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PRODUCTIVITY, QUALITY, AND NUTRIENT UPTAKE BY SUMMER PEARL MILLET AS INFLUENCED BY TRANSPLANTING DATES AND NITROGEN LEVELS

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KEYWORDS

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Pearl millet
RDN (Recommended dose of Nitrogen)
RSD (Recommended sowing date) and Transplanting

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ABSTRACT

The experiment was taken with three transplanting dates viz, Normal drilling at RSD (T_1), first transplanting (Transplanting on RSD, T_2) and second transplanting (Transplanting 25 days after RSD, T_3) and four levels of nitrogen viz., 75% RDN (N_1), 75% RDN + *Azospirillum* (N_2), 100% RDN (N_3) and 125% RDN (N_4). Treatment T_1recorded significantly higher grain yield (35.90 kg ha^{-1}), protein content (11.03%) total N content (2.50%), N uptake (131.31 kg ha^{-1}), P content (0.664%) and P uptake (29.35 kg ha^{-1}) by crop as well as available N (191.60 kg ha^{-1}) in soil after harvesting of crop. Among nitrogen levels treatment N_4 (125% RDN) showed the similar trends with respect to, protein content (11.01%), nutrient content (2.33% N and 0.654% P)and uptake (136.51 kg ha^{-1} N and 30.12 kg ha^{-1} P) by crop. Hence, summer pearlmillet crop should be sown by normal drilling or transplanting on RSD with 100% RDN.

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INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) is one of the major cereal crop grown in arid and semiarid region of the world among the major food grain crop of India. Pearl millet is the most drought tolerant of all domesticated cereals and can yield grain under rainfall as low as 200 to 250 mm (Bidinger and Hash, 2003) making it one the reliable cereals in the direct rain fed regions of the arid and semi-arid tropics. India is the largest producer of this crop, both in terms of area 8.79 million ha with total production 7.95 MT and with an average productivity of 1164 kg ha^{-1}. Rajasthan shares 58.05%, Maharashtra 11.61% and Gujarat 7.55% of India for pearl millet (Anonymous, 2012-13).Early crops are important to farmers as they break the hunger gap, transplanting early crops breaks this gap two to three weeks earlier and yield more (often double) than normal direct-sown crops, providing food when it is in short supply and very expensive in the market place. Transplanting of seedling increase the yield and also compensate the yield losses due to delay sowing (Upadhyay *et al.*, 2001).

Poor soil fertility and erratic rains are the most important constraints to cropproduction in arid and semi arid region. Soil fertility management *i.e* nutrient management particularly nitrogen plays a major role in increasing production and productivity of pearl millet. Nitrogen (N) is an essential nutrient and key limiting factor in crop production of different agro-ecosystems. Nitrogen is considered as one of the most important plant nutrients for growth and development of crop plant. It also plays an important role in synthesis of chlorophyll and amino acids that contribute to the building unit of protein and thus, growth of plants. Nitrogen helps in early establishment of leaf area capable of photosynthesis. Pearl millet is an exhausting crop and heavy consumer of plant nutrients. Nitrogen promotes leaf and stem growth rapidly which consequently increase the yield and its quality. Nitrogen is the major nutrient required by pearl millet which positively increases the growth attributes, length and width of panicle, test weight, number of grainpanicle^{-1}, grain weight panicle^{-1} and finally improve the yield (Prasad *et al.,* 2014) Keeping the importance of pearl millet sowing and transplanting date and importance of nitrogen fertilizer, an experiment was conducted to assess the yield, quality nutrient content and uptake of pearl millet with different sowing dates and nitrogen levels under south Gujarat conditions. The paper deals with the effect of transplanting dates and nitrogen levels on productivity, quality and nutrient uptake by pearl millet.

MATERIALS AND METHODS

A field experiment was conducted during summer season of 2013-14 at the college farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The soils of south Gujarat are locally known as 'Black Cotton Soil'. The soil of experimental field was medium in available nitrogen (176 kg ha^{-1}) and phosphorus (32 kg ha^{-1}) and high in available potassium (350 kg ha^{-1}). Twelve treatment combinations were laid out in a factorial randomized block design (FRBD) with three replications with three dates of transplanting viz, Normal drilling at

recommended dose of sowing T_1, first transplanting (Transplanting on recommended sowing date) T_2 and second transplanting (Transplanting 25 days after recommended sowing date) T_3 in and four levels of nitrogen (75% RDN, 75% RDN + *Azospirillum*, 100% RDN and 125% RDN) in with recommended dose of 120:60:00 kg N:P:K ha^{-1}. Seeds of pearl millet variety GHB-558 were used for sowing. For the treatment N_2 (75% RDN + *Azospirillum*) in normal drilling the seeds of pearl millet were soaked in water for over night and dressed with *Azospirillum* culture @ 20g/kg of seed as prescribed by Pathak and Charaborti (2014).Application of *Azospirillum* for the treatment $N_2$was also given to the seedlings of pearl millet by the method of seedling dipping as prescribed by Muraleedharan *et al.*(2010) for the transplanting treatments. Normal drilling was done on 12th March, First transplanting was done on 13th March (nursery 25 days before normal drilling) and second transplanting was done on 4th April (nursery on the date of recommended sowing times) at 45 cm x 10 cm spacing. The nutrient status (OC%, Available N and P kg ha^{-1}) of soil before and after harvesting of crop as well as total N and P content from grain and straw was determined with the methods prescribed by Jackson (1967). The protein content in grain was determined by multiplying nitrogen percentage with factor 6.25 (Bhuiya and Choudhary, 1974). The uptake values of nitrogen (N) and phosphorus (P) were worked out by following formula.

$$\text{Nutrient uptake(kg ha}^{-1}) = \frac{\text{Nutrient content in grain + straw (\%)} \times \text{Grain + straw yield (kg ha}^{-1})}{100}$$

The statistical analysis of data recorded for different characters during the course of investigation was carried out through the procedure appropriate to the Factorial Randomized Block Design of the experiment as described by Panse and Sukhatme, 1967.

RESULTS AND DISCUSSION

Effect of transplanting dates

Different techniques and dates of transplanting showed remarkable influence on yield and protein content of crop (Table 1). Treatment normal drilling (T_1) registered significantly higher grain yield (35.90 q ha^{-1}), straw yield (92.11 q ha^{-1}), protein content (11.03%) and protein yield (369.09 kg ha^{-1}) however, treatment T_1 did not differ significantly with T_2 in case of grain yield and straw yield of pearlmillet. Normal drilling recorded maximum maximum harvest index (28.05%) of pearlmillet. This might be due to higher moisture availability for crop owing to better moisture conservation, due to more vegetative growth resulting from efficient utilization of nutrients, water, radiation and increased metabolic activities followed by increased translocation towards above mentioned yield contributing characters under normal drilling.. Similar results of were also observed by Andhale *et al.*(2007),Radhouane (2008), Ali *et al.* (2013) in pearl millet and by Pawade (2010) in maize. Different techniques and dates of transplanting also showed remarkable influence on nutrient content, their uptake and nutrient status of soil after harvest (Table 2). The total N content (2.50%), N uptake (131.31 kg ha^{-1}), P content (0.664%), P uptake (29.35 kg ha^{-1}) and organic carbon (0.436%) were recorded with treatment T_1 (normal drilling), however treatment T_1 did not showed significant differences with treatment T_2 (Transplanting on recommended sowing date) in case of total N content. This might be attributed to better root growth due to better aeration and good drainage might have also increased microbial activity with optimum moisture and nutrient availability for its growth. The findings were in accordance with those earlier reported by Patel *et al.* (2008), Parihar *et al.* (2008). Significantly higher available N (218.34 kg ha^{-1}) and P (25.64 kg ha^{-1}) after in soil harvesting were found under the treatment T_3 (Transplanting 25 days after recommended sowing time) which was found statistically at par with treatment T_2 (Transplanting on recommended sowing date).

Effect of nitrogen levels

The variable performance of pearl millet was recorded with nitrogen levels on growth parameters (Table 1). Significantly higher grain yield (22.25 q ha^{-1}), straw yield (94.45 q ha^{-1}),

Table 1: Effect of dates of transplanting and levels of nitrogen on yield and quality of summer pearl millet.

Treatments	Grain yield(q ha^{-1})	Straw yield(q ha^{-1})	Harvesh index (%)	Protein content (%)	Protein yield (kg ha^{-1})
Dates of transplanting					
T_1	35.90	92.11	28.05	11.03	396.09
T_2	33.21	85.83	27.89	10.67	354.35
T_3	30.65	79.38	27.85	10.36	317.53
SEm. ±	0.97	3.42	0.73	0.12	11.10
CD at 5%	2.85	10.02	NS	0.34	32.56
Levels of nitrogen					
N_1	18.53	78.19	26.69	10.34	299.24
N_2	19.13	82.92	27.60	10.64	333.74
N_3	21.00	87.66	28.42	10.76	375.20
N_4	22.25	94.45	28.65	11.01	418.85
SEm. ±	0.92	3.95	0.84	0.14	12.82
CD at 5%	2.69	11.57	NS	0.39	37.60
Interaction (T X N)					
SEm. ±	1.59	6.87	1.45	0.23	22.20
CD at 5%	NS	NS	NS	NS	NS

T_1 : Normal drilling on recommended sowing date, T_2 : Transplanting on recommended sowing date, T_3: Transplanting 25 days after recommended sowing time, N_1 :75% RDN, N_2 : 75% RDN + *Azospirillum*, N_3 : 100% RDN, N_4 :125% RDN

Table 2: Effect of dates of transplanting and levels of nitrogen on nutrient content and uptake by crop and nutrient content of soil after harvesting of summer pearl millet

Treatments	Total N content (%)	Total N uptake (kg ha^{-1})	Total P content (%)	Total P uptake (kg ha^{-1})	Nutrient status of soil after harvest		
					OC (%)	Available N (kg ha^{-1})	Available P (kg ha^{-1})
Dates of transplanting							
T_1	2.50	131.31	0.664	29.35	0.436	191.60	24.84
T_2	2.44	119.35	0.633	25.90	0.413	209.28	25.36
T_3	2.29	101.75	0.627	23.56	0.395	218.34	25.64
SEm. ±	0.027	2.06	0.005	0.59	0.012	5.70	0.76
CD at 5%	0.078	6.05	0.014	1.72	NS	16.71	NS
Levels of nitrogen							
N_1	2.33	101.55	0.627	22.59	0.403	220.35	25.98
N_2	2.41	111.61	0.640	24.80	0.405	209.52	25.82
N_3	2.41	120.21	0.651	27.57	0.412	205.83	24.66
N_4	2.50	136.51	0.654	30.12	0.425	189.79	24.65
SEm. ±	0.031	2.38	0.006	0.68	0.013	6.60	0.88
CD at 5%	0.090	6.98	0.016	1.99	NS	19.30	NS
Interaction (T X N)							
SEm. ±	0.053	4.12	0.01	1.17	0.023	11.40	1.52
CD at 5%	NS	NS	NS	NS	NS	NS	NS

T_1 : Normal drilling on recommended sowing date, T_2 : Transplanting on recommended sowing date, T_3: Transplanting 25 days after recommended sowing time, N_1 :75% RDN, N_2 : 75% RDN + Azospirillum, N_3 : 100% RDN, N_4 :125% RDN

protein content (11.01%) and protein yield (418.85 kg ha^{-1}) were observed under application of 125% RDN (Recommended dose nitrogen) and found statistically at par with 100% RDN in case of grain yield and with75% RDN + *Azospirillum* with respect to straw yield and protein content (Table 1). Treatment N_4 (125% RDN) also recorded maximum harvest index. This might be due to the fact that nitrogen led to higher availability of nutrient that promoted growth and development and ultimately resulting in increasing yield attributes. Application of nitrogen fertilizer provides grater and prolonged availability of nutrients to the crop. Different nitrogen levels also had a significant influence on nutrient content and their uptake (Table 2). Treatment N_4 (125% RDN) recorded significantly higher total N content (2.50%), N uptake (136.51 kg ha^{-1}), P content (0.654%) and P uptake (30.12 kg ha^{-1}) but found at par with N_3 (100% RDN) and N_2 (75% RDN + *Azospirillum*) with respect to total N and P content in crop. Significantly higher available N (220.35 kg ha^{-1}) and P (25.98 kg ha^{-1}) in soil after harvesting were found under the treatment N_1 (75% RDN) which was found statistically at par with treatment N_2 and N_3 with respect to available N in soil after harvesting of crop. These results are in close conformity with those of Gautam and Kaushik (1988), Kanzaria *et al*. (2010) and Prasad *et al*. (2014).

REFERENCES

Ali, S. A. M., Adam, K. I., Bahar, A. H. and Hassan, T. A. 2013. Effect of sowing date and variety on growth and yield of pearl millet (*Pennisetum glaucum* L.) grown on two soil types under rain - fed condition at Zalingei area in Sudan. *ARPN J. Science and Technology*. **3(4):** 340-344.

Andhale, R. P., Shinde, S. H., Sinare, B. T. and Tambe, A. D. 2007. Effect of sowing dates and fertilizer levels on uptake of N, P and K in pearl millet (*Pennisetum glaucum* L.) hybrids in summer season. *Journal of Maharashtra Agricultural University*. **32(3):** 399-400.

Anonymous. 2012-13. Website < http:// www.agricoop.nic.in > All-India area, production and yield of pearl millet from 1950-51 to 2013-14.

Bhuiya, Z. H. and Chowdhary, S. V. 1974. Effect of N, P, K and S on quality of groundnut. *Indian J. Agricultural Science*. **44(1):** 751-754.

Bidinger, F. R. and Hash, C. T. 2003. Pearl millet in: Ngugen (ed) integration of physiology and molecular biology in plant breeding., *N. Y, U.S.A.: Marcel- Decker*.

Gautam, R. C. and Kaushik, S. K. 1988. Effect of bio-fertilizer on the yield of pearl millet. *Indian J. Agronomy*. **33(2):** 196-197.

Jackson, M. L. 1967. "Soil Chemical Analysis". Prentice Hall of India pvt. Ltd., New Delhi. pp. 183-192.

Kanzaria, K. K., Sutaria, G. S., Akbari, K. N., Vora, V. D. and Padmani, D. R. 2010. Effect of integrated nutrient management on productivity of pearl millet (*Pennisetum glaucum*) and soil fertility of sandy loam soils under rainfed conditions. *An Asian J. Soil Science*. **5(1):** 154-156.

Muraleedharan, H., Seshadri, S. and Perumal, K. 2010. Booklate on bio-fertilizer (Phosphobacteria). *Shri AMM Murugappa Chettiar Research Centre Taramani, Chennai*. pp. 10-11.

Panse, V. G. and Sukhatme, P. V. 1967. Statistical methods for Agricultural workers*, ICAR, New Delhi,* pp. 187-197.

Parihar, C. M., Rana, K. S. and Parihar, M. D. 2008. Crop productivity, quality and nutrient uptake of pearl millet (*Pennisetum glaucum*) and Indian mustard (*Brassica juncea*) cropping system as influenced by land configuration and directand residualeffect of nutrient management. *Indian J. Agriculture Science*. **79(11):** 927-930.

Patel, H. H., Patel, S. D. and Patel, T. U. 2008. Effect of land configuration and nutrient management in rabi sorghum (*Sorghum bicolor*) under south Gujarat conditions. Proceeding of National symposium on "New Paradigms in Agronomic Research", Nov., 19-21, 2008, Navsari, Gujarat. pp. 251-252.

Pathak, A. and Chakraborti, S. K. 2014. Impact of bio-fertilizer seed treatment on seed and seedling parameters of maize (*Zea mays* L.). *The Bioscan*. **9(1):** 133-135.

Pawade, P. D. 2010. Response of winter maize (*Zea mays* L.) to sowing time and inter row spacing under South Gujarat condition. M.Sc. (Agri.) thesis (Unpublished) submitted to N.A.U., Navsari.

Prasad, S. K., Samota, A., Singh, M. K. and Verma, S. K. 2014. Cultivars and nitrogen levels influence on yield attributes, yield and protein content of pearl millet under semi-arid condition of vindhyan region. *The Ecoscan: Special issue*, Vol. **VI**: 47-50.

Prasad, S. K., Singh, M. K. and Singh, R. 2014. Effect of nitrogen and zinc fertilizer on pearl millet (*Pennisetumglaucum*) under agri-horti system of eastern Uttar Pradesh. *The Bioscan.* **9(1):** 163-166.

Radhouane, L. 2008. Autochthonous pearl millet ecotype (*pennisetum glaucum*) response to different sowing dates in Tunisia. *Sjemenarstvo*. **25(2):** 123-138.

Upadhyay, P. N., Dixit, A. G., Patel, J. R. and Chavda, J. R. 2001. Response of summer pearl millet (*Pennisetum glaucum* L) to time and method of planting, age of seedling and phosphorus grown on loamy sand soils of Gujarat. *Indian J. Agronomy*. **46(1):** 126-130.