GROWTH AND PRODUCTION OF COTTON AS INFLUENCED BY CULTIVAR AND PLANTING DATE IN MOZAMBIQUE

INFLUÊNCIA DA CULTIVAR E DA ÉPOCA DE PLANTIO NO CRESCIMENTO E PRODUÇÃO DE ALGODÃO EM MOÇAMBIQUE

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Resumo

O algodoeiro tem ampla capacidade de adaptação a diferentes condições de clima e solo, permitindo o alcance de produtividades rentáveis se condições adequadas de manejo forem feitas. Em Moçambique a produtividade do algodoeiro é baixa, provavelmente devido ao uso de variedades pouco adequadas ao ambiente. Neste trabalho, descreve-se experimento de campo conduzido para avaliar a produtividade que pode ser obtida com uma variedade melhorada, a BRS 293, comparativamente a uma variedade usada localmente. Estudou-se, ainda, três diferentes datas de plantio, a cada 15 dias uma da outra, a partir de 21/12/2012, no começo do período chuvoso. O desenho experimental foi em parcelas subdivididas, com as variedades compondo as parcelas e as datas de plantio compondo as subparcelas, em delineamento de blocos ao acaso, com quatro repetições. Mediu-se variáveis de crescimento e componentes de produção. A variedade BRS 293 mostrou produtividade superior à testemunha local (1.027 kg/ha de algodão em caroço comparado a 649 kg/ha) quando plantada no início do período chuvoso, com estande de 10-12 plantas/m. Entretanto, perdeu produção continuamente em plantios feitos 15 e 30 dias depois. A variedade local apresentou baixo estande de plantas, com baixa capacidade de compensação no número de capulho por planta, resultando em baixa produtividade, que permaneceu inalterada, sem mudanças como efeito da data de plantio.

Palavras-chave: *Gossipium hirsutum* L.. Produtividade de plantas. Estresse de plantas. Melhoramento de algodão. Projeto Pro Savana.

Abstract

Cotton has got wide capacity of adaptation to different conditions of clime and soil, allowing reaching profitable productivity if proper crop management is made. In Mozambique, cotton productivity is low, possibly caused by the usage of locally inadequate varieties. In this work it is reported the results of a field experiment conducted to check out the productivity that would be obtained when using an advanced variety, BRS 293, comparatively to a local variety. It was also studied three different dates of planting, spaced every 15 days, starting in 21/12/2012, beginning of the rainy season. The experimental design used was a subdivided plot, in randomized blocks with four replications, with varieties as the plots and the planting dates the subplots. It was measured parameters of plant growth and productivity. Variety BRS 293 showed higher productivity than the local one (1,027 kg of cottonseed compared to 649 kg/ha) when planted at the beginning of the rainy season, with stand of 10-12 plants/m. However, it has shown decreasing productivity in plantings at 15 and 30 days later. Local variety presented a lower stand of plants, with a low capacity of compensating the number of flower bolls per plant, resulting in low productivity, which remained without changes as effect of the date of planting.

Key words: *Gossipium hirsutum* L. Plant productivity. Plant stress. Cotton breeding. Pro Savana project.

Introduction

Although cotton (*Gossipium hirsutum* L.) is a plant tolerant to soil salinity and water stress, it has got high demand of nutrients and of adequate water supply (between 900 and 1200 mm during its growth cycle) to render good productivity. Overall, top productivity is obtained in soils with medium to high natural fertility, deep enough to provide long roots development, and good capacity to store water.

In the Brazilian Cerrados, for instance, in soils with these conditions, topped with 1400 to 1800 mm of rain annually, productivities vary from 3,900 kg to 5,000 kg of seed cotton/ha (Freire, 2011; Carvalho et al., 2011). In contrast, in Mozambique, where there are about 188,000 ha under cotton cultivation, split in small properties of around 0.7 ha per family, productivity is on average 452 kg seed cotton/ha (Instituto de Algodão de Moçambique, 2012). Such low productivity could be credited to lack of suitable and productive cotton varieties, absence of proper fertilization and pests and diseases control, plus the irregularity of rain in these areas (Ronquim et al, 2013; Bolfe et al., 2011).

In this work, it is reported results of an experiment conducted to compare a Mozambican cotton variety and a Brazilian one, reportedly known to be responsive to best practices, to check out how they respond to different planting date.

Material and Methods

The study was conducted into the experimental field of the Instituto de Investigação Agrícola de Moçambique, in Muriaze, Nampula. Soil in the area is a typical sandy soil whose main characteristics are presented in Table 1.

Two cultivars of cotton were tested, the Brazilian BRS 293, developed by Embrapa (Morello et. al, 2010), and a common local cultivar (LOCAL). Three planting dates spaced quarterly were compared, 21/12/12, 04/01/13 and 19/01/2013. The experimental design was a randomized split plot block, with four replications for each treatment. Main block was the planting date and the plots were the cultivars. Plots encompassed five planting rows of five m each, spaced 0.90 m each, with 10 seed planted per lineal m. Soil was limed with the equivalent to 1 ton of lime/ha, and fertilized at planting with the equivalent to 130 kg N/ha, 120 kg P_2O_5/ha, and 60 kg K_2O/ha. Their sources were, respectively, urea, triple superphosphate and potassium chloride. After 30 days of plant emergence a further 20 kg N/ha and 40 kg K_2O/ha was broadcasted in the whole experimental area.

For general evaluations, only the three central lines were considered in a full harvest done in 13/06/2013. Evaluations encompassed characteristics of plant growth (plant height and height of insertion of the first cotton boll) and plant production (final plant stand, number of bolls per plant, average mass of bolls, number of green cotton bolls, number of open bolls, and productivity). The data obtained for each parameter was submitted to variance analysis and means were compared using Tukey test (Gomes, 1987).

Results and discussion

There was a strong water stress during the plant flowering, for about 30 days, between February and March. There was also a strong attack of non-characterized caterpillars. Altogether, these factors impacted production, because of losses of flower buds and restriction to cotton bolls opening. Also, plant stand was affected, resulting in large variation in the number of plants within the rows, especially with the LOCAL cultivar (Figure 1).

Possible problems with seed quality also affected the plant stand in the field, reaching short of what would be a good stand for effective performance of the varieties, at least 10 plants per lineal m. This resulted in a significant different ($P<0.05$) number of plants per area (Table 2), which affected productivity comparison per area, and impaired the true evaluations all other parameters evaluated.

The only marked difference between the cultivars is that they have a significantly different response ($P<0.05$) regarding the height of the first boll (Table 2). The LOCAL cultivar presented higher height of the first boll, although it has to be considered that both varieties increased it from 18.7 cm to 34.3 cm with the delayed planting date. Such variation could be credited to the great loss of flower buds caused by the water stress above mentioned. On the other hand, it could be the result of a more intense vegetative growth.

There was significant interaction (P<0.05) for the effects of planting date for productivity per area. When planted at the first date, BRS 293 was significantly (P<0.05) superior to the LOCAL cultivar. However, it showed a decreasing production if planted afterwards, losing around 20 kg of cottonseeds for every missed day ever after (Figure 1A). The LOCAL cultivar presented a constant and lower production throughout all three tested planting dates (Figure 1A). However, it seems to have taken advantage of the resulting lower plant stand and space. When comparisons take into production per plant the LOCAL cultivar was more productive than the BRS 293 cultivar (Figure 1B). It should be tested, though, if it would be responsive to a more intense management, such as increased plant population in the field and fertilization, for example.

Conclusions

There was no clear difference between the performance of the two tested cultivars, as they were severely affected by plant establishment and water stress.

Early planting such as 21 December help the cotton cultivars tested to reach attain good productivity.

It is recommended that the study be replicated over years, to get a real measure of effects of cotton cultivars and adjustments of the best planting date.

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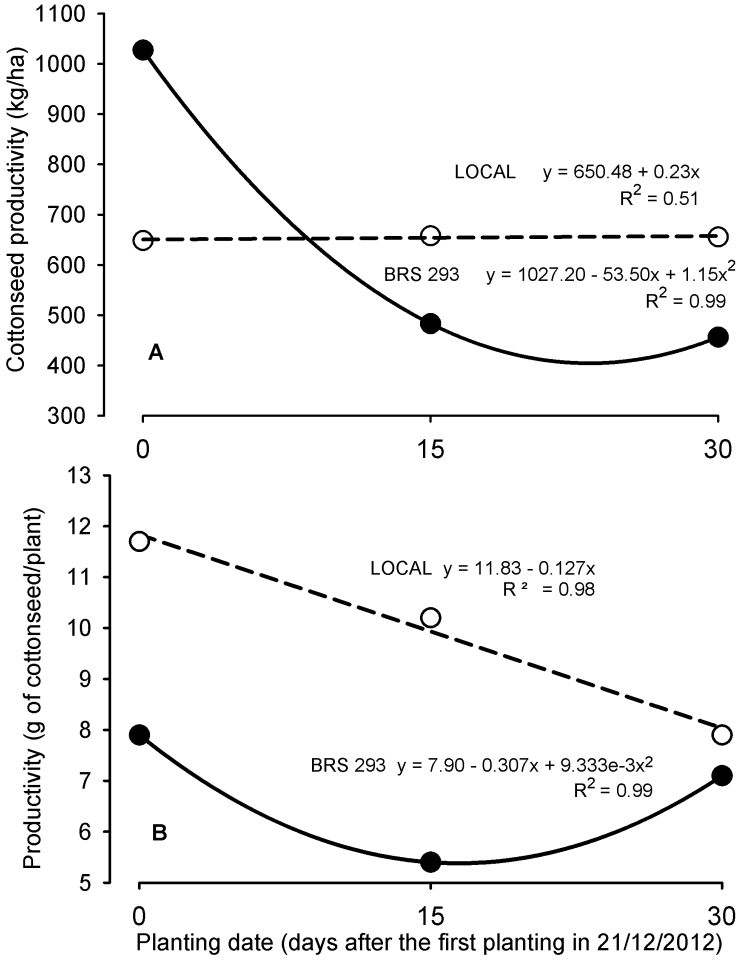

Figure 1. Cottonseed productivity per area (A) and per plant (B) as affected by cultivar (BRS 293 and LOCAL) and days of growth after the first planting date (21/12/2012). Muriaze, Nampula, Mozambique, crop season 2012/2013.

Table 1. Main characteristics of the soil in the experimental area in Muriaze, Nampula, Mozambique, October 2012.

pH[1]	P[2]	K[2]	Al[3]	Ca[3]	Mg[3]	H+Al[4]	CTCt	CTCe	SB	V	OM	Clay
in water	mg/dm^3					$mmol_c/dm^3$				%	g/dm^3	
6,0	7,5	82	0,0	13,3	4,1	17,4	36,9	19,5	19,5	52,8	11	90

[1]pH in water, 1:2.5 soil:water. [2]Extractor Mehlich-1, 1:10 soil:solution; [3]Extractor KCl 1 mol/L, 1:10 soil:solution; [4]Calcium Acetate 0.5 mol/L, pH 7.0. CTCe – soil natural Cation Exchange Capacity; CTCt – CTC at pH 7,0; SB – Sum of exchangeable basis (K+Ca+Mg); MO – Soil Organic Matter, Walkey-Black method.

Table 2. Effects of cotton cultivar and planting date on final plant stand (FPS, plant/m), plant height (HP, cm), number of bolls/plant (NBP), average boll mass/plant (ABM), height of first boll (H1B), and number of closed bolls (NCB). Muriaze, Nampula, Mozambique, cropping season 2012/2013.

Variety	FPS	HP	NBP	ABM	H1B	NCB
	pl/m	cm	bolls/pl	g	cm	bolls/pl
			Effects of variety (V)			
BRS 293	8.5a[1]	66.3a	5.0a	5.2a	21.1b	41.2a
LOCAL	6.1b	58.2a	4.7a	5.4a	28.6a	33.8a
			Effects of planting date (PD)			
21/12/12	8.3a	67.1a	5.1a	5.4a	21.5b	47.1a
04/01/13	6.9a	61.3a	5.0a	5.4a	18.7b	40.8a
19/01/13	6.7a	58.6a	4.5a	5.2a	34.3b	24.7a
			Analysis of variance			
Variety	3.41*[2]	1.37 ^{ns}	0.13 ^{ns}	1.25 ^{ns}	3.87*	0.64 ^{ns}
Planting date	0.61^{ns}	0.53 ^{ns}	0.37 ^{ns}	.60 ^{ns}	6.42**	2.12 ^{ns}
V x PD	3.75*	1.30 ^{ns}	0.51 ^{ns}	0.44 ^{ns}	1.84 ^{ns}	1.95 ^{ns}
CV %	43.1	27.2	34	8.3	37.4	59.8

[1]Values followed by the same letter in every parameter are not different (P<0.05). [2] ^{ns}, *, and ** indicates non-significant (P>0.05), or significant (P<0.005 and P<0.001) effects, respectively.