

Effect of Date of Sowing and Nutrient Management on Nutrient Uptake and Yield of Foxtail Millet (*Setaria italica* L.)

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Abstract

A field experiment was conducted at College of Agriculture Farm, Raichur on medium black soil during *kharif*, 2017 to study the effect of date of sowing and nutrient management on nutrient uptake and yield of foxtail millet (*Setaria italica* L.). The experiment was laid out in split-plot design with three replications. The treatments consisted of four sowing dates (second fortnight of June, first fortnight of July, second fortnight of July and first fortnight of August) and three levels of RDF (75%, 100% and 125% RDF). The results revealed that, early sowing during second fortnight of June recorded significantly higher uptake of nitrogen (112.12 kg ha⁻¹), phosphorus (10.82 kg ha⁻¹), potassium (60.66 kg ha⁻¹), grain yield (2368 kg ha⁻¹), stover yield (8916 kg ha⁻¹) net returns (₹ 24978 ha⁻¹) and benefit cost ratio (2.46). However, it was found to be on par with first fortnight of July. A higher nutrient uptake, yield and economics were recorded by the application of 100% RDF (nitrogen, phosphorus, potassium, grain yield, stover yield, net return, benefit cost ratio; 99.74 kg ha⁻¹, 9.19 kg ha⁻¹, 44.86 kg ha⁻¹, 2140 kg ha⁻¹, 7176 kg ha⁻¹, ₹ 19394 ha⁻¹ and 2.13, respectively) and it was in turn on par with 125% RDF. But, interaction effect of date of sowing and nutrient management was found to be non significant with respect to nutrient uptake and yield. Sowing during second fortnight of June in combination with application of 100% RDF noted significantly higher grain yield (2424 kg ha⁻¹), stover yield (9350 kg ha⁻¹) and benefit cost ratio (2.51).

Keywords: Nutrient uptake, grain yield, stover yield, foxtail millet

1. Introduction

Foxtail millet (*Setaria italica* L.), a member of the family Poaceae, is highly drought resistant crop grown under rainfed condition and produces high quality grains than many other cereals under extreme conditions like unfertile soil, intense heat and prolong drought. In India, the cultivation of foxtail millet is confined to Andhra Pradesh, Karnataka and Tamil Nadu. It is widely grown in Haveri, Dharwad and Belgum districts of Northern Transitional Zone of Karnataka. Proper time of sowing is one of the major non-monetary inputs which if managed properly could boost the productivity in terms of quality and quantity both without increasing the cost of cultivation and affecting the soil and environmental health. Therefore, to keep the pace with estimated requirement there is a need to identify suitable time for sowing to minimize the end result of the changing climatic condition and at the same time to increase the production of foxtail millet. The yield potential of minor millets including foxtail millet has been very low under rainfed area because of practically negligible use of fertilizers, conventional cultivation of low yielding cultivars and lack of good management practices. The common belief is that minor millets may not profitably respond to applied nutrients

under rainfed condition. No doubt application of fertilizers becomes essential need for high yielding varieties of minor millets to exploit their maximum potential. So, experiment was conducted to know the effect of date of sowing and nutrient management on the nutrient uptake and yield of foxtail millet (*Setaria italica* L.).

2. Materials and Methods

A field experiment was conducted during the *kharif*, 2017 at Agricultural College farm, Raichur which comes under North Eastern Dry Zone (Zone 2) of Karnataka. The experiment was laid out in split-plot design with 12 treatments replicated thrice. The treatments consist of four sowing dates (second fortnight of June, first fortnight of July, second fortnight of July and first fortnight of August) and three levels of RDF (75%, 100% and 125% RDF). A pre release variety, HN-46 was selected for study. Half the dose of nitrogen and entire dose of phosphorous and potassium in the form of urea, diammonium phosphate (DAP) and muriate of potash (MOP) respectively were band placed as per the treatments at the time of sowing. Remaining 50% of nitrogen was applied at 30 DAS. The soil of the experimental site was medium black, moderately alkaline



with a pH of 8.4 and had a low nitrogen (202.56 kg ha⁻¹) and medium phosphorus and potassium (18.42 and 257.24 kg ha⁻¹) availability in soil. Sowing was done by dibbling on four different dates (D₁: 27th June, D₂: 12th July, D₃: 28th July, D₄: 12th August 2017).

3. Results and Discussion

3.1. Effect of date of sowing

The grain yield of foxtail millet cv. HN- 46 was significantly influenced due to different dates of sowing (Table 1). Sowing during second fortnight of June recorded significantly higher grain yield ha⁻¹ (2368 kg ha⁻¹) and it was on par with first fortnight of July (2271 kg ha⁻¹). Late sowing during first fortnight of August recorded significantly lower grain yield of 1616 kg ha⁻¹. Significantly higher yield in second fortnight

of June is mainly due to the increase in yield attributing characters like ear head length (22.30 cm), ear head weight (10.64 g), grain yield plant⁻¹ (10.86 g) and test weight (5.24 g). These parameters were on par with sowing during first fortnight of July. The reason could be that early sown crop had prolonged photoperiod as a result of which higher assimilates were translocated towards ear head and produced maximum number of grains in ear head. Similar results were reported by Amanullah et al. (2015) who recorded higher number of grains panicle⁻¹, panicle weight and thousand grain weight in early sowing (20th June) as compared to late sowing (10th July and 30th July). These results are in compliance with the findings of Gavit et al. (2017). Earlier sown crop had ideal growth condition as a result bold grains were produced when compared to late sown crop. Similar variations were reported by Teare et al. (1993) and he observed that early sowing (10th June)

Table 1: Effect of dates of sowing and nutrient management on yield and yield attributing characters of foxtail millet

Treatments	No. of tillers plant ⁻¹ at harvest	Ear head weight (g)	Grain yield plant ⁻¹ (g)	Test weight (1000 grains)	Grain yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Harvest index
<u>Date of sowing (D)</u>							
D ₁ : Second fortnight of June	3.89	10.64	10.86	5.24	2368	8916	0.23
D ₂ : First fortnight of July	3.80	9.55	10.40	4.92	2271	8713	0.22
D ₃ : Second fortnight of July	2.39	8.19	5.72	3.56	1992	5623	0.29
D ₄ : First fortnight of August	1.32	6.10	3.74	3.47	1616	4346	0.32
SEm±	0.03	0.21	0.24	0.08	29.98	104.33	0.01
CD (p=0.05)	0.10	0.71	0.82	0.29	103.70	360.88	NS
<u>Nutrient management (F)</u>							
F ₁ : 75% RDF	2.61	8.22	7.35	4.10	2002	6492	0.28
F ₂ : 100% RDF	3.06	9.09	8.33	4.44	2140	7176	0.26
F ₃ : 125% RDF	2.88	8.55	7.37	4.35	2043	7031	0.25
SEm±	0.09	0.28	0.38	0.12	39.15	178.46	0.02
CD (p=0.05)	0.28	0.84	1.12	0.35	116.37	530.52	NS
<u>Interaction (D×F)</u>							
SEm±	0.12	0.52	0.65	0.22	79.37	394.10	0.03
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS

significantly improved seed weight as compared to late sowing (20th July).

The growth and yield of crop plants were determined by the presence of nutrients in the soil in available form for plant uptake (Table 2). Uptake of nutrients is associated with the concentration of ions in the external medium. There was a decrease in the uptake of nutrients with delaying sowing date. Early sowing during second fortnight of June recorded significantly higher nitrogen uptake (112.12 kg ha⁻¹) at harvest followed by first fortnight of July (101.38 kg ha⁻¹). A lower uptake was noticed when crop was sown during first fortnight of August (77.15 kg ha⁻¹). Similar trend was noticed

in phosphorus and potassium uptake. This result was in agreement with the result of Gavit et al. (2017).

3.2. Effect of nutrient management

The grain and stover yield of foxtail millet was significantly influenced due to the application of RDF (Table 1). Application of 100% RDF recorded significantly higher grain and stover yield (2140 kg ha⁻¹ and 7176 kg ha⁻¹) and it was on par with 125% RDF (2043 kg ha⁻¹ and 7031 kg ha⁻¹). The increase in grain and stover yield with increased nitrogen and phosphorus supply could be explained on the basis of high beneficial effects of nitrogen and phosphorus on growth and yield contributing characters like number of tillers, dry matter production per



Table 2: Nutrient uptake and economics of foxtail millet as influenced by dates of sowing and nutrient management

Treatments	N (kg ha ⁻¹)	P (kg ha ⁻¹)	K (kg ha ⁻¹)	Cost of Cultivation (₹ ha ⁻¹)	Gross returns (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)	B:C ratio
<u>Date of sowing (D)</u>							
D ₁ : Second fortnight of June	112.12	10.82	60.66	17065	42044	24978	2.46
D ₂ : First fortnight of July	101.38	9.22	45.85	17065	40467	23401	2.37
D ₃ : Second fortnight of July	91.36	8.13	34.47	17065	32350	15285	1.90
D ₄ : First fortnight of August	77.15	7.12	25.13	17065	25304	8239	1.48
SEm±	1.23	0.18	0.61	-	429	429	0.03
CD (p=0.05)	4.25	0.62	2.10	-	1484	1484	0.09
<u>Nutrient management (F)</u>							
F ₁ : 75% RDF	89.73	8.48	37.89	16794	33570	16776	2.00
F ₂ : 100% RDF	99.74	9.19	44.86	17142	36536	19394	2.13
F ₃ : 125% RDF	97.04	8.80	41.84	17261	35017	17756	2.03
SEm±	2.50	0.25	0.86	-	509	509	0.03
CD (p=0.05)	7.45	0.65	2.56	-	1512	1512	0.09
<u>Interaction (D×F)</u>							
SEm±	2.92	0.11	0.88	-	1073	1073	0.06
CD (p=0.05)	NS	NS	NS	-	NS	NS	NS

plant, ear head weight, thousand grain weight and ear head length (NeerajYadav and Pulla Rao, 2014). Application of RDF increased the concentration of nutrient ions in the soil solution and availability of sufficient nutrients might have helped in higher nutrient uptake. Significantly, higher uptake of nitrogen, phosphorus and potassium (99.74, 9.19 and 44.86 kg ha⁻¹, respectively) was recorded with 100% RDF when compared with 125% and 75% RDF (97.04, 8.80 and 41.84 kg ha⁻¹; 89.73, 8.48 and 37.89 kg ha⁻¹, respectively). These results are in accordance with the findings of Nigade and More (2013).

The growth and yield of crop plants were determined by the presence of nutrients in the soil in available form for plant uptake (Table 2). Uptake of nutrients is associated with the concentration of ions in the external medium. Application of RDF increased the concentration of nutrient ions in the soil solution and availability of sufficient nutrients might have helped in higher nutrient uptake. Significantly, higher uptake of nitrogen, phosphorus and potassium (99.74, 9.19 and 44.86 kg ha⁻¹, respectively) were recorded with 100% RDF when compared with 125% and 75% RDF (97.04, 8.80 and 41.84 kg ha⁻¹; 89.73, 8.48 and 37.89 kg ha⁻¹, respectively). These results are in accordance with the findings of Nigade and More (2013).

3.3. Interaction effects

Uptake of NPK and yield were not influenced by the interaction effect of date of sowing and nutrient management (Table 2). Similar study in pearl millet was conducted by Dapake et al. (2016) and he concluded that the interaction between sowing

time and nutrient management of pearl millet were found to be non-significant in respect of yield attributing parameters, quality parameters and available NPK status.

3.4. Economics

There was significant difference in economic analysis of foxtail millet cv. HN-46 due to sowing during different dates (Table 2). Significantly higher gross returns (₹ 42,044 ha⁻¹), net returns (₹ 24,978 ha⁻¹) and benefit cost ratio (2.46) were recorded by sowing during second fortnight of June (D₁). However, first fortnight of August (D₄) recorded significantly lower gross return (₹ 25,304 ha⁻¹), net return (₹ 8,239 ha⁻¹) and benefit cost ratio (1.48). The increased gross returns, net returns and benefit cost ratio were mainly due to increased grain and straw yield due to sowing during second fortnight of June (D₁) over rest of the sowing dates. Similar results were also reported by Dapake et al. (2016).

Application of 100% RDF recorded significantly higher gross returns (₹ 36,536 ha⁻¹), net returns (₹ 19,394 ha⁻¹) and benefit cost ratio (2.13) when compared to the application of 125% RDF (₹ 35,017 ha⁻¹, ₹ 17756 ha⁻¹ and 2.03, respectively) and 75% RDF (₹ 33,570 ha⁻¹, ₹ 16,776 ha⁻¹ and 2.0, respectively). The higher gross and net returns were mainly due to higher economic yield associated with optimum levels of fertilizer applied treatment. These results are in close conformity with reports of Patel et al. (2013).

Interaction effect of date of sowing and nutrient management was found to be non significant with respect to gross returns,

net returns and benefit cost ratio. This result was in orthodoxy with the result of Dapake et al. (2016).

4. Conclusion

Early sowing during second fortnight of June along with application of 100% RDF recorded significantly higher uptake of NPK, grain yield, stover yield, net returns and benefit cost ratio. However, it was found to be on par with sowing during first fortnight of July and application of 125% RDF. Interaction effect of date of sowing and nutrient management was found to be non significant with respect to nutrient uptake, yield and economics.

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