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Research Communication

Effect of nitrogen levels and varieties on economics and yield of little millet (*Panicum sumatrense*) under rainfed conditions

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ABSTRACT

A field experiment on sandy-loam soil carried out during the rainy season (*kharif*) of 2019 at Rajendranagar, Hyderabad, Telangana, to study the effect of nitrogen levels and varieties on growth and yield of little millet (*Panicum sumatrense* Roth ex Roem. & Schult.) under rainfed conditions. Treatments included 5 levels of nitrogen (0, 10, 20, 30 and 40 kg N/ha) and 3 varieties 'OLM 203', 'VS 06' and 'VS 25', making 12 treatment combinations 15.13. Results indicated that, the highest gross returns, net returns and benefit: cost ratio were obtained with 40 kg N/ha and among varieties, 'VS 25' variety recorded the highest gross returns, net returns and benefit: cost ratio.

Key words: Economics, Little millet, Nitrogen levels, Productivity, Varieties

Millets are cultivated in India from pre-historic times. Small millets are a gaggle of small-seeded cereals, which are grown in a very distinct range of environments. These crops provide staple food to poor and tribal people with low-cost sources of minerals and proteins. The productivity of these crops is low as compared to other major cereals, as these crops are mainly cultivated within the lands of abiotic stresses with poor soil nutrition. Thus, the small millets are the-poor man's food particularly within the dry regions of the country, where it is not possible to grow other food crops. They are called Nutri-cereals of their superiority in providing proteins, minerals, fibre etc. Area of small millets in India is 649,000 ha with production of 390,000 tonnes, with productivity of 602 kg/ha and in Telangana State area is 1,000 ha, production 1,000 tonnes and productivity 1,000 kg/ha (Annual Progress Report, ICAR–AICRP on Small Millets 2017–18).

Little millet is a reliable catch crop owing to its earliness and resistance to adverse agro-climatic conditions. It is generally consumed as rice and any recipe that demands staple rice are often prepared using little millet. It will yield some grain and useful fodder under very poor conditions. Because of its wider adaptability under moisture-stress conditions and adaptability with sowing time, this crop has become promising and popular among the farmers of the dry zone. But the yield of crop is restricted because of its cultivation on marginal and sub-marginal lands with imbalanced nutrition and negligence in cultivation practices. The low productivity is on account of inadequate and imbalanced use of fertilizers, non-adoption of suitable varieties and weed-control measures by the farmers. The soils of arid and semi-arid areas are deficient in nitrogen and low in organic carbon due to rapid rates of decomposition of organic material because of higher soil temperature. With harsh atmospheric conditions and low fertility of the soil, effective nutrient management is of considerable importance to beat the situations of limited yields in these areas. Nutrient management could be a key issue in achieving higher biomass of any crop plant and also maintaining soil fertility. Nitrogen is the primary nutrient which determines the growth and yield of a crop. Further, nitrogen is important in little millet for the manufacturing of proteins.

The experiment was carried out during the rainy season (*kharif*) of 2019 at College Farm, College of Agriculture, Rajendranagar, Hyderabad, Telangana. The experimental site was sandy loam in texture. It was laid out in factorial randomized block design, consisting of 12 treatment combinations, replicated thrice with 5 levels of nitrogen (0, 10, 20, 30 and 40 kg N/ha) and 3 varieties 'VS 25', 'VS 06' and 'OLM 203'. It is geographically situated at (17°19' N latitude and 78°23' E longitude at an altitude of 542.6 m above mean sea–level). The little millet varieties were

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sown at a spacing of 30 cm × 10 cm with a seed rate of 8 kg/ha. The full dose of P was applied at the time of sowing in the form of single superphosphate and N was applied in 3 splits as per treatment requirement in the form of urea–the first split was applied as basal and the next 2 splits applied at 30 and 45 days after sowing (DAS) respectively.

Among nitrogen levels, an application of 40 kg N/ha (N_5) resulted in the highest grain and straw yields which was at par with 30 kg N/ha (N_4) and significantly superior to the other nitrogen levels. The lowest grain yield was observed with no-nitrogen application (N_1) (Table 1). Increased nitrogen supply increased the values of all the growth parameters, yield-attributing characters which ultimately contributed to increasing in yield. The above results are in conformity with the findings of Kalaghatagi *et al*. (2000) and Hasan *et al*. (2013). The maximum grain and straw yields were given by the variety 'VS 25' (V_3), which were however comparable with the yields produced by the variety 'VS 06' (V_2) and the lowest grain and straw yields were recorded with the variety 'OLM 203' (V_1). Differences in yields among the varieties are often attributed to their genetic potentiality to supply and translocate photosynthates from source to sink. The superiority of variety 'VS 25' is owing to higher plant height, number of tillers, leaf area and higher dry-matter accumulation lead to higher yield attributes which were reflected in higher grain yield (Fig. 1). Our results confirm the findings of Dubey and Shrivas (1999), Intodia (1994), Saini and Negi (1996) and Divya and Maurya (2013). The very best harvest index was recorded with 40 kg N/ha (N_5) which was at par with 30 kg N/ha (N_4). The lowest harvest index was recorded with no-nitrogen (N_1) treatment. At higher nitrogen levels, there was less increase in grain yield corresponding to increase in biological yield. Among different varieties, the highest harvest index was registered by 'VS 25' (V_3), which was at par with 'VS 06' (V_2) variety, whereas the lowest harvest index was recorded with 'OLM 203' (V_1) variety.

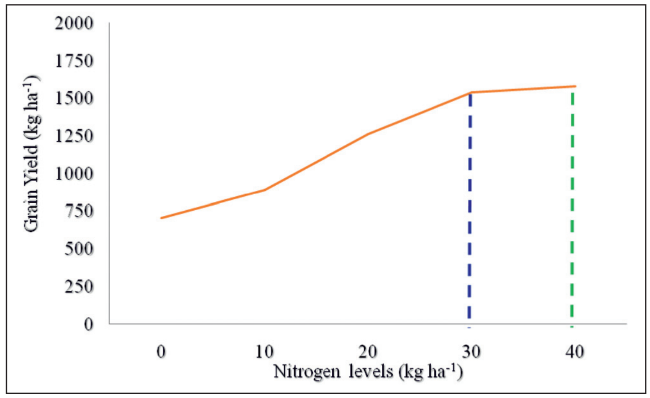

Fig. 1. Response of little millet to different nitrogen levels

With respect to the nitrogen levels, an application of 40 kg N/ha (N_5) resulted in the highest gross returns, being at par with 30 kg N/ha (N_4); and the lowest gross returns were observed with no-nutrient application (N_1). The upper level of nitrogen application increased the gross returns, this can be because of better nutrient-use efficiency leading to increased grain and straw yields.The highest gross returns were because of higher grain and straw yields (Table 2). Net returns of little millet were significantly influenced by different nitrogen levels and varieties, while the interaction was found to be non-significant. The highest net returns were registered with application of 40 kg N/ha (N_5), which was comparable with 30 kg N/ha (N_4).

Table 1. Grain and straw yields (kg/ha) and harvest index (%) of little millet as influenced by nitrogen levels and varieties

Treatment	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
Nitrogen levels (kg N/ha)			
N_1, Control	704	1,682	29.5
N_2, 10	890	2,092	29.8
N_3, 20	1,262	2,567	33.2
N_4, 30	1,537	3,194	37.5
N_5, 40	1,578	3,310	38.9
SEm±	61	94	1.3
CD (P=0.05)	178	274	3.9
Varieties			
V_1, 'OLM 203'	1,014	2,250	32.4
V_2, 'VS 6'	1,180	2,581	35.9
V_3, 'VS 25'	1,289	2,736	37.5
SEm±	47	73	1.1
CD (P=0.05)	138	212	3.1
Interaction			
SEm±	106	163	2.3
CD (P=0.05)	NS	NS	NS

NS, Non-significant

Table 2. Cost of cultivation, gross returns, net returns and benefit: cost (B:C) ratio of little millet as influenced by nitrogen levels and varieties

Treatment	Cost of cultivation ₹/ha	Gross returns ₹/ha	Net returns ₹/ha	Benefit: cost ratio
Nitrogen (kg N/ha)				
N_1, Control	17,332	22,533	4,615	1.30
N_2, 10	17,462	28,489	10,537	1.47
N_3, 20	17,592	40,377	22,426	2.29
N_4, 30	17,722	48,867	30,915	2.75
N_5, 40	17,852	50,822	32,870	2.84
SEm±	–	1,959	1,960	0.13
CD (P=0.05)	–	5,706	5,706	0.38
Varieties				
V_1, 'OLM 203'	17,852	35,640	17,708	1.92
V_2, 'VS 6'	17,852	37,773	19,821	2.14
V_3, 'VS 25'	17,852	41,240	23,288	2.33
SEm±	–	1,517	1,518	0.103
CD (P=0.05)	–	4,419	4,420	0.30
Interaction				
SEm±	–	3,394	3,394	0.23
CD (P=0.05)	–	NS	NS	NS

NS, Non-significant

The low net returns were recorded with no-nitrogen application (N_1) (Table 2). The higher net returns might be owing to higher grain and straw yields recorded under higher nitrogen levels. The present results confirm the results of Divya and Maurya (2013) and Navya Jyothi *et al.* (2015). Among the varieties, significantly higher net returns were noticed with variety 'VS 25' (V_3), followed by 'VS 06' (V_2). The lowest net returns were obtained with 'OLM 203' (V_1). The maximum benefit: cost ratio was recorded with 40 kg N/ha (N_5), being at par with 30 kg N/ha (N_4) and the lowest with no-nitrogen application (N_1). Similar results were reported by Divya and Maurya (2013).The highest benefit: cost ratio was observed with the variety 'VS 25' (V_3) which was at par with VS 06 (V_2) (Table 2). The bottom benefit: cost ratio was obtained with 'OLM 203' (V_1).

Thus, little millet responded significantly up to 40 kg N/ha with higher productivity and economic returns. However, 30 kg N/ha was found to be optimum for all the varieties used in the study. Among the 3 varieties, 'VS 25' and 'VS 06' performed well which were at par with each other. Among different nitrogen levels, higher economics was found with 30–40 kg N/ha with 'VS 25' (V_3) variety.

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