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Original Article

Different Growth Media Effect on The Germination and Seedling Growth of Pearl Millet (*Pennisetum glaucum*)

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Abstract

The study on the effect of different growth media on germination and seedling growth of *Pennisetum glaucum* (Pearl millet) was conducted, where two main research objectives were formulated to guide the researcher to investigate the effect of different growth media on germination and seedling growth of Pearl millet (*Pennisetum glaucom)* and to assess the different levels of growth and germination of Pearl millet (*Pennisetum glaucom*) on different media. The seeds were sown on three different media: compost vegetable waste, rice hull (husks), and compost wood bark. The finding reveals that the seedling growth performance of the compost waste vegetable has a high germination percentage. Plant height, no. of leaves, and steam diameter. Therefore, the government/policy makers should encourage farmers to use compost vegetable waste as growth media, and farmers should emphasize the use of vegetable growth media among the three different growth media.

Keywords: Graminae, germination percentage, *Pennisetum glaucum*, seedling growth.

Introduction

Pearl millet (*Pennisetum glaucum*) is a cereal crop that grows well in the semi-dry and dry lands of most African and South Asian countries (Baltensperger, 2002). The plant is a short-day crop that starts flowering earlier when day lengths are short (Clerget *et al.,* 2007; Loganathan *et al.,* 2022), because day lengths usually delay flowering (Uzoma *et al.*, 2010). Pearl millet grain is usually processed into flour and serves as a staple food for rural households in the world's poorest countries (Basavaraj *et al.*, 2010), providing a source of food to nearly five hundred million households in the dry and semi-dry tropics, especially in the south-eastern part of Asia and some African countries. Pearl millets provide a source of diet and can contribute immensely to a healthy, balanced diet (Kajal *et al.,* 2020). Pearl millet plant chaffs are a valuable product used for livestock feed in Africa, India, and most South Asian countries (Basavaraj *et al.,* 2010). In developed countries like Europe and the United States, pearl millet is cultivated during summer periods as forage and feeds for wildlife and birds (Ajagekar *et al.,* 2023).

Pearl millet (*Pennisetum glaucum*) is one of the ancient cultivated food crops known to man (Theuri, 2023). Encouraging the use of pearl millets can also help to provide a source of income for farmers and processors of the crop (Ilango & Antony, 2021). As is more common with many cereal crops, the historical background of the crop is wide and very difficult to monitor, but the crop seems to have originated in Africa, India, and China (Mathew & Joseph, 2022; Voelkel-Meiman *et al.*, 2013). Pearl millet might also have probably originated in the western tropics of Africa about 3000 years ago, where it spread across the African continent and South Asian countries (Voelkel-Meiman *et al.,* 2013). In the Republic of Niger, the pearl millet is the major staple food being used and is the most common crop in agricultural production, contributing almost about 0.75 of the total annual national cereal production (Amadou *et al.*, 2013).

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The productivity of pearl millet is usually low, about 300–550 kg/ha (Graef & Haigis, 2001). In some parts of the country due to natural disasters such as floods and short rainy seasons (Graef & Haigis, 2001) and poor quality of soils. In the Republic of Niger, the long growing period is mainly due to the date of the first rainfall (Sivakumar, 1988) and differs widely on a yearly basis (Wimalasiri *et al.*, 2023). However, because of the non-static rainfall pattern in the Sahel areas, the first rainfall that is suitable for planting the crop is usually receded by many days of shortage of rainfall, which causes the crop to not germinate, thereby requiring replanting by the farmers again (Shah *et al.*, 2023).

According to Filardi *et al.* (2005), pearl millet has higher protein contents than the maize crop and has an average value of 85% of the carbohydrate level of the maize plant. To boost the grain yield capacity of pearl millet in Nigeria (Dayakar and Nune, 2021), it is imperative to develop and produce a hybrid of high-grain pearl millet varieties that can grow and thrive well. Nwasike and Oyejola (1989) have reported studies on the performance of several pearl millet varieties in the Samaru axis of the north central part of Nigeria and discovered that pearl millet varieties of Ex-Benue and Ex-Borno produce the highest yield among all other varieties tested. Similarly, Izge *et al.* (2007) reported millet cultivar SE2124 to have given the highest yield in Samaru, in the north central part of Nigeria. However, there is relatively little or few information on pearl millet yields among the cultivated pearl millet varieties in the north-eastern part of Nigeria, despite pearl millet being a prominent crop in this part of the country, Therefore, there is a need to choose pearl millet cultivars that can grow and produce high yields in this area. Thus, it is imperative that research be conducted to assess the performance of different types of pearl millet hybrids and cultivars in respect of their yield characteristics in the Guinea and Sudan savannah vegetation zones in north-eastern Nigeria, where the pearl millet crop is a major staple food; hence, this study aims to assess the effect of different growth media on the germination and seedling growth of the pearl millet (*Pennisetum glaucum*).

Material and Methods

Study area: Studies were conducted in Damaturu, the capital city of Yobe State, Nigeria. Damaturu is located in the north Eastern part of Nigeria with a latitude of 11’11’15^{o}N and longitude 30’05’^{o}S with a total population of 88,014 (National Population Commission, 2016)

Plant Materials: Pearl millet (*Pennisetum glaucum)* seeds were obtained be from Damaturu main market, fourty (40) seeds was planted on the on the different growing media at Yobe State University Biological Garden.

Sample collection: Three (3) different growing media samples was collected:

- Compost: Waste of vegetables, fruit scraps, leaves, or byproducts decomposed by the digestive activities of insects, fungi, and bacteria was collected with the Damaturu.
- Rice Hulls: Collected at rice milling companies in Damaturu.
- Composted bark/composted wood: collected in Damaturu timber sheed.

Sowing of seed: Pearl millet seeds were sown on the different growth media, and the controls were also sown in the department’s biological garden in a polythene bag. Fourty (40) polythene bags were used for the study. 10 bags each were used per growth medium for a total of 30 bags, and the other 10 bags (control) were filled with sandy soil obtained from the biological garden. Two seeds were sown in each polythene bag in a complete randomize design (CRD) layout.

Data Collection: Data were collected weekly based on germination percentage, plant height, number of leaves, no. of branches, and stem diameter.

Data Analysis: The Duncan Multiple Range Test (DMRT) was used to determine the level of significance among means at 5% using the statistical package for social sciences (SPSS) version 21.0.

Results

Table 1 First Week after sowing

Sample	Germination %	Plant height	No of leaves	Steam diameter
Waste Vegetable	100%	7.5Cm	4	1.6cm
Rice Hulls	100%	2cm	1	0.2cm
Composted Wood Bark	100%	4cm	2	0.9cm
Sand/Control	100%	4.2	3	0.5

Table 2 Second Week after sowing.

Sample	Plant height	No of leaves	Steam diameter
Waste Vegetable	10.5Cm	8	2cm
Rice Hulls	6cm	5	1.3cm
Composted Wood Bark	8cm	4	1.8cm
Sand/Control	7.2	6	1.5

Table 3 Third Week after sowing.

Sample	Plant height	No of leaves	Steam diameter
Waste Vegetable	22.8Cm	10	4cm
Rice Hulls	0cm	0	0cm
Composted Wood Bark	15cm	7	2.1cm
Sand/Control	10.2	4	1.3

Table 4 Fourth Week after sowing

Sample	Plant height	No of leaves	Steam diameter
Waste Vegetable	30.8Cm	15	5cm
Rice Hulls	0cm	0	0cm
Composted Wood Bark	17cm	10	2.6cm
Sand/Control	15.2	6	1.5cm

Discussion

From the results obtained from the seed sown in the biological garden in different media, In the first weeks of sowing, it shows that plants were 100% germinated from all the media and controls. The plant height in waste vegetables is 7.5 cm, which is the highest among all other media, followed by control/sand at 4. cm, and then composted wood bark at 4cm. Waste vegetables have the highest number of leaves, which is 4, followed by control with 3 leaves. Steam diameter in first-week waste vegetables is the highest at 1.6 cm, followed by composted wood bark at 0.9cm. This clearly shows that waste vegetables have a higher nutrient content than other growth media. This finding agrees with the results of Al-Seedi and Gatteh (2010), who said that waste vegetables have high plant-required nutrients for growth and germination. (Table 1)

In the 2nd week of the sowing, Table 2 reveals that waste vegetables have the highest plant heights at 10.5 cm, followed by composted bark at 8cm, sand/control at 7.2cm, and rice hulk has the lowest plant height at 6cm. In the 2nd week, still-waste vegetables have the highest number of leaves, which is 10, followed by sand/control with 8 leaves. The steam diameter in the 2nd week shows that waste vegetables have the highest in all the growth media and the control.

In the 3rd week of sowing, the results reveal that waste vegetables have high plant height, plant leaves, and steam diameter, followed by composted wood bark, then control/sand, but rice hulk was dead. Also, it was observed that waste vegetables have a higher nutrient content than other growth media. This finding agrees with the results of Al-Seedi and Gatteh (2010), who said that waste vegetables have high nutrients required for plant growth and germination. (Table 3)

In the 4th week of the sowing, the results reveal in Table 4 that waste vegetables have a high plant height of 30.3cm, 15 plant leaves, and a steam diameter of 5. cm. The rice hulk is dead in week 4. The composted wood bark has plant heights of 8 cm, a number of leaves of 4, and a steam diameter of 1.8 cm, and the control/sand has a plant height of 15.2cm, a number of leaves of 6, and a steam diameter of 1.5cm. Also, it was observed that waste vegetables have a higher nutrient content than other growth media. This finding agrees with the results of Al-Seedi and Gatteh (2010), who said that waste vegetables have high plant-required nutrients for growth and germination.

Conclusion

In conclusion, three different growth media, which include compost waste vegetable, rice hulk, and composted bark of wood, were used to investigate the effect of different growth media on the germination and seedling growth of pearl millet (*Pennisetum glaucum).* Findings from the research reveal that the germination rate and seedling growth performance of compost waste vegetables have the highest germination percentage, number of leaves, plant height, and stem diameter when compared with the two other media.

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Conflict of Interest

The authors declare no conflict of interest

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