The Bioscan 14(3): 183-189, 2019
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

SCREENING OF FOXTAIL MILLET (*Setaria italica* L.) GENOTYPES AT DIFFERENT SOWING DATES FOR HIGHER RETURNS IN NORTHERN TRANSITION ZONE OF TELANGANA.

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KEYWORDS
Foxtail millet
Genotypes
Growth
Yield

Received on :
14.04.2019

Accepted on :
05.08.2019

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ABSTRACT

A field experiment was conducted during Kharif season of 2017 at Regional Agricultural Research Station Polasa Jagatial, PJTSU to study the response of foxtail millet (*Setaria italica* L.) varieties to different dates of sowing. Among different varieties SIA 3085, recorded significant plant height (117.5cm), maximum number of tillers (m2) (93), number of ears / plant (5.10), grain yield (1350 kg ha-^{1}), stover yield (2559 kg ha-1) and harvest index (34.8 percent) as compared to other genotypes SIA 3156 and suryanandi. Among different dates of sowing crop sown on 30th August found significantly higher plant height (120.7 cm), maximum number of tillers (m2) (100), number of ears / plant (5.0), grain yield (1428 kg ha^{-1}) , straw yield (2848 kg ha^{-1}) and harvest index (33.5 %) as compared to 10th August, 20th August and 10th September dates of sowing. The maximum gross and net returns and B: C ratio was recorded in genotype SIA 3085 and crop sown on 30th August. The growth and yield of foxtail millet genotype SIA 3085 and sowing date 30th August provides favourable weather condition for better growth, yield and profitable under Transition Zone of Telangana condition.

INTRODUCTION

Millets are small seeded cereals that are often termed nutri-cereals or dry land cereals found to be domesticated around 8000 years ago in the highlands of central China (Amgai *et al*., 2011). In recent years, there is an increased awareness 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 (Verma *et al*., 1983). Foxtail millet (*Setaria italica* (L.) Beauv.) is thought to be indigenous to southern Asia and is considered one of the oldest and second most cultivated small millets for food and fodder cultivated millets (Oelke, 1990). Foxtail millet is a member of the Poaceae family is cultivated globally and India. It is highly drought resistant summer crop grown under rainfed condition. Foxtail millet produces high quality grains than any other cereals under extreme conditions: like unfertile soil, intense heat and prolong drought.

In India foxtail millet is grown in an area of 98,489 ha producing about 56,327 tons of grain with an average productivity of 576 kg ha^{-1} (Anonymous, 2017). In India, Andhra Pradesh, Karnataka, Tamilnadu are the major foxtail millet growing states contributing about 90 % of the total area under cultivation. In Telangana State, foxtail millet is mostly grown in Mahbubnagar and Rangareddy districts (Hari prasanna, 2006). It has good nutritive value and 100 g of foxtail millet grains contain 9.9 g protein, 72 g carbohydrates, 2.5 g fat, 3.5 g ash, 10 g crude fibre, 0.27 mg potassium, 0.01 mg thiamine, 0.099 mg riboflavin, 0.82 mg pantothenic acid, 3.70 mg niacin, 0.02 mg folacin and 351 kilo calories of energy (Sarita and Singh, 2016). It is tolerant to drought, and it can escape some drought because of early maturity. Due to its quick growth, it can be grown as a short-term catch crop. It is adapted to a wide range of elevation, soils, and temperatures. However, the potentiality of this crop is not fully exploited. The low seed yield in foxtail millet is attributed to genetic, physiological, and its cultivation in marginal land. The sowing date for direct seeding of millet plays vital role in improving its growth and increasing the yield (Farell *et al*., 2003).Timely planting of crops generally ensures sufficient time for root development and vegetative growth for optimum harvesting of available soil nutrients and radiant energy (Soler *et al*., 2007). It is tolerant to drought, and it can escape some drought because of early maturity. Due to its quick growth, it can be grown as a short-term catch crop. It is adapted to a wide range of elevation, soils, and temperatures.

Nandini and Sridhara (2019) revealed that late sowing condition, the weather parameters were not favourable for the foxtail millet varieties, thus affecting of growth and yield parameters which ultimately reduced the yield. However, the potentiality of this crop is not fully exploited. The low seed yield in foxtail millet is attributed to genetic, physiological, and its cultivation in marginal land. The productivity of foxtail millet in Northern Telangana zone is very low due to the lack of suitable genotype. The potential of foxtail millet as rainfed crop has not been fully exploited. The suitability of genotypes and time of sowing is an important factor that affect the growth cycle of the millet. Keeping in above points in view the present experiment was designed to find out the most suitable genotype and sowing date for higher yield and yield components on foxtail millet far north telangana zone.

MATERIALS AND METHODS

A field experiment was conducted during kharif season of 2017 to study the response on productivity and economics of foxtail millet genotypes with different dates of sowing at Regional Agricultural Research Station, Polasa, Jagtial, Telangana State. The soil of the experiment site was sandy loam in texture, having slightly alkaline (pH 8.21), normal in salinity (EC 0.16 d Sm^{-1}), low in available N (220.6 kg ha^{-1}), high in available phosphorus (28.23 kg ha^{-1}) and medium in available potassium (249.0 kg ha^{-1}) and organic carbon content (0.66 %). The treatment consisted three improved genotypes *viz*, SIA 3156, SIA 3085 and Suryanandi and four different dates of sowing *viz*, 10th August, 20th August, 30th August and 10th September 2017 with 12 treatment combination on a plot size of 3.6 x 3.0 m2. The total quantity of nitrogen, phosphorus as per recommendation of 40:30:0 per hectare in the form of Urea (46%), single super phosphate (16%) respectively were applied below the seeds, and it was mixed thoroughly into the soil at the time of sowing. Foxtail millets seeds were sown with a spacing of 30cm x 10 cm and covered with the soil. Two split application of nitrogen was applied, one at basal and the second application at top dressing. All the agronomic practices were carried out uniformly to raise the crop. For taking data on growth and yield components on foxtail millet, five plants were selected randomly in each plot. The data collected from the experiment at different growth stages were subjected to statistical analysis by adopting Fisher's method of analysis of variance as outlined by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant height differed significantly at harvest due to different sowing dates. Among different genotypes, significantly taller plants were recorded with SIA 3156 (120.4cm) and were on par with SIA 3085 (117.5 cm) and superior over Suryanandi (105.4 cm). However, the effect of varieties may be due to the genetic makeup of the individual varieties. Significantly taller plants were noticed with crop sown on August 30th (120.7cm), as compared to crop sown

on August 20th (115.6 cm), August 10th (11.3 cm) and September 10th (108.9) (Table 1). The difference in plant height among the varieties might be due to the variation in their genetic character and inter nodal length. The above results are in conformity with the findings of Navya Jyothi *et al*. (2015).The interaction effect between different sowing dates and genotypes were not significant concerning plant height. The possible reason could be that early sown crop had availed prolonged photoperiod for vegetative growth as a result plant attained maximum plant height as compared to late sown crop and similar observations were also made by Maurya *et*

Plate 3.1a : General view of the experimental field

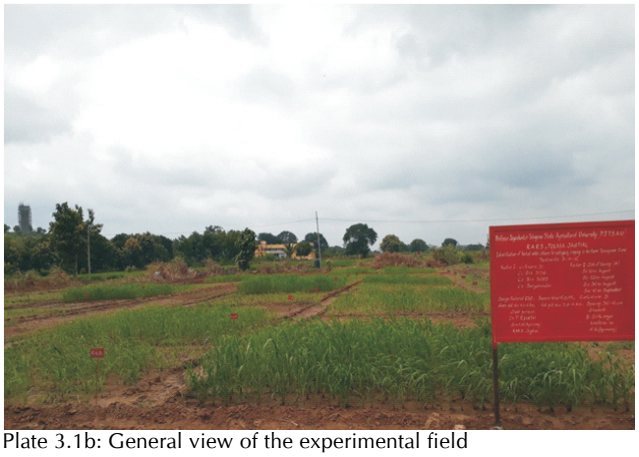
Plate 3.1b: General view of the experimental field


Plate 3.2 Lay out of the field


Plate 3.3 Sowing operation

Table 1: Performance of foxtail millet as influenced by varieties and sowing dates

Treatment	Initial plant popu lation (m^{-2})	Final plant popu lation (m^{-2})	Plant height (cm)				No.of tillers m^{-2}				No. ears $plant^{-1}$	Grain weight ear $head^{-1}$ (g)
			At 20 DAS	At 40 DAS	At 60 DAS	At Har vest	At 20 DAS	At 40 DAS	At 60 DAS	AtHar vest		
Varieties												
C1: SiA3156	31	29	14.1	71.3	113.7	120.4	29	62	94	90	3.7	4.2
C2: SiA3085	33	31	13.1	68.1	110.1	117.5	31	68	100	93	5.1	4.8
C3: Suryanandi	29	28	11.9	61.7	105.3	105.4	25	57	82	79	3.1	3.9
SEm±	1	1	0.2	1.3	1.56	1.7	0.9	1.7	2.6	2.7	0.2	0.2
CD (P = 0.05)	2.9	3	0.6	3.7	4.6	4.9	2.7	5.1	7.6	7.9	0.5	0.5
Sowing dates												
D1: 10th August	31	28	12.8	63.9	104.3	111.3	27	60	91	81	3.6	4.2
D2: 20th August	32	31	13.1	72.2	111.5	115.6	30	65	96	97	4.4	4.3
D3: 30th August	34	32	13.6	73.5	115.4	120.7	31	68	100	100	5	4.7
D4: 10th Sept	28	27	12.5	58.5	107.6	108.9	26	56	81	72	2.8	3.9
SEm±	1.1	1.2	0.2	1.5	1.8	1.9	1.1	2	3	3.1	0.2	0.2
CD (P = 0.05)	3.3	3.5	0.7	4.3	5.3	5.6	3.1	5.9	8.7	9.1	0.6	0.5
Interaction												
SEm±	2	2.1	0.4	2.5	3.1	3.3	1.8	3.5	5.1	5.4	0.4	0.3
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	11.4	13	6	7	5.3	5.4	12	10	10	11.3	13.2	11

Table 2 : Productivity and Economics of foxtail millet as influenced by varieties and dates sowing

Treatment	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest Index (%)	Available Nitrogen (kg ha^{-1})	Available Phosphorus (kg ha^{-1})	Available Potassium (kg ha^{-1})	Gross returns (. ha^{-1})	Net returns (^{1} . ha^{-1})	B: C ratio
Varieties									
C1: SiA 3156	1,176	2,302	33.9	210.9	28.8	172.4	27,032	14,269	1.12
C2: SiA 3085	1,350	2,559	34.8	197.4	21.7	165.3	30,987	18,224	1.44
C3: Suryanandi	989	2,138	32.7	225	26.2	181.3	22,822	10,058	0.79
SEm±	52.39	92.21	1.22	2.38	0.34	1.84	1162	1162	0.09
CD (P = 0.05)	154.6	272.2	NS	7	1	5.4	3430	3430	0.3
Sowing dates									
D1: 10th August	1,063	2,384	30.8	233.2	26.7	173.8	24,588	11,975	0.95
D2: 20th August	1,228	2,508	32.6	189.2	24	172.1	28,275	15,662	1.24
D3: 30th August	1,428	2,848	33.5	144.9	20.9	167.8	32,835	20,222	1.6
D4: 10th Sept	968	1,591	37.82	277.1	30.8	178.3	22,089	8,876	0.67
SEm±	60.49	106.48	1.41	2.75	0.42	2.13	1342	1342	0.11
CD (P = 0.05)	178.6	314.3	4.2	8.1	1.3	6.3	3961	3961	0.3
Interaction									
SEm±	104.78	184.42	2.44	4.76	0.73	3.68	2324	2324	0.18
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	16.6	14.8	13.1	4.3	5.2	4	15.99	29.9	15.83
Initial NPK values			220.6	28.23	249				

Plate 3.4: Thinning and gap filling

al. (2016) in pearl millet.

Maximum number of tillers per m^2 of foxtail millet was observed at 60 DAS and thereafter slightly declined up to harvest. This may be due environmental conditions which cause more senescence of tillers. Among the cultivars SIA 3085 produced maximum number of tillers m-2 than SIA 3156and Suryanandi during all the growth stages of crop. Similarly, the crop sown on August 30th was produced better number of tillers m^{-2} when compared with other dates of sowing during all the growth stages of crop. These results are also reported by Siddig *et al*. (2013) and Jan *et al*. (2015). The reason could be that early sowing crop which has prolonged

photoperiod as a result of more assimilates was utilized by the plant in producing more number of tillers as compared to late sown crop. These results conform to the findings of Amgai *et*

Plate 3.5 Life saving irrigation to D_4 treatment

Plate 4.1 Germination affected in D_4 plot

Plate 4.2 Leaf blast disease incidence

Plate 3.6 Inflorescence of SiA -3156, SiA -3085 and Suryanandi varieties

al. (2013) and Maurya *et al*. (2016).

The economic yield of a crop is the integrated results of some physiological processes. An adequate supply of nutrient is necessary for metabolic activity as it finally affects the vegetative as well as reproductive phases. Significantly maximum number of ears plant^{-1} (5.1) and grain weight per ear head (4.8 g) were noticed with the cultivar SIA 3085 than SIA 3156 and Suryanandi. Among dates of sowing the maximum number of ears plant^{-1} (5.0) and grain weight per ear head (4.7 g) were obtained with D3 (August 30th) date of sowing, while the lowest was obtained with D4 (September10th).

Significantly higher yield components was noticed with genotype SIA 3085 grain weight per ear head (4.8 g) and it was found to be on par with SIA 3156 (4.2 g) and superior

Plate 4.3 Maturity stage of SiA -3156 variety

Plate 4.4 Maturity stage of SiA -3085 variety

Plate 4.5 Maturity stage of Suryanandi variety

over Suryanandi (Table 1). The reduction of yield components with delayed sowing due to decrease in moisture in late sown condition which reduces cell division and cell expansion which influences meristematic development of yield components as a result less production of photosynthates due to shorter growing period. Lower test weight in late sowing is due to shrivelling of grain due to hot winds prevailed during milk and grain filling stage.

The economic yield of a crop is the integrated results of some physiological processes. An adequate supply of nutrient is necessary for metabolic activity as it finally affects the vegetative as well as reproductive phases. In the present study genotypes significantly influenced the grain yield of foxtail millet SIA 3085 (1350 kg ha^{-1}), straw yield (2559 kg ha^{-1}) and it

Plate 3.7 Harvesting of the crop

Plate 3.8 Drying and threshing

was on par with SIA 3156 (1176 kg ha^{-1}), straw yield (2302 kg ha^{-1}) and there is no any significant difference with respect to harvest index. Highest harvest index was noticed with SIA 3085 (34.8 %) as compared to SIA 3156 and Suryanandi (Table 2)..This increase in yield was attributed to the greater yield components such as panicle length, test weight and total dry matter accumulation per plant due to different dates of sowing. Low yield in grain yield may be attributed to shorter growth period available for crop results in decreased grain yield and its components. Similar findings were also reported by Tejagouda, *et al*. (2015) and Nandhini and Sridhara (2019).

Among different dates of sowing, August 30th recorded significantly higher grain yield (1428 kg ha^{-1}) straw yield (2848 kg ha^{-1}) as compared to other dates of sowing. The reduction of yield components with delayed sowing due to decrease in moisture in late sown condition which reduces cell division and cell expansion which influences meristematic development of yield components as a result less production of photosynthates due to shorter growing period. Lower test weight in late sowing is due to shrivelling of grain due to hot winds prevailed during milk and grain filling stage. The results support the findings of Maurya *et al*. (2016), Divya and Maurya (2013), Revathi *et al*. (2017) and Jyothi *et al*. (2016). The maximum gross and net returns and B: C ratio was recorded in genotype SIA 3085 and crop sown on 30th August was higher when compared to other cultivars and dates of sowing.

Highest available nutrient status (N, P and K) of soil was obtained with the cultivar Suryanandi and this was significantly superior over other two varieties of foxtail millet. Significantly lowest nutrient status was recorded with SIA 3085, might be due to better uptake of nutrients which has been reflected in low available nitrogen, phosphorous and Potassium in soil after harvest of crop. Among the dates of sowing the crop that was sown on Septemeber 10th (D4) registered highest available N, P and K in soil after harvest. In the similar way less availability of N, P and K was registered with D3 (30th August) and D2 (30th August). This might be attributed to better root growth due to better aeration and good drainage might have also increased microbial activity dates of sowing indicates favourable moisture condition in soil helped in more uptake

of nutrients with optimum moisture and nutrient availability for its growth (Chouhan *et al* .,2015). Research results are in conformity with the finding of Navya Jyothi *et al*. (2015).

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