GAU Research Journal 41 (2) : 61-64 (July 2016)

Integrated nitrogen management in summer pearl millet *[Pennisetum glaucum* (L) R. Br. Emend Stuntz]

VANITA R. PATEL[1], B.M. PATEL[2], J.M. PATEL[3] AND P.M. PATEL[4]

Department of Agronomy, C. P. College of Agriculture
S. D. Agricultural University, Sardarkrushinagar - 385 506 (Gujarat)

Received : 23 February, 2015

ABSTRACT

An experiment was conducted at Agronomy Instructional Farm, C. P. College of Agriculture, SDAU, Sardarkrushinagar during summer, 2013 to study the effect of integrated nitrogen management in summer pearl millet. The experiment consisted of 10 different treatments of integrated nitrogen management practices for application of recommonded dose of nitrogen (RDN) to pear millet *i.e.* 160 kg/ha through different sources *viz.*, organic (FYM, vermicompost and castor cake), inorganic fertilizer alone or incombination with organic sources. The crop fertilized with 75 % RDN through fertilizer and 25 % RDN through either FYM or castor cake produced significantly higher growth parameters, grain yield (2948 kg ha^{-1}), straw yield (6248 kg ha^{-1}) and economics. The integration of nitrogen through inorganic and organic sources helped to sustain soil fertility.

Key words : Grain yield, straw yield, nitrogen, pearl millet

Pearl millet is one of the most important food grain crops of India and ranks fourth after rice, wheat and sorghum. In Gujarat, major pearl millet growing districts are Banaskantha, Mehsana, Patan and Kachchh. It is well adapted to production systems characterized by drought, low soil fertility and high temperature. Summer cultivation of pearl millet, particularly in the irrigated areas of North Gujarat has attracted the farmers because of the assurance of targeted crop yield. Integrated nutrient management involving soil resources, chemical fertilizers, bio-fertilizers and organic manures is the key to the sustained productivity as it reduces dependence on chemical fertilizers and not only improves fertilizer use efficiency, but also improves soil productivity by improving physical, chemical and biological properties of soil. The role of organic manures is well recognized and considered as balanced manures which supplies macro and micro nutrients which are essential for plant growth. It helps to build up the soil micro flora, which are useful to maintain the soil fertility. Microbial population increases more than five times with the application of vemricompost (Rout *et al.* 2001).

[1] Extension Officer, Dantiwada Taluka Panchayat, Dantiwada
[2] Associate Professor, Main Wheat Research Station, Vijapur,
[3] Assistant Research Scientist, Cetnral Instrumentation Laboratory, [4] Assistant Research Scientist, Dirctorate of Extension Education.

MATERIALS AND METHODS

A field experiment was conducted on loamy sand soil, Agronomy Instruction Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during summer 2013. The experimental soil was loamy sand in texture, low in organic carbon (0.26%) and available nitrogen (158 kg ha^{-1}) and medium in phosphorus (50.4 kg ha^{-1}) and potassium (271 kg ha^{-1}) status. The experiment comprised of ten nitrogen management treatments viz. T_1 : 100% RDN through fertilizer, T_2 : 100% RDN through FYM, T_3 : 100% RDN through castor cake, T_4 : 100% RDN through vermicompost, T_5 : 75% RDN through fertilizer + 25% RDN through FYM, T_6 : 75% RDN through fertilizer + 25% RDN through castor cake, T_7 : 75% RDN through fertilizer + 25% RDN through vermicompost, T_8 : 50% RDN through fertilizer + 50% RDN through FYM, T_9 : 50% RDN through fertilizer + 50% RDN through castor cake and T_{10} : 50% RDN through fertilizer + 50% RDN through vermicompost were tried in randomized block design (RBD) with four replications. GHB 732 variety of pearl millet was sown at 45 cm row distance and 15 cm plant to plant distance with 3.750 kg ha^{-1}seed rate. A common application of 60 kg P_2O_5 ha^{-1} was applied to all plots after adjusting amount of phosphorus supplied by respective organic source.

Other agronomic practices were adopted as per recommendation of the crop. Observations on growth attributes at different stages, yield components and yield were recorded at harvest. Protein content and nutrient uptake as per standard procedure and economics of produce considering the local prevailing market price of inputs and output were also estimated. The data were statistically analysed and results were presented.

RESULTS AND DISCUSSION

The results (Table 1) indicated that different treatments had significant effect on growth and yield attributes as well as yield of pearl millet. Plant height at 30 DAS and at harvest was significantly influenced due to different nitrogen management treatments. Treatment T_5 (75% RDN - fertilizer + 25% RDN - FYM) recorded significantly higher plant height at 30 DAS (70.3 cm) and at harvest (158.5 cm), but remained at par with treatment T_6. Significant differences were observed in number of effective tillers per plant due to nitrogen management treatments. Application of 75% RDN - fertilizer + 25% RDN - FYM (T_5) recorded significantly higher number of effective tillers per plant (3.30), being at par with T_4 treatment. Integrated supply of nitrogen from organic and inorganic sources produced vigorous plants that ultimately resulted into better growth and development of crop.

Different nitrogen management treatments showed significant influence on yield attributes *viz.*, length of ear head, girth of ear head and grain yield per plant. Significantly higher length of ear head (23.5 cm) and girth of ear head (10.2 cm) were observed under treatment T_5, but it remained statistically at par with treatments T_6 and T_7. Application of 75% RDN - fertilizer + 25% RDN - FYM (T_5) produced significantly higher grain yield per plant (45.5 g). However, it was statistically at par with treatment T_6. Results further indicated that application of 75% RDN - fertilizer + 25% RDN - FYM (T_5) produced significantly higher grain (2948 kg ha^{-1}) and straw yields (6248 kg ha^{-1}), but remained statistically at par with treatments T_6 and T_7 in case of grain yield and treatment T_6 in case of straw yield, respectively. The increase in grain and straw yields under treatment T_5 was due to increased yield attributes which were enhanced with application of inorganic fertilizer in conjunction with organic sources like vermicompost, castor cake and FYM. Organic sources improved the physical condition of the soil apart from slowly releasing nutrients during entire crop growth period. Further, yield improvement was possible on account of better nutrient use efficiency. Similar findings were reported by Singh *et al.* (2013) and Damame *et al.* (2014).

Nitrogen is key element to improve the protein content of grain. Significantly higher protein content (11.42%) and protein yield (336.6 kg ha^{-1}) were registered when crop was fertilized with 75% RDN - fertilizer + 25% RDN - FYM (T_5). However, it remained statistically at par with treatments T_6 and T_7. Integrated supply of nitrogen through organic and inorganic sources enhanced the protein content in grain probably due to utilization of photosynthates in protein synthesis and its translocation to grains. Verma *et al.*, (2012) also reported similar results.

Various nitrogen management treatments had positive effect on soil fertility after harvest of the crop. Significantly higher organic carbon content (0.27%) in the soil after harvest of the crop was recorded under treatment T_4 (application of 100% RDN through vermicompost), but it remained statistically at par with treatment T_5. Significantly higher available nitrogen (183.4 kg ha^{-1}) was registered under treatment T_4 (100% RDN through vermicompost). However, it remained statistically at par with treatments T_5 and T_3. All the treatments failed to exert significant influence on available phosphorus content in the soil after harvest of crop. The increased organic carbon and available nitrogen under organic treatments might be due to addition and decomposition of organic matter and greater multiplication of soil microbes which could convert organically bound nitrogen in available form leading to build up of high available nitrogen. Present results are in line with the findings reported by Patil *et al.* (2006).

A perusal of economics data indicated that the highest net return of ₹ 49896 ha^{-1} with BCR of 4.08 was registered under treatment T_1 (100% RDN through fertilizer) which was closely followed by treatments T_6 (net return of ₹ 48980 ha^{-1} and BCR of 3.35) and T_5 (net return of ₹ 48962 ha^{-1} with BCR of 3.18).

CONCLUSION

Looking to the results obtained from the presented investigation, it can be concluded that for securing higher grain and straw yield, net realization and maintain soil fertility under North Gujarat agro-climatic conditions on loamy sand soil, summer pearl millet

Table 1 Effect of different nitrogen management treatment on yield attributes and yield of pearl millet

Treatment	Plant height (cm)		Effective tillers/ Plant	Ear head length (cm)	Girth of ear head (cm)	Grain yield per plant (g)	Yield (kg/ha)	
	30 DAS	At harvest					Grain	Straw
T_1: 100% RDN through fertilizer	65.5	145.8	2.78	21.1	9.1	43.2	2730	5745
T_2: 100% RDN through FYM	60.2	146.3	2.88	21.8	9.6	43.6	2804	5850
T_3: 100% RDN through castor cake	58.1	146.2	2.98	22.8	9.6	43.8	2802	5865
T_4: 100% RDN through vermicompost	67.5	147.0	3.08	21.8	9.4	42.8	2687	5813
T_5: 75% RDN through fertilizer + 25% RDN through FYM	70.3	158.5	3.30	23.5	10.2	45.5	2948	6248
T_6: 75% RDN through fertilizer + 25% RDN through castor cake	67.3	153.4	2.95	23.0	10.0	45.0	2894	5987
T_7: 75% RDN through fertilizer + 25% RDN through vermicompost	66.3	152.0	2.98	22.8	9.7	43.5	2856	5904
T_8: 50% RDN through fertilizer + 50% RDN through FYM	61.0	150.3	3.03	21.7	9.4	43.9	2675	5968
T_9: 50% RDN through fertilizer + 50% RDN through castor cake	58.5	149.0	2.90	22.0	9.5	43.8	2696	5949
T_{10}: 50% RDN through fertilizer + 50% RDN through vermicompost	62.8	148.4	2.90	22.0	9.6	43.4	2794	5958
S.Em ±	1.2	2.2	0.08	0.39	0.20	0.40	48.1	90.5
C.D	3.1	6.1	0.23	1.13	0.57	1.17	139.6	262.8
C.V %	6.61	2.78	5.27	3.91	4.06	1.84	3.45	3.05

Table 2 Effect of different nitrogen management treatment on quality of pearl millet, nutrient status in soil and net return

Treatment	Protein content in grain (%)	Protein yield (kg/ha)	O.C. (%)	Available N (kg/ha)	Available P_2O_5 (kg/ha)	Net return (₹/ha)	BCR
T_1: 100% RDN through fertilizer	11.20	305.7	0.22	146.1	50.1	49896	4.08
T_2: 100% RDN through FYM	10.83	303.6	0.24	168.7	51.2	26391	1.64
T_3: 100% RDN through castor cake	10.77	301.7	0.24	170.4	51.9	32831	1.94
T_4: 100% RDN through vermicompost	10.64	285.8	0.27	183.4	52.6	5607	1.09
T_5: 75% RDN through fertilizer + 25% RDN through FYM	11.42	336.6	0.26	176.5	50.6	48962	3.18
T_6: 75% RDN through fertilizer + 25% RDN through castor cake	11.31	327.3	0.24	154.9	50.9	48980	3.35
T_7: 75% RDN through fertilizer + 25% RDN through vermicompost	11.28	322.1	0.24	164.4	50.6	41844	2.54
T_8: 50% RDN through fertilizer + 50% RDN through FYM	10.61	283.8	0.24	162.1	50.1	36645	2.27
T_9: 50% RDN through fertilizer + 50% RDN through castor cake	10.55	284.4	0.24	161.7	50.7	40251	2.57
T_{10}: 50% RDN through fertilizer + 50% RDN through vermicompost	10.45	291.9	0.24	159.3	50.3	29823	1.79
S.Em ±	0.19	7.85	0.01	4.52	1.02	–	–
C.D	0.55	22.77	0.02	13.32	NS	–	–
C.V %	3.50	5.17	12.07	12.34	3.99	–	–

(GHB 732) crop may be fertilized by 75% RDN through inorganic fertilizer and 25% RDN through either FYM or castor cake. The integration of nitrogen through inorganic and organic sources helped to maintain soil fertility.

REFERENCES

Damame, S.V., Bhingarde, R.N. and Pathan, S.H. 2014. Effect of different nitrogen levels on nutritional quality and nitrate nitrogen accumulation in forage pearl millet genotypes under rainfed condition. *Forage Research* **39**(3):120-123.

Patil, E.N., Chaudhari, P.M., Pawar, P.P. and Patel, H.E. 2006. Integrated moisture conservation techniques and nutrient management system for pearl millet in semi-arid condition. *Indian Journal of Dryland Agricultural Research and Development*, **21**(1):85-87.

Rout, D., Satapathy, M.R. and Mohapatra, B.K. 2001. Effect of bio-fertilizer on nitrogen economy in maize. *Madras Agricultural Journal*, **88**(7-9):530-532.

Singh, R., Gupta, A.K, Tulasa Ram, Choudhary, G.L. and Sheoram, A.C. 2013. Effect of integrated nitrogen management on transplanted pearl millet. *Indian Journal of Agronomy*, **58**(1):81-85.

Verma, B.K., Pandey, U.P. and Lodhi, M.D. 2012. Effect of sowing dates in relation to integrated nitrogen management on growth, yield and quality of *rabi* maize. *The Journal of Animal and Plant Sciences*, **22**(2):324-329.