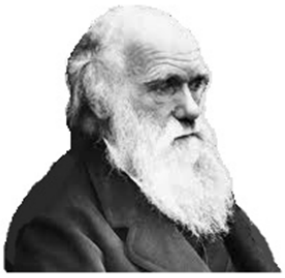
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Effect of rooting media on germination and vegetative growth of okra [*Abelmoschus esculentus* (L.) Moench]

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ABSTRACT

This study was conducted to find out the effect of rooting media on germination and vegetative growth of okra. The treatment which includes cocopeat, sawdust, cow dung and soil. The soil alone serves as the control while the other three rooting media; soil mixed with cocopeat, soil mixed with sawdust and soil mixed with cow dung were prepared in the ratio 5:2, 3:4, 4:4 each giving the media a total of 10 treatment with four replications. The study was carried out in the screen house of botanical garden department of plant biology, Bayero University Kano using Complete Randomized Design (CRD) at different intervals of 2,4,6,8 weeks. All data collected were subjected to analysis of variance (ANOVA) using Excel. Means were separated using least significant differences (LSD) at 5% level of significance ($P<0.05$). The findings of the study revealed that okra plant treated with soil mixed with cocopeat at the ratio 3:4 recorded the best number of days okra plant takes to germinate (5days), days to flowering (46 days) and days to fruiting (49 days). While soil alone recorded the least 7 days, 47 days and 51 days respectively even though there were no significant differences. Significant differences were observed the treatment soil mixed with cocopeat at the ratio 3:4 recorded the maximum number of leaves (6), stem height (24 cm). while soil alone recorded the minimum number of leaves (3), stem height (14 cm) at 8 weeks after planting.

***Keywords*:** Okra, Rooting media, germination, vegetative growth, *Abelmoschus esculentus*

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1. INTRODUCTION

Okra, also known as lady's fingers, is a warm-season crop that is widely grown in tropical and subtropical regions (Singh *et al*., 2018). It is a member of the Malvaceae family and is characterized by its elongated, ribbed, and green pods. (Zouaoui *et al.,* 2021). Okra has a wide range of culinary uses and is a popular ingredient in many dishes, especially in the southern United States, West Africa, and the Caribbean (Iwu *et al*., 2014). It is a highly nutritious vegetable that is rich in vitamins, minerals, and dietary fiber (Gemede *et., al* 2015). Okra is also known for its medicinal properties and is used in traditional medicine to treat various ailments (Kumar *et al*., 2013). Overall, okra is a versatile and valuable crop that is appreciated for its nutritional, culinary, and medicinal benefits.

Rooting media is one of the most important factors that significantly influences germination and vegetation growth of plants. It is known that good growing media provides a reservoir for plant nutrients, hold plant available water, and provides a means for gas exchange and good anchorage for the plants. The use of growing media is proved effective for higher production of agricultural crops, due to their good water holding capacity, aeration and more uptake of nutrients. A good quality growing media plays an important role for obtaining luxuriant vegetative growth. Maximum net profit for commercial crops can be obtained when various kind of growing media were used in combination with organic substrates because growing media play direct or indirect role in plant growth (Ali *et al.,* 2011; Shen *et al.,* 2019).

Growing media is the material which is organic or inorganic provides anchorage to the plants by holding the root system. It provides the essential plant nutrients required for the metabolism, growth and development of the plants. Growing media are an integral part of most Agricultural production systems. There is a wide range of media available, the purpose of growing media and the qualities that growers should look for when selecting media for different purposes (Elkhalifa *et al.,* 2021; Savello *et al.,* 1980; Ge *et al.,* 20216; Zhang *et al.,* 2018).

2. MATERIALS AND METHOD

2. 1. Study site

The experiment was conducted at the screen house of Botanical Garden, Department of plant Biology Bayero University Kano which lie between latitude 12°37’7” North and longitude 9°22’22” East with altitude of 44m above sea. The screen house provides a fairly uniform environment and helped in reducing insect attack on okra.

2. 2. Sample collection

The okra seed Maha F1 variety was collected at Centre for Dryland Agriculture (CDA), Bayero University Kano and it was authenticated at the herbarium unit of plant biology department.

2. 3. Sample preparation

The sample collected were prepared in the screen house of the botanical garden of the department of plant biology using established procedure. All the Forty pots were filled and watered thoroughly before planting. Sown was done on 13th January 2023. Four seeds were planted in the polyethylene bag which were later thinned down into two.

Black perforated nursery polyethylene bags of 21 × 14.5 cm. Three holes were punched in each of the pots at a spacing of 6 cm and about 1cm depth. The Okra was sown one seed per holes and correct tags and labels were ensured to be assigned in each planted pot. A watering can was used to water the plants at an interval of one day till the experiment was completed.

The weight of the samples was measured using weighing balance with model WA40001Y. Soil (1,309g), soil mixed with cocopeat in 5:2 (935g and 104g), soil mixed with cocopeat in 3:4 (561g and 208g), soil mixed with cocopeat in 4:4 (748g and 208g), soil mixed with cow dung in 5:4 (935g and 212g), soil mixed with cow dung in 3:4 (561g and 424g), soil mixed with cow dung in 4:4 (748g and 424g), soil mixed with sawdust in 5:2 (935g and 76g), soil mixed with sawdust in 3:4 (561g and 152g), soil mixed with sawdust in 4:4 (748g and 152g). (Ogundare *et al*., 2015) with modifications.

2. 4. Treatment and experimental design

The treatment which includes Cocopeat, Sawdust, Cow dung and soil. The soil alone serves as the control while the other three rooting media; soil mixed with cocopeat, topsoil mixed with sawdust and soil mixed with cow dung were prepared in the ratio 5:2, 3:4, 4:4 each giving the media a total of 10 treatment.

The treatments were replicated four times and assigned to the experimental units at random using Completely Randomized Design (CRD) with four replications. The experimental pots were arranged randomly and the seed for each of the treatment that was planted in each pot were selected randomly in order to obtain proper and unbiased data. The experiment was conducted at each of the treatment that was planted in each pot an interval of 2weeks, 4weeks, 6 weeks and 8 weeks after planting.

2. 5. Data collections

The data collected include the following: Days to germination, number of leaves, Stem height, Days to flowering and Days to fruiting

2. 5. 1. Days to germination

The days at which the okra seeds start germinating after planting were recorded in each plot.

2. 5. 2. Number of leaves

The number of leaves were recorded at the 2^{th}, 4^{th}, 6^{th} and 8^{th} weeks after planting. The number of leaves can be done manually by counting the leaves in each plot.

2. 5. 3. Stem height

Okra stem height was recorded at 2^{th}, 4^{th}, 6^{th} and 8^{th} weeks after planting in each plot. The stem height was taken using a ruler in centimeter and thread to measure from the base of the main stem to the tips of the highest stem.

2. 5. 4. Days to flowering

The days at which the okra plant start producing flower after planting were recorded in each plot.

2. 5. 5. Days to fruiting

The days at which the okra plant start producing fruits after planting were recorded in each plot.

2. 5. 6. Data analysis

The data collected were subjected to analysis of variance (ANOVA) using Excel. Test of means of significance was done by using Pischer least significant differences at 5% level of probability.

Table 1. Effect of soil mixed with rooting media in different concentrations on days to germination of okra.

Treatment	Days to germination
soil alone	6.75
soil + cocopeat 3:4	5.00
soil + sawdust 3:4	5.75
soil + cow dung 3:4	5.50
soil + cocopeat 5:2	5.75
soil + sawdust 5:2	5.75
soil + cow dung 5:2	6.00
soil + cocopeat 4:4	5.25
soil + sawdust 4:4	5.25
soil + cow dung 4:4	5.75
LSD	NS

Keys: Mean at 0.05 level of confidence. NS = not significant

Table 2. Effect of soil mixed with rooting media in different concentration on the number of leaves at 2,4,6,8 weeks after plant.

Treatment	2WAP	4WAP	6WAP	8WAP
soil alone	1.00^{c}	3.00^{b}	2.00^{c}	2.50^{d}
soil + cocopeat 3:4	3.00^{a}	5.50^{a}	4.50^{a}	5.75^{a}
soil + sawdust 3:4	1.75^{c}	3.00^{b}	2.50^{b}	3.00^{d}

soil + cow dung 3:4	2.75^{ab}	3.00^{b}	3.25^{b}	3.00^{d}
soil + cocopeat 5:2	2.50^{ab}	2.50^{b}	3.25^{b}	3.50^{cd}
soil + sawdust 5:2	2.50^{ab}	3.00^{b}	3.00^{b}	3.00^{d}
soil + cow dung 5:2	2.00^{b}	3.00^{b}	3.00^{b}	4.25^{bc}
soil + cocopeat 4:4	2.75^{ab}	4.75^{a}	3.50^{ab}	5.25^{ab}
soil + sawdust 4:4	2.00^{b}	2.50^{b}	2.25^{c}	3.00^{d}
soil + cow dung 4:4	2.00^{b}	2.75^{b}	3.00^{b}	3.50^{cd}
LSD	0.76	1.31	1.03	1.09

Keys: Means with different letters (a, b, c, d) in the column indicate statistically significant differences between the treatments ($p<0.05$). 2WAP = 2 weeks after planting, 4WAP = 4 weeks after planting, 6WAP = 6 weeks after planting, 8WAP = 8 weeks after planting.

Table 3. Effect of soil mixed with rooting media in different concentration on the stem height (in centimeter) at 2,4,6,8 weeks after plant.

Treatment	**2WAP**	**4WAP**	**6WAP**	**8WAP**
soil alone	4.75^{d}	8.00^{c}	9.25^{f}	13.75^{f}
soil + cocopeat 3:4	10.50^{a}	14.75^{a}	15.75^{a}	23.75^{a}
soil + sawdust 3:4	8.25^{bc}	12.50^{bc}	14.25^{a}	21.25^{c}
soil + cow dung 3:4	8.50^{b}	12.50^{bc}	14.00^{bc}	20.00^{e}
soil + cocopeat 5:2	8.75^{b}	14.00^{a}	13.00^{cd}	21.75^{cd}
soil + sawdust 5:2	8.25^{bc}	11.00^{cd}	11.75^{de}	20.75^{de}
soil + cow dung 5:2	7.50^{c}	11.00^{cd}	12.50^{c}	22.25^{bc}
soil + cocopeat 4:4	10.25^{a}	13.50^{ab}	15.50^{ab}	23.00^{ab}
soil + sawdust 4:4	7.50^{c}	10.25^{d}	11.25^{e}	21.25^{c}
soil + cow dung 4:4	8.50^{b}	12.25^{b}	13.75^{c}	23.00^{ab}
LSD	0.94	1.32	1.50	1.09

Keys: Means with different letters (a, b, c, d) in the column indicate statistically significant differences between the treatments ($p<0.05$). 2WAP = 2 weeks after planting, 4WAP = 4 weeks after planting, 6WAP = 6 weeks after planting, 8WAP = 8 weeks after planting.

Table 4. Effect of soil mixed with rooting media in different concentration on the days to flowering at 2,4,6,8 weeks after planting.

Treatment	Days to flowering
soil alone	47.25
soil + cocopeat 3:4	46.00
soil + sawdust 3:4	46.70
soil + cow dung 3:4	46.50
soil + cocopeat 5:2	46.50
soil + sawdust 5:2	47.50
soil + cow dung 5:2	46.75
soil + cocopeat 4:4	46.25
soil + sawdust 4:4	46.25
soil + cow dung 4:4	46.75
LSD	NS

Keys: Mean at 0.05 confidence. NS = not significant.

Table 5. Effect of soil mixed with rooting media in different concentration on the days to fruiting at 2,4,6,8 weeks after plant.

Treatment	Days to fruiting
soil alone	51.00
soil + cocopeat 3:4	49.50
soil + sawdust 3:4	49.75
soil + cow dung 3:4	50.00
soil + cocopeat 5:2	50.00
soil + sawdust 5:2	50.00
soil + cow dung 5:2	50.00
soil + cocopeat 4:4	49.50

soil + sawdust 4:4	49.75
soil + cow dung 4:4	49.75
LSD	NS

Keys: Mean at 0.05 confidence. NS = not significant.

3. RESULTS AND DISCUSSION

3. 1. Days to germination

The result on the effect of soil mixed with rooting media in different concentration on days to germination after planting were presented on Table 1 above. No significant difference was observed at 0.05 confidence level. It shows the treatment soil mixed with cocopeat at the ratio 3:4 takes less number of days for the okra seeds to germinate with a mean value (5.00) while soil alone takes more number of days for the okra seed to germinate with a mean value of (6.75). This agrees with the similar work of Bhattacharjee and Saha (2017), the study found that the use of cocopeat as a growing media improved the days to germination of okra plant compared to soil based growing media. However, okra plant treated with soil alone recorded the least number of days okra takes to germinate in which take seven days to germinate.

3. 2. Number of leaves

The results were presented on Table 2 above. Significant difference were observed at 0.05 level of confidence at 2,4,6,8 weeks after planting. At 2 weeks after planting where okra plant treated with soil mixed with cocopeat at the ratio 3:4 with a mean value (3.00) recorded the highest number of leaves. While soil alone recorded with a mean value (1.00) recorded the least number of leaves. At 4weeks after planting where okra plant treated with soil mixed with cocopeat at the ratio 3:4 recorded the highest number of leaves with a mean value (5.50). While soil mixed with sawdust at the ratio 4:4 recorded the least number of leaves with a mean (2.50). AT 6 weeks after planting where okra plant treated with soil mixed with cocopeat at the ratio 3:4 recorded the highest number of leaves with a mean value (4.50). While soil alone recorded the least number of leaves with a mean value (2.00). At 8 weeks after planting where okra plant treated with soil mixed with cocopeat at the ratio 3:4 recorded the highest number of leaves with a mean value (5.75). While soil alone recorded the least number of leaves a mean value (2.50). This agrees with the similar work of Bhattacharjee and Saha (2017), the study found that the use of cocopeat as a growing media improved the number of leaves of okra plant compared to soil based growing media.

3. 3. Stem height

The results were presented on Table 3 above. Significant difference were observed at 0.05 level of confidence at 2,4,6,8 weeks after planting. At 2 weeks after planting where okra plant treated with soil mixed with cocopeat at the ratio 3:4 with a mean value (10.50) recorded the highest stem height. While soil alone with a mean value (4.75) recorded the least stem height. At 4weeks after planting where okra plant treated with soil mixed with cocopeat at the ratio 3:4 recorded the highest stem height with a mean value (14.75). While soil alone recorded the least stem height with a mean value (8.00). AT 6 weeks after planting where okra plant treated with

soil mixed with cocopeat at the ratio 3:4 recorded the highest stem height with a mean value (15.75). While soil alone recorded the least stem height with a mean value (9.25). At 8 weeks after planting where okra plant treated with soil mixed with cocopeat at the ratio 3:4 recorded the highest stem height with a mean value (23.75). While soil alone recorded the least stem height a mean value (13.75). This agrees with similar work of Odofin (2016). The study found that the use of cocopeat as growing media improved the stem height of okra plant compared to soil- based growing media.

3. 4. Days to flowering

The results were presented on Table 4 above. No significant difference was observed at 0.05 confidence level. It shows the treatment soil mixed with cocopeat at the ratio 3:4 takes less number of days for the okra plant to start flowering with a mean value (46.00) while soil alone takes more number of days for the okra plant to start flowering with a mean value of (47.25).

This agrees with similar work of Islam *et al*., (2014). The study found that the use of cocopeat as growing media improved the number of days to flowering.

3. 5. Days to fruiting

The results were presented on Table 5 above. No significant difference was observed at 0.05 confidence level. It shows the treatment soil mixed with cocopeat at the ratio 3:4 takes less number of days for the okra plant to start fruiting with a mean value (49.50) while soil alone takes more number of days for the okra plant to start fruiting with a mean value of (51.00). This agrees with similar work of Islam *et al*., (2014). The study found that the use of cocopeat as growing media improved the number of days okra plant takes to start fruiting.

4. CONCLUSION

The study revealed the effect of rooting media in different concentration on the germination, vegetative growth and reproduction of okra. The result shows that the treatment soil mixed with cocopeat at the ratio 3:4 recorded the best number of days okra plant takes to germinate. At 8 weeks after planting the treatment soil mixed with cocopeat at the ratio 3:4 recorded the maximum number of leaves, stem height, days to flowering and days to fruiting.

The treatment that shows the best effect on the germination, vegetative growth and reproduction of okra plant is soil mixed with cocopeat at the ratio 3:4.

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