The Pharma Innovation Journal 2022; 11(12): 3052-3055

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(12): 3052-3055

www.thepharmajournal.com
Received: 01-10-2022
Accepted: 05-11-2022

Syed Shireen JR
PG Student, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

Asewar BV
Associate Dean and Principal, College of Agriculture Golegaon, VNMKV Parbhani, Maharashtra, India

Aher KP
PG Student, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

Sachin S
PG Student, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
Syed Shireen JR
PG Student, College of Agriculture, VNMKV, Parbhani, Maharashtra, India

Impact of different plant densities and nutrient levels on growth and yield of little millet (*Panicum sumatrense* L.)

Syed Shireen JR, Asewar BV, Aher KP and Sachin S

Abstract
An experiment was conducted at PG Research Farm, Department of Agronomy, College of Agriculture, VNMKV, Parbhani (M.S) during *kharif* season of 2021 with an objective to study the effect of different spacings and fertilizer levels on growth and yield of little millet. The experiment consists of three spacings *viz.*, 22.5 cm × 10 cm, 30 cm × 10 cm and 45 cm × 5 cm and four fertilizer levels *viz.*, 30:15:15 NPK kg ha^{-1}, 40:20:20 NPK kg ha^{-1}, 50:25:25 NPK kg ha^{-1} and 60:30:30 NPK kg ha^{-1} each replicated thrice in split plot design. At regular intervals, data on the yield and growth parameters were collected and analyzed. Result of the study revealed that spacing 45 cm × 5 cm recorded highest values of number of tillers plant^{-1}, number of functional leaves plant^{-1}, leaf area plant^{-1} and dry matter accumulation plant^{-1}, grain yield, straw yield, biological yield and harvest index except plant height which was higher in 22.5 cm × 10 cm spacing. Among fertilizer levels 60:30:30 NPK kg ha^{-1} recorded maximum plant height, number of tillers plant^{-1}, number of functional leaves plant^{-1}, leaf area plant^{-1} and dry matter accumulation plant^{-1}, grain yield, straw yield, biological yield and harvest index and found at par with 50:25:25 NPK kg ha^{-1}.

Keywords: Fertilizer levels, growth, little millet, spacing, yield

1. Introduction
Little millet (*Panicum sumatrense* L.), one of the minor millets which is widely grown in India. It is referred to as Indian millet and is native to India. China, East Asia, Malaysia, and India are the main regions where it is grown. It belongs to family *poaceae* and sub family Panicoideae. It is resilient to unfavourable agro-climatic conditions such as extreme drought and water logging. The low production is caused by the farmers' ineffective and imbalanced use of fertilizers, lack of adoption of acceptable varieties and doses of nitrogen, as well as ineffective weed-control efforts. By capturing as much solar radiation as possible, crop geometry plays a key role in improving soil moisture and nutrient uptake (root spread) and above-ground development (plant canopy) (Uphoff *et al*., 2011) [10]. The ideal plant population puts almost maximum pressure on the plants to fully utilise the resources of the environment, increasing crop yield. In order to sustain the soil's nutrient supply, fertilizer must be used as a key source of plant nutrients. Unquestionably, fertilizer plays a crucial part in establishing sustainable production because it affects both crop quality and people's health when it comes to food production. Given that they are responsible for 50% of global food production, fertilizers are regarded as vital inputs. Achieving optimum use efficiency is a crucial challenge in dryland or rainfed conditions when uneven soil moisture predominates to a greater extent. Major nutrients, such as nitrogen, phosphorous, and potassium, are given by various fertilizers. Nutrient management is therefore crucial for increasing agricultural plant biomass and preserving soil fertility (Divyashree *et al*., 2018) [2]. According to the natural fertility level of the soil, the surrounding conditions, and the genotype, the response of crops to fertilizers varies greatly from location to location (Siddiqui *et. al*., 2020) [7].

2. Materials and Methods
The field experiment was conducted at PG Research Farm, Department of Agronomy, College of Agriculture, VNMKV, Parbhani during *kharif* 2021-22. Geographically, Parbhani is situated 409 m above the mean sea level at 19º 16' North latitude and 76 º 47' East longitude, Its height from mean sea level is about 879 m. Most of the rainfall is received from Southwest monsoon.
Climatic conditions were favourable for enhanced growth and development during the experimental period.

The experimental plot was clay in texture with low in available nitrogen (194.60 kg ha^{-1}), medium in available phosphorus (12.73 kg ha^{-1}) and high in available potassium (513.84 kg ha^{-1}) and slightly alkaline in reaction pH (7.8). The experiment has been laid out in a split plot design with 3 replications and 12 treatment combinations. The main plot consisted of three spacings *viz.*, 22.5 cm × 10 cm (4,44,444 plants ha^{-1}), 30 cm × 10 cm (3,33,333 plants ha^{-1}) and 45 cm × 5 cm (4,44,444 plants ha^{-1}) and subplot consisted of four fertilizer levels *viz*., 30:15:15 NPK kg ha^{-1}, 40:20:20 NPK kg ha^{-1}, 50:25:25 NPK Kg ha^{-1} and 60:30:30 NPK Kg ha^{-1}. Available nitrogen was estimated by alkaline potassium permanganate method (Subbiah and Asija, 1956) [8], available phosphorus by Olsen's method (Olsen *et al*. 1954) [5] and available potassium from soil samples was estimated by using flame photometer method given by Jackson (1973) [4]. Plants from each treatment in the plot were selected at random and tagged for taking the observation on growth parameters *viz*, plant height, number of tillers $plant^{-1}$, number of functional leaves $plant^{-1}$, leaf area $plant^{-1}$ and dry matter accumulation $plant^{-1}$ and yield *viz*, grain yield, straw yield, biological yield and harvest index. Data obtained from various observations were analyzed as per the standard analysis of variance (ANOVA) procedure laid down by Gomez and Gomez (1984). Leaf area was measured by using the automatic leaf area meter and harvest index was worked out by using the formula,

$$\text{Harvest index} = \frac{\text{Economic yield (kg)}}{\text{Biological yield (kg)}} \times 100$$

3. Results and Discussion

3.1 Effect of spacing and fertilizer levels on growth parameters

The data represented in Table 1 revealed that spacing 22.5 cm × 10 cm recorded maximum plant height than rest of the treatments. It could be attributed to the fact that higher plant density resulted in mutual shading and reduced the availability of light, particularly to lower leaves. As a result, the individual plant tends to grow taller in search of light in higher plant density up to adequate nutrient availability.

Plant spacing of 45 cm × 5 cm produces higher values of number of tillers $plant^{-1}$, number of functional leaves $plant^{-1}$, leaf area $plant^{-1}$ and dry matter accumulation $plant^{-1}$. This might be due to higher availability of light, moisture and nutrients in wider spacing which resulted in more number of healthy and robust tillers $plant^{-1}$, maximum number of functional leaves which ultimately results into increased leaf area. Larger leaf area may be resulted in more photosynthetic activities and more accumulation of carbohydrates and thereby increased dry matter production when compared to closer plant geometry. Similar results were recorded by Siddiqui *et al*. (2020) [7].

In case of fertilizer levels application of 60:30:30 NPK Kg ha^{-1} recorded maximum plant height, number of tillers $plant^{-1}$, number of functional leaves $plant^{-1}$, leaf area $plant^{-1}$ and dry matter accumulation $plant^{-1}$ and found at par with 50:25:25 NPK kg ha^{-1}. This might be possible as a result of the balanced fertilizer application levels that improved cell division, cell multiplication and tissue differentiation. These factors help to extensively elongate the cell along the main axis, which in turn promotes more growth of internodes and ultimately increases the height of the plant and luxuriant availability of nutrients also promotes the growth and development of auxillary bud from which tillers are emerged. Increased availability of nitrogen, phosphate, and potassium, which were critical for quick cell division may be the cause of the greater leaf area values seen in plant. Due to favourable physical conditions that boosted the fertilizer's mineralization mobility, which in turn led to higher nutrient uptake and crop development, which in turn led to larger dry matter build up. The results are in conformity with those obtained earlier by Divyashree *et al*. (2018) [2]. However 40:20:20 NPK kg ha^{-1} was noticed to be at par with 30:15:15 NPK kg ha^{-1}.

3.2 Effect of spacing and fertilizer levels on yield of little millet

Different spacing had a profound influence on the yield. Significantly superior grain yield, straw yield, biological yield and harvest index was obtained when crop was sown at 45 cm × 5 cm and found at par with 22.5 cm × 10 cm, it may be due to similar plant population in 45 cm × 5 cm and 22.5 cm × 10 cm. This might be due to optimum plant geometry provided favourable microclimate which enables efficient utilization light, moisture and nutrients by the individual plant which in turn leads to maximum productivity and also this might be because of denser planting, as in field crops optimum plant population was an essential element of productivity. Similar results were recorded by Swathi *et al*. (2020) [9].

Among different fertilizer levels application of 60:30:30 NPK Kg ha^{-1} recorded higher grain yield, straw yield, biological yield and harvest index over the treatment 40:20:20 NPK kg ha^{-1} and 30:15:15 NPK kg ha^{-1} and found at par with 50:25:25 NPK Kg ha^{-1}. Similar trend was observed with straw yield, biological yield and harvest index. This could be as a result of the application of a higher level of fertilizer to little millet, which aids in enhancing the overall fertility state of the soil. Vigorous plant development may have generated more photo synthates which led to increased plant height, number of tillers, number of functional leaves $plant^{-1}$, leaf area, and total dry matter accumulation, which improved resulted in straw yield, increasing yield attributes like grain yield $panicle^{-1}$, grain yield $clump^{-1}$ and grain yield and ultimately showed the positive reflection on biological yield. This result supports the findings of Charate *et al.* (2018) [1] and Raundal *et al.* (2018) [6]. However 40:20:20 NPK kg ha^{-1} was noticed to be at par with 30:15:15 NPK kg ha^{-1}.

3.3 Interaction effects: Interaction effects between plant densities and fertilizer levels were found non significant.

Table 1: Effect of spacing and fertilizer levels on different growth parameters

Treatments	Plant height (cm)	No. of tillers plant^{-1}	No. of leaves plant^{-1}	Leaf area plant^{-1} (dm^2)	Dry matter accumulation plant^{-1} (g)
Spacing (S)					
S_1-22.5 cm × 10 cm	105.63	2.78	6.43	2.17	5.42
S_2-30 cm × 10 cm	96.87	3.09	7.36	2.49	6.04
S_3-45 cm × 5 cm	87.59	3.41	8.12	2.76	6.62
SE (m) ±	2.12	0.07	0.17	0.05	0.12
C.D. at 5%	8.33	0.23	0.65	0.20	0.49
Fertilizer levels (F)					
F_1-30:15:15 NPK kg ha^{-1}	89.98	2.88	6.79	2.00	5.44
F_2-40:20:20 NPK kg ha^{-1}	92.97	2.94	6.98	2.15	5.67
F_3-50:25:25 NPK kg ha^{-1}	100.66	3.21	7.61	2.82	6.37
F_4-60:30:30 NPK kg ha^{-1}	103.17	3.33	7.83	2.94	6.61
SE (m) ±	2.49	0.08	0.19	0.06	0.14
C.D. at 5%	7.38	0.24	0.57	0.17	0.43
Interaction effect (S× F)					
SE (m) ±	4.30	0.14	0.33	0.10	0.25
C.D. at 5%	NS	NS	NS	NS	NS
G.M	96.69	3.09	7.30	2.47	6.02

Table 2: Effect of spacing and fertilizer levels on yield characters

Treatment	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Spacings (S)				
S_1-22.5 cm × 10 cm	909	1642	2551	35.65
S_2-30 cm × 10 cm	774	1492	2266	34.16
S_3-45 cm × 5 cm	934	1682	2616	35.72
SE (m) ±	30.35	34.03	65.26	-
C.D. at 5%	119.14	133.61	256.20	-
Fertilizer Levels (F)				
F_1-30:15:15 NPK kg ha^{-1}	782	1476	2257	34.65
F_2-40:20:20 NPK kg ha^{-1}	814	1529	2343	34.74
F_3-50:25:25 NPK kg ha^{-1}	925	1687	2612	35.41
F_4-60:30:30 NPK kg ha^{-1}	967	1729	2696	35.87
SE (m) ±	34.38	48.56	73.75	-
C.D. at 5%	102.16	144.30	219.12	-
Interaction effect (S×F)				
SE (m) ±	59.55	84.12	127.73	-
C.D. at 5%	NS	NS	NS	-
G.M	872	1605	2477	35.17

4. Conclusion

From the results of experiment it can be concluded that adoption of spacing 45 cm × 5 cm found to be apt for growth characters and yield while yield characters 45 cm × 5 cm found to be at par with 22.5 cm × 10 cm. Among fertilizer levels 60:30:30 NPK kg ha^{-1} found to be more productive and noticed to be at par with 50:25:25 NPK kg ha^{-1}.

5. References

1. Charate S, Thimmegowda MN, Rao GE, Ramachandrappa BK, Sathish A. Effect of nitrogen and potassium levels on growth and yield of little millet (*Panicum sumatrense*) under dry land alfisols of southern Karnataka. International journal of pure and applied bioscience. 2018;6(6):918-923.
2. Divyashree U, Kumar MD, Sridhara S, Naik TB. Effect of different levels of fertilizers on growth and yield of little millet (*Panicum sumatrense* Roth ex Roem and Schult). International Journal of Farm Sciences. 2018;8(2):104-108.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley & Sons; c1984.
4. Jackson ML. Soil Chemical Analysis. Prentice Hall of Englewood cliffs, New Jersey, USA; c1973.
5. Olsen BR, Cole CV, Watanable FS, Dean LA. Estimation of $NaHCO_3$ extractable phosphorous from soil. Circular US Department of Agriculture. 1954, 939.
6. Raundal PU, Pawar PP, Musamade AM, Mahajan MS, Desale SB. Response of little millet varieties to different levels of fertilizers under rainfed condition. A peer-Reviewed Multi-Disciplinary International Journal. 2017, 18-23.
7. Siddiqui DA, Sharma GK, Chandrakar T, Thakur AK, Pradhan A. Differential Levels of Fertilizer and Row Spacing Affects Growth and Yield of Brown Top Millet [*Brachiaria ramosa* (L.)] in Entisols of Bastar Plateau Zone of Chhattisgarh. Int. J Curr. Microbiol. App. Sci. 2020;9(8):3459-3472.
8. Subbiah BV, Asija GC. A rapid procedure for the estimation of available nitrogen in soil. Current Science. 1956;25:259.
9. Swathi B, Murthy VRK, Rekha MS, Lalitha KJ. Performance of pearl millet as influenced by plant geometry and sowing windows. Journal of Pharmacognosy and Phytochemistry. 2020;9(2):1898-1900.

10. Uphoff NT, Marguerite Devi J, Behera D, Verma AK, Pandian BJ. National colloquium on system of crop intensification (SCI). Field immersion of system of crop intensification (SCI), Patna, 2011.