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Productivity of Foxtail Millet (*Setaria italica* L.) Varieties as Influenced by Nitrogen Levels in Rice-Fallows of North Coastal A P

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ABSTRACT

A field experiment was conducted during *rabi*, 2017-18 on sandy loam soils of Agricultural College Farm, Naira to study the effect of varieties and nitrogen levels on growth, yield attributes and yield of foxtail millet. The experiment was laid out in RBD design with factorial concept. The variety SiA 3156 recorded the higher growth parameters, yield attributes and yield. Application of 80 kg N ha^{-1} markedly improved the growth parameters, yield attributes and yield. The results concluded that cultivation of SiA 3156 variety of foxtail millet with application of 80 kg N ha^{-1} during *rabi* was found to be the best package in rice fallows of north coastal Andhra Pradesh.

Key words: *Foxtail millet, Nitrogen levels, Varieties, Yield attributes and Yield.*

Foxtail millet (*Setaria italica* L.), locally known as korra is one of the oldest small millets cultivated for food and fodder. It ranks second in total production among small millets. It is of climate resilient, short duration and low cost consumptive crop, nutritionally superior, providing protein and minerals at a cheaper cost and forms staple food for the poorer sections of the society. In India, small millets are grown in an area of 6,49,900 hectares with annual production of 3,90,900 tonnes and in Andhra Pradesh and it is being grown in an area of 51,000 hectares with annual production of 49,000 tonnes at a mean productivity level of 961 kg ha^{-1} (Ministry of Agriculture, Government of India, 2015 -16).

Rice-rice fallow pulse, a predominant system in North-Coastal Andhra Pradesh is gradually declining in the recent past due to severe attack of viral diseases besides rampant weed growth which severly competes with pulse crops for residual moisture and nutrients and thus responsible for sharp fall in pulse yield to the tune of 53 to 75% (Rao, 2008). In this changing scenario, farmers of North Coastal Andhra Pradesh are shifting to rice fallow maize in place of pulse during *rabi* wherever irrigation facilities are fairly satisfactory. However, in areas where the water resources are frugal there is a prospective situation for taking up foxtail millet as an alternative crop to pulse in the rice fallows during *rabi*.

The yield potential of foxtail millet is low in India compared to the potentially achievable yield because of inadequate application of fertilizers, conventional cultivation of low yielding cultivars and lack of good management practices. Maximum yield potential can be achieved by growing high yielding varieties with improved tolerance to drought and response to fertilizer application. For higher productivity, there is a need for application of higher dose of fertilizers, especially nitrogen. Nitrogen is the major nutrient required by the millets for higher growth, yield attributes and yield (Prasad *et al*., 2014).

For realising higher yields in any crop, development of suitable agro-techniques is one of the key strategies. Among various agrotechniques, identification of a suitable variety for the tract and optimal nitrogen dose are the two factors that have a greater influence on the grain yield.

Keeping all the above points in view, the present study is undertaken to obtain information on "Performance of foxtail millet varieties under different nitrogen levels in rice-fallows of North Coastal A.P.

MATERIAL AND METHODS

A field experiment was conducted during *rabi* of 2017-18 at the Agricultural College Farm, Naira, Andhra Pradesh. The soil was sandy loam in texture with a pH of 7.04 and EC of 0.078 dSm^{-1}, low in organic carbon (0.61%) and available nitrogen (252.5 kg ha^{-1}), medium in available phosphorus (29.5 kg ha^{-1}) and potassium (352.5 kg ha^{-1}). Sowing was done on 12th December 2017, by adopting a seed rate of 6.25 kg ha^{-1}. The seed was broadcasted uniformly to obtain optimum planting density. The plot size was 6 m × 5 m. The experiment was laid out in RBD with factorial concept design comprising of three varieties SiA-3085(V_1) , SiA-3156(V_2) and SiA-3088(V_3) and four nitrogen levels *viz*., control (N_1), 40 kg N ha^{-1} (N_2), 60 kg N ha^{-1} (N_3) and 80 kg N ha^{-1} (N_4) and replicated thrice. The crop was harvested on 29th March, 2018.

Table 1. Growth parameters of foxtail millet as influenced by different varieties and nitrogen levels

Treatments	Plant height (cm) at			Number of tillers m-2			Drymatter production (kg ha^{-1}) at			Days to 50 per cent flowering	Days to maturity
	30DAS	60 DAS	Maturity	30 DAS	60 DAS	Maturity	30 DAS	60 DAS	Maturity		
Varieties											
V1: SiA -3085	34.4	84.9	113.4	48	75.6	67.4	841	2417	2937	59	92
V2: SiA - 3156	36.3	84.5	106.3	51.3	78.6	70.3	872	2655	3330	59	91
V3: SiA - 3088	34.8	83.8	107.4	43.6	71.8	61.6	827	2618	3113	60	93
SEm±	0.65	1.78	1.61	2.01	1.79	1.78	16.93	89.36	51.42	0.77	0.82
CD (P=0.05)	NS	NS	4.7	5.9	5.3	5.2	NS	NS	150	NS	NS
Nitrogen Levels (kg ha-1)											
N1: 0	30.3	59.6	89.8	38.2	65.7	57	783	1858	2504	61	92
N2: 40	33.9	84.1	105.7	46.7	73.9	62.6	829	2448	3043	59	90
N3: 60	37.1	94.7	117.6	49.2	78.2	69.7	863	2786	3370	59	92
N4: 80	39.4	99.1	123	56.6	83.6	76.4	911	3163	3590	59	93
SEm±	0.75	2.06	1.86	2.32	2.07	2.06	19.55	103	59.38	0.89	0.94
CD (P=0.05)	2.2	6.0	5.4	6.8	6.0	6.0	57.0	302	174	NS	NS
Interaction											
SEm±	1.3	3.58	3.23	4.03	3.59	3.57	33.87	178	102	1.54	1.64
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	6.3	7.8	4.0	15.0	7.7	9.2	7.1	11.8	6.0	4.8	3.0

Table 2. Yield attributes of foxtail millet as influenced by different varieties and nitrogen levels

Treatments	Panicles (No. m^{-2})	Panicle Length (cm)	Filled grains (No. $panicle^{-1}$)	1000 grain weight (g)
Varieties				
V_1: SiA - 3085	61	14.8	1034	2.35
V_2: SiA - 3156	65	16.1	1182	2.48
V_3: SiA - 3088	62	14.8	988	2.40
SEm±	1	0.33	45.87	0.07
CD (P=0.05)	3	1	134	NS
Nitrogen Levels (kg ha^{-1})				
N_1: 0	53	13.4	716	2.05
N_2: 40	61	15.1	1045	2.35
N_3: 60	67	16.0	1252	2.58
N_4: 80	70	16.3	1260	2.68
SEm±	1.15	0.39	52.96	0.08
CD (P=0.05)	3.00	1.10	155.00	0.25
Interaction				
SEm±	2.00	0.68	91.74	0.14
CD (P=0.05)	NS	NS	NS	NS
CV(%)	5.6	7.2	15.9	10.5

Table 3. Grain, stover yield (kg ha^{-1}) and harvest index (%) of foxtail millet varieties as influenced by varieties and nitrogen levels

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
Varieties			
V_1: SiA – 3085	1143	2151	34.7
V_2: SiA – 3156	1290	2427	34
V_3: SiA – 3088	1165	2246	33.9
SEm±	31.59	72.4	0.97
CD (P=0.05)	92	212	NS
Nitrogen Levels (kg ha^{-1})			
N_1: 0	586	1259	32.0
N_2: 40	1085	2074	34.5
N_3: 60	1442	2666	35.2
N_4: 80	1684	3101	35.1
SEm±	36.48	83.6	1.12
CD (P=0.05)	107	245	NS
Interaction			
SEm±	63.19	144	1.95
CD (P=0.05)	NS	NS	NS
CV(%)	8.2	10.4	8.8

RESULTS AND DISCUSSION

Growth Parameters

Plant height of foxtail millet varieties recorded at 30 and 60 DAS were found to be non significant. At maturity significantly taller plants (113.4 cm) were noticed in SiA 3085 (V_1), while SiA 3156 (V_2) (106.3) was found to be on par with SiA 3088 (V_3) *i.e*. 107.4.

Significantly taller plants at 30 DAS (39.4 cm), 60 DAS (99.1cm) and at maturity (123.0 cm) were observed with the highest level of nitrogen 80 kg N ha^{-1} (N_4) tried at all the three stages of sampling except at 60 DAS where 60 kg ha^{-1}(N_3) was found to be on par with 80 kg ha^{-1} (N_4). The plants were of their shortest stature with non application of nitrogen (N_1) (Table 1).

Maximum number of tillers m^{-2} were registered across all the stages (30 DAS -51.3, 60 DAS -78.6 and maturity-70.3) of the sampling with SiA 3156 (V_2) and it was remained parity with SiA 3085 (V_1).Significantly higher tiller count at 30 DAS (56.6), 60 DAS (83.6) and maturity (76.4) was recorded with the highest dose of nitrogen supplied (80 kg ha^{-1}) . The tiller production was significantly lower with control (N_1).

Differences in drymatter production among foxtail millet varieties sampled at 30 and 60 DAS were found to be non significant while at maturity significantly higher drymatter production (3330 kg ha^{-1}) was noticed with SiA 3156 (V_2) while, it was minimum with SiA 3088 (V_1). As regards to drymatter production, it was highest with the highest level of nitrogen tried (80 kg N ha^{-1}) at all the three stages of sampling (911 kg ha^{-1} – 30 DAS, 3163 kg ha^{-1} -.60 DAS and at maturity-3590 kg ha^{-1}) except at 30 DAS which was on par with 60 kg ha^{-1} (N_3). Drymatter production was the lowest with no nitrogen (N_1) at all the stages of sampling. The difference in growth characters may be attributed to the fact that it is basically governed by the genetic constitution of the varieties inherited through parental lines. Similar views were also expressed by Radhakumari *et al*. (2017) and Jyothi *et al*. (2016) in foxtail millet.

Number of days to 50% flowering and maturity did not alter significantly either due to varieties or the incremental doses of nitrogen and their interaction.

Significantly higher growth stature was noticed with application of the highest dose (80 kg ha^{-1}) of nitrogen (N_4) at all the stages of sampling except at 60 DAS, where 60 kg ha^{-1}(N_3) was found parity with 80 kg ha^{-1} (N_4). It could be attributed to the fact that higher levels of nitrogen might have stimulated cellular activity which is useful for the process of cell division, meristamatic growth coupled with cell enlargement resulting in vertical increase in the plant height. These findings are in corroboration with those reported by Raundal and Patil (2017), Jyothi *et al.* (2016) in case of little millet and foxtail millet respectively.

Yield attributes

Significantly large yield structure comprised of number of panicles m^{-2} (65), panicle length (16.1) and filled grains $panicle^{-1}$ (1182) were observed with SiA 3156 (V_2) compared to rest of the two varieties (Table 2). However, the differences in 1000-grain weight among the three varieties tested did not alter significantly. This might be due to the inherent genetic constitution of varieties. The results are in conformity with the findings of Shanti *et al*. (2017) in case of foxtail millet and finger millet, respectively (Table 2).

Yield structure of foxtail millet varieties was found to be significantly higher in plots which received the highest dose of nitrogen 80 kg ha^{-1} (N_4) with regard to number of panicles m^{-2} (70), panicle length (6.3 cm), Number of filled grains $Panicle^{-1}$ (1260) and 1000-grain weight (2.68 g). However, 80 kg ha^{-1} (N_4) found parity with 60 kg ha^{-1} (N_3). It might be due to the availability of liberal amounts of nitrogen at the ecorhizosphere of the foxtail millet which inturn might have resulted in higher accumulation of photosynthetic assimilates as reflected in greater accumulation of drymatter at these doses. Higher accumulation of photosynthates during the reproductive phase results in increased translocation of these resources from source to sink resulting in enhanced number of filled grains $panicle^{-1}$ besides production of larger size panicles. Raundal and Patil (2017) and Shankar *et al.* (2015) in case of little millet and finger millet also reported similar findings.

Yield

The variety SiA 3156 (V_2) out yielded rest of the two varieties and exhibited its statistical supremacy in producing the highest grain yield (1290 kg ha^{-1}) and stover yield (2427 kg ha^{-1}). It was minimum with SiA 3085 (V_1) (Table 3). This might be due to their genetic potentiality to utilize and translocate photosynthates from source to sink. Highest drymatter production associated with SiA 3156 (V_2) together with better yield structure observed with the same variety which might have translated in to significantly higher yield levels. The results are in agreement with those reported by Bhomte *et al* (2016) in kodo millet (Table 3).

Application of the 80 kg ha^{-1} (N_4) enabled significantly higher grain (1684 kg ha^{-1}) and stover yield (3101 kg ha^{-1}) over the subsequently lower doses of N indicating the response of foxtail millet varieties to the highest level of nitrogen 80 kg ha^{-1} (N_4) tried. It might have lead to be attributed to better availability and uptake of nitrogen which inturn might have lead to efficient metablolism of SiA 3156 (V_2). Significantly

superior growth stature coupled with large yield structure except 1000 grain weight registered with highest level of nitrogen supplied might have enabled it to produce the highest grain yield (1684 kg ha^{-1}). These findings are in corroboration with those reported by Jyothi *et al* (2016), Khan and Krishna (2016) in foxtail millet. Harvest index could not be altered significantly either due to foxtail millet varieties or varied levels of nitrogen and their interaction.

CONCLUSION

Conclusively, the present investigation revealed that higher growth and productivity of foxtail millet could be obtained with cultivation of SiA 3156 variety in combination with application of 80 kg ha^{-1} during *rabi* season in rice fallows of North Coastal A.P**.**

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