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YIELD AND ECONOMICS OF FOXTAIL MILLET (*SETARIA ITALICA* L.) AS INFLUENCED BY DIFFERENT FERTILIZER LEVELS AND ROW SPACINGS

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ABSTRACT

A field experiment was carried out during *kharif*, 2023 at Experimental Farm, Department of Agronomy, College of Agriculture, Latur on clayey soil to find out the effect of fertilizer levels and row spacings on yield and economics of foxtail millet. The experiment was laid out in Factorial Randomized Block Design with two factors and replicated thrice. First factor consists of three fertilizer levels *viz.*, F_1 - 75 % RDF, F_2 -100 % RDF and F_3 -125 % RDF, second factor consists of three-row spacing *viz.*, S_1 -22.5 cm × 10 cm, S_2 - 30 cm × 10 cm and S_3 - 45 cm × 10 cm. The results revealed that application of 125 % RDF (F_3) recorded significantly higher number of panicles plant^{-1} (4.09), panicle length (21.40 cm), weight of panicle plant^{-1} (19.51 g), number of grains panicle^{-1} (2710), grain yield (2833 kg ha^{-1}), test weight (4.23 g), gross monetary returns (153008) and net monetary returns (99840) which was comparable with 100 % RDF (F_2) and found significantly superior over 75 % RDF (F_1). Among row spacings, wider row spacing of 45 cm × 10 cm (S_3) recorded significantly higher number of panicles plant^{-1} (3.90), panicle length plant^{-1} (20.88 cm), weight of panicle plant $^{-1}$, number of grains panicle^{-1} (2690) and test weight (4.21 g) closely followed by 30 cm x 10 cm. Grain yield (2829 kg ha^{-1}), gross monetary returns (152775 ha^{-1}) and net monetary returns (100848 ha^{-1}) were highest with closer row spacing of 22.5 cm x10 cm (S_1) which was comparable with 30 cm × 10 cm (S_2) and significantly superior over 45 cm × 10 cm (S_3).
***Keywords* :** Foxtail millet, RDF, Fertilizer levels, Row spacings

Introduction

Millets are the group of small grained annual cereal crops belonging to family Poaceae. Foxtail millet is one among the six millets and is called by different names such as Navani, Kangni, Tenai, Korra and Rala in many regional names in different parts of the country. It is one of the millets that can withstand droughts fairly well. It can be planted as a short-term catch crop because of its rapid growth. Its grain is fed to poultry and caged birds as well as used for human consumption. Foxtail millet's low seed output is typically linked to genetic, physiological, agronomic and seed production issues. In addition to them, the potentiality of the cultivars, the optimum plant density and nutrient management are key factors in determining the maximum yield of foxtail millet. Foxtail millet ranks second in the world's total millet production. It is an elite drought-tolerant crop due to its high water use efficiency and short life cycle (Zhang *et al.*, 2012). Millets are nutritionally superior to other major cereals as they are rich in dietary fibers, resistant starches, vitamins, essential amino acids, storage proteins and other bioactive compounds (Amadou *et al.*, 2013).

Foxtail millet (*Setaria italica* L.) is an important minor millet having good nutritive value. It is a neglected hardy crop, usually grown in poor fertility soil and moisture limiting condition, gown by small and marginal farmers. It is the greatest crop to cultivate to meet world's nutritional needs because it is a short-term drought-tolerant crop that can be grown on marginal terrain. It is also grown in China, Russia, Japan, the USA and other African and East Asian nations, in addition to India. In India, Andhra Pradesh

(4,79,000 ha), Karnataka (2,32,000 ha) and Tamil Nadu (20,000 ha) are the major foxtail millet growing states contributing about 90 per cent of total area under cultivation. Andhra Pradesh is a major foxtail millet growing state contributing about 79 per cent of the total area (Yadav and Singh, 2023).

The yield potential of foxtail millet is very low because of inadequate application of fertilizers, conventional cultivation of low yielding cultivars and lack of good management practices. The common belief that foxtail millet may not respond profitably to applied nutrients does not hold good under suitable management practices. Application of fertilizers has become essential for high yielding varieties of foxtail millet to realize their maximum yield potential. The lower crop productivity is mainly due to poor crop management practices such as inadequate planting density and nutrition, high weed infestation, incidence of disease and insect pests. Intra and inter row spacing is one of the important components of systematic cultivation and manipulation, that could enhance productivity of this important crop. With the proper spacing, plant can harvest sufficient sunlight, water and nutrition from soil, which can influence healthy yield and gross returns. Therefore, there is a need to understand the relationship between plant density and yield so as to identify the optimum population. In the view of above facts, the present research was conducted to find out the effect of fertilizer levels and row spacings on yield and economics of foxtail millet.

Materials and Methods

An experiment was conducted to determine the response of foxtail millet (*Setaria italica* L.) to row spacings and fertilizer levels during *kharif* season of 2023-2024 at Experimental Farm, College of Agriculture, Latur. Geographically Latur district of Maharashtra state is located at 18^o 05' to 18^o 75' North latitude and 77^o 25' to 77^o 36' East latitude with the total geographical area is 7.37 million ha. Latur area comes under semi-arid region of Maharashtra. The average annual rainfall of the Latur district is 689.72 mm. The soil of experimental field was medium and black in colour with good drainage, low in available nitrogen (230 kg ha^{-1}), medium in available phosphorous (16.5 kg ha^{-1}) and very high in available potassium (432 kg ha^{-1}). The soil was moderately alkaline in reaction having p^H 7.02. The experiment was laid out in Factorial Randomized Block Design with two factors and replicated thrice. First factor consists of three fertilizer levels *viz*., F_1 - 75 % RDF, F_2 -100 % RDF and F_3 -125 % RDF, second factor consists of three-row spacing *viz*., S_1 -22.5 cm × 10 cm, S_2 - 30 cm × 10 cm and S_3 - 45 cm × 10 cm. The experimental gross plot size was 5.4 x 4.5 m^2 and net plot size was as per treatments. Sowing was done on 8th July 2023. The recommended cultural practices and plant protection measures were undertaken. The statistical technique for the analysis of variance was employed to analyze the recorded data (Panse and Sukhatme, 1967).

Methodology

Number of panicles plant^{-1}

The number of panicles per plant was recorded by counting panicles of five observation plants at the time of harvesting and then average was worked out.

Length of panicle plant^{-1} (cm)

The number of panicles emerging directly from main stem was counted. The number of panicles plant^{-1} from the five observational plants were counted at 30 days interval from 60 DAS till harvest.

Weight of the panicle plant^{-1} (g)

The weight of harvested panicles from the five observation plants were weighed individually and data was recorded.

Number of grains panicle^{-1}

Number of grains panicle^{-1} from the five representative plant panicles were counted individually and data was recorded.

Test weight (g)

One thousand representative seeds counted from the produce of net plot and their weight was recorded in grams.

Grain yield (kg ha^{-1})

After harvesting, the plants from each net plot were threshed and seeds were cleaned by winnowing. The cleaned seeds obtained from each net plot were weighed in kg which was then converted into grain yield (kg ha^{-1}) by multiplying with hectare factor.

Gross monetary returns (ha^{-1})

The gross monetary returns (ha^{-1}) occurred due to different treatments in the present study were worked out by considering market prices of economic product, by product and crop residues during the experimental year.

Net monetary returns (ha^{-1})

The net monetary returns (ha^{-1}) of each treatment were worked out by deducting the cost of cultivation (ha^{-1}) of each treatment from the gross monetary returns (ha^{-1}) gained from the respective treatments.

Benefit: Cost ratio (B:C)

The benefit: cost ratio of each treatment was calculated by dividing the gross monetary returns with the mean cost of cultivation.

Results and Discussion

Yield attributes

Yield attributing characters of foxtail millet *viz*., number of panicles plant^{-1}, panicle length (cm), weight of panicles plant^{-1}, number of grains panicle^{-1} and test weight (g) of foxtail millet were affected significantly (Table 1) due to difference fertilizer level of and row spacings.

Effect of fertilizer levels

Higher number of panicles plant^{-1} (4.09), panicle length (21.40 cm), weight of panicles plant^{-1} (19.51 g), number of grains panicle^{-1} (2710) and test weight (4.23 g) of foxtail millet were recorded with application of 125 % RDF ha $^{-1}$ which was at par with 100 % RDF and found significantly superior over application of 75 % RDF. It might be due to application of major nutrients as per crop needs, which enhanced crop growth and photosynthetic efficiency resulting in higher values of yield attributing characters of the crop. Similar results were reported by Kadrekar and Bhosale (1981), Purshottam *et al.* (1994), Umesh (2006), Ahiwale (2011), Divyashree *et al.* (2018), Mane *et al.* (2019) and Sunil *et al.* (2023).

Effect of row spacings

Higher number of panicles plant^{-1} (3.90), panicle length (20.88 cm), weight of panicle plant^{-1} (17.367 g) number of grains panicle^{-1} (2690) and test weight (4.21 g) of foxtail millet were recorded with the wider row spacing of 45 cm × 10 cm which was comparable with 30 cm × 10 cm and found significantly superior over closer row spacing under wider row spacing of 22.5 cm × 10 cm. It might be due to more space available for crop under wider row spacing thereby more availability of nutrients, moisture and sunlight compared to closer row spacing, which enhanced the growth and yield attributing characters of the plant. Similar finding was reported by Kadam (2017) and Jawarhar *et al.* (2018) and Pavankumar *et al.* (2021)

Yield

Data in Table – 2 and figure - 1 revealed that yield of foxtail millet was affected significantly due to difference fertilizer level of and row spacings.

Effect of fertilizer levels

The application of 125 % RDF ha $^{-1}$ recorded higher grain yield (2833 kg ha^{-1}) of foxtail millet which was at par with 100 % RDF and found significantly superior over application of 75 % RDF. It might be due to optimum utilization of the nutrients as per crop need which helped to develop better source sink relationship, resulted in higher yield attributes and yield. Similar results were reported by Kadrekar and Bhosale (1981), Purshottam *et al.* (1994), Umesh (2006), Ahiwale (2011), Divyashree *et al.* (2018), Mane *et al.* (2019) and Sunil *et al.* (2023).

Effect of row spacings

Among the different row spacings, the closer row spacing of 22.5 cm × 10 cm recorded higher grain yield (2829 kg ha^{-1}) of foxtail millet, comparable with 30 cm × 10 cm and found significantly superior over 45 cm x 10 cm. It might be due to higher plant population per unit area with closer row spacing. Similar findings were reported by Jawahar *et al.* (2018), Govinakoppa *et al.* (2021) and Lokesh *et al.* (2023).

Interaction effect

The effect of interaction between fertilizer levels and row spacings on yield attributes of foxtail millet were found to be non – significant.

Economics

The gross monetary returns (ha^{-1}), net monetary returns (ha^{-1}) and B:C ratio of foxtail millet were affected significantly due to difference fertilizer level of and row spacings shown in (Table 2) and figure -2.

Effect of fertilizer levels

The application of 125% RDF (F_3) recorded significantly the highest gross monetary returns (1,53,008 ha^{-1}) and net monetary returns (99,840 ha^{-1}) of foxtail millet which was at par with 100% RDF (F_2) and found significantly superior over 75 % RDF. Highest B:C ratio (2.89) was observed with the application of 125% RDF (F_3), followed by 100% RDF (F_2). This might be due to good market price and increased grain yield. Similar findings were found by Ahiwale (2011), Patil *et al.* (2023) and Sunil *et al.* (2023).

Effect of row spacings

The closer row spacing of 22.5 cm × 10 cm recorded significantly the highest gross monetary returns (1,52,775 ha^{-1}) and net monetary returns (100848 ha^{-1}) of foxtail millet which was at par with 30 cm × 10 cm and found significantly superior over 45 cm x 10 cm. Highest B:C ratio was observed with row spacing of 22.5 cm × 10 cm, followed by 30 cm × 10 cm. This was mainly due to production of higher grain yield. Similar findings were recorded by Govinakoppa *et al.* (2021).

Interaction effect

The effect of interaction between fertilizer levels and row spacings on economics of foxtail millet were found to be non – significant.

Conclusion

The application of 125 % RDF proved to be effective for getting higher yield attributes, yield and economics followed by 100 % RDF. Among row spacings, 22.5 cm × 10 cm was found to be more remunerative for getting higher yield and economics, followed by 30 cm × 10 cm.

Table 1: Number of panicles plant^{-1}, panicle length (cm), weight of panicle plant^{-1} (g), number of grains panicle^{-1} and test weight (g) of foxtail millet as influenced by fertilizer levels and row spacings.

Treatments	No. of panicles plant^{-1}	Panicle length (cm)	Wt. of panicle plant^{-1} (g)	No. of grains panicle^{-1}	Test wt. (g)
Fertilizer levels (F)					
F_1: 75 % RDF	3.28	18.36	13.10	2326	3.62
F_2: 100 % RDF	3.82	20.16	18.52	2581	4.09
F_3: 125 % RDF	4.09	21.40	19.51	2710	4.23
S. E m ±	0.09	0.51	0.53	65.20	0.11
CD at 5%	0.28	1.54	1.58	195.45	0.33
Row spacings (S)					
S_1: 22.5 cm × 10 cm	3.42	18.78	15.88	2386	3.79
S_2: 30 cm × 10 cm	3.87	20.26	17.58	2541	3.94
S_3: 45 cm × 10 cm	3.90	20.88	17.67	2690	4.21
S. E m ±	0.09	0.51	0.53	65.20	0.11
CD at 5%	0.28	1.54	1.58	195.45	0.33
Interaction (F x S)					
S. E m ±	0.17	0.89	0.91	112.93	0.19
CD at 5%	NS	NS	NS	NS	NS

Table 2: Grain yield (kg ha^{-1}), gross monetary returns (ha^{-1}), net monetary returns (ha^{-1}) and B:C ratio of foxtail millet as influenced by fertilizer levels and row spacings.

Treatments	Grain yield (kg ha^{-1})	Gross monetary returns	Net monetary returns	B:C ratio
Fertilizer levels (F)				
F_1: 75 % RDF	2433	131369	81823	2.64
F_2: 100 % RDF	2727	147257	95616	2.85
F_3: 125 % RDF	2833	153008	99840	2.89
S. E m ±	70	3787	3787	-
CD at 5%	210	11351	11351	-
Row spacings (S)				
S_1: 22.5 cm × 10 cm	2829	152775	100848	2.93
S_2: 30 cm × 10 cm	2703	145943	93965	2.82
S_3: 45 cm × 10 cm	2461	132916	82465	2.62
S. E m ±	70	3787	3787	-
CD at 5%	210	11351	11351	-
Interaction (F x S)				
S. E m ±	122	65586	65586	-
CD at 5%	NS	NS	NS	-

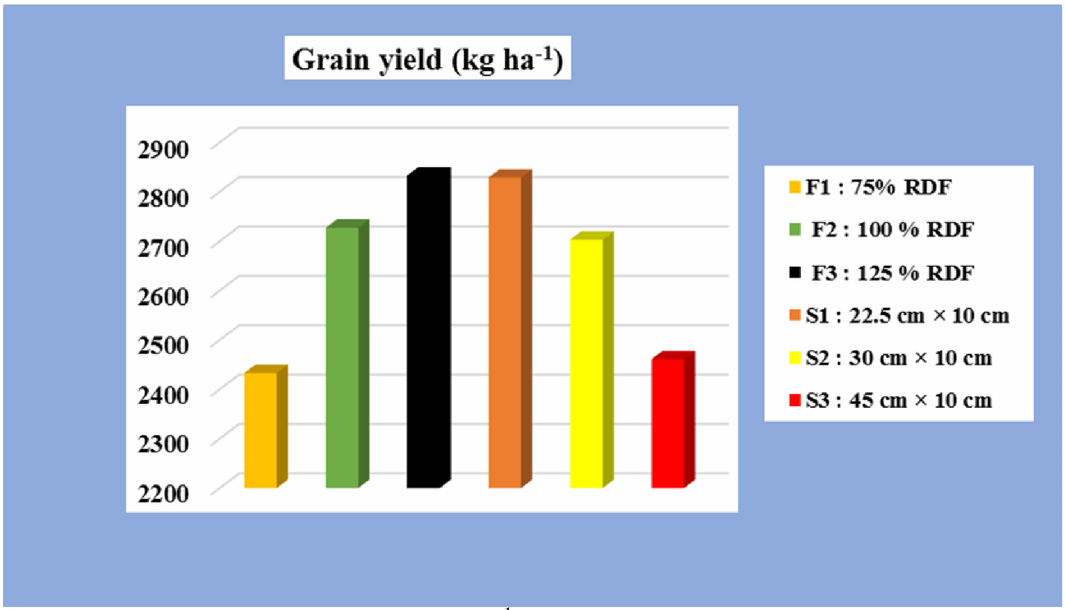

Fig. 1: Grain yield (kg ha $^{-1}$) of foxtail millet as influenced by fertilizer levels and row spacings

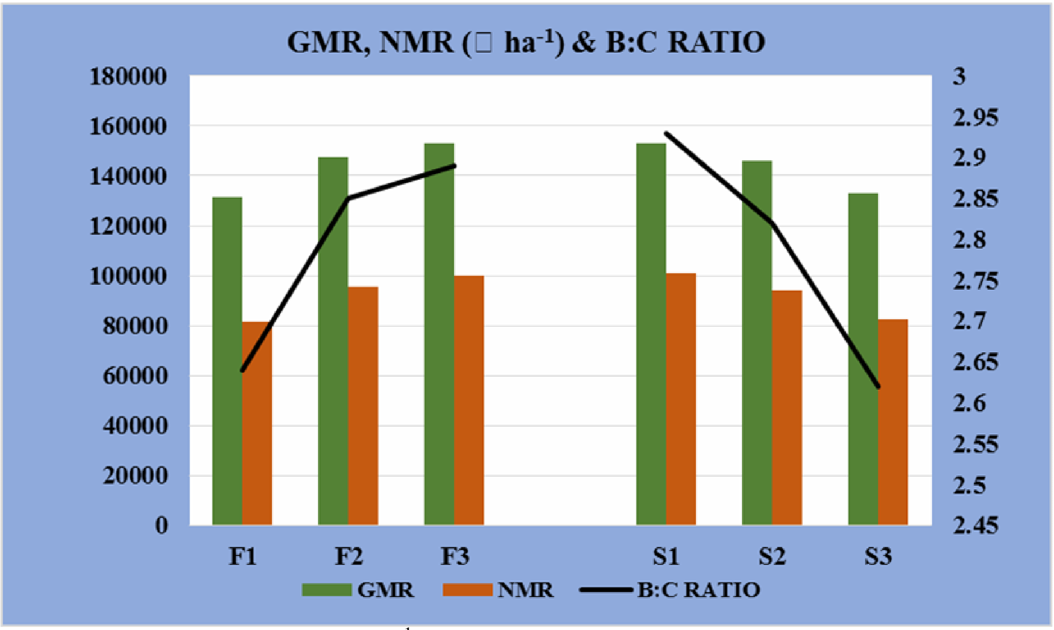

Fig. 2: GMR, NMR (ha $^{-1}$) and B:C ratio of foxtail millet as influenced by fertilizer levels and row spacings

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References

Ahiwale, P. H., Chavan, L.S., Jagtap, D.N., Mahadhar, U.V., and Gawade, M. B. (2011). Effect of establishment methods and nutrient management on yield attributes and yield of finger millet (*Eleusine coracana* G.). *Crop Research*. **45**(1-3), 6 – 12.

Amadou I, Gounga ME, Le GW. (2013). Millets: nutritional composition, some health benefits and processing - a review. *Emirates Journal of Food and Agriculture*. 25, 501–508.

Divyashree, U., Kumar, M.D., Sridhara, S., and Naik, T.B. (2018). Effect of different levels of fertilizers on growth and yield of little millet (*Panicum sumatrense* Roth ex Roem and Schult). *International Journal of Farm Sciences*. **8**(2), 104-108.

Govinakoppa, N., Kamatar, D., Anil Kumar, H. and Sudha, T. (2021). Impact of fertilizer, spacing and genotypes on yield, income and related traits in little millet. *The Pharma Innovation Journal*. **81**(1), 1256-1260.

Jawahar, S., Suseendran, K., Kalaiyarasan, C., Ramesh, S., and Elankavi, S. (2018). Optimization of age of seedlings and spacing to enhance the productivity and profitability of kodo millet under transplanted condition grown in Annamalai University Experimental Farm, Annamalai Nagar, Tamil Nadu. *Journal of Emerging Technologies and Innovative Research (JETIR)*. **5** (9), 930 – 936.

Kadam, C.V. (2017). Response of finger millet to different planting geometry and fertilizers levels (Doctoral dissertation), MPKV, Rahuri. Retrieved from - https://krishikosh.egranth.ac.in/handle/1/5810194701. Accessed on July 20, 2023.

Kadrekar, S.B. and Bhosale, R.J. (1981). Nitrogen and phosphorus response of finger millet under rainfed conditions. *Indian Journal of Agronomy*. **26**(1), 103- 104.

Lokesh, T., Choudhary, A.A. and Mairan, N.R. (2023). Effect of different sowing windows and line spacings on yield and economics of foxtail millet during *rabi* season. *The Pharma Innovation Journal*. **12**(2), 1121-1123.

Mane M.J., Mahadhar, U.V., Jagtap, D.N., Sagavekar, V.V., and Dhekale, J.S. (2019). Effect of land situations, various planting geometry and levels of fertilizer on yield attributes, yield and quality of finger millet (*Eleusine coracana* (L) Gaertn) grown under lateritic soil of Konkan region. *International Journal of Chemical Studies*. **7**(6), 636 – 646.

Panse V. G. and Sukhatme P. V. (1967). Statistical method for Agricultural Workers. ICAR, New Delhi. pp. 376.

Patil P. D., Karanjikar P. N., Deshmukh S.B., Sawadadkar M.R. and Kale, O.R. (2023). Effect of fertilizer levels on growth and yield of fodder sorghum (*Sorghum bicolor* L.) varieties. *The Pharma Innovation Journal*. **12**(12), 2444 – 2446.

Pavankumar, N., Hemalatha, S., Subramanyam, D., Kumar, A.N. and Sagar, G.K. (2021). Effect of plant geometry and nitrogen levels on growth and yield of brown top millet (*Brachiaria ramosa* L.) under Southern Agro-climatic zone of Andhra Pradesh. *The Pharma Innovation Journal*. **10**(12), 207-211.

Purushottam, S., Hosmani, M.M. and Sharma, K.M.S. (1994). Response of finger millet to fertilizer application under rainfed conditions. *Karnataka Journal of Agricultural Science*. **7**(1), 72- 73.

Sunil, C.M., Sahana, S.R., Raveendra, H.R. and Bhagyalakshmi, T. (2023). Response of finger millet (*Eleusine coracana* (L.) Gaertn) varieties to different fertilizer levels under Cauvery command area of Karnataka (Zone – 6). *The Pharma Innovation Journal*. **12**(10), 1174 – 1177.

Umesh, M.R. and Kiran Kumar, K.C. 2006). Effect of integrated nutrient management on growth, yield and nutrient removal by finger millet (*Eleusine corocana* G.). *Journal of Soil and Crops*. **16**(1), 130- 134.

Yadav, B. B., and Singh, R. (2023). Effect of spacing and potassium levels on yield and economics of foxtail millet (*Setaria italica* L.). *International Journal of Environmental and Climate Change*. **13**(3), 41-46.

Zhang G, Liu X, Quan Z. (2012). Genome sequence of foxtail millet (*Setaria italica*) provides insights into grass evolution and biofuel potential. *Nature Biotechnology*, **30**, 549-554.