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# EFFECTS OF INTRA – ROW SPACING ON THE GROWTH AND YIELD OF PEARL MILLET (*Pennisetum glaucum* L.) IN WARAWA AND GEZAWA SAVANNAH ZONE OF NIGERIA

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## ABSTRACT

Pearl millet (*Pennisetum glaucum* L.R.Br.): is locally known as gero in northern Nigeria and belongs to the family poaceae, genus *Pennisetum* and tribe paniceae. It is usually grown as a rain-fed crop in the dry tropics; it is an erect and tall cereal crop with determinate growth habit. It has a fibrous root system with strong lateral roots. It has the ability to withstand stress and thrive in hot region, with wide range of soil, which has made it quite popular in hot region and especially across many African countries. The aim of this research work was to determine the effect of intra- row spacing on Growth and yield of pearl Millet (*Pennisetum glaucum* L.R.Br.). The experiment was laid out in Randomized complete block design (RCBD) consist of twelve (12) treatments, which were replicated three (3) times, with a total of Thirty six (36) plots. The treatments comprised of three (3) intra-row spacing (25cm, 50cm and 75cm) The data collected was subjected to analysis of Variance (ANOVA) using the Genstat statistical package. Student new Man Kurl (SNK) was used to separate and compare the treatment means at 5% level of significance. Plant height, number of leaves, and leaf area, were observed as growth characters while number of stands, number of tillers, panicle length, panicle diameter, panicle weight, stover weight, 1000 seed weight and grain yield were observed as yield parameters had significant effect at *(P<0.05)*. Based on the results of this experiment intra row spacing of (75cm) would be beneficial to pearl millet farmers in the sudan savannah zone of Nigeria. Therefore, it could be concluded that maintenance of wider intra row spacing at (75cm) influences the maximum growth and yield of pearl millet as it observed from the plot with spacing of (25cm) that produced fewer tillers compared to the plots with wider intra row spacing of (75cm) which produced more tillers and healthy plants.

**Keywords**: Intra – Row Spacing, Growth, Yield, Pearl Millet

## INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.R.Br.): is locally known as gero in northern Nigeria and belongs to the plant family poaceae, genus *Pennisetum* and tribe paniceae (Bidinger and Hash, 2003). It is usually

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grown as a rain-fed crop in the dry tropics; it is an erect and tall cereal crop with determinate growth habit. It has a fibrous root system with strong lateral roots. Pearl millet is one of the most important cereals and a staple grain for over 150 million people in West Africa and India (FAOSTAT, 2019). It makes up about two-third of the total cereal production in Africa therefore regarded as one of the worlds essential cereal crops (millet, rice, maize and sorghum). It has the ability to withstand stress and thrive in hot region, with wide range of soil, which has made it quite popular in hot region and especially across many African countries. (Bhagavatula *et al*, 2013). African countries have accounted for about 55 percent of the global total pearl millet and also take up to 59 percent of the global total area under pearl millet cultivation. The global production of pearl millet has estimated to 26 million hectares spread over 40 countries that are mostly arid and semi-arid, where rain fall is not sufficient (200-600mm).

The Northern part of Nigeria provides an ideal agro-ecological condition for the production of pearl millet. For this reason it is predominantly produced and consumed within the region, which made staple for over 40 percent of the populace. (Jirgi *et al*, 2010). Pearl millet has become a valuable component of the people's livelihood, because no part of the plant is wasted. As a regional staple, the people have created diverse method and forms of processing it for consumption, such as thick paste (Locally called 'tuwo'), thick dough (Locally called 'fura'), dumpling, grits, porridge and gruel. Beyond food, it is used as animal feed while the stalks of some varieties are traditionally used as building materials and for fire wood. The importance of pearl millet extends beyond food; its production also serves as an important source of income to farmers. (Akinsuyi, 2011). Pearl millet is the fifth most important cereal crop globally and ranks fourth amongst important tropical cereals (Ismail, 2012). In recognition of the vital role the pearl millet plays in food security, the Nigerian government in 1975 established 'lake Chad-Research institute' (LCRI) mandated to facilitate research in millet production in the country. Although Pearl Millet plays important roles in food security and Nigeria economy, the yield recorded by the farmers in the country is still very low compare with the current increase in population, there is a need to take some measures to increase millet production to meet the demand of the rapid growing population. However, many farmers fail to understand the use of suitable plants spacing so as to optimize their yield. It was generally observed that Millet fail to grow better and produce good grains in plots without adequate nutrients, to achieve optimum grain production, appropriate fertilizer is essential. The aim of this research work was to determine the effect of intra- row spacing on Growth and yield of pearl Millet (*Pennisetum glaucum* L.R.Br.). (Miller, 2020).

## MATERIALS AND METHODS

### Experimental Site

Field trial were conducted in 2021 wet season in two locations; Warawa Local Government Area, latitudes( N $11^0$21'48.4" ) and longitudes (E $009^0$52' 35.3") with an Elevation of (413m) above sea level, the mean annual rainfall is (1021.22mm/an ), mean minimum annual temperature range of ($29^0$C ) and mean maximum annual temperature of ($42^0$C ) and Gabasawa Local Government Area of Kano State, latitudes (N $11^0$28' 16.4") and longitudes ( E $009^0$ 27' 33.2" ) with an Elevation of (442m) above sea level, the mean annual rainfall is (915.12mm/an ), mean minimum annual temperature range of ($26^0$C ) and mean maximum annual temperature of ($43^0$C ). Soil of the experimental site is well

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drained sandy loam as reported by Rajakumar, 2014).

**Experimental Design**

Field experiment was laid out in Randomized complete block design (RCBD) consist of twelve (12) treatments, which were replicated three (3) times, with a total of Thirty six (36) plots. The treatments comprised of three (3) intra-row spacing (25cm, 50cm and 75cm). The plot size was 3.0m x 3.75m (11.25 $m^2$). All the Plots were pegged and separated from each other by 0.5m and 1.0m between the replications respectively.

**Land Preparation**

The land was cleared, harrowed, followed by ridging. The ridges were later marked out in to plots, discard and pathway using measuring tape, ropes and pegs ( Diouf, 2009).

**Seed and Seed Protection**

The Millet seed was obtained from ICRISAT and treated with Imidacloprid 10% + Thiram 10% (Seed Care), before planting which is a very effective systemic insecticide and fungicide seed treatment on cereals ICRISAT, 2009.

**Sowing**

Millet variety (Super sosat) was used as a test crop. The Sowing was done manually, immediately after the rain was established, at a spacing of 25cm, 50cm and 75cm within rows and 75cm between the rows, 5-15 seeds were planted per hole. Each replication consists of 12 plots, each plot consists of 5 ridges and each ridge carried a number of stands depending on the intra-row spacing allocated to each particular plot (Umar, 2018).

**Weeding and Thinning**

Weeding was carried out at three and five weeks after sowing, over all the plots to clear the unwanted grasses while the Seedlings were thinned to three (3) plants per stand at two weeks after sowing (Bidinger and Hash, 2003).

**Harvesting**

The Plants were harvested on 27 and 29 August, for the two sides respectively, using Cutlass by cutting the plants at their base close to ground, tagged and allows drying in the sun for further observation and recording (Ausiku, 2020).

**Data Collection**

The data was collected on crop growth and yield parameters. Five millet plants were selected at random from three inner ridges of each plot, tagged, measured and then recorded. The Growth Parameters (Plant height, number of leaves per plant and leaf area) were observed at 2wks, 4wks, 6wks, and 8wks after sowing, while the yield ones (number of stands, number of productive tillers, panicle length, panicle diameter, Panicle weight, stover weight, 1000 seeds weight and grain yield) were observed at harvest as reported by (Chauhau, 2012).

**Plant Height (cm)**

The Plant Height was measured from the ground level to the tip of each of the five tagged Plants at 2, 4, 6, and 8 weeks after sowing, using a meter Rule. The mean value for each plot was computed and recorded in cm as the Plants height.

**Leaf Area (L.A) $cm^2$**

The Leave Area per Plant was determined at 2, 4, 6, and 8 weeks after sowing by measuring and multiplying the Length by Breath of the Leaves of each of the five tagged Plants, The mean value of the product was also be recorded.

It is given by:

L.A=L ***x*** B ***x C***

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Where; L is Length and B is the Breath of the leave and C is the coefficient of the crop (0.75) which is constant (Miller, 2020).

**Number of Stands per Plot**

The number of stands per plot was obtained by counting and recording manually.

**Stover Weight (ton/ha)**

The Stover weight of the five tagged plant of each plot was measured using a sensitive weighing balance after been dried and then converted to ton/ha.

**1000 Seeds Weight (g)**

The 1000 seed from the harvested tagged plants of each plot was counted manually, weighed using a sensitive weighing balance and then recorded in gram.

**Statistical Analysis of Data**

Statistical analysis was conducted with standard procedure, all the data collected were subjected to analysis of Variance (ANOVA) using the Genstat statistical package, as described by Snedecor and Cochran (1967). Finally, Student new Man Kurl (SNK) was used to separate and compare the treatment means at 5% level of significance.

## RESULTS AND DISCUSSION

**Plants Height**

The effect of Intra – row spacing on the Growth and yield of Pearl Millet is presented in Table 1: At Warawa location the intra row spacing do not have significant effect on plant height across the weeks, at 2 weeks and 4 weeks there were no significant difference between the three 3 spacing 25, 50 and 75cm, but at 6 weeks and 8weeks there were statistical differences with tallest plant at plots with 75cm spacing and shorter plants at closer spacing 25cm.The plant height increases with an increase in intra row spacing. There was significant effect at Gezawa location across the weeks with mean value (102.92cm) and (208.50cm) except at two 2 weeks after planting. At 6 and 8 weeks plant height increased with an increase in intra row spacing, while at 2 and 4weeks the effect was statistically similar. This variation observed could be attributed to different in environmental conditions where the trails were carried out. This may be supported by Aliyu *et. al.,*(2011), who reported that, the wider space (75cm), produced the tallest plant; it is also in conformity with Emechebe, (2006) who revealed that intra row spacing had significance influence on plant height in pearl millet.

**Table 1:** Effect of Intra – Row Spacing on Plant Height on Growth and Yield of Peal Millet (*Pennisetum glaucum* L.) at Warawa and Gezawa during the 2021 wet season

| **Treatments** | | **Warawa** | | | | | **Gezawa** | |
|---|---|---|---|---|---|---|---|---|
| Spacing cm | 2 WAS | 4 WAS | 6 WAS | 8 WAS | 2 WAS | 4 WAS | 6 WAS | 8 WAS |
| 25x 75 | 21.09a | 29.50a | 102.5a | 181.73a | 22.44a | 33.62b | 96.75b | 183.25b |
| 50 x 75 | 21.69a | 30.14a | 107.55a | 191.12a | 24.45a | 36.73a | 97.80b | 194.52b |
| 75 x 75 | 21.23a | 29.61a | 109.02a | 195.43a | 23.50a | 36.29a | 102,93a | 208.50a |
| SE+ | 0.31 | 0.34 | 3.42 | 7.00 | 1.01 | 1.68 | 3.31 | 12.65 |
| Sign Level | NS | NS | NS | NS | NS | * | * | * |

Means with the same letter in the same column of any set of treatments are not significantly different at P < 0.05% using SNK (Students Newman Keuls test) WAS = Weeks after Sowing NS = Not Significance * = Significance

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**Leaves Area**

The effect of Intra – row spacing on the Growth and yield of Pearl Millet is presented in Table 2: The intra row spacing has no significant effect on the leaf area throughout the weeks at Warawa, though, the result indicated that, the effect of the three (3) spacing (25, 50 and 75cm) were statistically similar at two (2) and four (4) weeks after planting, but at 6weeks and 8weeks, the smallest leaf area were observed at closer spacing (25cm) while (75cm) spacing recorded the largest leaf area. At Gezawa there was significant effect on leaf area throughout the weeks except at two (2) weeks after planting. At two (2) and four (4)weeks, the leaf area were statistically similar but at 6weeks and 8weeks there were significant differences among the three spacing. Similar trend with Warawa was observed, the smallest leaf area was observed at closer spacing (25cm) while (75cm) spacing recorded the largest leaf area. This is in agreement with results of a study conducted elsewhere which reported the largest leaf area of a rain fed pearl millet planted at 90cm than 50cm spacing (Kamal, *et. al.,* 2013).

**Table 2:** Effect of Intra – Row Spacing on Leave Area on Growth and Yield of Peal Millet (*Pennisetum glaucum* L.) at Warawa and Gezawa during the 2021 wet season

| **Treatments** | **Warawa** | | | | **Gezawa** | | | |
|---|---|---|---|---|---|---|---|---|
| Spacing cm | 2 WAS | 4 WAS | 6 WAS | 8 WAS | 2 WAS | 4 WAS | 6 WAS | 8 WAS |
| 25x 75 | 20.56a | 26.76a | 165.67a | 204.8a | 23.77a | 29.36b | 190.06b | 234.02b |
| 50 x 75 | 20.35a | 30.0a | 167.39a | 214.66a | 24.75a | 30.85b | 197.54b | 256.65ab |
| 75 x 75 | 21.01a | 28.98a | 187.47a | 227.05a | 24.60a | 33.63a | 228.45a | 273.81a |
| SE+ | 0.33 | 1.64 | 12.12 | 11.15 | 0.53 | 2.17 | 20.35 | 19.96 |
| Sign Level | NS | NS | NS | NS | NS | * | * | * |

Means with the same letter in the same column of any set of treatments are not significantly different at P < 0.05% using SNK (Students Newman Keuls test) WAS = Weeks after Sowing NS = Not Significance * = Significance

**Number of Stand**

The effect of Intra – row spacing on the Growth and yield of Pearl Millet is presented in Table 3: At both locations, the intra row spacing has significant effect on the number of stands, the three (3) Spacing (25, 50 and 75cm) gave statistically different mean values, the result have evidently shows that, the plot with closer spacing (25 x 75cm) have more number of stands than the plot with wider spacing (75 x 75). The wider plant spacing produced superior absolute number of stand compared to the narrower spacing, this is supported by the result of study conducted by Shinggu and Gain (2002) which reported that a narrow intra row spacing of 10cm produced stand count of millet plant than 20cm intra row spacing.

**Table 3:** Effect of Intra – Row Spacing on Number of Stand on Growth and Yield of Peal Millet (*Pennisetum glaucum* L.) at Warawa and Gezawa during the 2021 wet season

| **Treatments** | **Warawa** | **Gezawa** |
|---|---|---|
| Spacing cm | Number of Stand | |
| 25x 75 | 118.41a | 131.83a |
| 50 x 75 | 61.58b | 74.00b |
| 75 x 75 | 49.17c | 56.52c |
| SE+ | 36.92 | 39.52 |
| Sign Level | * | * |

Means with the same letter in the same column of any set of treatments are not significantly different at $p < 0.05\%$ using SNK (Students Newman Keuls test) WAS = Weeks after Sowing NS = Not Significance * = Significance

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**Stover Yield**

The effect of Intra – row spacing on the Growth and yield of Pearl Millet is presented in Table 4: Intra row spacing on Stover yield were significant across all locations. The closer spacing 25cm has recorded the highest mean value (11.97), followed by 50cm and 75cm which were statistically similar at both locations. The stover yield across all the locations which was statistically significant may be attributed to the climatic and soil requirement enjoyed by the plants in the areas where the trails were carried out. It could also be supported by the work of Egharerba *et., al.,*(2004), who report that, in cereals, spacing has little or no effect on stover yield ideal condition.

**Table 4:** Effect of Intra – Row Spacing on Stover Yield on Growth and Yield of Peal Millet (*Pennisetum glaucum* L.) at Warawa and Gezawa during the 2021 wet season

| Treatments | Warawa | Gezawa |
|---|---|---|
| Spacing cm | Stover Yield | |
| 25x 75 | 10.41a | 11.97a |
| 50 x 75 | 6.77b | 8.31b |
| 75 x 75 | 6.65b | 7.75a |
| SE+ | 2.13 | 2.28 |
| Sign Level | * | * |

Means with the same letter in the same column of any set of treatments are not significantly different at P < 0.05% using SNK (Students Newman Keuls test) WAS = Weeks after Sowing NS = Not Significance * = Significance

**1000 Seeds Weight**

The effect of Intra – row spacing on the Growth and yield of Pearl Millet is presented in Table 5: The effects of intra row spacing and on 100 seeds weight were significant across the locations. The wider spacing (75cm) produced the heavier 1000 grains while the closer spacing (25cm) gave out the lighter 1000 grains across the locations. This could be attributed to reduced competition enjoyed by the plants at wider spacing, this is in line with the finding of (Kumawat, 2017) who reported that intra row spacing has significant effect on 1000 seeds weight, thought, it is not in line with the finding of (Mkindi, 2016).

**Table 5:** Effect of Intra – Row Spacing on 1000 seeds weight on Growth and Yield of Peal Millet (*Pennisetum glaucum* L.) at Warawa and Gezawa during the 2021 wet season

| Treatments | Warawa | Gezawa |
|---|---|---|
| Spacing cm | 1000 seeds weight | |
| 25x 75 | 7.42b | 8.42c |
| 50 x 75 | 9.33a | 10.33b |
| 75 x 75 | 9.75a | 11.00a |
| SE+ | 1.24 | 1.34 |
| Sign Level | * | * |

Means with the same letter in the same column of any set of treatments are not significantly different at P < 0.05% using SNK (Students Newman Keuls test) WAS = Weeks after Sowing NS = Not Significance * = Significance

## CONCLUSION

Result of this experiment revealed that, maintenance of wider intra row spacing influences the maximum growth and yield of pearl millet as it observed from the plot with spacing of (25cm) that produced fewer tillers compared to the plots with wider spacing of (75cm) which produced more tillers and healthy plants. Therefore, based on the results of the experiment intra row spacing of (75cm) would be beneficial to pearl millet farmers in the sudan savannah zone of Nigeria.

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