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YIELD, NUTRIENT UPTAKE AND POST HARVEST SOIL AVAILABLE NUTRIENT STATUS OF LITTLE MILLET AS INFLUENCED BY TIME OF SOWING AND VARIETIES

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ABSTRACT

A field experiment was conducted at S.V. Agricultural College Farm, Tirupati, Acharya N.G. Ranga Agricultural University, Andhra Pradesh, India during *kharif* season of 2020 to analyze the yield, nutrient uptake and post harvest soil available nutrient status of little millet varieties under different times of sowing. The treatments consists of four main plots which include time of sowing and three sub plots which includes varieties imposed in Split-Plot design with replicated thrice. Sowing of crop in I FN of July resulted in highest grain and straw yield, nutrient uptake and lower amount of post harvest soil available nutrients. Among the varieties tried, OLM 203 produced higher grain and straw yield, higher nutrient uptake and lower amount of post harvest soil available nutrients.

KEYWORDS: Little millet varieties, Nutrient uptake, Times of sowing, Yield and Post harvest soil available nutrients

INTRODUCTION

Little millet also called as poorman's crop, sama or kutka and grown on the soils which are not suitable for other crops. It is good famine food and can produce some grain under drought conditions when all the other crops fail to produce. It can withstand both drought and water logging. It has potential as fodder crop and matures in 80-110 days. The grain size is smaller than other millets with rich iron content and high antioxidant properties. It contains about 67.0 per cent carbohydrates, 7.7 per cent protein, 4.7 per cent lipids, and 7.6 per cent crude fiber. The husked grain of this millet is cooked almost in a manner similar to rice or rotis can be prepared with this flour.

Timely sowing of crop with available soil moisture during *kharif* season is a major problem in semi-arid regions of India. Timely sown crop experiences the favorable environmental conditions during various phenological stages and results better performance. Selection of suitable variety is an important factor responsible for enhancing productivity of millets. Growing of variety with short duration, medium height, drought resistant and high yielding capacity is most important to get viable yields under semi arid regions.

MATERIAL AND METHODS

The present investigation was carried out at dryland farm, S.V. Agricultural College, Tirupati of Acharya N.G. Ranga Agricultural University. The experiment was laid out in a split-plot design with four main plots and three sub-plots replicated thrice. The main plots consist four times of sowing *viz.* T_1: Second Fortnight of June, T_2: First Fortnight of July, T_3: Second Fortnight of July and T_4: First Fortnight of August and three sub plots consist varieties *viz.* OLM 203, CO 2 and BL 6. The crop was sown at a spacing of 20 cm × 10 cm. The experimental field was sandy loam in texture which is low in organic carbon (0.35%). The soil is neutral in reaction (pH 6.9), low in available N (176.0 kg ha^{-1}), high in available P (38 kg ha^{-1}) and medium in available K (232.0 kg ha^{-1}). A total rainfall of 1017.2 mm was received in 43 rainy days during the crop growing period. A uniform recommended dose of 20-20-0 kg N, P_2O_5 and K_2O ha^{-1} was applied to little millet. The nutrients were applied in the form of urea and single super phosphate. Available soil nitrogen (N) was estimated by the method described by Subbiah and Asija (1956) and the nitrogen status was expressed in kg ha^{-1}. Soil available phosphorus was determined as described by Olsen *et al*. (1954) using spectrophotometer and expressed in kg ha^{-1}. Soil available Potassium was estimated by neutral normal ammonium acetate extraction method using Flame Photometry (Stanford and English, 1949) and expressed in kg ha^{-1}. Plants from each treatment in the plot were selected at random and tagged for taking the observation *viz.*, nutrient uptake of NPK. The oven dried samples of plants material were ground in a willey mill and analyzed for N, P and K contents. The nitrogen,

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phosphorus and potassium uptake were calculated by multiplying the nutrient content of the plant sample with corresponding total dry matter and expressed in kg ha^{-1}. The total nitrogen content in the plant sample was estimated by the Micro Kjeldal method as suggested by Humphries (1956). The total phosphorus content in the plant sample was estimated with triple acid digestion method by Jackson (1973). The total potassium content in the plant sample was estimated with triple acid digestion method using Flame Photo Meter as suggested by Jackson (1973). The data collected were analyzed statistically following the procedure given by Panse and Sukhatme (1978) wherever the treatmental differences were significant, critical differences were worked out at five per cent probability level. Treatment differences that were not significant are denoted as NS.

RESULTS AND DISCUSSION

Grain yield

Grain yield of little millet varied significantly due to times of sowing as well as varieties. Interaction effect of times of sowing and varieties on grain yield was found to be non significant (Table 1).

The highest grain yield was realized when little millet was sown during I FN of July (T_2) which was significantly superior to rest of the treatments tried. It was followed by II FN of June (T_1) and II FN of July (T_3) and I FN of August (T_4) in the order of descent and the difference between these three however, was not significant. Lower grain yield was obtained with the crop sown during I FN of August (T_4). Crop sown during I FN of July (T_2) might have experienced favorable weather conditions with prolonged photoperiod due to which higher assimilates were translocated towards panicle and hence resulted in higher number of productive tillers $panicle^{-1}$, number of grains $panicle^{-1}$, test weight and thus the grain yield. The results of present investigation are in agreement with the findings of Anusha (2015) and Detroja *et al.* (2018).

Among the little millet varieties tried, significantly higher grain yield was recorded with OLM 203 (V_1). The next best variety was CO 2 (V_2) followed by BL 6 (V_3) with significant disparity between each other. The variety BL 6 (V_3) registered significantly lower grain yield. All the three varieties maintained significant disparity between them. Difference in yields among the varieties can be attributed to their genetic potentiality to utilize and translocate photosynthates from source to sink. Superiority of the variety OLM 203 (V_1) in producing number of tillers m^{-2}, number of productive tillers m^{-2}, number of grains $panicle^{-2}$ and test weight which had positive effect on grain yield of little millet. The similar results were reported with Balaravi *et al.* (2010).

Straw yield

Times of sowing and varieties exerted significant influence on the straw yield of little millet, while their interaction effect was found to be non significant (Table 1).

Significantly higher straw yield was registered with little millet sown during I FN of July (T_2) followed by II FN of July (T_3) and I FN of August (T_4) and II FN of June (T_1) in the order of descent which were however, comparable with each other. Lesser straw yield was with the crop sown during II FN of June (T_1). Higher straw yield with I FN of July sown crop might be due to favorable weather conditions like bright sunshine hours and adequate rainfall that has resulted in better growth parameters like leaf area and dry matter accumulation which have directly influenced the straw yield. The results of present investigation are in agreement with the findings of Anusha (2015), Gavit *et al.* (2017) and Detroja *et al.* (2018).

Among the varieties tested, higher straw yield was registered with the variety CO 2 (V_2), which was however, comparable with OLM 203 (V_1) and significantly superior over BL 6 (V_3), while the latter one registered significantly lower straw yield. This might be due to genetic potential of the variety which resulted in better vegetative growth leading to higher straw yield. The similar results were reported by Bhavani (2020).

NUTRIENT UPTAKE

Nutrient uptake of little millet varied significantly due to times of sowing and varieties, while the interaction effect found to be non significant (Table 1).

1. Nitrogen uptake

The highest nitrogen uptake was recorded when the crop was sown during I FN of July (T_2) which was however comparable with crop sown during II FN of June (T_1) and significantly superior over II FN of July (T_3). Crop sown during I FN of August (T_4) resulted in the lowest nitrogen uptake. Little millet variety OLM 203 (V_1) taken higher amount of nitrogen which was comparable with CO 2 (V_2). Lower amount of nitrogen uptake was observed with BL 6 (V_3).

2. Phosphorus uptake

Significantly the highest phosphorus uptake was recorded with little millet crop sown during I FN of July (T_2) followed by II FN of June (T_1) and II FN of July (T_3), latter two were comparable with each other. Significantly the lowest phosphorus was uptake recorded in crop sown during I FN of August (T_4). The little millet variety OLM 203 (V_1) taken highest amount of phosphorous, which was significantly superior over CO 2 (V_2). Significantly lower amount of phosphorus uptake was recorded with BL 6 (V_3).

3. Potassium uptake

Significantly the highest potassium uptake was recorded with little millet crop was sown during I FN of July (T_2) followed by II FN of June (T_1) and II FN of July (T_3). Significantly the lowest phosphorus uptake was recorded in crop sown during I FN of August (T_4). Little millet variety OLM 203 (V_1) taken higher amount of potassium which was comparable with CO 2 (V_2). Lower amount of potassium uptake was observed with BL 6 (V_3).

Higher nutrient uptake (Nitrogen, Phosphorus and Potassium) was recorded when the crop was sown during I FN of July (T_2). This might be due to higher nutrient uptake efficiency of the crop and to produce higher dry matter the crop requires more nutrients. Similar results were obtained by Mubeena *et al.* (2019). This might be due to better development of tillers and dry matter production which requires more absorption of nutrients in OLM 203 (V_1).

POST HARVEST SOIL AVAILABLE NUTRIENT STATUS

Post harvest fertility status of soil after harvesting of little millet significantly varied due to sowing times and varieties, while the interaction effect was not-significant (Table 2).

1. Post harvest soil available nitrogen

Higher values of post harvest soil available nitrogen was recorded with the crop sown during I FN of August (T_4) which was on par with II FN of July (T_3) and significantly superior over II FN of June (T_1). The difference in soil available nitrogen due to II FN of July (T_3) and II FN of June (T_1) was not significant. Lower values of post harvest soil available nitrogen recorded with crop sown during I FN of July (T_2). Among the little millet varieties tried, BL 6 (V_3) recorded the highest amount of post harvest soil available nitrogen which was significantly superior over CO 2 (V_2). OLM 203 (V_1) recorded the lowest amount of post harvest soil available nitrogen, which was in turn on par with CO 2 (V_2) variety.

2. Post harvest soil available phosphorus

Significantly higher values of post harvest soil available phosphorus recorded with the crop sown during I FN of August (T_4) followed by II FN of July (T_3) and II FN of June (T_1). While the latter two are however comparable. Significantly lower values of post harvest soil available phosphorus recorded with crop sown during I FN of July (T_2). The little millet variety BL 6 (V_3) recorded significantly the highest amount of post harvest soil available phosphorus followed by CO 2(V_2). Significantly the lowest amount of post harvest available soil phosphorus recorded with OLM 203 (V_1) variety.

3. Post harvest soil available potassium

Higher values of post harvest soil available potassium was recorded with crop sown during I FN of August (T_4) which was on par with II FN of July (T_3) and significantly superior over II FN of June (T_1) and the latter two were also having significant disparity between them. Significantly lower values of post harvest soil available potassium recorded with crop sown during I FN of July (T_2). The variety BL 6 (V_3) recorded significantly the highest amount of post harvest soil available potassium which was significantly superior over CO 2 (V_2). OLM 203 (V_1) recorded lowest amount of post harvest soil available potassium, which in turn on par with CO 2 (V_2) variety.

Reduction in soil available nutrients with crop sown during I FN of July (T_2) might be due to higher nutrient uptake efficiency of the crop and to produce higher crop dry matter requires more nutrients. Increase in post harvest soil available nutrients with delayed sowing as resulted from the present experiment is similar with the findings of Gavit *et al.* (2017). This might be due to better development of tillers and dry matter production which requires more absorption of nutrients in OLM 203 (V_1) which leads to reduction of post harvest soil available nutrients. The similar results were reported by Bhavani (2020).

CONCLUSION

From this study it can be concluded that Sowing of Little millet can be taken up during I FN of july results

Table 1. Yield and nutrient uptake at harvest as influenced by time of sowing and varieties of little millet

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Nitrogen uptake (kg ha^{-1})	Phosphorus uptake (kg ha^{-1})	Potassium uptake (kg ha^{-1})
Times of Sowing (T)					
T_1 : II FN of June	1170	2333	22.49	21.16	61.3
T_2 : I FN of July	1368	2670	23.81	24.70	67.7
T_3 : II FN of July	1092	2386	18.49	20.57	51.2
T_4 : I FN of August	990	2362	17.81	18.10	47.4
SEm±	32.7	61.8	0.433	0.662	1.65
CD (P = 0.05)	113	218	1.53	2.34	5.9
Varieties (V)					
V_1 : OLM 203	1348	2531	22.33	24.45	61.2
V_2 : CO 2	1121	2702	20.87	21.04	58.0
V_3 : BL 6	996	2081	18.73	17.90	51.5
SEm±	32.2	55.0	0.515	0.511	1.36
CD (P = 0.05)	97	166	1.56	1.54	4.1
Times of sowing (T) × Varieties (V)					
V at T					
SEm±	56.6	107.1	0.750	1.147	2.87
CD (P = 0.05)	NS	NS	NS	NS	NS
T at V					
SEm±	61.9	109.0	0.946	1.065	2.77
CD (P = 0.05)	NS	NS	NS	NS	NS

higher grain yield, straw yield and nutrient uptake and lower amount of post harvest soil available nutrients. The variety OLM 203 produced higher grain yield, straw yield and higher nutrient uptake and lower amount of post harvest soil available nutrients.

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Table 2. Post harvest soil available nitrogen, phosphorus and potassium as influenced by time of sowing and varieties of little millet

Treatments	Available nitrogen (kg ha^{-1})	Available phosphorus (kg ha^{-1})	Available potassium (kg ha^{-1})
Times of Sowing (T)			
T_1 : II FN of June	177	20.5	211
T_2 : I FN of July	172	18.1	191
T_3 : II FN of July	193	20.8	229
T_4 : I FN of August	197	24.7	241
SEm±	4.0	0.66	4.6
CD (P = 0.05)	14	2.3	16
Varieties (V)			
V_1 : OLM 203	173	17.9	193
V_2 : CO 2	174	21.0	215
V_3 : BL 6	207	24.2	247
SEm±	3.6	0.51	8.0
CD (P = 0.05)	11	1.5	24
Times of sowing (T) × Varieties (V)			
V at T			
SEm±	6.9	1.15	7.9
CD (P = 0.05)	NS	NS	NS
T at V			
SEm±	7.0	1.06	13.9
CD (P = 0.05)	NS	NS	NS

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