Effect of Set Size and Fertilizer Types on Early Growth and Development of Plantain Suckers

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ABSTRACT
Inspite of increase in demand for plantain and its products, its production still remain low as a result of unavailability of high quality suckers at the right time. In order to circumvent this problem, this present research was carried out to evaluate the effects of set sizes and organic growth medium on proliferation, growth and development of plantain suckers. The study was carried out at the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomosho. Three propagule sizes (S1, S2 and S3) and five nitrogen rates using compost (0, 30, 60, 90 and 120 kg N/ha) were evaluated. The emerged suckers were allowed to grow for a period of 12 weeks. During the growth period, data were collected on pseudo stem height and number of leaves and leaf length. At six weeks after fertilizer application, leaf samples were taken for dry matter assessment and leaf tissue nutrient content. Data collected were subjected to analysis of variance ($P \leq 0.05$) and Duncan multiple range test was used to separate the significant means. Corm sizes and compost application had significant effects on growth and development of the suckers' response variables. Stem girth, pseudo stem height and number of leaves increased with the level of compost application. In addition, it was observed that corm size three (S_3) gave the highest number of leaves and highest leaf tissue nutrient uptake even though it has the least value of stem girth and height. Application of 90 and 120 kg N/ha compost to corm size three (S3) gave the highest nutrient content that was not significantly different from each other. Planting of corm size three (S3) with application of 90 kg N/ha compost is therefore recommended for use by the local farmers.
Keywords: corm, fertilizer, Nigeria, plantain.

INTRODUCTION

Crouch *et al.,* (1998) reported that Bananas and plantains (*Musa* species L.) are the most important tropical fruit crops, while it was ranked as the fourth most important global food commodity after rice, wheat and milk in terms of gross value of production. Plantain can be propagated using the natural method which involves the use of suckers. Progressive decline in plantain over the years has been attributed to high susceptibility to pathogens, weeds, drought and organic matter status of the soil (Rasheed, 2003) and poor suckering ability (Ndubizu, 1985). However, the most limiting factor to larger scale production of plantain and/or expansion of existing production is difficulty in obtaining the planting materials.

Fertilizer application is of importance in plantain because it increases the amount of humus in the soil. Fertilizer application is needed to increase the essential plant nutrients particularly the major nutrient, N, P, K in optimum quantity through correct method and time of application in right proportion to have high fruit yield (Espinosa and Belalcázar, 2000). The estimation of contribution of fertilizer in increasing crop productivity is about 50%, although farmers know that fertilizers are important for maximizing crop yield, they are still reluctant to use these fertilizers for vegetables (Olasantan, 1994). Several inorganic fertilizer combinations have been recommended for plantain in Nigeria (Ndubizu, 1981; Obiefuna, 1984a and 1984b; Swennen, 1990; Baiyeri, 2002). However, inorganic fertilizers are rather expensive for the subsistence farmers and often difficult to obtain (Brandjes *et al.,* 1989). In contrast, animal manure is often readily available and may constitute a valuable source of nutrients and organic matter, which can improve soil physical conditions (Munoz *et al.,* 2004; Baiyeri, *et al.,* 2013). Increasing organic matter content improves the biophysical characteristics of the soil, and makes it more sustainably productive. Thus, manure or compost application may increase soil nutrients and organic matter, with long lasting residual effects on crop yield and soil properties (Eghball *et al.,* 2004). Fertilizer best management practices are based on the concept of applying the correct fertilizer formula at the appropriate rate, time, and place (Gruhn *et al*., 2000; Fixen and Reetz, 2006). The way fertilizers are managed can have a major impact on the efficiency of nutrient use by crops and potential impact on the surrounding environment (Gruhn *et al*., 2000; Snyder *et al.,* 2009). Lotfollahi *et al*., (1997) reported a significant nitrogen fertilizer placement effects on root growth and grain protein of wheat. Thus, it is essential to place the nutrient in such a way that it provides rapid uptake by the crop and reduces potential losses**.**

Comparatively, little experimental information is available on plantain's response to organic manure, despite the predominance of its manure-based cultivation in West Africa, whereby pure stands of the crop are perennially maintained in plots that receive organic matter and nutrients from household refuse (Swennen, 1990). This study was carried out to evaluate the effect of manure application on the growth of plantain sucker set size with emphasis on shoot growth, root development, and nutrient accumulation.

MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farm of LAUTECH, Ogbomoso (Long. 4° 10' E; Lat. 8° 10' N). Soil was collected, sieved and filled in polypot. Maize cobs and poultry manure were the composting materials used and heap method of composting was adopted. The floor was lined with black polyethene sheet after collecting sufficient materials they were mixed in the ratio 3:1 dry weights maize cobs to poultry manure following the procedure of (Akanbi, 2002) At maturity, the compost was evacuated from the heap, allowed to air-dry, shredded and bagged into jute bags.

Plantain sucker set sizes tried are 300 g (S1), 600 g (S2) and 900 g (S3) while the compost fertilizer rates applied are 0 (T1), 30 (T2), 60 (T3), 90 (T4), and 120 (T5) kg N/ha respectively. This gave a total of 15 treatment combinations which was replicated three times to give 45 treatment units of 45 polypots filled with 12 kg sieved soil. The sucker set were planted in nursery for three months before they were transplanted into the polypots. Fertilizers was applied two weeks after transplanting into polypots using ring method. Weeds were removed and watered as required to prevent drying up of the plantlets. Data Collection was commenced two weeks after fertilizer application and continued every forth night till 8 weeks after transplant. Growth response data collected were stem height, girth, leaf length, number of leaves and tissue nutrient concentration. Analysis of variance (ANOVA) was employed to analyze the data collected and means were compared using the least significant difference at 5% probability level.

RESULTS AND DISCUSSION

There was significant influence of the treatments tried on growth response parameter of plantain. The smallest set size has medium growth, smaller leaves but higher in number of leaves compared with other set sizes. The effects of set size and rate of nitrogen applied on plantain leaf length is shown on Table 1. The length increases with increase in set size and nitrogen rate. However, there was no significant difference in value obtained when responses of 900 and 600 g were compared, and likewise across nitrogen level at 6 weeks after fertilizer application. The number of leaves counted was presented on Table 2. The highest number (6) was obtained across the sizes and nitrogen level applied, therefore the treatments did not influence the number of leaves developed by plantain. Both macro and micro nutrient elements analysed Table 3 and 4 were not significantly influenced by level on nitrogen tried but set size.

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TABLE 1: Effect of propagule size and fertilizer rates on plantain leaf length (cm) at different growth stages

	Fertilizer rate (kg N/ha)				
Propagule size	0	30	60	90	120
			2 weeks before fertilizer application		
Large (900g)	16a	15.7a	16.3a	17.4a	16.3a
Medium (600g)	11.2b	12.0b	12.0b	10.6b	11.8b
Small (300g)	8c	10c	8.0c	8b	8.0b
			2 weeks after fertilizer application		
Large (900g)	17.0a	17.3a	18.0a	17.8a	18.3a
Medium (600g)	11.0b	13.2b	12.1b	12.3b	12.7b
Small (300g)	8c	13.5b	10.0b	9.5b	10.5b
			4 weeks after fertilizer application		
Large (900g)	17.0a	17.0a	17.0a	17.0a	17.0a
Medium (600g)	11.5b	11.5b	11.5b	11.5b	11.5b
Small (300g)	8.5b	8.5b	8.5b	8.5b	8.5b
			6 weeks after fertilizer application		
Large (900g)	12.1a	12.1a	12.1a	12.1a	12.1a
Medium (600g)	11.6a	11.6a	11.6a	11.6a	11.6a
Small (300g)	8.7b	8.7b	8.7b	8.7b	8.7b

TABLE 2: Effect of propagule size and fertilizer rates on number of leaves of plantain at 6 weeks after fertilizer application

	Fertilizer rate (kg N/ha)				
Propagule size	0	30	60	90	120
Large (900g)	4.0c	5.0a	6.0a	4.0b	4.0c
Medium (600g)	5.0b	5.0a	4.0c	6.0a	5.0b
Small (300g)	6.0a	4.0b	5.0b	6.0a	6.0a

TABLE 3: Effect of propagule size and fertilizer rates on macronutrients concentration of plantain suckers.

	Fertilizer rate (kg N/ha)				
Propagule size	0	30	60	90	120
			Nitrogen		
Large (900g)	1.92a	1.96a	1.97a	2.03b	2.15a
Medium (600g)	1.90a	1.98a	2.12a	2.18b	2.22a
Small (300g)	1.94a	1.08b	2.17a	2.34a	2.38a
			Phosphorus		
Large (900g)	0.5b	0.6b	0.7a	0.7b	0.7b
Medium (600g)	0.6a	0.7a	0.7a	0.7b	0.8a
Small (300g)	0.5a	0.7a	0.7a	0.8a	0.8a
			Potassium		
Large (900g)	3.0a	3.1b	3.3a	3.2b	3.3b
Medium (600g)	3.1a	3.3a	3.3a	3.3ab	3.4ab
Small (300g)	3.1a	3.3a	3.3a	3.4a	3.5a
			Calcium		
Large (900g)	2.1a	2.1a	2.2a	2.2a	2.2a
Medium (600g)	2.2a	2.2a	2.3a	2.3a	2.1a
Small (300g)	2.1a	2.3a	2.3a	2.3a	2.4a
			Magnesium		
Large (900g)	0.1a	0.2b	0.2b	0.2b	0.1b
Medium (600g)	0.2a	0.3ab	0.3ab	0.4a	0.2b
Small (300g)	0.2a	0.4a	0.4a	0.4a	0.5a

TABLE 4: Effect of propagule size and fertilizer rates on micronutrients concentration of plantain suckers.

Propagule size (g)	Fertilizer rate (kg N/ha				
	Fertilizer rate (kg N/ha)				
	0	30	60	90	120
			Iron		
Large (900g)	1.1a	1.2a	1.3b	1.3b	1.4b
Medium (600g)	1.2a	1.4a	1.4ab	1.5a	1.6a
Small (300g)	1.2a	1.4a	1.5a	1.6a	1.6a
			Copper		
Large (900g)	0.4a	0.4a	0.4a	0.4a	0.5a
Medium (600g)	0.3a	0.4a	0.4a	0.5a	0.5a
Small (300g)	0.4a	0.5a	0.5a	0.5a	0.6a
			Zinc		
Large (900g)	0.2a	0.3a	0.3b	0.3b	0.4b
Medium (600g)	0.3a	0.4a	0.4ab	0.4b	0.5ab
Small (300g)	0.3a	0.4a	0.5a	0.6a	0.6a