Evaluation of some cultivars and advanced breeding lines in tropical lowland of Brazil

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In the last ten years bean (*Phaseolus vulgaris* L.) production during the winter period, has expanded into the lowland tropics. Between May and October the day and night temperature about 4 degrees Celsius lower, but still too high for good bean production. High temperature or/and water stress during the reproductive stage results in yield loss (Laing et al., 1984). For good bean yield the mean night and day temperature during flowering stage should be around 21.0°C e 29.5°C, respectively. Temperature higher than 35°C impedes the flower formation (Stobbe et.al., 1966). Since there is no precipitation during this period, bean must be watered through sub-irrigation system. In this environment bean yield obtained by local farmers is around 500 kg ha^{-1}. One reason for the low yield is the lack of adapted cultivar and all cultivars used in this region are from the southern part of Brazil and not bred for the low latitude. Therefore, evaluation for adapted cultivars for this region is urgently needed. To meet the demand an experiment was conducted to evaluate commercial and advanced breeding lines in the tropical lowland area. The soil is classified as hydromorphic soil and the characteristic of the site is shown in Table 1.

Bean was planted with spacing of 0,45 m between rows and density of 18 seed per meter. Complete fertilizer type 8-20-20 was applied at the rate of 500 kg ha^{-1}. Nine lines were planted in complete randomized design with 6 repetitions and the net plot size was 5 m^2. Dry spell has occurred in Formoso do Araguaia site during the pre-flowering period and this increased the incidence of *Elasmopalpus lignosellus* causing low final plant population and yield (Table 3). At the other two sites the final plant population of the black lines were higher than the Carioca grain type. It was difficult to control this insect by insecticides, because this insect is highly mobile in subsurface of the soil. Ruda gave the highest yield (1972 kg ha^{-1}) followed by Carioca. The growth cycle of all lines were shortened for several days. Ruda, Xamego, Carioca Pitoco and Carioca shortened the growth cycle only 4 days, and yielded above 1500 kg ha^{-1}. Breeding lines such as CNF7603 and local check yielded 1850 and 1798 kg ha^{-1}, respectively. Unknown line looked promising. With good humidity control through sub-irrigation such as at Cobrape* the average bean yield was about 30% higher than the local productivity, which is around 500 kg ha^{-1}. This indicate that this region has the potential for bean production. At the moment there is 200 thousands hectares with sub-irrigation available, provided there are well adapted cultivars available. The National Bean Evaluation Network will be the best source for introduction of new bean germplasm into the region.

Reference:

Laing, D.R., P.G.Jones, J.H.C Davis, 1984. Common bean (*Phaseolus vulgaris* L.) . In: P.R. Goldsworthy and N.M. Fisher (eds). The Physiology of Tropical Crops. John Wiley & Sons. N.Y.,pp. 305-351.

Stobbe, E.H.; Ormrod, D.P.; Wooley, C. I., 1966 Blosoming and fruit set patterns in *Phaseolus vulgaris* L. as influenced by temperature. Canadian Journal of Botany,44, 813-819.

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Table 1. Soil chemical characteristics of the two experimental sites.

Location	Depth (cm)	pH	Ca	Mg	Al	H + Al	P	K	Cu	Zn	Fe	Mn	O.M.
		water	$mmol_c\ dm^{-3}$				$mg\ dm^{-3}$						$g\ dm^{-3}$
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
	20 – 40	5.5	34.2	13.8	6	114	52.2	51	2.4	2.2	187	36	43
Formoso	0 – 10	6.0	35.1	9.0	0	75	13.7	51	2.3	4.0	121	13	66
do	10 – 20	6.3	40.5	14.0	0	70	12.9	59	2.5	5.7	121	15	62
Araguaia	20 – 40	6.4	28.8	14.4	0	71	3.6	95	2.2	1.5	76	11	55

*Cobrape means Companhia Brasileira de Agropecuaria

Table 2. The growth cycle, seed color and growth habit of the nine cultivars.

Identification	Growth cycle (days)		Seed color	Growth habit
	Moderate climate	Tropical lowland		
Ruda	90	86	Carioca	II
Carioca	81	78	Carioca	III
CNF 7603	70	63	Stripped	II
Local check	-	-	Cream	II
BRS Valente	86	78	Black	II
Carioca Pitoco	81	78	Carioca	II
Xamego	86	85	Black	II
Jalo Precoce	72	65	Manteiga	II

Table 3. Yield and yield components of the lines tested in tropical lowland.

Identification	Cobrape			Formoso			Mean		
	Final plts pop. ($plts\ m^{-1}$)	100 seed weight (g)	Yield ($kg\ ha^{-1}$)	Final plts pop. ($plts\ m^{-1}$)	100 seed weight (g)	Yield ($kg\ ha^{-1}$)	Final plts pop. ($plts\ m^{-1}$)	100 seed weight (g)	Yield ($kg\ ha^{-1}$)
Ruda	5.85 d	17.81 ef	2578 a	9.72 ab	13.56 d	1165 bc	7.79 cd	15.68 e	1972 a
Carioca	7.52 cd	22.73 b	2244 a	9.65 ab	18.63 c	1456 a	8.59bcd	20.68 b	1850 ab
CNF 7603	8.02 bcd	31.09 a	2657 a	12.52 a	29.68 a	938 c	10.27bc	30.38 a	1798 ab
Local check	10.65 bc	20.20 cd	2384 a	8.35 b	19.34 bc	1168abc	9.50bcd	19.77 bc	1776 ab
CNF 7560	11.85 b	19.60 de	2402 a	9.10 ab	17.58 c	1366 ab	10.47 b	18.59 cd	1640 ab
Carioca Pitoco	11.12 bc	22.04 bc	2152 a	9.12 ab	13.84 d	878 a	10.12bc	17.94 d	1515 ab
Xamego	16.47 a	15.92 f	1983 a	10.20ab	11.10 e	998 bc	13.34 a	13.51 f	1491 ab
JaloPrecoce	5.37 d	31.98 a	1823 a	9.35 ab	28.55 a	974 bc	7.36 d	30.01 b	1398 b
CNF 7119	-	-	-	11.10ab	21.05 b	1165 abc	-	-	-
CV (%)	18	4	19	15	5	16	17	5	19
LSD 5%	4.11	2.28	999	0.83	2.26	408.9	0,83	0,49	164,1
Mean	9.61	22.61	2278	9.93	19.03	1091	9.68	20.82	1680

Obs: Means followed by the same letter in the same column do not significantly different by Tukey at 5%.