

## PERFORMANCE OF SIX COMMON BEANS CULTIVARS IN THREE DIFFERENT PLANTING DATES IN LICHINGA, NIASSA, MOZAMBIQUE

### DESENVOLVIMENTO DE SEIS CULTIVARES DE FEIJÃO VULGAR EM TRÊS ÉPOCAS DIFERENTES DE PLANTIO EM LICHINGA, NIASSA, MOÇAMBIQUE

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#### Resumo

Conduziu-se ensaio de campo, em área do Centro Zonal Norte do Instituto de Investigação Agrária de Moçambique (IIAM), em Lichinga, Niassa, Moçambique, objetivando-se verificar a adaptação de cultivares de feijão vulgar às condições edafoclimáticas locais. Usou-se um desenho experimental fatorial completo 6x3, englobando seis variedades (BRS Pontal, BRS Agreste, BRS Perola e BRS Requite, desenvolvidas pela Embrapa, Brasil; e duas variedades locais, Manteiga e Encarnada) e três épocas de plantio (12/12/2012, 29/12/2012, e 13/01/2013). Adubou-se o solo em cobertura no plantio (500 kg/ha da formula NPK 2-24-12) e vinte dias após a emergência das plantas (130 kg de N/ha). Cada tratamento foi replicado quatro vezes no campo, em blocos completos ao acaso, sendo cada repetição cinco linhas de 6 m lineares cada, espaçadas 0,45 m entre si, com nove sementes plantadas/m. Na colheita, em área útil de 3 m das três linhas centrais, avaliaram-se o estande final de plantas, grau de acamamento, número de vagens por planta, número de grãos por vagem, peso de 100 sementes e a produtividade. As cultivares brasileiras mostraram-se mais produtivas nas condições estudadas do que as locais, especialmente a BRS Agreste, com produção média de 2,387 kg de grãos/ha. Em geral, a melhor época de plantio foi ao final de Dezembro.

**Palavras-chave:** Adaptação de plantas. Competição de cultivares. Desenvolvimento de sistemas de produção. Projeto Pro Savana.

#### Abstract

A field experiment was conducted in the area of the Centro Zonal Norte do Instituto de Investigação Agrária de Moçambique (IIAM), em Lichinga, Niassa, Moçambique, with the

objective of checking out the performance of common beans cultivars in response to local environmental conditions. A complete 6x3 factorial experimental design was used, encompassing six cultivars of common beans (BRS Pontal, BRS Agreste, BRS Perola, and BRS Requite, developed by Embrapa, Brazil; and two locals, Manteiga and Encarnada), and three planting dates (12/12/2012, 29/12/2012, e 13/01/2013). There was soil cover fertilization at planting (500 kg/ha of the mixed NPK 2-24-12) and after 20 days of plants emergency (130 kg de N/ha). Each treatment was replicated four times in the field, in randomized blocks (18 m<sup>2</sup> each, with five liner of six lineal meters each, spaced 0,45 cm, with nine seeds seeded per meter). At harvest (area of 3 m within the central lines), it was evaluated the plant final stand, degree of lodging, number of pods per plant, number of grains per pod, weight of 100 grains, and productivity. The Brazilian cultivars showed higher productivity than the local ones within the studied conditions, especially BRS Agreste, with an average production of 2,387 kg of grains/ha. The best planting date was at the end of December.

**Key words:** Plant adaptation. Cultivar competition. Development of production systems. Pro Savanna Project.

## **Introduction**

Common beans (*Phaseolus vulgaris* L.) are the most important leguminous plant for human consumption, especially in developing countries (Singh, 1999). It is a feed with high nutritive value, rich in proteins (Shinano et al., 1993; Fageria, 2002). Development of new cultivars by breeding is paramount to enhance productivity, resistance to diseases and grain quality improvements. At the same time, it is known that the behavior of plants cultivars may be affected by variations on the environment where they are cropped (Redden et al., 2000; Dalla Corte et al., 2002). Thus, it is important to check out performance of selected cultivars on a wide range of environments.

In this paper we report the performance evaluation of four Brazilian cultivars of common bean, developed by Embrapa, in the environmental conditions of Lichinga, Niassa, Mozambique. They were evaluated in three different planting dates, in comparison to two Mozambican common bean varieties commonly cropped in the area. The objective of the study was to check out if the introduction of proper technologies, such as improved varieties, adequate fertilization and crop management, may contribute to increase productivity of common beans in this area of the Corridor of Nacala.

## **Material and Methods**

The experiment was carried out in the Zonal Center of Investigation North-West, in Lichinga, Niassa, Mozambique. Soil in the experimental area is a clayish one, whose main characteristics are presented in Table 1.

Experimental design was a factorial 6x3, encompassing six cultivars and three planting dates. From the six evaluated cultivars of common beans tested, four were developed by Embrapa, Brazil, namely BRS Pontal, BRS Agreste, BRS Perola, and BRS Requite; and two varieties are Mozambican, namely Manteiga and Encarnada. Planting dates were spaced quarterly, matching the beginning of the rainy season in the area. The first planting date was 12/12/2012, the second was 29/12/2012, and the third one was 13/01/2013. Both Mozambican varieties were planted only in the second and third planting dates.

Every treatment was replicated four times in plots in the field, distributed in a complete randomized block design. Each plot was composed by five rows of six meters each, spaced among them 0.45 meters. Nine seeds of every cultivar were planted per lineal meter in their respective treatment and replication. The equivalent to 500 kg/ha of the NPK formula 2-24-12 was broadcasted over the soil before planting. Later, it was done a further cover fertilization, with the equivalent of 130 kg/ha of urea, in 23/01/2013, 05/02/2013 and 15/02/2013, for the first, second, and third planting date, respectively.

For production and other variables determination procedures, an area of three lineal meters within the three central planting lines was considered. The evaluated parameters were final plant stand, percent of plant lodging, number of pods per plant, number of grains per pod, mass of 100 grains, and grain productivity. All data were statistically compared through variance analysis, using Tukey test ( $P < 0.05$ ) to compare every parameter average.

## **Results and discussion**

The emergence of plants happened in 16/12/2012, 04/01/2013, and 19/01/2013, for the first, second and third planting dates, respectively. Harvests of the plants developed following each of these planting dates were made, respectively, in 20/03/2013, 21/03/2013, and 13/04/2013.

In average, all Brazilian cultivars produced more than the Mozambican ones (Table 1 and Table 2). Their best performance was seen when they were planted in late December (second planting date), achieving larger plant stands, lower percentage of lodging, higher number of pods per plant and higher grains per pods (Table 1).

BRS Agreste was the most productive among the tested cultivars, reaching 2,850 kg of grains per hectare in the second planting date. It produced 2,387 kg of grains per hectare as average of the three planting dates (Table 3). There was no significant difference ( $P > 0.05$ ) between the production of the other Brazilian varieties. On the other hand, on average, they produced more than the Mozambican varieties tested, which showed a similar production ( $P > 0.05$ ).

These results indicate that the Brazilian varieties are responsive to the improved conditions of fertilization, management and environmental characteristics of Lichinga, being suitable to be cropped in the area to enhance local common beans productivity.

However, as these are the results of a first year evaluation, it is recommended that the experiment be further replied on time, to better check the effects of eventual annual climatic variation.

## **Conclusions**

The Brazilian cultivars of common beans were more productive than the Mozambican ones in the tested conditions.

The cultivar BRS Agreste showed the best performance, producing 2.5 times as much as the local cultivar Manteiga.

The best planting date for all tested varieties was late December (29/12/2012).

It is advisable to repeat the experiment in subsequent years, to check out annual variations on climatic conditions.

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**Table 1.** Main characteristics of the soil within the experimental area in Lichinga, Niassa, Mozambique.

Organic matter	Clay	pH	P(Mehl)	K	Ca	Mg	Al	H+Al	CTC	SB	V
----- % -----			----- mg/dm <sup>3</sup> ---								
-		Water	--				----- cmol <sub>c</sub> /dm <sup>3</sup> -----				%
2.4	44.0	6.1	23.7	116.0	1.1	0.5	6.5	74.3	73.8	19.0	25.7

**Table 2.** Final plant stand (FPS), grade of lodging (GL), number of pods per plant (NPP), number of grains per pod (NGP), weight of 100 grains (W100), and average productivity (PROD) of six different common bean varieties planted in three different dates (1<sup>st</sup> = 12/12/2012; 2<sup>nd</sup> = 29/12/2012; and, 3<sup>rd</sup> = 13/01/2013), in Lichinga, Niassa, Mozambique.

Cultivar	Planting date	FPS pl/m	GL 1 to 9	NPP	NGP	W100 g	PROD kg/ha
BRS	1 <sup>st</sup>	6.0	2.0	19.5	6.3	25.3	2,127
Agreste	2 <sup>nd</sup>	8.5	1.0	25.8	6.3	24.4	2,850
	3 <sup>rd</sup>	7.8	1.0	19.8	6.3	22.5	2,184
BRS	1 <sup>st</sup>	3.5	5.3	16.8	6.0	27.7	2,127
Perola	2 <sup>nd</sup>	7.7	1.7	20.3	6.0	25.8	2,85
	3 <sup>rd</sup>	5.5	2.8	18.5	6.5	23.1	2,184
BRS	1 <sup>st</sup>	4.0	5.5	15.0	6.3	23.6	1,882
Pontal	2 <sup>nd</sup>	7.5	1.3	20.3	7.5	22.6	2,210
	3 <sup>rd</sup>	6.3	2.3	17.8	6.3	22.6	1,149
BRS	1 <sup>st</sup>	6.3	2.8	18.8	6.5	23.6	1,882
Requinte	2 <sup>nd</sup>	7.0	1.3	21.5	7.5	22.6	2,210
	3 <sup>rd</sup>	6.3	2.0	17.8	6.3	22.6	1,149
Encarnada	1 <sup>st</sup>	-	-	-	-	-	-
	2 <sup>nd</sup>	7.8	1.5	9.8	4.8	30.2	783
	3 <sup>rd</sup>	6.8	2.5	7.8	3.5	26.0	927
Manteiga	1 <sup>st</sup>	-	-	-	-	-	-
	2 <sup>nd</sup>	7.0	1.0	15.5	5.0	29.6	1,252
	3 <sup>rd</sup>	7.8	3.0	12.0	4.8	26.4	611

Probability of F test

Cultivar (cv)	6.02**	6.48**	15.14***	11.32**	8.09***	32.68***
Planting date (pd)	19.55**	29.12***	7.53**	2.90 <sup>ns</sup>	11.38***	25.65***
cv x pd	1.81 <sup>ns</sup>	2,28*	0.39 <sup>ns</sup>	0.88 <sup>ns</sup>	0.62 <sup>ns</sup>	3.40**
CV (%)	17.50	44.14	20.81	15.95	9.24	18.97

Numbers followed by \*, or \*\*, or \*\*\*, are statistically significant (P<0.05, P<0.01 or P<0.001, respectively), while <sup>ns</sup> means not significant (p>0.05)

**Table 3.** Average productivity (kg/ha) of the six common bean varieties tested in three different planting dates in Lichinga, Niassa, Mozambique.

Cultivar	Origin	Planting date			Mean
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	
		12/12/2013	29/12/2013	13/1/2014	
BRS Agreste	Brazil	2,127 a B*	2,850 a A	2,183 a B	2,387 A
BRS Perola	Brazil	1,330 b B	2,287 a A	1,699 ab AB	2,139 B
BRS Pontal	Brazil	1,509 ab B	2,271 a A	1,485 ab B	1,755 B
BRS Requite	Brazil	1,882 ab A	2,209 a A	1,149 bc B	1,747 B
Encarnada	Mozambique	-	783 a A	957 c A	855 C
Manteiga	Mozambique	-	1,252 b A	611 c B	931 C
Mean		1712 a	1942 a	1342 b	

\* Means followed by the same small letter within the planting date (column), or capital letter within each cultivar (row) are not statistically different (Tukey,  $p < 0.05$ ).