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Effects of Planting Distance and Seed Rate on the Growth and Yield of Egusi Melon (*Citrullus colocynthis*)

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ABSTRACT

Background: Egusi melon production is declining, even though the crop plays a significant role in the well-being of farmers. Few farmers that grow the crop do not allow adequate spacing and seed rate which compels the crop to produce flourishing vegetative parts without producing many fruits. The study was therefore, aimed at determining the effect of planting distance and seed rate on the growth and yield of egusi melon.

Methods: A split-plot design which was replicated thrice was adopted to carry out the study during 2018 and 2019 planting seasons. Twenty-four plots were made and were randomly assigned to eight treatment groups with each replicating thrice. The egusi melon seeds were sown in four different seed rates of one seed/hole, two seeds/hole, three seeds/hole and four seeds/hole and four different spacing of 30cm × 50cm, 45cm × 70cm, 60cm × 60cm and 60cm × 90cm respectively. Analysis of variance was used to analyze the data collected and was tested at 0.05 level of probability.

Result: The number of leaves/plant, branches/plant, flowers/plant, fruits/plant and fruit weight (g) were significantly higher in egusi melon planted at 60cm × 90cm. Furthermore, the parameters measured were significantly higher in egusi melon planted at 1 seed/hole.

Key words: Egusi melon, Legume, Performance, Planting distance, Seeds.

INTRODUCTION

Egusi Melon (*Citrullus colocynthis*) was discovered in Western Kalahai and part of Namibia and Botswana, where wide species still exist together with other species of *Citrullus* (Amali *et al*., 2013). Egusi melon belongs to the large family of Cucurbitaceae members of which are found in the warmer parts of all continents (Schippers, 2000). Egusi melon is one of the legume crops that creeps on the ground and therefore efficient for mixed cropping system as it suppresses weed on the farm because of its spreading nature (Bankole and Mabekoje, 2004).

It grows well in hot regions with rich light soil and can thrive in periods when rainfall is low. It is an annual cucurbit that is highly resistant to drought and is found in many regions of West Africa (Akpanbange *et al*., 2008). Egusi melon is mostly found in the humid savannah and forest agroclimatic belts lying between west to Central Africa (Ekpo *et al*., 2010). Two to three seeds per hole at a planting distance of 1 m are recommended for egusi melon (ECHO, 2019). Udensi *et al*. (2017) planted at the rate of 3 seeds per hole and a distance of 0.5 m × 1 m. It is not commonly planted as a single crop among the rural communities where it provides a suppressing effect on the weeds when planted in mixture with other crops. Egusi melon is mainly planted to get the seeds, which are used in preparing condiments for making soup and several foods (Olaniyi, 2008). In addition to using it as food, egusi melon also helps in nutritional improvement, improve food security, engineer rural development and enhance proper land management. Udoh *et al*. (2005) noted that egusi melon as a vegetable legume can be planted as a single crop or in mixture with other crops.

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Egusi melon seeds contain as much as 50% fat and 30% protein (Duncan and Ewing, 2015). The residue left after oil extraction is prepared for human consumption or used for the preparation of animal feed. Egusi melon provides significant nutrients to people with marasmus, kwashiorkor and other malnutritional problems (Gurudeeban and Ramanthan, 2010). Melon is known for its provision of vitamins and micronutrients particularly in rural communities. The high protein and fat values of egusi melon seeds make it a potential ingredient for the improvement of infant nutrition (Van der vossen *et al*., 2004).

Medically, egusi melon can be used to lower the pressure of the blood and reduce the development of coronary heart disease because of the high potassium value of the seeds. When pulverized, melon seeds can be used for the treatment of tuberculosis (Gurudeeban *et al*., 2010).

Vomiting can be prevented when the roasted seeds of melon are ground with salt and consumed with warm water or porridge (Olaniyi, 2008). Besides value as a source of food, egusi melon can also be used as medicine, cosmetics and bio-diesel (Ibironke and Oyeleke, 2014; Udoh *et al*., 2005).

Egusi melon production is declining, even though the crop plays a significant role in the well-being of farmers and the communities in its entirety. Mohammed (2011) asserted that the yield and quality of egusi melon production have seriously depreciated thus resulting in the deficit of melon supply. Few farmers that grow the crop do not allow adequate spacing and seed rate which compels the crop to produce flourishing vegetative parts without producing many fruits. It, therefore, became imperative to find out the effects of planting distance and seed rate on the growth and yield of melon.

MATERIALS AND METHODS

Experimental procedure

The study was carried out in the 2018 and 2019 early planting seasons at the Department of Agricultural Education demonstration farm, University of Nigeria, Nsukka located at 6.84°N, 7.37°E (Ugwuoke, *et al*., 2020). The study adopted experimental research based on a split-plot design which was replicated thrice. Land preparation was carried out according to the procedure described in Uguru (2011). The physiochemical characteristics of the soil were conducted and presented in Table 1 below. Twenty-four plots each measuring 1.5m × 1m with 0.5m alleys between were made and randomly assigned to eight treatment groups with each replicating three times. Healthy and viable egusi melon seeds were purchased from the Department of Crop Science, University of Nigeria, Nsukka. The melon seeds were sown in four different seed rates of one seed/hole, two seeds/hole, three seeds/hole and four seeds/hole and four planting distances of 30cm × 50cm, 45cm × 70cm, 60cm × 60cm and 60cm × 90cm. Pig manure was applied to the respective plots at 6t/ha and worked into the soil 2 weeks preceding planting to give room for decomposition, mineralization and nutrient release. Agronomic practices were done according to the recommendations of Duncan and Ewing (2015).

Table 1: Physiochemical characteristics of the soil.

Variables	Values
Soil pH (Water)	5.0
Soil pH (KCl)	4.10
Organic matter %	
Organic carbon	1.35
Organic matter	2.52
Total nitrogen	0.31
Available phosphorous (mg/kg)	11.32
Exchangeable bases (me/100g)	
Calcium	0.69
Magnesium	1.51
Potassium	0.06
Sodium	0.03
Exchangeable acidity (me/100g)	
Hydrogen	2.10
Aluminium	0.75
Cation exchange capacity	15.05
Textural class	
Sand	72
Clay	17
Silt	11
Textural class	Sandy loam

Data analysis

The data collected from the two seasons were aggregated and analyzed using mean and analysis of variance (ANOVA) at 0.05 level of significance while the separation of means for significant effects was carried out using least significant differences (LSD).

RESULTS AND DISCUSSION

Effect of planting distance on the growth of egusi melon

The number of leaves/plant, branches/plant and vine length were statistically significant ($p<0.05$) when planted at 60cm × 90cm (Table 2). The number of branches/plant was equally significant ($p<0.05$) when planted at 60cm × 60cm and 45cm × 70cm while vine length was also significant ($p<0.05$) when planted at 60cm × 60cm. The number of leaves/plant, branches/plant and vine length were significantly higher in egusi melon planted at 60cm × 90cm and decreased progressively as the planting distance decreased (Table 2). The number of leaves/plant, branches /plant and vine length increased progressively from 3 WAP to 9 WAP. The results showed that melon just like other legumes needs abundant space to creep. The growth of beans was found to be better at 30cm between plants than those planted at 20cm between plants (Kakahy *et al*., 2012). Tanko *et al*. (2013) discovered that the length of leaves of Lablab, the number of leaves and plant cover increased progressively from the week 3 to the week 12 and 30cm row planting dominated the 20 cm row planting in all the variables measured. Similarly, Abdulazeez (2018) discovered a better canopy cover in *Senna obtusifolia* at the widest spacing of 50 cm and recorded the least canopy cover at a narrow spacing of 10 cm.

Effects of planting distance on the yield of egusi melon

The number of flowers/plant, fruits/plant and fruit weight were not produced at 3 WAP and increased progressively from 6 WAP to 9 WAP (Table 3). The number of flowers/plant, fruits/plant and fruit weight were statistically significant ($p<0.05$) when planted at 60cm × 90cm (Table 3). Numbers of flowers/plant was equally significant ($p<0.05$) when planted at 60cm × 60cm and also frit weight was significant ($p<0.05$) when planted at other planting distances. The number of flowers/plant, fruits/plant and fruit weight were significantly higher in egusi melon planted at 60cm × 90cm than others and progressively decreased as the planting distance decreased (Table 3). The number of pods produced by legumes differs significantly with planting distances, where it was reported that mash bean planted at 60cm apart produced more pods than those planted at 40 cm apart (Nadeem *et al*., 2004). Similarly, Abdulazeez (2018) obtained the highest number of pods/plant and the highest number of seeds/pod in *Senna obtusifolia* planted at 50cm intra-row spacing and least in those planted at 10cm intra-row spacing. Pod production/ plant and 100 seed weight of common bean were found to be highest at the highest spacing between rows while pod/ plant and seed/pod were significantly highest at the highest spacing within rows (Masa *et al*., 2017). Similarly, Manjesh *et al*. (2019) discovered that the highest yield/plant in yardlong bean was obtained in the group planted at the widest plant spacing of 60cm × 75cm.

Table 2: Mean and ANOVA analysis of the effect of planting distance on the growth of egusi melon.

Planting distance	3 WAP	6 WAP	9 WAP	Mean	p-value
Number of leaves/plant					
30cm × 50cm	9.20	19.33	106.66	**45.06***	**0.09**
45cm × 70cm	10.70	21.00	101.00	**44.23***	**0.11**
60cm × 60cm	11.00	22.66	130.66	**54.77****	**0.06**
60cm × 90cm	11.43	55.33	144.36	**70.37*****	**0.01***
Mean	**10.58***	**29.58****	**120.67*****		
Number of branches/plant					
30cm × 50cm	2.00	4.00	6.66	**4.22***	**0.06**
45cm × 70cm	4.33	7.33	10.66	**7.44****	**0.03***
60cm × 60cm	5.33	8.33	12.00	**8.55****	**0.00***
60cm × 90cm	7.33	10.33	14.66	**10.77*****	**0.00***
Mean	**4.75***	**7.50****	**11.00*****		
Vine length(cm)					
30cm × 50cm	40.50	53.36	63.50	**52.45****	**0.20**
45cm × 70cm	55.21	60.53	70.63	**62.12****	**0.13**
60cm × 60cm	65.76	78.50	95.75	**80.00*****	**0.00***
60cm × 90cm	51.73	72.10	93.14	**72.32*****	**0.01***
Mean	**53.30***	**66.12****	**80.76*****		

Key: Means followed by the same number of asterisks (*) along the column are statistically similar (LDS, 5%).
WAP = Weeks after planting.

Table 3: Mean and ANOVA analysis of the effects of planting distance on the yield of egusi melon.

Planting distance	3 WAP	6 WAP	9 WAP	Mean	p-value
Number of flowers/plant					
30cm × 50cm	0.00	8.00	12.00	**10.00***	**0.16**
45cm × 70cm	0.00	12.00	13.33	**12.67****	**0.09**
60cm × 60cm	0.00	12.00	16.66	**14.33*****	**0.04***
60cm × 90cm	0.00	15.33	18.00	**16.67******	**0.00***
Mean	**0.00**	**11.75****	**15.00*****		
Number of fruits/ plant					
30cm × 50cm	0.00	1.00	5.66	**3.33***	**0.20**
45cm × 70cm	0.00	1.00	6.33	**3.67***	**0.15**
60cm × 60cm	0.00	3.00	8.00	**5.55****	**0.08**
60cm × 90cm	0.00	6.00	11.60	**8.88*****	**0.02***
Mean	**0.00**	**2.75****	**7.90*****		
Fruit weight (g)					
30cm × 50cm	0.00	96.00	385.00	**240.50***	**0.01***
45cm × 70cm	0.00	105.00	392.00	**248.50***	**0.01***
60cm × 60cm	0.00	135.00	600.00	**367.50****	**0.00***
60cm × 90cm	0.00	162.00	723.00	**442.50*****	**0.00***
Mean	**0.00**	**124.50****	**525.00*****		

Key: Means followed by the same number of asterisks (*) along the column are statistically similar (LDS, 5%).

Effect of seed rate on the growth of egusi melon

The number of leaves/plant and vine length were statistically significant (p<0.05) when planted at 1 seed/hole (Table 4). The Vine length was equally significant (p<0.05) when planted at 2 seeds/hole but no statistically significant difference (p>0.05) was recorded in the number of branches/plant planted at all the seed rate (Table 4). The number of leaves/plant, branches/plant and vine length increased progressively from 3 WAP to 9 WAP. The number of leaves/plant, branches/plant and vine length were significantly higher in egusi melon planted at 1 seed/hole than the others and progressively decreased as the seed rate increased (Table 4). In agreement with the results, Al-Suhaibani *et al* (2013) recorded a significantly higher relative growth rate, net assimilation rate and leaf area duration in faba bean at a lower plant density. In another study, soybean was found to produce more branches/plant at a lower seed rate when compared to higher seeds/hole (Cox and Cherney, 2011). Leaf area/plant, leaf dry matter/plant and the number of leaves/plant of *Mucuna flagellipes* were found to be significantly

Table 4: Mean and ANOVA analysis of the effect of seed rate on the growth of egusi melon.

Seed rate	3 WAP	6 WAP	9 WAP	Mean	p-value
Number of leaves/plant					
1 seed per hole	11.66	30.33	150.00	**64.00****	**0.00***
2 seeds per hole	6.66	23.33	137.00	**55.66***	**0.22**
3 seeds per hole	4.66	16.66	135.00	**52.11***	**0.25**
4 seeds per hole	4.66	18.00	128.00	**50.22***	**0.25**
Mean	**6.91***	**22.08****	**137.5*****		
Number of branches/plant					
1 seed per hole	2.00	5.20	14.00	**7.07*******	**0.15**
2 seeds per hole	2.00	4.35	10.66	**5.67*****	**0.28**
3 seeds per hole	1.33	3.15	8.58	**4.35****	**0.35**
4 seeds per hole	1.33	2.50	5.33	**3.05***	**0.38**
Mean	**1.50***	**3.80****	**9.64*****		
Vine length(cm)					
1 seed per hole	39.00	80.00	219.33	**112.78*****	**0.00***
2 seeds per hole	34.00	64.00	143.66	**80.55****	**0.00***
3 seeds per hole	20.00	37.66	80.00	**45.89***	**0.10**
4 seeds per hole	18.00	30.00	58.00	**35.33***	**0.13**
Mean	**27.75***	**52.92****	**125.25*****		

Key: Means followed by the same number of asterisks (*) along the column are statistically similar (LDS, 5%).

Table 5: Mean and ANOVA analysis of the effects of seed rate on the yield of egusi melon.

Seed rate	3 WAP	6 WAP	9 WAP	Mean	p-value
Number of flowers/plant					
1 seed per hole	0.00	13.00	17.33	**15.17*******	**0.00***
2 seeds per hole	0.00	11.33	15.33	**13.33*****	**0.00***
3 seeds per hole	0.00	8.55	10.66	**9.61****	**0.16**
4 seeds per hole	0.00	7.00	8.33	**7.67***	**0.21**
Mean	**0.00**	**9.97****	**12.91*****		
Number of fruits/plant					
1 seed per hole	0.00	5.00	10.00	**7.50*****	**0.04***
2 seeds per hole	0.00	3.00	8.00	**5.50****	**0.08**
3 seeds per hole	0.00	2.00	5.00	**3.50***	**0.14**
4 seeds per hole	0.00	1.00	3.00	**2.00***	**0.23**
Mean	**0.00**	**2.75****	**6.50*****		
Fruit weight(g)					
1 seed per hole	0.00	156.00	755.00	**455.50*****	**0.00***
2 seeds per hole	0.00	134.00	682.00	**408.00****	**0.00***
3 seeds per hole	0.00	121.00	358.00	**239.50***	**0.05**
4 seeds per hole	0.00	110.00	323.00	**216.50***	**0.09**
Mean	**0.00**	**130.25****	**529.50*****		

Key: Means followed by the same number of asterisks (*) along the column are statistically similar (LDS, 5%).

less at a higher plant population due to close spacing (Agba *et al*., 2014).

Effects of seed rate on the yield of egusi melon

The number of flowers/plant, fruits/plant and fruit weight was not recorded at 3 WAP and increased progressively from 6 WAP to 9 WAP (Table 5). The number of flowers/plant, fruits/plant and fruit weight were statistically significant ($p<0.05$) when egusi melon was planted at 1 seed/hole. The number of flowers/plant and fruit weight were also statistically significant ($p<0.05$) when planted at 2 seeds/hole. Furthermore, the number of flowers/plant, fruits/plant and fruit weight were significantly higher in egusi melon planted at 1 seed/hole than the others and decreased progressively as the seed rates increased (Table 5). The number of seeds in *Rabi* variety of soybean was found to be highest at a low plant density and decreased as the plant density increased (Rahman and Hossain, 2011). Besides, Hamid *et al*. (2002) discovered that the number of soybean branches/plant, filled pods/plant and seeds/plant were significantly highest at the lowest seed rate, emphasizing that the parameters decreased as the seeds/hole increased. The number of pods/plant and seed yield were found to be significantly highest at the lower seed rate for faba bean and recorded significantly lowest at the highest plant density (Wakweya and Meleta, 2016). Similarly, Sikka *et al*. (2018) reported that the number of pods/plant significantly decreased in soybean at a higher seed rate because of the competition for space, water, sunlight and plant nutrient.

CONCLUSION

Egusi melon is a creepy legume and as such requires enough space for spreading the vines. When enough space is allowed, egusi melon tries to grow vegetatively to cover the space and hence get access to adequate sunshine, enhanced photosynthesis, more growth, flowers and fruits. When grown without much space, the vegetative part of egusi melon tends to congest and accumulate within a restricted area thereby suffering congestion and suffocation.

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