International Journal of Research in Agronomy 2025; SP-8(2): 16-19

International Journal of Research in Agronomy

**E-ISSN:** 2618-0618
**P-ISSN:** 2618-060X

www.agronomyjournals.com
2025; SP-8(2): 16-19
Received: 13-11-2024
Accepted: 21-12-2024

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# Effect of land configurations and row spacing on growth and yield of finger millet (*Eleusine coracana* L.)

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**DOI:** https://doi.org/10.33545/2618060X.2025.v8.i2Sa.2512

## Abstract
A field experimentation was undertaken during 2023 at PGI Research farm, MPKV, Rahuri to study the Effect of land configurations and row spacing on growth and yield of finger millet (*Eleusine coracana* L.). The outcome of this research revealed that maximum growth and yield attributing characters were recorded with sowing crop on broad bed furrow with row spacing at 60 cm. Yield and economics of finger millet crop were recorded with sowing crop on broad bed furrow with 45 cm of row spacing.

**Keywords:** Land configurations, row spacing, economics, finger millet

## Introduction
Millets have been called nutri-cereals since they are rich in micronutrients like minerals and B-complex vitamins. Millet can also be used as a functional food and is rich in phytochemicals that promote health. Given that millets are a C4 crop, they are resistant to global warming. Millets are a good way to lower greenhouse gas emissions because they absorb carbon. The United Nations proclaimed 2023 to be the "International Year of Millets" in recognition of the importance of millets. This annual plant is a member of the Poaceae family, specifically the Chloridoideae subfamily, and is commonly farmed as a millet in the dry regions of Asia and Africa. India is the largest producer of various kinds of millets. Out of the total minor millets produced, finger millet (*Eleusine coracana* L Gaertn.) (ragi) accounts for about 85% of production in India (Negandhi, 2021) [6].

Finger millet is an annual herbaceous plant that is commonly cultivated in arid and semi-arid regions of Africa and Asia as a cereal crop. Being a tetraploid and self-fertile species, it most likely originated from *Eleusine africana*, a wild relative. It is a 50-120 cm tall, robust tufted annual plant with good tillering ability. The stem is erect or slightly kneed. The leaves are linear and distichous. The leaf sheaths are compressed, open, and glabrous, with more or less ciliate margins. The leaf sheath more or less envelops the entire stem and only small parts of the internodes are exposed. Internodes are not of equal length and are very short at the base. Finger millet can be grown at elevations higher than 2000 metres above sea level, it's ideal growth range is 18 to $27^{o}$c, although it can tolerate temperatures as high as 36 °C (Pollen viability up to 36 °C).Finger millet is a staple food for the working class and also an ideal food for people suffering from diabetes, cardiac and blood pressure issues, considering its higher dietary fibre one particularly healthy food that is recommended for people with diabetes is finger millet.

The way that land is configured, including features like flat beds, broad bed systems and ridges and furrows is essential for controlling rainfall runoff. By using furrows as drainage channels, these techniques enable precipitation to be swiftly removed from the fields. As a result, in comparison to flat beds, the root zone of the crop in ridge and furrow and broad bed and furrow systems obtains more moisture. The way that land is configured has a big influence on how crops grow and develop. Plant spacing plays an important role in the growth, development and yield of millet crops. Optimum plant density ensures plants grow properly through better utilisation of sunlight and soil nutrients.

## Materials and Methods

A field experiment was conducted at the Research farm, PGI, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar during the *kharif* season of 2023-24. The soil in the experimental field belongs to the Inceptisol order. Its texture is silty clay with a depth of more than 60 cm and the topography is uniform and levelled. For the assessment of initial soil fertility status, representative initial soil samples were taken. These soil samples were properly mixed, and a composite soil sample was created and evaluated for physical and chemical soil parameters. The soil is low in available nitrogen (186.8kg $ha^{-1}$), medium in available phosphorus (17.01 kg $ha^{-1}$) and very high in available potassium (390.12 kg $ha^{-1}$). In reaction, the soil in the experimental field was mildly alkaline (pH 8.4) with 0.57% organic carbon, soil electrical conductivity was 0.22 $dSm^{-1}$.

The experiment was laid out in split plot design with three replications and containing 3 Main plot treatments *viz*., $M_1$: flat bed, $M_2$: ridges and furrow, $M_3$: broad bed furrow and subplot treatments *viz*., S1: 30 cm, S2:45 cm, S3:60 cm. Finger millet variety Phule Kasari (KOPN 942) was used with recommended package of practices.

## Results

The growth and yield attributes are significantly influenced by land configurations and row spacing at harvest. Crop sown at broad bed furrow and 60 cm row spacing showed significantly more number of functional leaves (30.56), higher number of tillers (6.41), higher leaf area per plant (9.54 $dm^2$) and the highest dry matter accumulation (22.99 g $plant^{-1}$) at harvest and as far the yield attributes are concerned the parameters such as length of finger (8.6 cm), number of grains per finger (360.22), number of fingers per earhead (8.78) and weight of grains per earhead (11.12 g) were also significantly the highest in treatment comprised of sowing on broad bed furrow (mainplot factor) and 60 cm of row spacing (subplot factor).Significance of growth and yield parameters in broad bed furrow system creates a more favourable growing environment by improving soil conditions, moisture holding capacity, nutrient availability and reducing competition Similar results were reported by (Kumar *et al.* (2018) [4] and Nagarajan *et al.* (2018) [5].

Row spacing of 60 cm treatment performance was better as compared to other treatments, it might be due to improved light access, better air circulation, more efficient resource utilization and enhanced root development. Similar results were reported by (Prakasha *et al.* (2017) [8], and Reddy *et al.* (2021) [9]

**Table 1:** Growth attributes of finger millet as influenced by land configuration and row spacing

| Treatment | Plant height(cm) | Number of tillers $plant^{-1}$ | Number of functional leaves $plant^{-1}$ | Leaf area $plant^{-1}$ | Dry matter production $plant^{-1}$ |
|---|---|---|---|---|---|
| **A) Main plot: Land configuration** | | | | | |
| $M_1$ - Flat bed | 98.40 | 4.67 | 25.96 | 8.44 | 17.79 |
| $M_2$ - Ridges and furrow | 97.73 | 5.13 | 27.56 | 8.67 | 18.46 |
| $M_3$ - Broad bed furrow | 107.22 | 6.41 | 30.56 | 9.54 | 22.99 |
| SE (m) ± | 1.26 | 0.08 | 0.69 | 0.21 | 0.49 |
| CD at 5% | 4.97 | 0.30 | 2.69 | 0.82 | 1.94 |
| **B) Sub plot: Row spacing** | | | | | |
| $S_1$-30 cm | 107.07 | 4.57 | 25.40 | 7.93 | 18.16 |
| $S_2$-45 cm | 100.51 | 5.52 | 28.33 | 9.09 | 19.93 |
| $S_3$-60 cm | 95.78 | 6.12 | 30.33 | 9.73 | 21.14 |
| SE (m) ± | 2.72 | 0.20 | 0.95 | 0.26 | 0.54 |
| CD at 5% | 8.39 | 0.62 | 2.94 | 0.80 | 1.65 |
| **C) Interaction (M x S)** | | | | | |
| Between two subplots means at same level of main plot mean | | | | | |
| SE (m) ± | 4.72 | 0.35 | 1.65 | 0.45 | 0.93 |
| CD at 5% | NS | NS | NS | NS | 2.86 |
| Between two main plots means at same level of sub plot mean | | | | | |
| SE (m) ± | 4.05 | 0.29 | 1.51 | 0.42 | 0.90 |
| CD at 5% | NS | NS | NS | NS | 3.02 |
| CV % | 8.08 | 11.13 | 10.20 | 8.72 | 8.14 |
| **General mean** | 101.12 | 5.40 | 28.02 | 8.92 | 19.75 |

**Table 2:** Yield attributes of finger millet as influenced by land configuration and row spacing.

| Treatment | Number of fingers $earhead^{-1}$ | Number of grains $finger^1$ | 1000 grain weight(g) | Length of finger (cm) | Weight of grains $earhead^{-1}$(g) |
|---|---|---|---|---|---|
| **A) Main plot: Land configuration** | | | | | |
| M1 - Flat bed | 7.11 | 253.22 | 3.97 | 7.29 | 8.29 |
| M2 - Ridges and furrow | 8.11 | 315.89 | 3.98 | 7.66 | 9.87 |
| M3 - Broad bed furrow | 8.78 | 360.22 | 4.04 | 8.60 | 11.12 |
| SE (m) ± | 0.25 | 4.90 | 0.15 | 0.19 | 0.27 |
| CD at 5% | 0.98 | 19.26 | NS | 0.73 | 1.04 |
| **B) Sub plot: Row spacing** | | | | | |
| S1-30 cm | 7.28 | 268.89 | 3.87 | 6.96 | 8.61 |
| S2-45 cm | 8.01 | 311.22 | 4.05 | 8.02 | 9.72 |
| S3-60 cm | 8.71 | 349.22 | 4.07 | 8.57 | 10.94 |
| SE (m) ± | 0.21 | 9.14 | 0.15 | 0.19 | 0.26 |
| CD at 5% | 0.66 | 28.15 | NS | 0.60 | 0.80 |
| **C) Interaction (M x S)** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Between two subplots means at same level of main plot mean | | | | | |
| SE (m) ± | 0.37 | 15.82 | 0.26 | 0.33 | 0.45 |
| CD at 5% | 1.15 | 48.76 | NS | NS | 1.39 |
| Between two main plots means at same level of sub plot mean | | | | | |
| SE (m) ± | 0.39 | 13.82 | 0.26 | 0.33 | 0.45 |
| CD at 5% | 1.34 | 44.05 | NS | NS | 1.53 |
| CV % | 8.05 | 8.85 | 11.18 | 7.38 | 8.00 |
| **General mean** | 8.00 | 309.78 | 4.00 | 7.85 | 9.76 |

The grain yield and stover yield of finger millet were significantly influenced by the different treatments. Amongst the various treatments tested, significantly the highest grain yield (2285 kg ha$^{-1}$) and stover yield (4122 kg ha$^{-1}$) was obtained in broad bed furrow. This might be because all the growth and yield attributes were highest in this treatment Similar results were reported by (Krishnaprabhu (2015) [3], Kanwar (2015) [2], Babu (2016) [1] and Sanjivkumar (2022) [10].

Concerning row spacing of 45 cm recorded higher seed yield (2457 kg ha$^{-1}$) and stover yield (4502 kg ha$^{-1}$). This might due to the optimum plant population were present in the 45 cm of row spacing than that of 30 cm and 60 cm of row spacing. Optimum planting pattern is that the necessity for proper utilization of growth resources and ultimately to use the productivity of any crop Similar results were reported by (Prakasha (2017) [8], Prakash (2018) [7] and Reddy (2021) [9].

**Table 3:** Grain yield and stover yield of finger millet as influenced different treatments.

| Treatment | Grain yield (kg ha$^{-1}$) | Stover yield (kg ha$^{-1}$) |
|---|---|---|
| **A) Main plot: Land configuration** | | |
| $M_1$ - Flat bed | 2016 | 3942 |
| $M_2$ - Ridges and furrow | 2175 | 4056 |
| $M_3$ - Broad bed furrow | 2285 | 4122 |
| SE (m) ± | 19 | 20 |
| CD at 5% | 76 | 80 |
| **B) Sub plot: Row spacing** | | |
| $S_1$-30 cm | 2040 | 3941 |
| $S_2$-45 cm | 2457 | 4502 |
| $S_3$-60 cm | 1979 | 3678 |
| SE (m) ± | 39 | 68 |
| CD at 5% | 120 | 210 |
| **C) Interaction (M x S)** | | |
| Between two subplots means at same level of main plot mean | | |
| SE (m) ± | 68 | 118 |
| CD at 5% | 208 | 363 |
| Between two main plots means at same level of sub plot mean | | |
| SE (m) ± | 59 | 98 |
| CD at 5% | 186 | 307 |
| CV % | 7.93 | 8.48 |
| General mean | 2159 | 4040 |

Grain yield was significantly influenced by the interaction between land configuration and row spacing. The data on interaction effect of land configuration and row spacing are presented in Table 4. The finger millet sown on broad bed furrow at 45 cm row spacing produced significantly higher grain yield (2897 kg ha$^{-1}$) than rest of treatment combinations of land configuration and row spacing.

**Table 4:** Grain yield of finger millet (kg ha$^{-1}$) as influenced by interaction between land configuration and row spacing.

| Land configuration Row spacing | Flat bed | Ridges and furrow | Broad bed furrow | Mean |
|---|---|---|---|---|
| 30 cm | 2035 | 2181 | 1903 | 2040 |
| 45cm | 2164 | 2309 | 2897 | 2457 |
| 60cm | 1850 | 2034 | 2054 | 1979 |
| Mean | 2016 | 2175 | 2285 | 2159 |
| Source | | | SE (m) ± | CD at 5% |
| Between two subplots means at same level of main plot mean | | | 68 | 208 |
| Between two main plots means at same level of sub plot mean | | | 59 | 186 |

**Table 5:** Stover yield of finger millet (kg ha$^{-1}$) as influenced by interaction between land configuration and row spacing.

| Land configuration Row spacing | Flat bed | Ridges and furrow | Broad bed furrow | Mean |
|---|---|---|---|---|
| 30 cm | 4034 | 4104 | 3686 | 3941 |
| 45cm | 4270 | 4379 | 4856 | 4502 |
| 60cm | 3422 | 3786 | 3826 | 3678 |
| Mean | 3942 | 4056 | 4122 | 4040 |
| Source | | | SE (m) ± | CD at 5% |
| Between two subplots means at same level of main plot mean | | | 118 | 363 |

| | | |
|---|---|---|
| Between two main plots means at same level of sub plot mean | 98 | 307 |

Stover yield was significantly influenced by the interaction between land configuration and row spacings. The data on interaction effect of land configuration and row spacing are presented in table 5. The stover yield (4856 kg $ha^{-1}$) was obtained significantly higher when crop was sown on broad bed furrow at 45 cm row spacing.

## Conclusion

Based on one season experimentation, it can be concluded that direct sowing of finger millet on broad bed furrow at 45 cm row spacing is suggestive for higher grain (2897 kg $ha^{-1}$) and stover yield (4856 kg $ha^{-1}$) with higher monetary returns.

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