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Effect of Nitrogen and Zinc Levels on Yield and Economics of Fodder Pearl Millet (*Pennisetum americanum* L.)

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ABSTRACT

A field experiment was conducted on fodder pearl millet during kharif season of 2014, at Instructional Farm, College of Agriculture, SK Rajasthan Agricultural University, Bikaner situated in arid western hyper arid zone of Rajasthan. The treatments consist of five nitrogen levels viz. 0, 30, 60, 90 and 120 kg N/ha and four zinc levels viz. 0, 15, 30 and 45 kg $ZnSO_4$ ha^{-1}. The experiment was laid out in randomized block design (Factorial) with three replications. The results showed that maximum green fodder (196.61 and 184.21 q ha^{-1}) and dry matter (33.36 and 29.33 q ha^{-1}) yield of fodder pearlmillet at first and second cut, respectively; and economics viz. net return (Rs. 57,117 ha^{-1}) and B:C ratio (4.02) were recorded with 120 kg N ha^{-1}. Further, Significant increase in green fodder (347.21 q ha^{-1}) and dry matter (55.46 q ha^{-1}) yields; and economics viz. net return (Rs. 50,700 ha^{-1}) and B:C ratio (3.69) were obtained when the crop was fertilized with 30 kg $ZnSO_4$ ha^{-1} compared with control and 15 $ZnSO_4$ kg ha^{-1}.

Key words: *Dry matter yield, Green fodder yield, Net returns, Nitrogen levels, Zinc levels*

INTRODUCTION

Pearl millet (*Pennisetum americanum* L.) is one of the most important crop which grows in the arid and semi-arid areas in the world for both food and forage production. It is nutritious and palatable and can be fed as green, dry or as conserved fodder in the form of silage or hay. It is adapted to drought and poor soil fertility, but responds well to good management and higher fertility levels. The millet has great potential to supply nutritious fodder in areas characterized by moisture deficient and have comparatively higher temperature[12]. Optimum growth of forage crops can only be achieved if adequate supplies of plant nutrients are present in the soil. Efficient fertilizer management plays an important role in increasing the crop yield through efficient utilization of limited source of moisture supply. The soils of arid and semiarid areas are deficient in various nutrient elements especially in nitrogen and zinc.

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Nitrogen is an essential primary nutrient for profuse plant growth and plays a pivotal role in productivity of forage. Application of nitrogen to fodder crops is the most important way to increase forage production. Although the optimization of nitrogen fertilization is an important aspect in making pearl millet fodder production cost effective, use of nitrogen in excess leads to deterioration of soil health and accumulation of nitrate-N in fodder which is toxic to animals. The toxic effects of nitrate on ruminants are well known[3].

During past three and half decade, micro nutrient have occupied an important place in Indian agriculture and have become indispensible to the productivity of crop. Zinc is an essential micro nutrient and it is well a known fact that zinc is now considered as fourth most important yield-limiting nutrient after nitrogen, phosphorus and potassium[6]. It play indispensable role in various plant physiological processes such as photosynthesis, protein and sugar synthesis, fertility and production of seeds, growth regulation and disease immune system. Therefore, an attempt was made to increase the productivity of pearl millet with different nitrogen and zinc levels.

MATERIALS AND METHODS

A field experiment was conducted on fodder pearl millet during kharif season of 2014, at Instructional Farm, College of Agriculture, SK Rajasthan Agricultural University, Bikaner situated at 28.01^0N latitude and 73.22^0E longitude at an altitude of 234.70 meters above mean sea level in arid western hyper arid zone of Rajasthan. The soil was sandy loam in nature, having pH (1:2) 8.4, electrical conductivity (1:2) 0.20 dS/m, organic carbon 0.11 per cent and available N, P and K were 93.85, 21.91 and 234.0 Kg/ha, respectively. Mean weekly meteorological data for the period of the experimentation are presented in Figs. 1.

The experiment was laid out in randomized block design (Factorial) with three replications. The treatments consist of five nitrogen levels *viz.* 0, 30, 60, 90 and 120 kg N/ha and four zinc levels *viz.* 0, 15, 30 and 45 kg $ZnSO_4$ ha^{-1}. Sowing of fodder pear millet variety AVKB-19 was done manually with kera method on 24 July, 2014 with the onset of monsoon rain at row spacing 25cm using seed rate of 10 Kg/ha. Full dose of $ZnSO_4$ and one-third dose of nitrogen (as per treatment) was applied as basal and remaining two-third dose of nitrogen was top dressed in two splits equally *i.e*, first at 25 DAS and rest dose after about one week of first cutting (50 DAS). Plant population was recorded by counting number of plants per meter row length from three randomly selected spots in each plot at 25 DAS and at harvest. These were averaged to work out number of plant per meter row length. For green fodder, crop was harvested at 45 DAS and 90 DAS. First two rows as half metre from either side as border from each plot were harvested. Then crops were harvested from each net plot area individually, tagged and weighed. Weight was recorded and expressed in kg ha^{-1}. Then converted into green fodder yield (q ha^{-1}). Dry matter yield (q ha^{-1}) was taken from samples of fresh weight after complete drying or on the basis of the moisture content in biomass at cutting, putting sample in oven at 72^0C for 24 hours.

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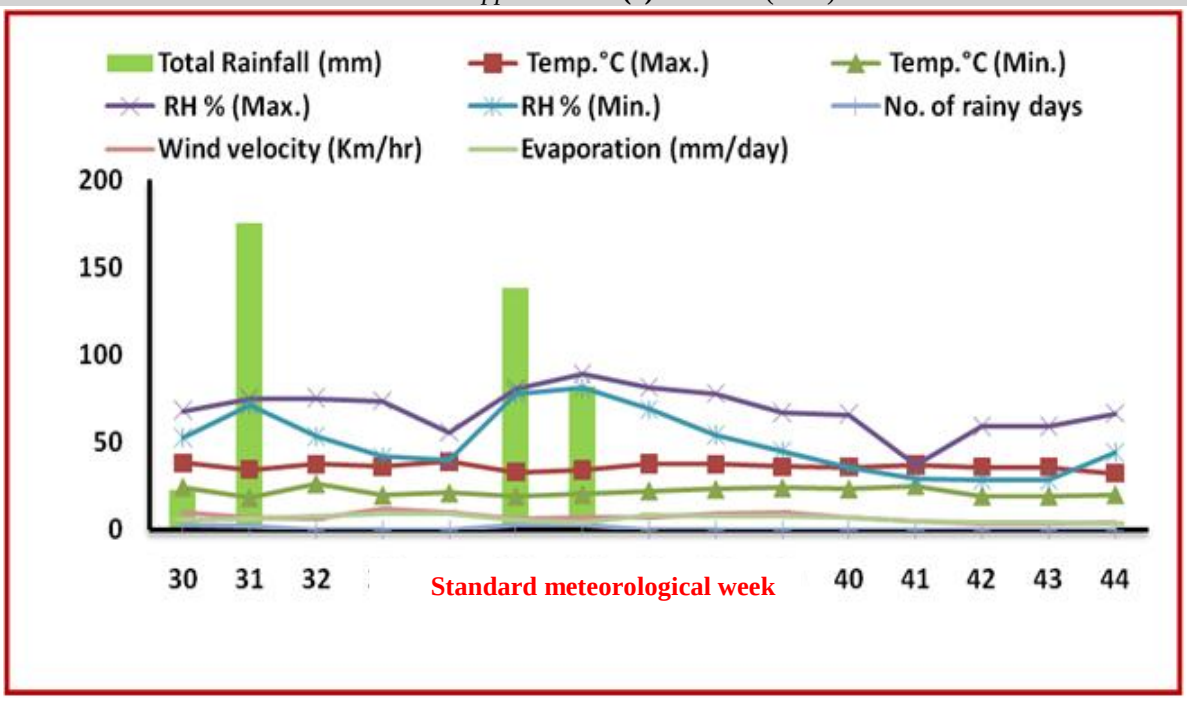

Fig. 1 Mean weekly meteorological data during crop season (Kharif 2014)

RESULTS AND DISCUSSION

Nitrogen Levels

Studies on nitrogen levels indicated that green fodder and dry matter yield; and economics of fodder pearlmillet significantly influenced by different nitrogen levels, however, plant population was not affected by nitrogen levels. Maximum green fodder (196.61 and 184.21 q ha^{-1}) and dry matter (33.36 and 29.33 q ha^{-1}) yield of fodder pearlmillet at first and second cut, respectively; and economics *viz*. net return (Rs. 57,117 ha^{-1}) and B:C ratio (4.02) were recorded with 120 kg N ha^{-1}. However, 90 and 120 kg N/ha gave at par values of green fodder and dry matter yield; and net returns of fodder pearlmillet (Table 1). This may be mainly attributed to positive influence of nitrogen on the growth of crop, which ultimately led to realization of higher fodder yields. Further, the beneficial effects of nitrogen on cell division and elongation, formation of nucleotides and co-enzymes which resulted in increased meristematic activity and photosynthetic area and hence more production and accumulation of photosynthates, yielding higher green fodder and dry matter. These results are in conformity with the findings of Tiwana *et al*[13]., Singh *et al*[11]., Singh *et al*[10]. and Sheoran and Rana[9].

Zinc Levels

Significant increase in green fodder (347.21 q ha^{-1}) and dry matter (55.46 q ha^{-1}) yields; and economics *viz*. net return (Rs. 50,700 ha^{-1}) and B:C ratio (3.69) were obtained when the crop was fertilized with 30 kg $ZnSO_4$ ha^{-1} compared with control and 15 $ZnSO_4$ kg ha^{-1} dose however it was found at par with 45 kg $ZnSO_4$, ha^{-1} (Table 1). The fodder yield, being a function of the cumulative effect of growth parameters such as plant height and dry matter accumulation per plant resulting in higher forage yield under this treatment. The results are in close conformity with findings of Singh *et al*[10]., Mehdi *et al*[7]., and Dhadich & Gupta[4] who were reported significantly increased green fodder and dry matter yield with application of 10 kg $ZnSO_4$ ha^{-1}.

Interaction effect of nitrogen and zinc

Pearl millet green fodder yield and net returns were significantly influenced by nitrogen x zinc fertilizer levels. The highest total green fodder yield (392.91 q ha^{-1}) and net returns (Rs. 60023.67 ha^{-1}) was recorded with 120 kg N/ha& 15 kg $ZnSO_4$ ha^{-1} treatment followed by

90 kg N/ha& 30 kg $ZnSO_4$ ha^{-1} treatment (Table 2 and 3). Such type of finding were also reported by Arora and singh[1] in barley, Khourgami and Bour[5] in wheat, Bhoya *et al*[2]., in sorgham and Sajad *et al*[8]., in maize reported positive interaction between nitrogen and zinc fertilization at lower levels.

Table 1: Effect of nitrogen and zinc levels on plant population, yield and economics of fodder pearl millet

Treatment	Plant population (meter^{-1} row length)		Green fodder yield (q ha^{-1})			Dry matter yield (q ha^{-1})			Net returns (₹ ha^{-1})	B :C ratio
	25 DAS	90 DAS	1st cut	2nd cut	Total	1st cut	2nd cut	Total		
Nitrogen levels (Kg/ha)										
N_0	14.62	12.16	134.33	119.99	254.33	20.25	15.54	35.79	33,403	2.92
N_{30}	14.85	12.35	160.84	144.08	304.92	23.83	19.13	42.96	43,126	3.40
N_{60}	14.93	12.41	176.59	156.98	333.58	27.60	22.90	50.50	48,461	3.64
N_{90}	15.00	12.47	190.93	178.72	369.65	32.91	28.21	61.12	54,816	3.97
N_{120}	15.02	12.48	196.61	184.21	380.82	33.36	29.33	62.69	57,117	4.02
S.Em ±	0.33	0.23	2.55	3.83	5.96	1.08	0.64	1.18	1,188	
CD at 5%	NS	NS	7.29	10.97	17.07	3.08	1.83	3.38	3,400	
$ZnSO_4$ levels (Kg/ha)										
Zn_0	14.90	12.39	152.69	142.78	295.47	23.17	19.01	42.17	41,931	3.50
Zn_{15}	14.88	12.37	169.70	154.74	324.44	26.16	21.46	47.62	47,120	3.64
Zn_{30}	14.90	12.39	182.63	164.58	347.21	30.08	25.38	55.46	50,700	3.69
Zn_{45}	14.85	12.35	182.43	165.09	347.52	30.95	26.24	57.19	49,787	3.52
S.Em ±	0.29	0.21	2.28	3.43	5.33	0.96	0.57	1.05	1,062	
CD at 5%	NS	NS	6.52	9.81	15.27	2.75	1.63	3.02	3,041	

Table 2: Interaction effect of nitrogen and zinc levels on total green fodder yield (q ha^{-1})

Treatment	N_0	N_{30}	N_{60}	N_{90}	N_{120}
Zn_0	238.25	246.75	261.58	350.69	380.07
Zn_{15}	254.75	289.13	330.53	354.86	392.91
Zn_{30}	261.58	335.41	357.71	392.01	389.36
Zn_{45}	262.74	348.40	384.48	381.06	360.92
S.Em±	11.93				
CD at 5%	34.15				

Table 3: Interaction effect of nitrogen and zinc on net return Rs. ha^{-1}

Treatment	N_0	N_{30}	N_{60}	N_{90}	N_{120}
Zn_0	31649.33	32954.21	35524.75	51093.90	58430.67
Zn_{15}	33974.39	40455.24	48338.87	52809.33	60023.67
Zn_{30}	34366.00	48735.33	52799.33	59263.60	58338.00
Zn_{45}	33623.00	50358.07	57179.80	56098.66	51675.80
S.Em±	2375.17				
CD at 5%	6799.93				

REFERENCES

1. Arora, S. and Singh, M., Interaction Effect of Zinc and Nitrogen on Growth and Yield of Barley (Hordeum vulgare on Typic Ustipsamments. *Asian J. Plant sci*., **3(1):** 103-106 (2004).
2. Bhoya, M., Chaudhari, P.P., Raval, C.H. and Bhatt, P.K., Effect of nitrogen and zinc on yield of fodder sorghum [*Sorghum Bicolor* (L.) Moench] Varieties. *Forage Res.* **39(1):** 24-26 (2013).
3. Binta, M.G. and Mushi, E.Z., Environmental Factors Associated with Nitrate Poisoning in Livestock in Botswana. *J. Pet. Environ. Biotechnol* . 4172/2157-7463 (2012).
4. Dadhich, L.K. and Gupta, A.K., Growth and yield of fodder pearl millet as influenced by sulphur, zinc and intercropping with cowpea. *Fertilizer News*, **50:** 55-57 (2005).

5. Khourgami, Ali, and Bour, Ghobad, Effect of nitrogen and zinc fertilizers on yield and protein content of durum Wheat (*Triticum turgidum var. durum*). Global Issue. Paddock Action." Edited by M. Unkovich.Proceeding of 14th Agronomy Conference, 21-25 September, Adelaide, South Australia (2008).
6. Maclean, J.L., Rawe, D.C. and Hettel, G.P., Rice Almanac: Source book for the most important economic activity on Earth. (3rd edn.), International Rice Research Institute, Manilla, Philippines and CABI, Wallingford, UK. 253 (2002).
7. Mehdi, S.S., Husain, B. and Singh, L., Influence of seed rate, nitrogen and zinc on fodder maize (Zea mays) in temperate conditions of western Himalayas. *Indian J. Agron.*, **57(1):** 85-88 (2012).
8. Sajad, A., Jamil, M., Ahmad, M., Abbasi, G.H. and Zaman, M.F.U., An investigation on nitrogen-zinc interaction synergies on maize (*Zea mays* L.) fodder quality. *World Applied Sci. J.*, **31(1):** 91-95 (2014).
9. Sheoran, R.S. and Rana, D.S., Relative efficiency of *Azotobacter* and nitrogen fertilizer in forage sorghum (*Sorghum bicolor* L.) under semi-arid conditions. *Forage Res.*, **32:** 65-68 (2006).
10. Singh, M., Mohan, S. and Kumar, R., Effect of nitrogen, phosphorus and zinc fertilization on yield and quality of kharif fodder -A review. *Agricultural Reviews*, **36(3):** 218-226 (2015).
11. Singh, B., Rana, D.S., Joshi, U.N. and Dhaka, A.K., Fodder yield and quality of pearlmillet genotypes as influenced by nitrogen levels. *Forage Res.*, **38(1):** 62-63 (2012).
12. Tariq, M., Ayub, M., Elahi, M., Ahmad, A. H., Chaudhary, M.N. and Nadeem M.A., Forage yield and some quality attributes of millet (Pennisetum americannum L.) hybrid under various regimes of nitrogen fertilization and harvesting dates. *African J. Agri. Res.*, **6(16):** 3883-3890 (2011).
13. Tiwana, U.S., Puri, K.P. and Sukhpreet, S., Fodder yield and quality of multicut pearl millet (*Pennisetum glaucum)* as influenced by nitrogen and phosphorus under Punjab conditions. *Forage Res*., **28(4):** 190–193 (2003).