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Response of growth and yield performance of foxtail millet varieties under central dry zone of Karnataka

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Abstract

An On Farm test (OFT) was conducted at farmers field by ICAR-Krishi Vigyan Kendra, Konehalli, UAS Bangalore during the *Kharif* season of 2024 focused on the "Effect of foxtail millet cultivars on growth and yield attributes at Central Dry Zone of Karnataka". The study employed a Randomized Complete Block design with four treatments involving four different foxtail millet genotypes Local variety –HaaluNavane, GPUF-3, HN-46 and SiA 3159. The soil is red sandy loam with saline pH (8.05), low organic carbon (0.41%), low nitrogen (234 kg/ha), medium phosphorus (23.80 kg/ha), and medium potassium (211 kg/ha) levels, received 2 tonnes of vermi compost ten days before sowing and RDF 40:40:20 NPK kg ha⁻¹ at sowing. The investigation monitored various growth parameters, including plant height, number of tillers per plant, number of functional leaves per plant, number of panicles per plant, panicle weight, test weight yield and economics of foxtail millet. The foxtail millet variety SiA 3159 exhibited superior performance in growth and yield attributes and economics compared to other varieties. The findings highlight the significance of considering foxtail millet varieties to optimize production in the given agro-climatic conditions of Koragere village, Chikkanayakanahalli Taluk of Tumkur District.

Keywords: Foxtail millet, genotypes, growth, yield, protein content and harvest index

Introduction

Millets are a group of highly variable small seeded grass, widely grown around the world as a cereal or grain crops for human food and animal fodder. In recent years, there has been an increasing recognition of the importance of millets as a substitute for major cereal crops. Millets have the potentiality of contributing to increased food production both in developing and developed countries. Millets are known for their climate-resilient features including adaptation to a wide range of ecological conditions, less irrigational requirements, better growth and productivity in low nutrient input conditions, less reliance on synthetic fertilizers, and minimum vulnerability to environmental stresses (Kole *et al.*, 2015) ^[5]. Also, millets are nutritionally superior to other major cereals as they are rich in dietary fibers, resistant starches, vitamins, essential amino acids, storage proteins. In India, it is mainly grown in Andhra Pradesh, Karnataka, Telangana, Rajasthan, Maharashtra, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, and in a small extent in the northeast states of India. Recent national initiatives (e.g. International year of millets 2023) have renewed interest in small millets for climate-resilient nutrition-sensitive farming. In India, foxtail millet is cultivated on 0.87 lakh hectares, producing approximately 0.66 lakh tones with an average yield of 762 kg/ha (*India stats.*, 2024). Andhra Pradesh, Karnataka, and Tamil Nadu account for 90% of foxtail millet cultivation, with Karnataka alone contributing 76% of the area. Among millets, foxtail millet (*Setaria italica* L.) and its wild progenitor, green foxtail (*Setaria viridis* L.) are extensively studied since they are considered as models for studying the traits related to C4 photosynthesis, stress biology, and bioenergy characteristics as reported by (Nandhini and Sridhara, 2019) ^[6]. However the productivity of foxtail millet found to be very low as compared to that of finger millet due to lack of suitable genotypes, as well as production packages. Crop production is greatly affected by climatic factors (rainfall and temperature), soil factors and cultural practices (e.g. sowing date, seed rate, plant spacing, sowing methods, weeding and harvesting methods). Among the various

management factors contributing to growth and development of foxtail millet, non-monetary inputs like time of sowing, row spacing and selection of variety play vital role in increasing crop productivity thus there is a need to work out on suitable variety for higher productivity to central dry zone of Karnataka hence an On Farm Test (OFT) was conducted on suitable Foxtail millet genotype to Central Dry Zone of Karnataka at Koragere village of Chikkanayakanahalli Taluk of Tumkur District by ICAR-Krishi Vigyan Kendra, Konehalli. The investigation on this aspect has clearly indicated that the different genotypes of foxtail millet showed different performance with respect to growth and yield attributes.

Materials and Methods

An On Farm Test (OFT) was conducted to evaluate the performance of foxtail millet (*Setaria italica* L.) genotypes at Central Dry Zone of Karnataka, Koragere village of Chikkanayakanahalli taluk of Tumkur District during Kharif 2024. Four foxtail millet genotypes viz., Local foxtail millet variety (Haalu Navane), GPUF-3 (UAS Bangalore, 2021), HN-46 (UAS Raichur, 2020) and SiA 3159 (AICRP small millets, Nandyal 2022) were grown at a spacing of 30 cm × 10 cm. The soil of experiment site was an red sandy loam soil with sand (60.6%), silt (19.4%) clay (20%). Experiment was laid out in Randomized Complete Block Design (RCBD) and replicated in five farmers plot. The sowing was carried out in respective plot in second week of July 2024 according to the treatments recommended fertilizer was applied in the seed furrows open manually and it was mixed thoroughly into the soil before sowing. Recommended dose of fertilizer 40:20:20 NPK kg per hectare was added to the well prepared land. Di-ammonium phosphate, Urea and Muriate of Potash were used as source of nutrients. Optimum plant population was maintained by thinning after 15 days of sowing. All other agronomic cultivation practices were followed. Observations on growth, yield and quality parameters were recorded at different crop growth stages and at harvest. Growth parameters like plant height was measured from base of the stem at ground level to the tip of the main shoot having fully opened top leaf and number of fully opened green leaves and number of tillers were recorded from the five healthy plants in each plot at 30, 60 days after sowing and at harvest. Yield parameters like Number of panicles per plant, panicle length, panicle weight, test weight and harvest index was recorded from the five randomly selected plants at the time of harvest. Panicle length was measured from the base of the Panicle to tip of the Panicle and expressed as Panicle length in centimeters (cm). A grain yield and straw yield of foxtail millet was obtained from net plot is computed for hectare and expressed in kilogram per hectare. Harvest index was determined by dividing the total grain yield by the total biological yield and expressed as percentage following Donald (1962) ^[1].

$$\text{Harvest Index} = \frac{\text{Economic Yield (kg/ha)}}{\text{Biological Yield (kg/ha)}}$$

Quality parameters

Crude protein content of grain is (%) nitrogen content in the grain was determined by Kjeldal Method as described and expressed in percentage. The crude protein content was worked out by multiplying the nitrogen percentage with factor 6.25 (Doubetz and Wells, 1968) ^[2].

$$\text{Crude protein (\%)} = \text{N content in grain (\%)} \times 6.25.$$

Results and Discussion

Data with respect to initial and final plant count of foxtail millet as influenced by genotypes is disclosed in Table 1. The growth attributing characters of foxtail millet were recorded periodically at an interval of 30, 60 days after sowing and at harvest of the crop are discussed below. The data referring to mean plant height at harvest were 109.80, 114, 128.20, 136.61 cms respectively. The plant height was influenced significantly due to different varieties of foxtail millet. The variety SiA 3159 recorded significantly maximum plant height (136.61 cm) and was on par with the variety GPUF-3 (128.20 cm) recorded at harvest where as the minimum plant height was recorded with the farmers practice variety –Haalu Navane (109.80 cm). Plant height is genetically governed phenomenon, hormonal balance, nutrient absorption and conversion of radiant energy to chemical energy in presence of chlorophyll. All these physiological processes were reflected in increased height and other yield attributing characteristics. Similar findings were perceived with Srikanya *et al.*, 2020 ^[9]. On perusal of data the number of tillers per plant at different crop growth stages influenced significantly to different foxtail millet genotypes. The variety SiA 3159 recorded significantly maximum number of tillers per plant (7.20) at harvest which was followed by the variety GPUF-3 (5.61). The minimum number of tillers per plant at harvest was recorded with farmers practice-haalu navane variety (3.92). Variation in number of tillers per plant among varieties may be due to the presence of genetic diversity for this feature. Similar results were noted by Srikanya *et al.*, 2020 ^[9]. Number of functional leaves per plant was influenced significantly due to different varieties. The variety SiA 3159 recorded significantly maximum number of functional leaves per plant (8.40) at harvest. However it was at par with the variety GPUF-3 (7.71) whereas farmer's practice-haalu navane variety produced significantly minimum number of functional leaves per plant (4.78) at harvest. Difference in their parental origins may have created variations in their genetic inheritance, which in turn may have contributed to the variance in leaf count among various varieties. These findings were confirmed with Nandhini and Sridhara 2019 ^[6]. The data pertaining to number of panicle per plant influenced by different foxtail millet genotypes are presented in Table 1. Number of panicles per plant was influenced significantly due to different varieties. The variety SiA 3159 recorded significantly maximum number of panicles per plant (4.69) at harvest and this was at par with GPUF-3 (4.13) whereas, the minimum number of panicle per plant was recorded with the variety Haalu Navane (3.20). The difference in panicle number among varieties might be due to variation in genetic makeup. The present findings were confirmed with Jyothi *et al.*, 2016 ^[3] and Nandhini and Sridhara, 2019 ^[7]. The results revealed that the panicle length (cm) was influenced significantly due to different varieties. The variety SiA 3159 recorded significantly maximum panicle length (20.09 cm) and the minimum panicle length was recorded in farmers practice (12.32 cm). Variations observed in panicle length might be related to difference in varietal features and dry matter partitioning. These findings were verified by Jyothi *et al.*, 2016 ^[3] and Nandhini and Sridhara, 2019 ^[7]. On perusal of data panicle weight per plant was influenced significantly due to different varieties. SiA 3159 produced significantly higher panicle weight per plant (4.31 g) and the variety with farmers practice produced lowest panicle weight (2.83 g). This might be due to higher number of panicles per plant and panicle length which in turn was caused by genetic potential of foxtail millet cultivars. These results were confirmed with Jyothi *et al.*, 2016

[3] and Srikanya *et al.*, 2020 [9]. The test weight (g) of foxtail millet was influenced significantly with different varieties. The variety SiA 3159 recorded significantly higher test weight (5.01 g) and was found to be at par with GPUF-3 (3.89 g), whereas haalu navane recorded minimum test weight (2.57 g). The difference in feature of cultivars might be the reason for fluctuation in test weight. These results are close to the findings of Srikanya *et al.*, 2020 [9]. Among the four genotypes SiA 3159 recorded significantly higher grain yield and straw yield (2210 and 3330 kg per hectare, respectively) followed by the variety GPUF-3 (1947 and 3180 kg per hectare, respectively) and the lowest grain yield and straw yield was recorded with farmers practice-haalu navane variety (1651 and 2850 kg per hectare, respectively) (Table-2). This increase in grain yield and straw yield may be due to increase in growth and yield parameters like plant height (136.61 cm), number of functional leaves (8.40), number of productive tillers (7.20), panicle weight (4.31 g) and test weight (5.01 g) at harvest with the variety SiA 3159. The results of this present investigation are in confirmation with the findings of Khafi *et al.*, 2000 [4] in pearl millet. The data presented in Table 2. indicated that the harvest index among different genotypes of foxtail millet did not have significant effect however highest harvest index was recorded with the variety SiA 3159 (34.25) followed by GPUF-3 (33.85) and the lowest harvest index was recorded with haalu navane (32.21) the harvest index among the varieties was found to be non-significant was also reported by Sanyukta *et al.*, 2024 [8]. Among different foxtail millet genotype SiA 3159 recorded significantly higher protein content (8.54 per cent) and was followed by the genotype GPUF-3 (8.23 per cent) and the lowest protein content was found with the genotype haalu navane (7.54 per cent).

Economics of foxtail millet

The calculated monetary data were presented in Table 3, which showed that varieties showed significant difference. Higher amount of gross and net returns was recorded with the variety SiA 3159 (Rs. 88,000/- and 43,312/- respectively) and was followed by the variety GPUF-3 (Rs. 77,400/- and 32,212/- respectively). The lowest gross and net returns was recorded with farmers practice-Haalu navane (Rs. 66,200/- and 21,825/- respectively). Similarly highest benefit cost ratio was recorded with the variety SiA 3159 (1.96) followed by GPUF-3 (1.73) and the lowest benefit cost ratio was recorded with haalu navane (1.49).

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