

Research Application Summary

Assessment of recently released soybean varieties through farmer's field demonstrations plots in Angónia and Tsangano Districts in Tete Province, Mozambique

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Abstract

Demonstration plot is an international method of participatory variety selection (PVS) which allows farmers to select the given variety/varieties rendering its traits enhanced from breeding programmes. This research used this method to assess recently released Soybean varieties through farmers in Angónia and Tsangano districts in Tete Province, Mozambique. The main aim of this research was to assess the freshly released better-quality Soybean varieties Wamini and Zamboane according its production technologies on-farm by comparison with the present variety called Storm. The research involved 40 farmers that were randomly selected to host the demonstrations. The recently soybean varieties Wamini and Zamboane performed well and gave mean yields of 3086.6 kg/ha and 2850.4 kg/ha, respectively. The current variety recorded a yield average of 2367.4 kg/ha and showed yield benefit over the control. The highest augmentation of production (719.2 kg/ha) was recorded through Wamini variety with a 30.5% yield benefit over the control (Storm) and the lowest yield aumentation was 482.8 kg/ha with a 20.4% yield advantage by Zamboane. It is recommended that Mozambique Government should popularize those two new varieties amongst a large number of farmers.

Keywords: Demonstration, improved, soybean, varieties

Résumé

La parcelle de démonstration est une méthode internationale de sélection participative des variétés (PVS) qui permet aux agriculteurs de choisir une variété donnée, en améliorant ses caractéristiques à partir des programmes de sélection. Cette recherche a utilisé cette méthode pour évaluer les variétés de soja récemment mises sur le marché grâce à des agriculteurs des districts d'Angónia et Tsangano dans la province de Tete, Mozambique. L'objectif principal de cette recherche était d'évaluer les variétés de soja de meilleure qualité récemment mises sur le marché, Wamini et Zamboane, en comparant leurs technologies de production sur le terrain avec la variété actuelle appelée Storm. La recherche a impliqué 40 agriculteurs sélectionnés au hasard pour accueillir les démonstrations. Les variétés de soja récemment mises sur le marché, Wamini et Zamboane, ont bien performé et ont donné des rendements moyens de 3086,6 kg/ha et 2850,4 kg/ha respectivement. La variété actuelle a enregistré une moyenne de rendement de 2367,4 kg/ha et a montré un avantage de rendement par rapport au témoin. La plus grande augmentation de production (719,2 kg/ha) a été enregistrée avec la variété Wamini, avec un avantage de rendement de 30,5% par rapport au témoin (Storm), et la plus faible augmentation de rendement était de 482,8

kg/ha, avec un avantage de rendement de 20,4% pour la variété Zamboane. Il est recommandé au gouvernement mozambicain de populariser ces deux nouvelles variétés auprès d'un grand nombre d'agriculteurs.

Mots-clés: Démonstration, améliorée, soja, variétés

Introduction

Mozambique after the end of the prolonged civil war in 1992, the country strived to expand commodities production and accelerate economic development by progressively increasing its use of foreign investors and international donors to recreate agricultural development projects (Matteo *et al.*, 2016).

Tete province is one recognized province in Mozambique for its amazing post-war reconstruction and economic recovery since the 1992 Peace Agreement. After civil war which lasted 16 years Mozambique started drawing strategies to boost the economic growth. One of strategies was to use agriculture sector as key component for robust financial progress and therefore the economic status has grown on mean 2.6% in 12 months using per capita gross domestic product (GDP) measurement in the 1990s, 4.2 percent in the 2000s and 4.6 percent in the 2010s. Until nowadays agriculture in Mozambique is the sector which is contributing for economic growth apart of tourism and extractive industry (Food and Agriculture Organization, 2017).

Soybean (*Glycine max* L.) is one of the most important pulse legumes produced in Mozambique in terms of both area and quantity produced. The entrance point in Mozambique was Gurue district in Zambezia through Cooperative League of United States of America (CLUSA) and then later was expanded to other provinces of Mozambique Centre Region. Currently, there is no exact information about soybean production area because the areas are still in continuous expansion in Northern and Centre Regions of Mozambique. In 2012, the soybean production was estimated in 15000 ha and now the crop is cultivated in different parts, mainly Central region in Tete, Zambezia and Manica provinces and Northern region in Nampuala and Niassa provinces. Their share of the national Soybean production is 41% for Tete province, 40 % for Niassa province and 15 for Maputo (Tubene *et al.*, 2018).

Actually, Mozambican soybean farmers produce 30,000 tons of soybean annually, in spite of petition being estimated at double that amount. Seven years ago the petition was expected to increase to 90,000 tons, and by 2020 could be as high as 130,000 tons per annum (Matteo *et al.*, 2016).

Many soybean varieties were released and popularized by the International Institute for Tropical Agriculture (IITA) in collaboration with National Agriculture Research Institute (IIAM). Main characteristics of improved varieties are high yielding, early maturity, high drought tolerant and disease resistant varieties, according of the requirements for local consumption and market orientation and management practices since early 1993s after civil war to enhance the productivity of Soybean and income. However, outstanding to the availability of high yielding varieties, suitable production environment and economic and food security importance of the crop, the actual smallholder farm yields (<1500 kg per hectare) are by far below the potential yield (4000

kg per hectare) at research stations and 3500 kg per hectare for research managed farmers field (Matteo *et al.*, 2016).

Table 1. Released Soybean varieties between 2008 and 2010

Name of variety	Pod color	Elevation (m)	Productivity (Kg/ha)		Year of release
			Research field	Farmers field	
Sana	Golden yellow	900-1500	300-3500	2500-3500	2010
Zamboane	Golden yellow	800-1500	3000-3800	2500-3200	2010
Wamini	Golden yellow	1000-1500	3100-4500	2700-3400	2010
Wima	Golden yellow	900-1500	300-4000	2600-3500	2010
Olima	Golden yellow	900-1500	300-4200	2600-3200	2010

Main constraints of soybean production in Mozambique basically are biotic, abiotic, poor agronomic practices and unaffordable price of enhanced seed and wobbly product price (Mohammed *et al.*, 2017). The Mozambican low-slung yield is associated to the low adoption of enhanced production technologies, lack of enhanced varieties and poor agronomic practice (Mbanya, 2011). The objective of this study, therefore, is to show the recently released improved Soybean varieties (Wamini and Zamboane) with their production technologies in farmers' field, assessment and select the appropriate variety for future wide-scale production and popularization.

Material and Method

General Picture of the Study Area. Angónia district is one of the productive and economic districts of Tete province of Central region of Mozambique, it is bordered by Malawi in Northeast and East, Dedza district to the south by the district of Tsangano, and to the northwest by the district of Macanga.

It is located at 230 km of provincial capital city with total area of 3,272 km². The area obtains mean rainfall of 1200 mm per year and it has an elevation between 900 and 1500 meters above sea level (TPF, 2015). The major economic sectors of the district are crop production, animal husbandry, and smallholder local traders. The main crops produced are a maze, soybean, irish potatoes, cowpeas, sweet potatoes, common beans and Groundnut (Ministério da Administração Estatal, 2012).

Tsangano district is one of the districts of Tete province in Central region of Mozambique, bordered by Angónia district North, Moatize district South, East republic of Malawi and West Macanga and Chiúta districts (MEF and MITADER, 2015). It is distanced by 126km from the provincial capital city with total area of 3,277 km². Tsangano District obtains meanof 1200 mm of rain per year and the rain season is from December to March. The elevation of the district is estimated to be in the range between 1000 and 1500m above sea level. The average temperature of the district lies between 15°C and 22, 5°C per year (MEF and MITADER, 2015). Agriculture is the primary economic activity and the majority of the population engaged and is estimated about 95%. The major crops produced in the district are maize, wheat, soybean, cowpea, irish potatoes, sweet potatoes, common beans and vegetables namely cabbage, garlic, onion and tomatoes

(Moçambique, 2017).

Field layout and farmers selection. For this research, to host the demonstration plots, a total of 40 soybean farmers were selected randomly based on farmer profile, community influence, quantity and quality of soybean production, soybean technology implementation, field management and location of field trial for the activity and partnership collaboration with extension agents and researchers. To demonstrate full new technology packages and to demonstrate new soybean varieties each selected farmer was supported to prepare about 0.20 hectare of land. The enhanced varieties (Wamini and Zamboane) that had been released by researchers were planted side by side to demonstrate and compare their performance with the one that farmers were using (Storm) as check. First, farmers received trainings from International Institute of Tropical Agriculture (IITA) and Instituto de Investação Agrária de Moçambique (IIAM) about improved Soybean production practices (seed rate, planting date, fertilizer rate, biofertilizer rate, spacing, protection, harvest and postharvest handling, improved varieties characteristics and the best recommended agronomic practices).

Agronomic practices for soybean production in Mozambique. Farmers were advised to prepare properly their land two times before planting Soybean. Normally in Mozambique, the planting time depends on the onset of rainfall and rainfall starts in November. It is highly recommended to plant soybean during first week of December and for good yield it is recommended to plant in rows with a seed rate of 50 kg/ha, spacing between rows should be 50 cm, and seeds in the row 10 cm apart. In poor soil, adding 50 kg/ha of SSP during planting is recommended and when the plants are deficient in nitrogen, they show leaf yellowing, at this moment, 50-100 kg urea could be applied as top dressing before flowering or during planting date. It is recommended to apply rhizobia (*Bradyrhizobium japonicum*) through inoculation. Manual weeding should be done twice or three times according to level of infestation, the first weeding is recommended two weeks after planting, and the next weeding six weeks after sowing. To control most important yield-reducing diseases, such as Phytophthora root and stem rot, pod and stem blight, frog-eye leaf spot, brown spot, downy mildew, cercospora leaf blight and purple seed stain, and Sclerotinia stem rot (white mold), it is recommended to plant clean disease-free seeds and avoid repeated cropping in the same field; planting disease tolerant varieties is recommended (Teshale *et al.*, 2008).

Data collection and analysis. For this research data were collected by the researchers directly from the field. Farmer's perception of the varieties was recorded from focus group discussion during the evaluation process. The collected data were analyzed using Genstat 15th Edition and variety preferences was based on ranking based on farmers' set criteria.

Results and Discussions

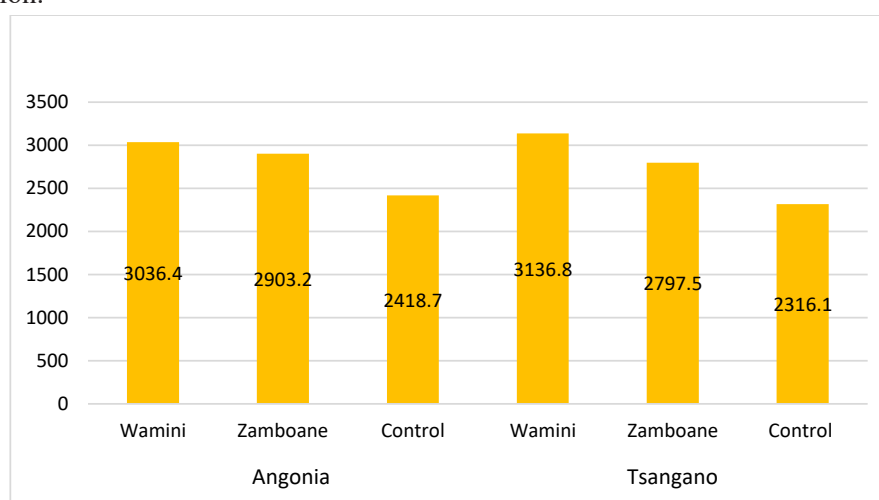
Comparison of yield performance. The recently released varieties of soybean had higher yield rise in comparison to the control in all research districts. The larger yield rise was reported from Angónia district with 617.7 kg/ha (25.5%) for Wamini variety and yield rise of 484.5 kg/ha (20.0 %) by Zamboane variety in comparison to the control. In Tsangano district, the two recently released improved Soybean varieties recorded higher yields in comparison to the control with yield increment of 820.7 kg/ha (35.4%) and 481.4 kg/ha (20.8 %) by Wamini and Zamboane respectively. Similarly, increase in yields of recently released varieties was documented by Kanojia *et al.* (2015) and Tukamuhabwa (2019).

Table 2. Soyabean yields in farmers demonstration plots

District	Variety	Average yield	Minimum yield	Maximum yield	Yield increment (kg/ha)	% Increase over control	SD
Angónia	Wamini	3036.4	2183.3	4008	617.7	25.5	114.7
	Zamboane	2903.2	2167.7	3833	484.5	20.0	124.1
Tsangano	Storm (Control)	2418.7	316.5	2400	-	-	112.1
	Wamini	3136.8	1150.3	3423	820.7	35.4	160.0
	Zamboane	2797.5	2312.3	3451	481.4	20.8	148.2
	Storm (Control)	2316.1	550	1701	-	-	141.5

Figure 1 also shows productivity comparison levels of the recently released varieties and the control (Storm). This comparison between the improved varieties (Wamini and Zamboane) and the control (Storm) was made using the control component. Storm was used as control or check variety obtained because it is the variety most commonly grown in the research areas and was from Zimbabwean SeedCo.

The results from the field demonstration plots showed that Angónia district had higher yield performance of Soybean varieties (3036.4 kg/ha, 2903.2 kg/ha and 2418.7 kg/ha) for Wamini, Zamboane and Storm, respectively. The result obtained are higher than what was reported (1580 kg/ha) by Singh (2018). The result also showed a 617.7 kg/ha yield increase by using only the recommended agronomic good practices excluding the varieties. In Tsangano district, the improved Soybean varieties showed higher yield performance than control (2316.1 kg/ha). In addition, the mean yield of the control from the demonstration was higher than the mean of Soybean productivity in the area reported by Singh (2018). The results further show an addition 504 kg/ha yield increase by using only improved agronomic recommendations on the same variety. Assessing the varieties performance across locations the recently introduced variety (Wamini and Zamboane) performed very well. The result conforms with that of Dima (2016) and suggests the positive effects of growing the two introduced varieties, to improve farmers yields in soybean production.

**Figure 1. Mean yield of varieties in Angonia and Tsangano districts**

Conclusion

The new soybean varieties (Wamini and Zamboane) exhibited higher yields than the control variety (Storm) on farmer's fields. Based on farmer's fields results the new varieties Wamini and Zamboane were chosen by the farmers over the control (Storm), and the new varieties also possessed farmers preferred traits. The traits that were preferred by the Soybean farmers were market demand, high yield, resistance to disease and insects, and drought tolerance.

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