



The Growth of Desert Date (*Balanites aegyptiaca* Del.) Seedlings under Varied Rates of Fertilizer and Pot Sizes in the Nursery

Mukhtar^{1*}, R. B., Musa², S., Dantani¹, A., Inuwa¹, A. and O. J. Abanikannda¹, J. O.

¹Department of Forestry and Wildlife Management, Faculty of Agriculture, Bayero University, Kano Nigeria.

²Department of Forestry and Fisheries, Kebbi State University of Science and Technology, Aliero, Kebbi State.

*rbmukhtar.fwm@buk.edu.ng

ABSTRACT

A study was carried out on the growth response of Desert date seedlings to varied rates of NPK fertilizer in different pot sizes. Polythene bags of various sizes (23× 8 cm, 23 ×14 cm and 23 × 26.4 cm) were filled with topsoil and later, viable seeds were directly sown in each bag and two weeks after germination, NPK (15:15:15) fertilizer was applied at four (4) different levels (0 g, 5 g, 10 g and 15 g) per polythene bag. The experiment was arranged in 3× 4 × 5 factorial experiment in a Completely Randomized Design. Seedlings were efficiently watered and data were collected fortnightly for 10 weeks on percentage survival, stem height, collar diameter and number of leaves. The data were analyzed with Analysis of Variance (ANOVA) and at P<0.05, the means were separated using Duncan Multiple Range Tests. The treatments posed significant effects on the seedlings where the polythene bag size of 23 × 26.4 cm filled with 3 kg of topsoil without fertilizer performed best in all the variables assessed hence recommended for the production of seedlings of Desert date in the nursery.

Keywords: *Balanites aegyptiaca*; Fertilizer; Polythene bag; Growths

INTRODUCTION

Early growth assessment is of paramount importance in the choice of species to plant in any plantation establishment, if the choice of species is not properly conducted, no matter the tending ability, the final result will be poor and mostly unprofitable, therefore, in any plantation program efforts should be made to plant a right species at a right time and in a suitable environment. In plants, growth manifest as an irreversible increase in size and form which physiologically may be regarded as synthesis of protoplasm, accompanied by a permanent increase in size and form. The growth and development of trees is very important in forestry, since it determines the amount of wood a forester can reasonably cut and time interval required for trees in the forest to reach merchantable size.

Container volume is a very important factor for seedlings production, on one side, big

containers increase substrates consumption and space demand in nursery, influencing directly the costs of production and transport, on the other hand, small containers can limit seedlings growth and reduce its quality (Lima *et al.*, 2006). Low quality seedlings result in plantations of reduced stand and yield. Success in greenhouse and nursery production of seedlings grown in a container depends largely on the physical and chemical properties of the growing media, the ideal potting medium (presumably free from weeds and diseases) and heavy enough to withstand frequent tipping over, and light enough for easy handling and shipping. The media should be well drained, having good ability to retain moisture thereby reducing frequent watering. Other parameters include cost, availability of potting mixture requirements as well as consistency between batches and stability in the media over time.



Selection of the proper media components is critical to the successful production of plants (James and Michael, 2009).

NPK fertilizer is the most important and costly input used to enhance seedlings growth. Most savanna soils are poor in terms of fertility (Sabo *et al.*, 2013). Hence, multipurpose trees respond positively to fertilizer application. The dosage depends on soil type, climate and system of planting (Sabo *et al.*, 2013). NPK fertilizer gives the soil equal amount of major nutrients (nitrogen, phosphorous and potassium) and this will enable researchers to evaluate equal application of nutrient and their functions to the seedlings (Al-Menaic *et al.*, 2012). The deficiency of NPK is a major production constraint in savanna soils which has inherent constraints like phosphorus fixation, rapid hydraulic conductivity, and high rate of infiltration and leaching of the basic cations (Bayala *et al.*, 2006). Thus, cultivating crops on savanna soils require large quantity of mineral nutrients to support its growth and yield (Bayala *et al.*, 2006). Insufficient supply of these nutrients during growth is considered to have negative impact on the reproductive capability, growth and yield of the plant (Nafiu *et al.*, 2011). Knowledge on how to use fertilizer rate must be provided if production of these important resources is to be realized. Cultivation of trees in savanna environment is done on poor nutrient soils and the cost of reconditioning such soils cannot be afforded by poor resources farmers in the area. To ensure conservation and sustainable use of these important natural resources, studies are needed on the effective and efficient regeneration methods beginning from the nursery to the field.

Balanites aegyptiaca belongs to family *Balanitaceae*, a multi-branched, evergreen tree species that is distributed throughout Sudano-Sahelian zone of African continent, Middle East and South Asia (Yadav and

Panghal, 2010), providing various goods for the economy of many Nations and significantly protecting the environment ecologically (Bukar *et al.*, 2004; Ojo *et al.*, 2006; Mukhtar 2016; and Mukhtar, 2017). The Growth of Desert Date seedlings under varied rates of fertilizer and pot sizes in the nursery is therefore vital for sustainable production and utilization of the species goods and services.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at forestry nursery of the faculty of agriculture, Kebbi State University of Science and Technology, Aliero (latitude 12°N and longitude 4°E). The climate is mainly semi-arid characterized by low rainfall usually between 550 – 700mm annually, occurring between May - October with a peak in August. Dry season starts from October and ends in May. Mean and maximum temperatures range from 35°C to 40°C (Mukhtar, 2016). The soil is sedimentary basement, complex type and is sandy with little organic matter content, humidity is recorded to be constantly below 40% in the dry season (November – May) but can rise up to 70% during the wet season (Mukhtar, 2016). The vegetation of the area is Sudan savannah characterized by few scattered trees amongst dominating herbaceous layers which are threatened by the inhabitants as a result of over exploitation without replacement.

Experimental procedure

A trial was conducted to examine the effects of the size of polythene bag and NPK (15:15:15) fertilizer on the growth performance of *B. aegyptiaca* in the nursery. Viable seeds (obtained from a plus stand in Aliero) were sown directly in to polythene pots of different sizes (23 × 8 cm, 23 × 14 cm and 23 × 26.4 cm filled with 1, 2 and 3 kg of topsoil respectively).



Watering was done once every day and after two (2) weeks of germination different levels of fertilizer were applied to seedlings at the rate of 0 g, 5 g, 10 g and 15 g per seedling (per polythene bag).

Experimental design

The experiment was a 3 × 4 × 5 factorial experiment (3 different sizes of polythene bags; 4 levels of fertilizer; 5 replications) in a Completely Randomized Design (CRD). Data was collected on seedlings survival (counted), seedlings heights in centimeter (measured with ruler), collar diameter (mm) (measured with micrometer) and number of leaves were also counted. Data was subjected to Analysis of Variance (ANOVA), and means were separated using

Duncan Multiple Range Test (DMRT) at 5% level of significance.

RESULTS

The result in Table 1 shows the effect of polythene bag size on the early growth of *B. aegyptiaca* seedlings and was found to be significant ($P < 0.05$). The findings revealed that, seedlings in pot size of 23 × 26.4 cm filled with 3 kg of topsoil had the highest performance (height (32.50 cm), collar diameter (3.41 mm) and number of leaves (63.30)) at ten weeks after treatments while lowest performance was obtained from pot size of 23 × 8 cm filled with 1 kg of topsoil with the height (9.25 cm), collar diameter (1.47 mm) and number of leaves (10.25).

Table 1: Effect of pot size on the early growth of *Balanite aegyptiaca*

TRT (kg)	H2WAE	H10WAE	D2WAE	D10WAE	NL2WAE	NL10WAE
23 × 8 cm	5.72 ^b	9.25 ^c	0.88 ^b	1.47 ^b	9.35	10.25 ^b
23 × 14 cm	11.10 ^{a,b}	21.85 ^b	1.40 ^{a,b}	2.47 ^a	14.35	55.00 ^a
23 × 26.4 cm	15.75 ^a	32.50 ^a	1.86 ^a	3.41 ^b	23.80	63.30 ^a
SE	1.974	3.394	0.219	0.352	2.569	9.568
P<0.05	*	*	*	*	ns	*

Means with the same letter(s) in the same column are not significantly different ($P > 0.05$). H2WAE: Height at 2 weeks after emergence (up to 10 weeks after emergence), D2WAE: Stem Diameter at 2 and 10 weeks after emergence, NL2WAE: Number of leaves at 2 and 10 weeks after emergence

Table 2 shows significant ($P < 0.05$) effect of different levels of NPK (15:15:15) fertilizer on the early growth of *B. aegyptiaca* seedlings. Seedlings with no NPK had the highest performance on heights (36.33 cm), diameter (4.44 mm) and number of leaves

(73.60) at ten weeks after treatments were applied while lowest performance was obtained from seedlings grown under 15 g of NPK fertilizer (height (5.60cm), diameter (0.77mm) and number of leaves (9.26)) at ten weeks after emergence.

Table 2: Effects of NPK fertilizer on early growth of *Balanites aegyptiaca*

TRT (g)	H2WAE	H10WAE	D2WAE	D10WAE	NL2WAE	NL10WAE
0 NPK	18.63 ^a	36.33 ^a	2.48 ^a	4.44 ^a	30.40 ^a	73.66 ^a
5 NPK	11.60 ^b	27.33 ^a	1.53 ^b	2.94 ^a	16.13 ^b	56.33 ^{ab}
10 NPK	8.66 ^{b,c}	15.53 ^b	0.96 ^c	1.64 ^c	10.46 ^c	32.13 ^c
15 NPK	4.53 ^c	5.60 ^b	0.54 ^c	0.77 ^c	6.33 ^c	9.26 ^c
SE	2.279	3.920	0.253	0.406	2.962	11.048
P<0.05	*	*	*	*	*	*

Means with the same letter(s) in the same column are not significantly different ($P > 0.05$)



DISCUSSION

The outcome of the research clearly shows higher seedlings growths rate in 23 x 26.4 cm filled with 3kg of top soil at the two and ten weeks after planting. These growths rates might be attributed to little wide space in the pot size of 23 x 26.4 cm with 3 kg of top soil. This support the findings of Adu-berko *et al.*, (2011) where pot size had significant influence on seed germination, seedlings vigor, number of leaves and other growth parameters of *Anacardium occidentale*. The result also conform with the findings of Oni *et al.* (2002) who stated that large polythene bags had effect on seedlings growths compared with small polythene bags. The study however, agreed with the findings of Geply *et al.*, (2011) where, the best soil media for growth of *Jatropha curcas* was river sand and big size pot. Best performance was observed in *B. aegyptiaca* grown in 0 g of NPK which serve as control as compared with 5 g, 10 g and 15 g of NPK treatment. Mortality was recorded on seedling treated with fertilizer

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(5, 10 and 15g of NPK) in the first week of application. These detrimental effects could be as a result of high quantity of fertilizer applied and also directly placed by the side of the seedlings. This corroborate with Fagbenro, (2004) who reported that, adding inorganic fertilizer beyond 25 mg.Nkg¹ for *Ceiba pantendra* and 100 mg.Nkg⁻¹ for both *Parkia biglobosa* and *Gmelina arboea* were not beneficial.

CONCLUSION AND RECOMMENDATION

NPK and pot size had significant effect on early growths of *B. aegyptiaca* and seedlings performed best with pot size of 23 x 26.4 cm filled with 3 kg of topsoil and with no NPK fertilizer application. Considering the detrimental effect of NPK at 5, 10 and 15 g on seedlings of *B. aegyptiaca*, it is suggested that the seedlings of the species should be raised without fertilizer in the nursery using a big sized polythene bag (23 x 26.4 cm) filled with 3 kg of topsoil.



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