99

Vieira, C. 1967. O feijoeiro comum: cuultura, doenças e melhoramento. Viçosa, University Press. 200p.