

THE PERFORMANCE OF FOUR CULTIVARS AND THE EFFECT OF FERTILIZATION ON BEANS GROWN UNDER SUB-IRRIGATION IN THE LOWLAND TROPICS.

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Bean as short growth cycle crop needs a high available nutrient supply in a short period of time and the highest nutrient absorption rate takes place during the flowering stage. Due to the high nutrient requirement bean can grow well only on medium to high fertile soils.

In lowland tropics the temperature is the most important factor that change the morphology and physiology of the bean plant. The highest day temperature for the normal bean (*Phaseolus vulgaris* L.) production is around 29.5°C and 19.0°C during the night (Laing et al., 1984). High temperature reduces not only the crop cycle, high flower fall, increased internode length and the grain yield. Yield decreased significantly when temperatures are higher than 30°C during the flowering stage. Mack & Singh (1969), reported that yield reduced up to 67%, when the temperature reached 38°C in this plant stage.

An experiment was conducted at COBRAPE farm in the State Tocantins with a sub-irrigation system (11° 45' S and 49° 15' W at 115 m a.s.l.) and the maximum and minimum temperature was 34.2°C and 20.0°C and altitude of 115 m. The previous crop was rice. The objective of this experiment was to study the performance of FT-Bonito, Perola, Ruda and Princesa under this environment with row spacing of 45 cm and the plant density of 10 to 15 seed m⁻¹. The four cultivars received 400kg ha⁻¹ fertilizer type 10:20:20. An extra fertilizer treatment with 800kg ha⁻¹ was applied to FT Bonito and Perola.

The soil characteristic of the site is shown in Table 1. This table shows that the fertile soil concentrated only at the layer between 0-20 cm. Below this lies the compacted sand saturated with water, hence no bean root can penetrate the deeper layer.

TABLE 1. Soil characteristics of the experimental site in COBRAPE.

Depth (cm)	pH (2:1)	mmol _c l ⁻¹			mg kg ⁻¹				g kg ⁻¹ O.M.	
		Ca	Mg	Al	P	K	Cu	Zn		Mn
0-10	5.45	36.3	16.6	4.3	67.4	158.0	2.6	2.0	20.0	41
10-20	5.50	13.2	5.7	7.0	29.2	47.3	1.8	0.5	10.0	16
20-30	5.67	8.7	3.7	5.3	4.6	21.7	1.3	0.3	10.0	5

During the crop cycle between May to August, the 19 years average of maximum and minimum temperature was 34.3°C and 20.3°C, respectively. Under this environment the crop cycle of all cultivars was less than 80 days. Princesa and Perola, both type III plant, produced higher yield than the erect Ruda and FT-Bonito (type II plant). Princesa was the highest yield with 1639 kg ha⁻¹ and had the highest plant population at harvest period (Table 2).

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TABLE 2. Growth cycle, final plant population and grain yield of bean cultivars*.

Cultivar*	Growth Cycle ** (days)	Final population (1000 plants ha ⁻¹)	Bean yield (kg ha ⁻¹)
Princesa	75	321 a***	1639 a***
Perola	80	162 b	1492 ab
Ruda	75	299 a	1261 bc
FT Bonito	78	193 a	1148 c
CV. (%)	-	18.4	10.1

*Planting date June 10, 99 and harvest August 25, 99. **Plant growth cycle from emergence to harvest. *** Means followed by the same letter are not significantly different at Tukey 5%.

TABLE 3. Yield of FT-Bonito and Perola as affected by fertilization.

Cultivar	Fertilization kg ha ⁻¹	Final population (1000 plant ha ⁻¹)	Yield kg ha ⁻¹
Bonito	400	193.3	1148d*
	800	199.4	2783a
Perola	400	161.7	1492c
	800	142.2	2022b
CV (%)			8.61

* Means followed by the same letter are not significantly different at Tukey 5%.

Although the experiment was conducted on fertilized soil the yield of Bonito and Perola cultivars increased significantly by doubling the doses of fertilizer (Table 3). These results suggest that higher fertilizer doses are still needed for high productivity under sub-irrigated system. This additional fertilizer doses supposed to replenish the rapidly depleted root zone due to the limited soil volume. This preliminary result shows that the bean production in the tropical lowlands is viable as long as sufficient nutrient is made available to the bean root grown on limited soil volume.

Future experiment will be conducted to study the raised seed-bed for increasing the soil volume for better root growth.

References:

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