INTEGRATED NITROGEN MANAGEMENT IN SUMMER PEARL MILLET

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ABSTRACT

A field experiment was conducted during summer 2015 at Agronomy Instructional Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, to study the "Integrated nitrogen management in summer pearl millet". Total nine integrated nitrogen treatments of chemical fertilizers with organic manures were tested with three replications in randomized block design. The results revealed that combined application of 50% RDN from chemical fertilizers + 25% nitrogen from vermicompost + 25% nitrogen from neemcake recorded higher value for plant height, dry matter accumulation per plant, total tillers per plant, earhead length, earhead girth, effective tillers, test weight, grain yield and straw yield over other combinations resulted to maximum net realization along with higher BCR value.

KEY WORDS: Biocompost, castorcake, integrated nutrient management, neemcake, pearl millet, RDF, vermicompost

INTRODUCTION

Pearl millet is fourth most important cereal crop after rice, wheat and maize in India. It is the staple food for millions of people in the semi-arid tropics. The agronomical importance of pearl millet is linked protein content and other essential minerals, especially micronutrients. It is generally grown as a rainfed crops in *kharif* season, but under intensive farming system, this crop is raised in summer season also, where irrigation facilities are available owing to its higher production potential during summer season. In India, pearl millet production is 9.25 million tonnes. Gujarat has an area of 7 lakh hectares under pearl millet cultivation and production of 12 lakh tonnes with productivity of 1869 kg/ha (Anonymous, 2014).

The high cost of chemical nitrogen fertilizer and low purchasing power of Indian farmers restricts its use on proper amounts, hampering crop production. Reliance on the increased use of chemical fertilizers and associated hazards put back attention on organic sources which are effective in promoting health and productivity of the soil. In addition to supply of nutrients, organic source improves the physical condition and biological health of soil, which improves the availability of applied and native nutrients. With a view to reduce the losses and indiscriminate use of chemical fertilizers, substitution of part of the chemical fertilizer by locally available organic sources of nutrients (Vermicompost, Biocompost, castercake and Neemcake) is

inevitable. The basic concept of integrated nutrient management is the supply of the required plant nutrients for sustaining the desired crop productivity with minimum deleterious effect on soil health and environment. Inadequate and imbalanced nutrient application by farmers is the most important limiting factor in crop production. It is now increasingly being realized that no single nutrient source could fully meet the nutritional requirement of crop. Moreover, injudicious use of chemicals enhanced the soil and plant health problems. In this context, use of alternative sources of plant nutrients such as organic manure is the need of the time.

Therefore, it becomes imperative to test role of organic manures and inorganic fertilizers as a source of nutrients in pearl millet. Therefore, in the present context, a judicious combination of organic, inorganic fertilizers help to maintain crop productivity. The lack of information on these aspects under summer conditions made as impetus to undertake the present study.

MATERIALS AND METHODS

A field experiment was conducted during summer season of 2015 at Agronomy Instructional Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, to study the "Integrated nitrogen management in summer pearl millet". Geographically, the Navsari is situated at 20^0 57' North Latitude and 72^0 54' East longitude with an elevation of 10 meter above the mean sea level and situated in the South Gujarat Agro-climate region. The climate of the region is warm humid with heavy monsoon. The soil of the experimental field was clayey in texture, low in organic carbon (0.37%) and showed medium rating for available nitrogen (276 kg/ha) and phosphorus (37 kg/ha) and high rating for available potassium (365 kg/ha). The soil was found slightly alkaline (pH 7.6) with normal electrical conductivity (0.58 dS/m). Nine treatment combinations comprising of chemical fertilizers and organic manures, *viz*., 100% recommended dose of nitrogen, 120:60:0 NPK/ha (T_1), 75% RDN + 25% N from vermicompost (T_2), 75% RDN + 25% N from biocompost (T_3), 75% RDN + 25% N from castorcake (T_4), 75% RDN + 25% N from neemcake (T_5), 50% RDN + 25% N from vermicompost + 25% N from castorcake (T_6), 50% RDN + 25% N from vermicompost + 25% N from neemcake (T_7), 50% RDN + 25% N from biocompost + 25% N from castorcake (T_8) and 50% RDN + 25% N from biocompost + 25% N from neemcake (T_9) were evaluated in randomized block design with three replications. Recommended dose of phosphorus @60 kg P_2O_5/ha was appended through single supper phosphate at the time of sowing. Organic manures were thoroughly incorporated in soil in furrow as per treatment and fertilizers were applied according to the treatments manually before sowing the seeds. The sources of nitrogen and phosphorus were urea and single super phosphate, respectively. All other cultural practices were performed uniformly for all treatments. Pearl millet variety (GHB 558) was sown on 11^{th} Feb, 2015 using recommended seed rate of 3.5 kg/ha and keeping 45 cm distance between two rows at the depth of about 4-5 cm. Thinning was carried out after 15 days of sowing to maintain optimum plant population in the experimental plots. Weeding and plant protection measures were undertaken as per the need. The collected data for various parameters were statistically analysed using Fisher's analysis of

variance (ANOVA) technique and the treatments were compared at 5% level of significance.

RESULTS AND DISCUSSION

Growth parameters, yield attributes and yield

Various growth and yield attributing characters of summer pearl millet *viz*., plant height, dry matter accumulation per plant, total tillers per plant, earhead length, earhead girth, effective tillers, test weight, grain yield and straw yield per hectare were significantly influenced by different treatments of nitrogen management. An application of 50% RDN through chemical fertilizers + 25% N through vermicompost + 25% N through neemcake (T_7) to summer pearl millet crop resulted in significantly the higher plant height (175.89 cm) at harvest, dry matter accumulation per plant (51.73 g) at harvest, total tillers at harvest (3.07 per plant), earhead length (23.20 cm), earhead girth (11.10 cm), effective tillers (1.67 per plant), grain yield per hectare (2613 kg/ha) and straw yield per hectare (6769 kg/ha) as compared to 100% recommended dose of nitrogen, 120:60:0 NPK/ha (T_1) for all these traits. The next best treatments with respect grain and straw yield per hectare were 50% RDN +25% N from vermicompost + 25% N from castorcake (T_6), 50% RDN + 25% N from biocompost + 25% N from neemcake (T_9), 50% RDN + 25% N from biocompost + 25% N from castorcake (T_8) and 75% RDN + 25% N from vermicompost (T_2). The percentage grain yield increased in the treatment T_7, T_6, T_9, T_8 and T_2 were to the tune of 27.0, 25.5, 20.6, 19.3 and 11.5 as compared to the treatment having 100% RDN through chemical fertilizer. The percentage straw yield increased in the treatment T_7, T_6, T_9, T_8 and T_2 were to the tune of 26.6, 25.2, 21.2, 20.1 and 10.5 as compared to the treatment having 100% RDN through chemical fertilizer. The highest grain and stover yield per hectare gained under these treatments might be due to chemical fertilizer in conjunction with organic manure might have provide favourable soil environment and nourishment for better plant growth resulted in maximum grain and stover yield. Yield of the crop is a function of several yield components which are dependent on complementary interaction between vegetative and reproductive growth of the crop. Positive responses in terms of yield attributes to integrated nitrogen management have also been reported by Narolia *et al.* (2009), Jakhar *et al.* (2011), Singh *et al.* (2013), Choudhary *et al.* (2014), Kumar *et al*. (2014) and Sinha (2015).

Economics

An economic analysis of the data revealed that higher net realization of rupees 18773/ha and BCR of 0.71 were obtained highest in the treatment of 50 % RDN + 25 % N from vermicompost + 25% N from neemcake (T_7) followed by 50 % RDN + 25 % N from vermicompost + 25% N from castercake (T_6) and 50 % RDN + 25 % N from biocompost + 25% N from neemcake (T_9). The lower net realization of rupees 12868/ha and BCR of 0.53 were recorded under treatment of 75 % RDN + 25 % N from biocompost (T_3). The reason is self explanatory that grain and straw yields were at par in these treatments as compared to rest of the treatments, but application of manures increased cost of inputs. These results are in close conformity with the findings of Kanzaria *et al.* (2010) and Saha *et al.* (2012).

CONCLUSION

The present study indicated that higher production and net profit from summer pearl millet (GHB 558) can be

secured by application of 50% RDN through chemical fertilizers + 25% N through vermicompost + 25% N through neemcake.

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Table 1: Growth parameters of pearl millet as influenced by integrated nitrogen management treatments.

Treatments	Plant Height (cm)			Dry Matter Accumulation (g/plant)			Total Tillers (Number/Plant)	
	At 30 DAS	At 60 DAS	At Harvest	At 30 DAS	At 60 DAS	At Harvest	At 60 DAS	At Harvest
T_1	20.75	122.67	143.33	6.33	19.78	41.02	1.80	2.47
T_2	20.15	131.13	158.00	5.43	22.39	46.47	2.00	2.80
T_3	20.45	123.00	147.00	5.13	20.50	42.24	1.73	2.53
T_4	19.88	124.16	148.16	5.27	20.67	42.58	1.73	2.53
T_5	20.38	127.28	151.28	5.80	21.21	43.33	1.80	2.60
T_6	20.22	144.21	168.21	5.67	24.04	49.47	2.00	2.87
T_7	20.08	151.89	175.89	5.10	25.32	51.73	2.13	3.07
T_8	20.42	138.33	162.33	5.33	23.06	47.75	2.00	2.80
T_9	20.52	143.33	167.33	5.53	23.89	48.67	2.07	2.87
S.Em ±	0.94	6.47	6.41	0.46	1.17	2.08	0.10	0.11
C.D.(P=0.05)	NS	19.41	19.23	NS	3.51	6.23	NS	0.32

Table 2: Yield attributes of pearl millet as influenced by integrated nitrogen management treatments.

Treatments	Length of Earhead (cm)	Girth of Earhead (cm)	Effective Tillers (Number/Plant)	Test Weight (g)
T_1	19.73	9.15	1.07	11.43
T_2	22.40	10.35	1.40	11.76
T_3	20.27	9.15	1.13	11.47
T_4	20.27	9.53	1.13	11.40
T_5	20.80	9.60	1.20	11.47
T_6	22.93	10.88	1.47	11.67
T_7	23.20	11.10	1.67	11.90
T_8	22.40	10.20	1.40	11.44
T_9	22.27	10.65	1.47	11.64
S.Em ±	0.71	0.32	0.09	0.12
C.D.(P=0.05)	2.14	0.97	0.27	NS

Table 3: Economics of pearl millet as influenced by integrated nitrogen management treatments.

Treatments	Yield (kg/ha)		Gross Return (₹/ha)	Cost of Cultivation (₹/ha)	Net Return (₹/ha)	BCR
	Grain	Straw				
T_1	2057	5347	35373	19866	15507	0.781
T_2	2294	5908	39339	24657	14682	0.595
T_3	2160	5607	37138	24271	12867	0.530
T_4	2126	5500	36508	22441	14067	0.627
T_5	2131	5515	36598	21325	15273	0.716
T_6	2582	6693	44366	27233	17133	0.629
T_7	2613	6769	44890	26117	18773	0.719
T_8	2455	6420	42299	26847	15452	0.576
T_9	2482	6482	42743	25731	17012	0.661
S.Em ±	112	315				
C.D.(P=0.05)	336	945				

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