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Effect of Rice Husk Incorporation Rate on the Growth of Okra [*Abelmoschus Esculentus* (L.) *Moench*] in Mubi Adamawa State Nigeria

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Abstract

Research work was conducted during 2021 cropping season at the Moringa Plantation garden Federal Polytechnic Mubi to determine the effect of rice husk material on some growth parameters of okra (*Abelmoschus esculentus (L) moench* .The design used for conducting the experiment was Randomized Complete Block Design (RCBD) comprising of four treatments replicated three times. The treatments were TA 30kg of rice husk; TB, 20kg of rice husk, TC 10kg of rice husk and TD = 0kg of rice husk, The respective rice husks were incorporated into the various plots. Data were collected on percentage emergence count at 3 WAS, plant height (cm), stem diameter (mm) and number of leaves at 4, 6 and 8 weeks respectively. Result obtained revealed that TB = 20kg rice husk had the highest emergence count of 80% followed by TC=10kg with 70% while the lowest emergence count was recorded against TD = 0kg or control plot. Result on plant height showed that TB-20kg rice husk recorded the tallest plant height of 43.36cm followed by TC-10kg with 39.50cm while TD-control had the shortest plant height of 24.50cm. Furthermore, result on stem diameter indicated that treatment TB =20kg had the thickest stem diameter of 2.00m, followed by TC 10kg with 1.96mm, while TD-0kg recorded the least stem diameter of 1.70mm, at 6 and 8 WAS. Result on number of leaves per plant, revealed that same treatment TB-20kg rice husk recorded higher number of leaves 19.51 followed by TC-10kg with 19.01 while TD-control had the least number of leaves 17.35. Base on the result of this study 20kg rice husk should be adopted by farmers in Mubi for maximum growth of Okra.

Keywords: Rice husk, Okra, Growth, Randomized and Incorporation rate.

Introduction

Okra [*Abelmoschus esculentus (L) Moench*], is an economically important vegetable crop that belongs to the family *malvacearum*. It was reported to have originated from Africa, Okra is believed to have originated near Ethiopia, where it was frequently cultivated by the Egyptians during the 12th century, and thereafter spread throughout the Middle East and North Africa (Kumar et al., 2013). The name Okra probably derives from one of Niger-Congo group of languages (the name for okra in the Twi language is Nkuruma. The term okra was in the use of English by the late 18th century. Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds (Dubey & Mishra, 2017) and

hereafter transported to other part of the countries by Portuguese. Okra is an annual plant with erect hairy stem that may grow up to 2m in height and become woody when matured (Elkhalifa et al., 2021). Also, okra (Abelmoschus esculentus (L.) Moench) is one of the important vegetables having better dietary value with medicinal and industrial importance. It isalso known as lady's finger, is flowering plant in the mallow family. (Sindhu & Puri, 2016). The fruit is elongated with relatively large pod and when mature, the pod is hard and woody. Seed are round or kidney like in shape. Okra is cultivated mainly for its immature fresh pod which are used as vegetable in making soup or dried and milled to powder for use as flavouring and has been used as blood plasma replacement (Sindhu & Puri, 2016). Fresh okra contains energy, 90% water, 7% carbohydrates, 2% protein, fibers (contains alpha-cellulose, hemicellulose, lignin, pectin, fat, and wax matter), some important soluble vitamins in water and fat, and minerals like calcium, iron, magnesium, phosphorus, potassium, and zinc (Yousaf et al., 2017). Therefore, okra is an important edible vegetable for human health. Okra is an important vegetable for human health because of its functional bioactive compounds as antioxidant. A polysaccharide of okra had some biological functions such as anti-fatigue, hypoglycemia, and phagocytic activities. Therefore, needed extensive studies of the biological research to identify the anticancer and antimicrobial properties of okra polysaccharide and nanoparticles forms to target the main purposes of polysaccharide uses, and develop its functions in the medical applications. (Yousaf et al., 2017) Okra seed oil is rich in unsaturated fatty acids such as linoleic acid, which is essential for human nutrition. Its mature fruit and stems contain crude fibre, which is used in the paper industry.(Yousaf et al., 2017)

The abundance of dietary fibers presents in Okra not only beneficial to controlling blood glucose and clearing up cholesterol deposits. It also helps in clearing up wastes in the small intestines. and results in a better digestion and prevention of constipation. (Das et al., 2019) Rice husk manure as an alternative source of soil nutrients, is one of the advocated strategies used to achieve high Okro performance in Northern Nigeria.Tekwa (2010) had earlier reported on the higher soil nutrient from rice husk application than cow dung in the same study area. As reported by (Das, 2019) the Chemical constituents of okra contains Petals yield 13 flavanoid glycosides; gossypetin and hibiscetin glucosides. Fresh fruits are rich in pectin and mucilage; it contains oxalic acid, protein, fat, minerals (potassium, sodium, Magnesium, Sulphur, Copper, Manganese and Iodine), carbohydrate, calcium and phosphorus. Fresh fruits also contain vitamin A, thiamine, riboflavin, ascorbic acid and niacin. d-Galactose, l-rhamnose and d-dalacturonic acid also isolated from the mucilage of the fruit. Flavonoid compound has been reported from fruits. Essential oil isolated from pods and seeds contain aliphatic alchohol, cyclohexanol, p-tolualdehyde (in fruits), a-terpenylacetate (in seeds) and citral; nonvolatile neutral part contains β-sitosterol & its 3β-galactoside (in seeds). Leaves have got more or less same constituents. Ripe seeds contain 10-22% edible oil Rice husks are the hard protective coverings of rice grains which are separated from the grains during milling process. Rice husk is an abundantly available waste material in all rice producing countries, and it contains about 30%–50% of organic carbon.

(Sekifuji & Tateda, 2019) In the course of a typical milling process, the husks are removed from the raw grain to reveal whole brown rice which upon further milling to remove the bran layer will yield white rice. .(Phonphuak & Chindaprasirt, 2015). Rice husk is an organic waste and is produced in large quantities. It is a major by-product of the rice milling and agro-based biomass industry. Rice husk is a cellulose-based fiber and contains approximately 20% silica in amorphous (Phonphuak & Chindaprasirt, 2015) The ash of rice husk contains approximately 90% silica, which is a highly porous structure and is lightweight, with high specific surface area. Rice hulk ash has been applied as an additive in many materials and applications, such as refractory brick, manufacturing of insulation, and materials for flame retardants (Sekifuji & Tateda, 2019). The thickness of the cellulose fiber is around 5e20 mm with a small amount of inorganic content deposited at its surfaces. The main chemical components are 52% SiO_2, 21% Al_2O_3, 9%Fe_2O_3, and 9% loss on ignition (Sekifuji & Tateda, 2019). Up to 5% pulp residue could be effectively used as pore former in producing clay brick at a firing temperature of 900°C.(Phonphuak & Chindaprasirt, 2015)

The use of crop residue as organo-mineral fertilizer other than local available plant nutrient for amendment of soil acidity have been emphasized, recently on studies of soil fertility of the tropical soil. Meaningful contribution to soil nutrient pool and beneficial effect on subsequent crop have been observed when crop residue returned to farmland on utilization form (G. Shanmugam, 1996) that organic matter has liming effect on soil, rice husk (RH) a crop residue of rice production enterprise has been used in agriculture as a soil amendment or soil conditioner and for growing vegetable hydropotically, (Solloman *et. al.,* 1995, Swarup 1996) in some instance where RH was used, it has often been incorporated for at least 3 weeks or more to aid decomposition of nutrient lockup in the soil organic matter to released and be made available to crop. Rice husk help to hold soil moisture and retained sand drifting as much as modifying the physical chemical and biological properties of the soil (P. Shanmugam & Pathak, 1996).that carbonized rice husk may protect the plant from nematode damage and increase soil Ph microbial activities. In rice production areas, the enterprises provide employment for more than 80% of the inhabitants in various activities along the production/distribution chain from cultivation to consumption (Ogundar and Okoruwa 2006).

In light of all these findings the research undertook the following objectives, to assess the effect of rice husk application rate on the growth of okra and to recommend the best application rate of rice husk fertilizer materials for okra growth in the study area

Figures Okro (Al-Shawi et al., 2021)

Area of Research/Methods

This research was conducted during 2021 cropping season in the Moringa Plantation of Horticultural Technology Department, Federal Polytechnic Mubi. Adamawa State –Nigeria. Mubi town is located between Latitude 10°16'8"N and 10°20'00"N as well between Longitude 13°16'14"E and 13°20'00"E .(Joshua & Odihi, 2018). Mubi is bordered by Michika Local Government Area to the North, Mandara mountain of Cameroun to the east, Askira/Uba to the west and Hong and Maiha local govern areas to South. Mubi has a population of 225,721 and has a total land area of 25 km² (2,500 hectares) including the floodable areas, rivers, and streams Figure 1 describes the location of Mubi in Adamawa State and at national level (Nigeria) as well as the international cattle routes, currently cattle market and the location of the proposed one. Mubi is a commercial town owing to its location on the border, many individuals from Nigeria and the neighbouring countries namely Cameroon, Chad, and Central Africa coming to make purchases in Mubi market and the cattle market, as well The people of Mubi are predominantly Fali, Gude, Margi and Higgi tribes as well as, Hausa and Fulani people among others tribes from neighbouring settlements .The Fali, Gude, Margi and Higgi people are mostly farmers, while the Fulanis are cattle rearers. (Joshua et al., 2018)

(Joshua et al., 2018)

TA = 30kg of rice husk
TB = 20kg of rice husk
TC = 10kg of rice husk
TD = 0kg (Control) of rice husk

Land preparation

The experimental site was cleared, ploughed and harrowed to obtain a fine soil tilth before sowing. Rice husk were incorporated three weeks before sowing to aid decomposition. The soil was leveled using simple hoe and was marked out into plots. The gross plots size was 3Mx 3.6M (10.8M²), and net plot size 1.8M x 27M (4.86M) with path way of 1M between replication and 0.5M between plot. Weeds were controlled manually using simple hoe when necessary.

Okra, Syria variety was obtained from Mubi local market and sown 3 per hole which was later thinned to 2 per stand at a spacing of 50 x 60cm. Data were collected on percentage emergence count at 3 WAS, plant height at 4, 6 and 8 WAS. Number of leaves and stem diameter at 4, 6 and 8 WAS, were subjected to statistical analysis of variance (ANOVA) appropriate for (RCBD) design using SAS software package. Means were separated using least significant different at 5% level of significant.

Result and Discussions

Result on emergence count at 3 WAS and plant height at 4, 6, and 8 WAS is presented in Table 1. Result revealed significant difference (P = 0.05) between the treatments with TB given the highest emergence count of 80% followed by TC 70% while the least emergence count of 50% was recorded against the control. Still on Table 1, result recorded showed significant differences with gradual increase in plant height of the seedling from 4 - 8 WAS. TB 20kg had the tallest plant height of 10.02, 21.29 and 43.36 cm followed by TC 10kg with 8.10, 18.02 and 39.20 respectively while control TD (control) okg recorded the shortest plant height of 6.00 14.02 and 24.50 respectively.

The significant differences amongst the treatment on emergence count might be caused by variation in the decomposed of rice husk material at the early stage, hence reduction in germination rate. The non-significant differences in plant height at 4 WAS might be attributed to the fact that production of dry matter which directly associated with growth did not pick up. This fully agree, with the findings of (Aliyu et al., 2011) who reported that at second week, plant height were not significant by rate of application of the organic amendment, while the significance among the treatment in plant height at 6 and 8 weeks after sawing might be caused by excessive concentration of rice husks material, hence reduction in plant height.

Table 3.1: Mean effect of different rate of rice husk on emergence count of Okra at 3 WAS, and plant height at, 4, 6 and 8 WAS (cm**)**

Treatment	3WAS	4WAS	6WAS	8WAS
A-30kg	60%	9.20	16.30	33.40
B-20kg	80%	10.02	21.29	43.36
C-10kg	70%	8.10	18.02	39.50
D-0kg	50%	8.00	14.02	24.50
LSD (0=0.5%)	10.40	0.44	0.567	0.849

LSD=Least significant difference. WAS=Weeks after sawing (Aliyu *et al*; 2011)

Result on number of leaves as influence by different application rates of rice husk at 4, 6 and 8 WAS is presented in Table 2. Result showed that there is no significant difference among the treatments, but TB 20kg rice husk recorded 19.51 which is slightly higher than TC10kg, likewise TC-10kg recorded 19.01 which is also slightly higher than TA–30kg, while TD 0kg recorded the least number of leaves.17.35. The slight fall in number of leaves recorded when using high rate of 30kg of rice husk might be due to the excessive increase in the amount of rice husk hence decrease in number of leaves or it might be cause by climatic factor that result in falling of the leaves.

Table 3.2: Mean effect of different rice husk incorporation on number of leaves of Okra at 4, 6 and 8 weeks after sowing (WAS) (cm)

Treatment	4WAS	6WAS	8WAS
TA-30kg	5.77	10.35	18.79
TB-20kg	6.68	11.20	19.51
TC-10kg	5.99	10.48	19.01
TD-0kg	5.10	10.00	17.35
LSD (0=0.5%)	0.272	1.162	0.575

LSD=Least significant difference. WAS=Weeks after sawing (Aliyu *et al*; 2011)

Result on stem girth as influenced by different rate of rice husk incorporation at 6 and 8 WAS is presented in Table 3. Result showed significant different (P=0.05) between the treatment with TB 20kg of rice husk having the thickest stem diameter of 1.68 and 2.00 at 6 and 9 WAS, followed by TC 10kg which recorded significantly thicker stem diameter of 1.62 and 1.96 while the least stem diameter was recorded from TD 0kg rice husk with 1.46 and 1.70 respectively. The non-significance different might be due to environmental factor.

Table 3.3 Mean effect of rice husk incorporation rate on stem diameter of Okra at 6 and 9 WAS all in cm

Treatment	6WAS	8WAS
TA-30kg	1.60	1.80
TB-20kg	1.68	2.00
TC-10kg	1.62	1.96
TD-0kg	1.46	1.70
LSD (0=0.5%)	0.53	0.064

LSD=Least significant difference. WAS=Weeks after sawing (Aliyu *et al*; 2011)

Conclusion

Rice husk materials help to hold soil moisture and have been used to improve the soil fertility with more available nutrient and better soil Ph. The growth of Okra plant increases with an increase in the rate of rice husk up to a maximum of 20kg, where further increase caused a decreased in plant growth, plant height, stem diameter and number of leaves were increasing application rate of 10kg-20kg but with increase above 20kg of rice husk, the growth began to decline.

Recommendation

- It is therefore recommended that 20kg /plot rice husk be used for maximum growth of Okra eight weeks after sawing
- Further research should be done on the use of rice husk material for the growth and yield of okra

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