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Response of Little Millet Varieties to Different Levels of Fertilizers under Rainfed Condition

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Abstract: An experiment was conducted during kharif 2016 at Post Graduate Research Farm, College of Agriculture, Kolhapur Maharashtra. The objectives of experiment were to find out suitable varieties of little millet, to study the fertilizer requirement of little millet, the interaction effects of fertilizer and variety on little millet and the economics of different treatments in little millet. The growth attributing characters of little millet expressed in terms of plant height, number of functional leaves hill^{-1}, number of tillers hill^{-1}, leaf area and dry matter accumulationplant^{-1}were significantly higher in Phule Ekadashi and application of 150 per cent RDF. The Phule Ekadashi variety recorded significantly highest grain (13.45 q ha^{-1}) and straw (16.21q ha^{-1}) yield over OLM 203 (viz., 9.70 and 12.83 q ha^{-1}grain and straw yield respectively). The fertilizer level 150 per cent RDF recorded significantly highest grain 13.40 q ha^{-1} and straw 16.10 q ha^{-1}yields followed by 125 per cent RDF 12.60 and 15.87 q ha^{-1} grain and straw respectively. The fertilizer level 100 per cent and 75 per cent RDF recorded lowest grain and straw yield as compared to 125 and 150 per cent RDF. The variety Phule Ekadashi recorded significantly higher net (Rs. 24695 ha^{-1}) monetary returns, benefit cost ratio (1.84) over OLM 203 viz., net (Rs. 9695 ha^{-1}) monetary returns, benefit cost ratio (1.33).

Keywords: Little millet varieties, Fertilizer levels, Interaction effect.

1. INTRODUCTION

Little millet (Panicumsumatrense L.) is one of the minor millet, which belongs to family Poaceae. Little millet is another reliable catch crop in view of its earliness and resistance to adverse agro-climatic conditions of high drought as well as water logging. It is grown throughout India and a traditional crop of Karnataka. It is mostly cropped with other millets, pulses and oilseeds. It is generally consumed as rice and any recipe that demands staple rice can be prepared using little millet. It is described as a "quick growing, short duration cereal which withstands both drought and water logging". Doubtless this is a valuable crop in difficult situations. It occurs as wild crop in Northern India and South Eastern Asia. It will yield some grain and useful fodder under very poor conditions. The crop is a balanced and staple food of tribal and economically poor section of the population. It provides low priced proteins, minerals and vitamins in the form of sustainable food. The stover is a good fodder for cattle.

Nitrogen is of vital importance to the physiology of little millet. It plays a critical role in the process of photosynthesis by which plants manufacture their own food from sunlight. Further, nitrogen is essential in little millet for manufacturing of proteins and in virtually every other aspect of its physiology. Plants that are deficient in nitrogen grow poorly and develop yellowing leaves. Nitrogen is major component of amino acids and the building blocks of protein. Major component of chlorophyll. Phosphorus is an essential nutrient for animals and plants. It plays a critical role in cell development and is a key component of molecules that store energy, such as ATP (adenosine triphosphate), DNA and lipids (fats and oils).

Insufficient phosphorus in the soil can result in a decreased crop yield. Phosphorus(P) is vital role in plant growth and is found in every living plant cell. It is involved in several key plant functions, including energy transfer, photosynthesis, transformation of sugars and starches, nutrient movement within the plant and transfer of genetic characteristics from one generation to the next. Traditionally, little millet is grown in low fertile soils without application or limited fertilizer application. However, experimental results indicate that the crop responds favorably low fertilizer application.

2. MATERIAL AND METHODS

The field experiment was laid out in a factorial randomized block design (FRBD) comprising eight treatment combinations replicated thrice viz. V_1-Phule Ekadashi, V_2-OLM 203, and four fertilizer levels F_1-75 per cent RDF, F_2-100per cent RDF, F_3-125per cent RDF,F_4-150 per cent RDF. The gross and net plot sizes were 4.50 x 3.0 m^2 and 3.90 x

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2.40 m^2, respectively. Little millet crop was transplanted at row to row and plant to plant spacing with 30 cm × 7.5 cm. The Post Graduate Research Farm, College of Agriculture, Kolhapur is geographically situated between $16^0$42' North latitude and $74^0$14' East longitude having elevation of 548 meters above the mean sea level. It comes under the Sub-montane zone of Maharashtra with average annual rainfall 1061 mm being received in 66 rainy days. Out of which 80 per cent rainfall receives from South West monsoon in June to September. Rest of the rainfall is received in the month of October and November from North East monsoon. The soil of experimental plot was sandy clay loam in texture, medium in available nitrogen and phosphorus and high in available potassium. It was slightly alkaline in reaction.

3. RESULTS AND DISCUSSION

Growth contributing characters

Effect of varieties: The highest plant height was observed in Phule Ekadashi which was significantly superior over OLM-203 at all growth phases. The increase in height of Phule Ekadashi is genetically governed phenomena of harmonal balance, nutrient absorption capacity and conversion of radiant energy in presence of chlorophyll. All this process reflects in increase in plant height and all growth contributing characters. Similar results were reported by Bhomte et al., (2013), Patil et al., (2015), and Anonymous (2015).The mean no of tillers $plant^{-1}$ and number of leaves were significantly higher in Phule Ekadashi over OLM-203. The Phule Ekadashi is significantly superior over OLM 203, from this results it was observed that Phule Ekadashi has more genetical potential to enlarge the leaf size during growth period than OLM 203.

The dry matter accumulation was higher in Phule Ekadashi which was significantly superior over OLM-203. Dry matter accumulation is the result of all the growth and yield attributes namely plant height, number of tillers, number of leaves, leaf area etc. The Phule Ekadashi had high source sink relationship as compared to OLM-203. The dry matter production is largely function of photosynthetic surface which had favorably influenced by Phule Ekadashi. Days to 50 percent flowering and maturity did not differ significantly due to little millet varieties.

Effect of fertilizer levels: The significantly higher plant height of little millet was recorded as 150 percent RDF which was on par with 125 percent RDF and significantly superior over rest of the treatments. 125 and 150 per cent RDF provides sufficient nutrient to plant which leads to anatomical changes such as increase in size of cells, intercullar spaces, thinner cell walls and lower development of epidermal tissue resulted to increase in plant height. Similar finding were reported by Sunitha et al., (2004), Deshmukh (2007) and Pradhan et al. (2011).

The higher number of tillers $plant^{-1}$of little millet observed due to 150 percent RDF which was on par with 125 percent RDF and significantly superior over rest of the treatments. This might be due to luxuriant availability of nutrient for growth and development of auxillary bud from which tillers are emerged. These results are in corroborative with the findings of Sunitha et al., (2004), Deshmukh (2007) and Pradhan et al. (2011).

The highest number of leaves $plant^{-1}$ and leaf area $plant^{-1}$of little millet were influenced significantly due to different fertilizer levels. Application of 150 per cent RDF recorded highest number of leaves $plant^{-1}$ and leaf area which was at par with 125 per cent RDF and significantly superior over rest of the treatments. This might be due to higher availability of nitrogen and phosphorus at vegetative and reproductive phases enables plants for promotion of cell division and expansion of leaves. Similar findings were reported by Deshmukh (2007).

Dry matter $plant^{-1}$ was significantly higher due to 150 percent RDF which was at par with 125 percent RDF and significantly superior over rest of the treatments. Similar result was also supported by Ramamoorthy and Lourduraj (2002), Sunitha et al., (2004), Deshmukh (2007) and Pradhan et al. (2011).

INTERACTION EFFECTS

All the interaction effects were found to be non-significant.

Yield attributing characters, yield and economics:

Effect of varieties :The length of panicle, grain weight per panicle and test weight of little were influenced significantly due to different little millet varieties. The Phule Ekadashi variety of little millet was recorded significantly higher length of panicle, grain weight per panicle and test weight over OLM-203. The difference in these characters in little millet varieties might be due to inherent genetic potential of varieties.

The grain and straw yield of little was influenced significantly due to different little millet varieties. The Phule Ekadashi variety of little millet was recorded significantly higher grain and straw yield over OLM-203. The difference in grain and straw yield in little millet varieties might be due to inherent genetical potential of little millet varieties. Similar result were observed in Anonymous (2015).

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The net monetary returns had significantly influenced by the different little millet varieties. The Phule Ekadashi variety of little millet recorded significantly higher net monetary returns (Rs. 24695 ha^{-1}.) over OLM 203 (Rs.9695 ha^{-1}). The Phule Ekadashi variety of little millet recorded higher B: C ratio (1.84) over OLM 203 (1.33).

Effect of fertilizer levels :The length of panicle of little was influenced significantly due to different fertilizer levels. The application of 150 percent RDF recorded significantly higher panicle length which was at par with 125 percent RDF and significantly superior over rest of the treatments. This might be due to availability of nitrogen and phosphorus to plants resulted in higher accumulation of photosynthetic assimilates might be responsible for higher length of panicle.

The test weight of little was differed significantly due to different fertilizer levels. The application of 150 percent RDF recorded significantly higher test weight which was at par with 125 percent RDF and significantly superior over rest of the treatments. Higher source to sink relationship leads to higher values of test weight. Results are in agreement with those obtained by Ramamoorthy and Lourduraj (2002), Pradhan et al. (2011).

The grain weight $panicle^{-1}$ of little was influenced significantly due to different fertilizer levels. The application of 150 percent RDF recorded significantly higher grain weight $panicle^{-1}$ which was at par with 125 percent RDF and significantly superior over rest of the treatments. This might be due to reproductive phase reduce seed membrane integrity, embryo RNA content, chlorophyll synthesis and dehydrogenase activity.

The grain yield of little was influenced significantly due to different fertilizer levels. The application of 150 percent RDF recorded significantly higher grain yield which was at par with 125 percent RDF and significantly superior over rest of the treatments. This might be due to high chlorophyll synthesis and dehydrogenase activity, also it affects source to sink relationship which reflects in higher yields. Similar result were observed in Bhomte (2013) and Anonymous (2015).

The straw yield of little was influenced significantly due to different fertilizer levels. The application of 150 percent RDF recorded significantly higher straw yield which was on par with 125 percent RDF and significantly superior over rest of the treatments. This might be due to better root activity, good source to sink relationship and high physiological activities which synthesized cytokinise. Similar result were reported by Kumar et al. (2003), Deshmukh (2007) and Pradhan et al. (2011).

Application of 150 per cent RDF gave significantly higher net monetary returns (Rs. 24027 ha^{-1}.), which was at par with 125 per cent RDF (Rs. 21139 ha^{-1}) and significantly superior over rest of the treatments viz. 75 and 100 per cent RDF. Similar results were also reported by Ramamoorthy and Lourduraj (2002) and Bhomte et al., (2013). Application of 150 per cent RDF recorded higher B: C ratio (1.81) followed by 125, 100 and 75 per cent RDF. Similar results were also reported by Ramamoorthy and Lourduraj (2002) and Sunitha et al., (2004) and Bhomteet al., (2013).

Interaction effects:

All the interaction effects were found to be non-significant

Table 1. Effect of varieties and fertilizer levels on growth contributing characters of little millet

Treatment	Plant height (cm)	Tillers $plant^{-1}$	Number of leaves $plant^{-1}$	Leaf area $plant^{-1}$ (dm^{-2})	Dry matter $plant^{-1}$ (g)	Days to 50% flowering	Days to maturity
Varieties							
V1–Phule Ekadashi	116.76	5.85	20.80	260.03	7.48	83	123
V2 – OLM 203	110.94	4.89	16.48	253.57	6.34	85	125
SE (m) ±	1.20	0.13	1.17	1.60	0.16	1.20	1.71
C.D. at 5 %	3.60	0.37	3.51	4.82	0.49	NS	NS
Fertilizer levels							
F1 – 75 % RDF	106.79	4.12	16.0	245.37	5.41	83	123
F2 – 100 % RDF	109.09	45.21	16.56	253.54	6.74	84	124
F3 – 125 % RDF	117.75	5.84	20.74	262.74	7.84	84	124
F4 – 150 % RDF	120.81	6.32	21.26	265.17	8.22	85	124
SE (m) ±	1.71	0.15	0.05	2.21	0.27	1.27	1.51
CD at 5%	3.54	0.44	3.17	6.64	0.81	NS	NS
Interaction effect (V x F)							
S.E (m) ±	2.42	0.29	1.18	2.30	0.29	1.30	1.28
C. D. at 5 %	NS	NS	NS	NS	NS	NS	NS
General mean	113.85	5.37	18.64	256.70	7.01	84	124

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Table 2. Effect of varieties and fertilizer levels on yield contributing characters, yield and economics of little millet

Treatment	Length of panicle (cm)	Grain yield panicle^{-1}	Test wt.(g)	Grain yield qha^{-1}	Straw yield qha^{-1}	Net returns (Rs ha^{-1})	B:C ratio
Varieties							
V1–Phule Ekadashi	24.16	3.82	2.52	13.45	16.21	24695	1.84
V2 – OLM 203	19.20	2.91	2.19	9.70	12.83	9695	1.33
SE (m) ±	0.33	0.04	0.04	0.40	0.52	1600	-
C.D. at 5 %	1.00	0.13	0.12	1.21	1.56	4810	-
Fertilizer levels							
F1 – 75 % RDF	19.21	2.88	2.01	9.32	12.01	8643	1.30
F2 – 100 % RDF	21.24	3.10	2.26	11.0	14.10	15051	1.51
F3 – 125 % RDF	22.40	3.54	2.54	12.60	15.87	21139	1.72
F4 – 150 % RDF	23.87	3.86	2.63	13.40	16.10	24027	1.81
SE (m) ±	0.38	0.15	0.04	0.32	0.21	1280	-
CD at 5%	1.14	0.45	0.12	0.97	0.64	3840	-
Interaction effect (V x F)							
S.E (m) ±	0.42	0.18	0.06	0.33	0.27	1320	-
C. D. at 5 %	NS	NS	NS	NS	NS	NS	-
General mean	21.68	3.37	2.41	11.58	14.52	17215	

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