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Influence of Planting Distance on Seed Yield and Size of M*oringa oleifera*

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Abstract **– The growing interest in the use of *Moringa oleifera* in human nutrition and as livestock feed has necessitated its cultivation on a commercial scale. There is need to explore means of improving its seed yield and size. The aim of this study is to verify the influence of spacing on the seed yield and size of *Moringa oleifera* seeds. An experimental site was set up at the pasture plot of Teaching and Research Farm, Ladoke Akintola University of Technology, LAUTECH, Ogbomoso. Smaller plots of 10 m x 10 m beds were made, and dried 2 seeds per hole were planted in the raining season in May 2013. The planting spacings adopted are 0.6 m x 0.6 m (T_1); 0.9 m x 0.9 m (T_2) and 1.2 m x 1.2 m (T_3), and these were replicated thrice. At exactly a year of age, dry pods were collected from each treatment using 1.5 m x 1.5 m quadrant sampling and weighed. The yields per treatment estimated and seed size measured and the data collected were analyzed statistically. Based on the findings from the use of mathematical computations in this study, it can be concluded that planting M*oringa oleifera* at spacing of (0.6 x 0.6) m^2 brings about the highest seed yield. The 1.2 m x 1.2 m spacing on the other hand turns out the lowest seed yield. Therefore the seed yield decreases with increase in spacing. In the case of the seed size of the plant, the spacing of 0.9 m x 0.9 m results into large seed size that improves germination and better growth leading to much higher yields.**

Keywords **– M*oringa oleifera*, Planting Distance, Seed Yield, Seed Size.**

I. Introduction

Pasture development has been instrumental to nutrition of ruminants. Forages of exceptional agronomic characteristics have been widely used to feed ruminants so as to increase production and thereby increase protein intake of man. Forage trees are important components of agro-forestry systems, especially with respect to livestock fodder production (1Nouman *et al.*, 2013). Again, 2Ayssiwede *et al*. (2011) reported that the use of multipurpose trees have been adopted, some of these were identified and evaluated in Senegal. The listed ones are *Moringa oleifera*, *Luecaena leucocephala, Adansonia digitata, Sesbania rostrata* and *Vigna unguiculata*.

There have been growing interests in the use of *Moringa oleifera*, a multipurpose plant (3Patty, 2012). *Moringa oleifera* is native to India and is now widely cultivated in Africa, Malaysia and Indonesia (4Foidl *et al*., 2001). 5Sheldon and Steve, (2010) reported that *Moringa oleifera* is a fast growing perennial which reaches a maximum height of 7 – 12 m. The plant is a medium-sized deciduous tree that develops underground root stock and produces elongated capsules which contains about twenty seeds in each (5Sheldon and Steve, 2010). The elongated capsule is about 20 – 60 cm long that hangs down from branches. The seeds according to 4Foidl *et al*., 2001 are round with a brownish semi-permeable seed hull, slightly three-angled (7 – 15 mm across) with three papery wings (5 – 25 mm long and 4 – 7 mm wide).

Sequel to the expanding population and coping with additional strains on food-oriented agriculture posed by bio-fuel production, it is becoming important to improve yield of seed crops. This could be achieved by increasing seed size (6Hughes, 2009).

7Elvis *et al*., (2005) found out that large seeds increased leaf area index and the root and shoot biomass of *Phaseolus Vulgaris*; and that plants from small seeds presented a higher relative growth rate than plants from large seeds.8Kelli (2000) found out that the bigger seeds have a higher germination percentage rate. It was also reported by 9Sangakkara (2008) that there was a positive relationship between seed size and plant growth characters. Larger seeds developed plants with better growth and yield component characters resulting in higher yields of *Phaseolus vulgaris*.

Some factors that affect seed size have been highlighted by 10David and Lesley (2000). These are genes, physiological constraints, maternal effect and reduced resource availability. Some other factors were also stated by 11George (2008) to include seed selection, harvesting (seed extraction), environment (edaphic and climatic) and experience of seed growers.

Since there is a growing interest in the use of *Moringa oleifera* as a fodder for animals, there is the need to improve seed yield, thus ensuring its availability. The central aim of this study is to verify the influence of spacing on the yield and size of *Moringa oleifera* seeds.

II. Materials and Methods

The experimental site was at the pasture plot of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso. An hectare of land was cultivated and divided into smaller plots of 10 m x 10 m beds. Seeds were planted directly on the field during the raining season in May 2013. Dried fresh seeds were collected from a nearby farm and were planted at 2 seeds per hole with different spacings. The spacings are 0.6 m x 0.6 m (T_1); 0.9 m x 0.9 m (T_2) and 1.2 m x 1.2 m (T_3). The spacings were replicated thrice.

The experimental design used was randomized complete block design.

$\{X_{ij} = \mu + \alpha_i + \beta_j + £_{ij}\}$

where:
X_{ij} = observation
μ = overall mean
α_i = mean effect if ith level of row factor relative to μ
β_j = mean effect of jth level of column factor relative to μ
$£_{ij}$ = inherent random variation

At exactly a year of age, dry pods were collected from each treatment using 1.5m x 1.5m quadrant sampling. The seeds were removed from the pods and then weighed in the laboratory. Seed yields per treatment were estimated and seed size measured with weighing scale. The data collected were analyzed statistically using 12SPSS (2000) and treatment means were separated using 13Duncan's New Multiple Range Test (1955).

III. Results and Discussion

Results of the seed yield and size, and the mean of seed as affected by spacing are presented in Tables I to III. Further representations of these are shown in Figures I and II.

Table I: Seed yield and seed size as affected by spacing.

	Seed yield (Kg/ha)	Seed size (g)
T_1R_1	18760	0.25
T_1R_2	10540	0.25
T_1R_3	2940	0.20
T_2R_1	11160	0.25
T_2R_2	10210	0.30
T_2R_3	9870	0.25
T_3R_1	870	0.20
T_3R_2	8060	0.20
T_3R_3	12270	0.30

Table II: mean of seed (Kg/ha) as affected by spacing.

	R1	R2	R3	Total	Mean
T1	18760	10540	2940	32240	10746.7
T2	11160	10210	9870	31240	10413.3
T3	870	8060	12270	21200	7066.7

Table I shows the seed yield per treatment in the three replicate. It is observed that the least spacing of (0.6 m x 0.6 m) has the highest seed yield of 32240 kg/ha. The seed yield from 0.9 m x 0.9 m (T_2) decreased to 31240 kg/ha while the least seed yield was recorded from treatment 3 (0.9 m x 0.9 m). These revealed that the closest spacing brings about the highest seed yield. The lowest seed yield was recorded at the spacing of 0.9 m x 0.9 m. This wide inter-row spacing does not improve seed yield.

Again there is no significant difference in the seed yield from T_1 and T_2 when they were separated using Duncan's New Multiple Range test. The largest spacing (T_3) was significantly different in yield from T_1 and T_2. This implies that planting at 0.6 m x 0.6 m & 0.9 m x0.9 m spacing is favourable for increase in seed yield which is one of the ways in increasing seed production to meet expanding population of both humans and livestock. This finding corroborates an earlier report by 6Hughes, 2009. For farmers that will go into seed production or *Moringa oleifera*, the observed safe and closest inter-row spacing is 0.6 m x 0.6 m. This result again is in agreement with that of 14Radovich (2011) that the close inter-row spacing is good for leaf production, and which then results into higher seed yield.

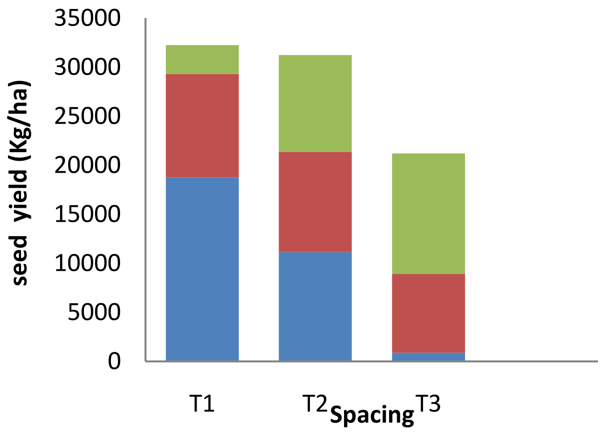

Figure I: Seed yield as affected by spacing.

Table III shows the average seed size (g) for each treatment. The highest average seed size was observed in T_2 (0.80g) with T_1 & T_3 having lower seed sizes. This variation as observed in Table III and Figure II show that spacings means (treatment means) are significantly different with the highest difference in T_2. This difference could be attributed to genes, architectural and physiological constraints, and reduced resource availability (10David and Lesley, 2000). Although seed size is generally controlled, it uniformly improves the precision of mechanical drilling (7Elvis *et al.*, 2005). Closest and widest inter-row spacing does not bring about increase in seed size.

Table III: Mean of seed size (in g) as affected by spacing.

	R1	R2	R3	Total	Mean
T1	0.25	0.25	0.20	0.70	0.23
T2	0.25	0.30	0.25	0.80	0.27
T3	0.20	0.20	0.30	0.70	0.23

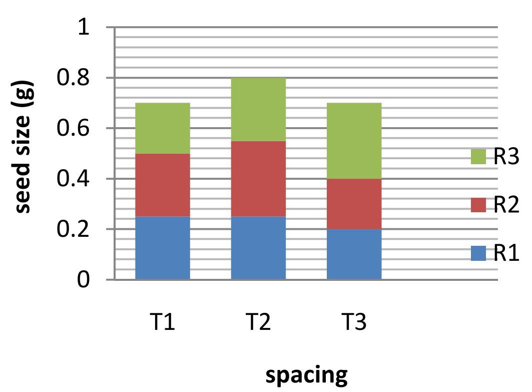

Fig.II. Representation of the variation in yield size and spacing

IV. Conclusion

Based on the findings from the use of mathematical computations in this study, it can be concluded that planting M*oringa oleifera* at spacing of (0.6 x 0.6) m^2 brings about the highest seed yield (10746,7 Kg/ha). The 1.2 m x 1.2m spacing on the other hand turns out the lowest seed yield (7066.7 Kg/ha). Therefore the seed yield decreases with increase in spacing. In the case of the seed size of the plant, the spacing of 0.9 x 0.9 m results into large seed size(0.27 g) that improves germination and better growth leading to much higher yields.

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