



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 IJCS 2018; 6(1): 32-35
 © 2018 IJCS
 Received: 18-11-2017
 Accepted: 19-12-2017

Maitrik P Joshi
 M.Sc. Student, Department of
 Agronomy, NMCA, NAU,
 Navsari Gujarat, India

RM Pankhaniya
 Associate Professor, Department
 of Agronomy, NMCA, NAU,
 Navsari Gujarat, India

Nazir Khan Mohammadi
 M.Sc. Student, Department of
 Agronomy, NMCA, NAU,
 Navsari Gujarat, India

Correspondence
Maitrik P Joshi
 M.Sc. Student, Department of
 Agronomy, NMCA, NAU,
 Navsari Gujarat, India

International Journal of Chemical Studies

Response of pearl millet (*Pennisetum glaucum* L.) to levels and scheduling of nitrogen under south Gujarat condition

Maitrik P Joshi, RM Pankhaniya and Nazir Khan Mohammadi

Abstract

A field experiment entitled "Response of pearl millet (*Pennisetum glaucum* L.) to levels and scheduling of nitrogen under south Gujarat condition" was conducted on heavy black soil at the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) during the summer season 2016. The experiment comprising twelve treatment combinations were laid out in factorial randomized block design and replicated three times. The treatment consisted combinations of four levels of nitrogen viz. 60 kg N/ha (N₁), 80 kg N/ha (N₂), 100 kg N/ha (N₃) and 120 kg N/ha (N₄) and three scheduling of nitrogen viz. 50% at basal + 50 top dressing at 30 DAS (M₁), 50% at basal + 50% top dressing at 45 DAS (M₂) and 50% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS (M₃). The recommended dose of phosphorus @ 40 kg/ha was applied uniformly to all the treatment as basal in form of single super phosphate. Nitrogen was applied as per treatment in form of urea. Highest growth, yield attributes and yield of summer pearl millet can be obtained by fertilizing the crop with 80 kg N/ha 50% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS.

Keywords: Growth, Yield attributes, Yield, Nitrogen levels, Nitrogen scheduling

1. Introduction

Pearl millet belongs to family gramineae (poaceae). It is the most drought tolerant crop among cereals and millets and water requirement is low. The nutritive value of pearl millet is fairly high and it is fairly rich in fat content as compared to other cereals. In India, it is annually grown on 7.95 million ha area producing nearly 8.79 million tonnes of grains with productivity of 1,106 kg/ha. (Anon., 2014) [2]. The major production factor to boost up the yield of pearl millet is fertilizer management, which has contributed to the extent of 27 per cent. Nitrogen, phosphorus and potassium are major elements required to increase the crop production. Among these elements, nitrogen is one of the decisive as well as expensive inputs which govern the cereal crops production. It has the quickest and the pronounced effect on plant growth. Insufficient nitrogen may reduce yield drastically and deteriorates the quality of produce. Split application of N fertilizers commensurate with crop growth stage is an useful approach for increasing the efficiency of applied N in Pearl millet it is therefore necessary to judiciously manage the inflow of the nitrogen. Therefore, levels and scheduling of nitrogen are crucial.

2. Materials and methods

The present study was conducted on the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during summer season of 2016. Navsari falls under Agro-ecological situation-III of south Gujarat Heavy Rainfall Zone which is characterized by fairly warm summer. The present investigation carried out with pearl millet hybrid variety GHB 558. It takes about 75-80 days to mature. It has long thick compact conical ear heads and produces obovate dark grey bold grains. It is also resistant to downy mildew disease. The experiment comprising twelve treatment combinations were laid out in factorial randomized block design and replicated three times. The treatment consisted combinations of four levels of nitrogen viz. 60 kg N/ha (N₁), 80 kg N/ha (N₂), 100 kg N/ha (N₃) and 120 kg N/ha (N₄) and three scheduling of nitrogen viz. 50% at basal + 50 top dressing at 30 DAS (M₁), 50% at basal + 50% top dressing at 45 DAS (M₂) and 50% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS (M₃). The recommended dose of phosphorus @ 40 kg/ha was applied uniformly to

all the treatment as basal in form of single super phosphate. Nitrogen was applied as per treatment in form of urea.

3. Result and Discussion

Effect of nitrogen levels

Significantly higher plant height was recorded treatment N₄ (120 kg N/ha) *i.e.* 76.25 cm at 45 DAS and 146.60 cm at harvest, but it remain at par with treatment N₃ (100 kg N/ha) *i.e.* 70.72 cm at 45 DAS and 144.40 cm at harvest. Thus there is an increase in plant height with nitrogen application throughout the crop growth span. The probable reason might be positive effect of nitrogen on growth character due to augment of cell division and cell expansion. The study was in close conformity as observed by Rajput (2008) [12], Ali (2010) [1], Meena *et al.* (2012) [8], Patel (2014) [9] and Raval *et al.* (2014) [13]. Number of effective tillers/plant at harvest were also increased with an increase in nitrogen level (Table 1) wherein an application of nitrogen @ 120 kg N/ha produced significantly higher (3.06) number of effective tillers/plant just before harvest as compared with 60 kg N/ha (N₁) *i.e.* 2.67 and 80 kg N/ha (N₂) *i.e.* 2.75 but statistically it was at par with 100 kg N/ha (N₃) *i.e.* 2.83. Nitrogen enhances the development of strong cell walls and therefore stiffer straw which might be resulted into profuse tillering. These results are already in agreement with those reported by Rajput (2008) [12], Ayub *et al.* (2007), Pathan and Bhilare (2009) [11] and Patel (2014) [9].

The yield attributing characters *viz.*, ear head length, ear head girth and test weight were significantly influenced due to varying levels of nitrogen. Significantly higher ear head length (25.89 cm), ear head girth (10.28 cm) and test weight (9.72 g) were obtained under application of nitrogen in treatment N₄ (120 kg N/ha) and remain at par with application of nitrogen in treatment N₃ (100 kg N/ha) *i.e.* number of effective tillers/plant 2.83, ear head length 24.94 cm, ear head girth 9.95 cm, test weight 9.36 g. While treatment N₁ (60 kg N/ha) recorded lowest values of number of effective tillers/plant *i.e.* 2.67, ear head length *i.e.* 22.83 cm, ear head girth *i.e.* 9.47 cm and test weight *i.e.* 8.67 g (Table 1). The probable reason for increase in test weight due to highest level of nitrogen might be attributed to the better filling of grains resulting into bold sized seeds and consequently highest test weight. Thus, all the yield attributes were remarkably improved and gave significant response of nitrogen application. The beneficial effect of nitrogen in growth and yield attributes were also reported by Patel and Patel (2002) [10], Sakarvadia *et al.* (2012) [14] and Patel (2014) [9].

Grain yield of pearl millet (Table 2) was significantly influenced due to varying levels of nitrogen wherein significantly higher grain yield of 4505 kg/ha was achieved under treatment N₄ (120 kg N/ha) but it was at par with treatment N₃ (100 kg N/ha) *i.e.* 4211 kg/ha and treatment N₂ (80 kg N/ha) *i.e.* 4055 kg/ha, whereas treatment N₁ (60 kg N/ha) recorded significantly lowest grain yield (3770 kg/ha). Straw yield of pearl millet (Table 2) was significantly influenced due to varying levels of nitrogen wherein significantly higher straw yield of 8856 kg/ha was achieved under treatment N₄ (120 kg N/ha) but it was at par with treatment N₃ (100 kg N/ha) *i.e.* 8322 kg/ha and treatment N₂ (80 kg N/ha) *i.e.* 8084 kg/ha, whereas treatment N₁ (60 kg N/ha) recorded significantly lowest grain yield (7356 kg/ha). The highest grain & straw yield could be due to the cumulative effect of improvement in yield attributes *viz.*, number of effective tillers/plant, ear head length and girth and test weight. The improvement in straw yield was mainly on

account of increase in the growth parameters due to nitrogen application. These results are also in agreement with findings of Hegde *et al.* (2006) [5], Ayub *et al.* (2009) [3], Jadhav *et al.* (2011) [6], Sakarvadia (2012) [14] and Patel (2014) [9]. Nitrogen levels did not influence significantly on harvest index of pearl millet (Table 2). But numerically maximum harvest index of pearl millet (34.00%) observed under treatment N₁ (60 kg N/ha) and followed by treatment N₄ (120 kg N/ha) *i.e.* 33.73% and treatment N₃ (100 kg N/ha) *i.e.* 33.56%, while lowest harvest index produced under treatment N₂ (80 kg N/ha) *i.e.* 33.53%.

Effect of nitrogen scheduling

Data presented in Table 1 indicated that plant height recorded at 45 DAS and at harvest produced significantly by nitrogen scheduling. Plant height at 45 DAS was significantly higher in nitrogen split application in treatment M₁ (50% at basal + 50% top dressing at 30 DAS) and remained at par with treatment M₃ (50% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS). While, plant height at harvest was significantly higher in nitrogen application in treatment M₃ (50% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS) and remained at par with treatment M₂ (50% at basal + 50% top dressing at 45 DAS). The improvement of growth and yield parameters with scheduling of nitrogen might have been attributed to better and timely availability of nitrogen for their utilization by plant. Similar result was reported by Mathukia *et al.* (2014) [7] and Ali (2010) [1].

The yield attributing characters (Table 1) *viz.*, number of effective tillers/plant, ear head length, ear head girth and test weight were significantly influenced due to scheduling of nitrogen. Significantly higher number of effective tillers/plant (2.96), ear head length (25.57 cm), ear head girth (10.13 cm) and test weight (9.57 g) were obtained under nitrogen application in treatment M₃ (50% basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS) and remain at par with application of nitrogen in treatment M₂ (50% basal + 50% top dressing at 45 DAS) *i.e.* number of effective tillers/plant 2.85, ear head length 24.26 cm, ear head girth 9.84 cm, test weight 9.23 g. While treatment M₁ (50% basal + 50% top dressing at 30 DAS) recorded lowest values of number of effective tillers/plant *i.e.* 2.67, ear head length *i.e.* 23.40 cm, ear head girth *i.e.* 9.62 cm and test weight *i.e.* 8.89 g.

Grain yield of pearl millet (Table 2) was significantly influenced due to scheduling of nitrogen wherein significantly higher grain yield of 4319 kg/ha was achieved under treatment M₃ (50% basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS) but it was at par with treatment M₂ (50% basal + 50% top dressing at 45 DAS) *i.e.* 4262 kg/ha, whereas treatment M₁ (50% basal + 50% top dressing at 30 DAS) recorded significantly lowest grain yield (3823 kg/ha). Straw yield of pearl millet was significantly influenced due to scheduling of nitrogen wherein significantly higher straw yield of 8661 kg/ha was achieved under treatment M₃ (50% basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS) but it was at par with treatment M₂ (50% basal + 50% top dressing at 45 DAS) *i.e.* 8157 kg/ha, whereas treatment M₁ (50% basal + 50% top dressing at 30 DAS) recorded significantly lowest straw yield (7646 kg/ha). Scheduling of nitrogen at different days after sowing produced remarkable increasing in growth and yield attributes and ultimately increasing of grain and straw yield. This may be due to reduced loss of nitrogen and extent supply, owing to

continuous and sufficient availability of nitrogen during different growth and development period of the plant. Similar results were also reported by Choudhary and Prabhu (2014)^[4], Tadesse *et al.*, (2013)^[16], Mathukia *et al.*, (2014)^[7] and Singh *et al.*, (2013)^[15]. Scheduling of nitrogen did not influence significantly on harvest index of pearl millet. But numerically maximum harvest index of pearl millet (34.34%)

observed under application of nitrogen in treatment M₂ (50% at basal + 50% top dressing at 45 DAS) and followed by treatment M₁ (50% at basal + 50% top dressing at 30 DAS) *i.e.* 33.47%, while minimum harvest index observed under nitrogen application in treatment M₃ (50% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS) *i.e.* 33.31%.

Table 1: Growth and yield attributes of pearl millet as influenced by levels and scheduling of nitrogen

Treatments	Plant height at 45 DAS (cm)	Plant height at harvest (cm)	Number of effective tillers/plant	Ear head length (cm)	Ear head girth (cm)	Test weight (g)
Nitrogen levels						
N ₁	65.06	127.80	2.67	22.83	9.47	8.67
N ₂	68.13	132.90	2.75	23.98	9.75	9.18
N ₃	70.72	144.40	2.83	24.94	9.95	9.36
N ₄	76.25	146.60	3.06	25.89	10.28	9.72
S.Em. ±	2.33	4.28	0.09	0.62	0.14	0.21
C.D. at 5%	6.84	12.55	0.25	1.82	0.42	0.61
Nitrogen scheduling						
M ₁	73.38	131.00	2.67	23.40	9.62	8.89
M ₂	65.46	137.10	2.85	24.26	9.84	9.23
M ₃	71.28	145.56	2.96	25.57	10.13	9.57
S.Em. ±	2.02	3.70	0.07	0.54	0.13	0.18
C.D. at 5%	5.93	10.87	0.22	1.58	0.37	0.52
Interaction						
S.Em. ±	4.04	7.41	0.15	1.07	0.25	0.35
C.D. at 5%	NS	NS	NS	NS	NS	NS
C.V.%	10.00	9.31	9.18	7.66	4.42	6.71

N₁-60 kg/ha, N₂-80 kg/ha, N₃-100 kg/ha, N₄-120 kg/ha, M₁-50% at basal + 50% top dressing at 30 DAS, M₂-50% at basal + 50% top dressing at 45 DAS, M₃-25% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS

Table 2: Grain yield, straw yield and harvest index of pearl millet as influenced by levels and scheduling of nitrogen

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
Nitrogen levels			
N ₁	3770	7356	34.00
N ₂	4055	8084	33.53
N ₃	4211	8322	33.56
N ₄	4505	8856	33.73
S.Em. ±	156.40	306.60	1.02
C.D. at 5%	458.60	899.30	NS
Nitrogen scheduling			
M ₁	3823	7646	33.47
M ₂	4262	8157	34.34
M ₃	4319	8661	33.31
S.Em. ±	135.40	265.60	0.88
C.D. at 5%	397.10	778.90	NS
Interaction			
S.Em. ±	270.80	531.12	0.35
C.D. at 5%	NS	NS	NS
C.V.%	11.34	11.28	9.09

Conclusion

Based on one year field experimentation, it is concluded that highest growth and yield attributes and yield of summer pearl millet can be obtained by fertilizing the crop with 80 kg N/ha 50% at basal + 25% top dressing at 30 DAS + 25% top dressing at 45 DAS along with recommended fertilizer dose of 40 kg P₂O₅/ha in south Gujarat heavy rainfall Agro-ecological situation III (AES-III).

References

1. Ali EA. Grain yield and nitrogen use efficiency of pearl millet as affected by plant density, nitrogen rate and splitting in sandy soil. *American-Eurasian Journal of Agricultural & Environmental Science*. 2010; **7**(3):327-335.
2. Anonymous. Agriculture statistics at a glance 2014, ministry of agriculture. Government of India, 2014.
3. Ayub M, Nadeem MA, Tahir M, Ibrahim M, Aslam MN. Effect of Nitrogen Application and Harvesting Intervals on Forage Yield and Quality of Pearl Millet. *Pakistan Journal of Life social sciences*. 2009; **7**(2):185-189.
4. Choudhary M, Prabhu G. Quality fodder production and economics of dual-purpose pearl millet (*Pennisetum glaucum*) under different fertility levels and nitrogen scheduling. *Indian Journal of Agronomy*. 2014; **59**(3):410-414.
5. Hegde R, Devaraja M, Subash Gumaste. Effect of stage of harvesting of seed crop, nitrogen and phosphorus levels on the forage yield and ratoon ability of forage pearl millet. (*Penisetum tyohoides*). *Indian Journal of Agricultural Research*. 2006; **40**(3):232-234.

6. Jadhav RP, Khafi HR, Raj AD. Effect of nitrogen and vermi-compost on protein content and nutrient uptake in pearl millet [*Pennisetum glaucum* L. R. Br. Emend Stuntz]. Agricultural Science Digest- A Research Journal. 2011; 31(4):319-321.
7. Mathukia RK, Kapadiya JK, Panara DM. Scheduling of nitrogen and potash application in irrigated wheat (*Triticum aestivum* L.). *Journal of Wheat Research*. 2014; 6(2):171-172.
8. Meena SN, Jain KK, Prasad D, Ram A. Effect of nitrogen on growth, yield and quality of fodder pearl millet (*Pennisetum glaucum*) cultivars under irrigated condition of North- Western Rajasthan. *Annals of Agricultural Research*. New series. 2012; 33(3):183-188.
9. Patel AC. Effect of nitrogen and sulphur on growth, yield and quality of summer pearl millet (*Pennisetum glaucum* L.). M.Sc. Thesis submitted to N.M. College of Agriculture. N. A.U. Navsari, 2014.
10. Patel BJ, Patel IS. Response of summer pearl millet to different dates, method of sowing and nitrogen levels under North Gujarat Agro-climatic conditions. *Crop Research*. 2002; 24(3):476-480.
11. Pathan SH, Bhilare RL. Growth parameters and seed yield of forage pearl millet varieties as influenced by nitrogen levels. *Journal of Maharashtra Agricultural University*. 2009; 34(1):101-102.
12. Rajput SC. Effect of integrated nutrient management of productivity and monetary returns of pearl millet (*Pennisetum glaucum* L.). *Research on Crops*. 2008; 9(2):248-250.
13. Raval CH, Patel AM, Rathore BS, Vyas KG, Bedse RD. Productivity, quality and soil fertility status as well as economics of multi-cut summer forage pearl millet as influenced by varying levels of irrigation and nitrogen. *Research on Crops*. 2014; 15(4):785-789.
14. Sakarvadia HL, Golakiya BA, Parmar KB, Polara KB, Jetpara PI. Effect of nitrogen and potassium on yield, yield attributes and quality of summer pearl millet. *An Asian Journal of Soil Science*. 2012; 7(2):292-295.
15. Singh D, Singh RA, Lalbahadur. Response of wheat (*Triticum aestivum*) varieties to sowing methods and nitrogen scheduling under late sown conditions. *Current Advances in Agricultural Sciences*. 2013; 5(1):117-120.
16. Tadesse T, Assefa A, Liben M, Tadesse Z. Effects of nitrogen split application on productivity, nitrogen use efficiency and economic benefits of maize production in Ethiopia. *International Journal of Agricultural Policy and Research*. 2013; 1(4):109-115.