Evaluation of different rates of Jathropha (Jathropha curcas) seed cake on the growth of Amaranthus caudatus

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Key words: Amaranthus caudatus, Jathropha, Cake, Yield

Abstract

A field experiment was conducted at Kwara State University Teaching and Research Farm, Malete, Kwara State, Nigeria to evaluate the performance of different rates of Jathropha seed cake on the growth and yield of Amaranthus caudatus. The five treatments tested were; 3 Jathropha seed cake application rates (2.0, 2.5 and 3.0 t/ha), NPK at 100kg N/ha and control. The treatments were laid out in a randomized complete block design with three replications. Growth and yield parameters such as plant height, number of leaves, stem girth and fresh weight were taken. The results (p<0.05) indicated that application of Jathropha seed cake at 2.5 t/ha produced taller plants more profuse leaves and higher shoot fresh weight compared to NPK or the control treatment. In conclusion, Jathropha seed cake at 2.5 t/ha could be good alternatives to NPK fertilizer in raising leafy vegetable.

Introduction

Amaranthus caudatus is grown for its leaves and is among the highly prized leaf vegetables in Nigeria due to their high nutritional and commercial significance. There is an increasing awareness of value of leafy vegetable in contributing to balanced diet, particularly in area where animal protein is deficient. Nitrogen was found to be the primary limiting factors of amaranths production (Pospisil *et al*., 2006). Most Nigerian soils have low nitrogen and the low nitrogen status is usually supplemented with N fertilizer and the importance of this source has increased over the year. Several sources of organic materials and residues abound in Nigeria which can be processed, packaged and made available as branded organic fertilizer at a cheap rate for home gardening, horticulture and farming as a whole (Olowoake and Adeoye, 2010). Seed cake of Jatropha is a major by-product of the Bio-diesel extraction process. The cake is rich in nitrogen (3.2%) and phosphorus (1.4%) and potassium and can be used as manures (Openshaw, 2000, Keremane, *et al.*, 2003). Hence, the prospect of Jathropha cake as one of the organic materials needs to be further evaluated in greater details. This study explores the possibility for using jatropha seed cake waste as an organic fertilizer on the growth and yield of Amaranthus caudatus.

Material and methods

Experiment were conducted during 2011 and 2012 cropping seasons at Kwara State University Teaching and Research Farm, Malete (8^0 71'N and 4^0 44'E) Kwara State, Nigeria. Prior to land preparation, soil samples from the top 0 - 15 cm were collected from the experimental site for laboratory analysis (Okalebo *et al*., 2002). The seeds of Amaranthus caudatus were sown on prepared nursery beds and water regularly using a watering can and checked for seedling emergence. Transplanting of amaranths seedlings into their respective plots in the field took place two weeks after sowing. The site was manually cleared and 15 raised beds were made to conserve the soil and its nutrient availability. The experimental plot was divided into three blocks each containing five beds. Each bed size was 2m x 1m with 1m alley between plots and blocks. Seedlings were transplanted at 2 weeks after transplanting on beds at spacing 50cm x 20cm. The treatments consisted of Jathropha seed cake at the rate of 2.0, 2.5 and 3.0t/ha, NPK at 100kg N/ha and control. Each vegetable bed contained thirty plants out of which five were randomly tagged for data collection. Collection of data commenced from 2 weeks after transplanting and was done weekly till 6th weeks. The data taken include, plant height, stem girth, number of leaves per plant, fresh root weight and yield. The data collected were subjected to analysis of variance (ANOVA) and treatment means were separated by Duncan Multiple Range Test (DMRT).

Results

Table 2 shows the effect of different rates of Jathropha cake and NPK on plant height, number of leaves and stem girth of Amaranth at 6 WAT (Weeks After Transplanting). Plants treated with NPK had mean height of 54.5cm which was significantly higher than the control but not significantly different (p<0.05) from values obtained in Jathropha cake at 2.5 t/ha. However, other Jathropha cake at 2.5 and 3.0 t/ha out performed the control, which had the lowest plant height of 44.2cm at 6 WAT. Jathropha cake 2.5 t/ha produced highest

number of leaves, which is significantly difference from other treatment. Among the fertilizer treatments, the use of Jathropha cake at 2.5t/ha gave the best stem girth (3.7 cm) which was significantly different ($p<0.05$) from NPK, Jathropha cake at 2.0 t/ha, 3.0 t/ha including control.

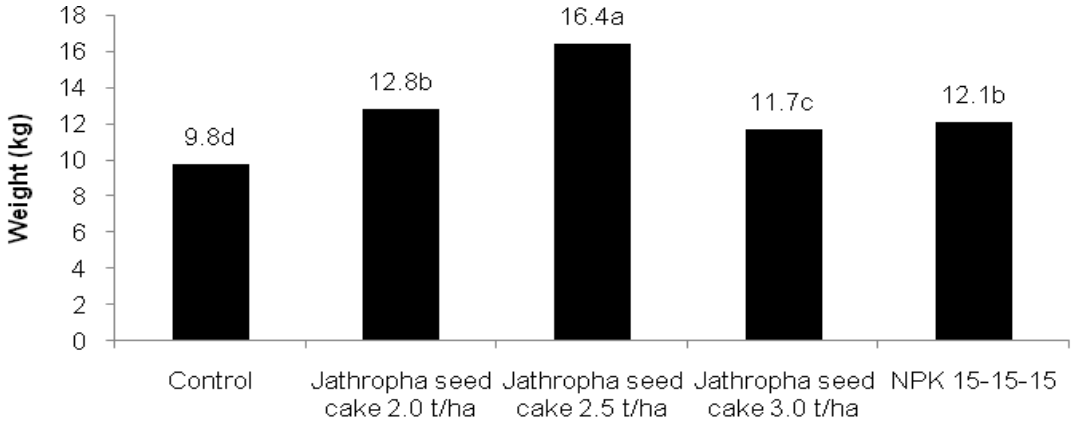

Fig. 1 Effects of fertilizer treatments on the yield of Amaranthus caudatus

Means having the same letter along the columns indicate no significant difference using Duncan's Multiple Range Test at 5% probability level.

Figure 1 shows the results obtained from application of fertilizer treatments on the yield of Amaranthus. Jathropha seed cake at 2.5t/ha had the highest yield (16.4 t/ha) which was significantly higher ($p<0.05$) than the yield obtained from other fertilizer treatments including control

Discussion

The highest plant height obtained from NPK and Jathropha cake at 2.5 t/ha may probably due to faster release of NPK and immobilization of N from of Jathropha cake (Ogunlade *et al*., 2011; Van Lauwe *et al.,* 2002). Jathropha cake at 2.5 t/ha significantly enhanced the production of leaves than NPK and other treatments including control. The same trend applies to stem girth at 6 WAT. This could be to quick decomposition and consequent release of nutrients in Jathropha cake (Balasubramaniyan *et. al*., 2003). The higher number of leaves from Jathropha cake at 2.5t/ha over the NPK could be due to sustaining release of nutrients from the former over the latter. Yields of *Amaranthus caudatus* obtained from Jathropha cake at 2.5 t/ha had the highest value of 16.4 t/ha were significantly different than the yield obtained from other treatments. This is similar to work of Busiso (2007) who reported higher maize yield from application of Jathropha seed cake.

Table 1: Amaranthus as affected by NPK and Jathropha seed cake at 6 WAT

Treatment	Plant Height (cm)	No of Leaves	Stem girth (cm)
Control	44.2c	58.7.0d	2.0c
Jathropha seed cake 2.0 t/ha	48.4b	68.7c	3.2b
Jathropha seed cake 2.5 t/ha	51.3a	96.2a	3.7a
Jathropha seed cake 3.0 t/ha	49.1b	66.4c	3.4b
NPK 15-15-15	54.5a	89.0b	3.4b

Conclusion

The use of organic wastes as soil amendments remains a sustainable way to improve soil productivity and enhanced food security. Results obtained from this study showed that Jathropha cake at 2.5 t/ha can be applied as organic amendments to improve growth and yield of *Amaranthus caudatus* instead of mineral fertilizers.

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