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Effect of FYM, Nitrogen and *Azospirillum* on Yield, Economics and Soil Nutrient Status of Forage Pearl Millet

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A field experiment was conducted at C.P. College of Agriculture, S.D. Agricultural University, Sardar Krushinagar, Gujarat during *Kharif* 2007 to find out the influence of FYM, nitrogen levels and bio-fertilizer on the productivity and economics of forage pearl millet. The experiment comprising of twelve treatment combinations *viz*., two levels of FYM (M_0-0 and M_1-10 t ha^{-1}), three levels of nitrogen (N_1-80,N_2-100 and N_3-120 kg ha ^{1}) and two levels of biofertilizer (I_0 -without inoculation and I_1 -inoculation with *Azospirillum*) was laid out in factorial randomized block design with four replications. Results revealed that FYM 10 t ha^{-1}, nitrogen 100 kg ha ^{1} and inoculation with *Azospirillum* recorded significantly higher green forage yield than their respective lower levels. Similar trends of superiority were observed in economical parameters and soil status of organic carbon, available nitrogen and phosphorus by application of FYM 10t ha^{-1}, N 100kg ha^{-1} and seed inoculation with *Azospirillum* as compared to no FYM, 80 kg N ha^{-1} and without inoculation, respectively. The interaction effect revealed that among different treatment combinations, the treatment $M_1N_2I_1$ (10 t FYM + 100 kg N ha^{-1} + *Azospirillum* inoculation) recorded significantly higher green forage yield, net return and BCR as compared to rest of treatment combinations.

Key words: Forage pearl millet, net return, BCR, forage yield, available soil nutrient

Pearl millet, (*Pennisetum glaucum* L.) a native of Africa was introduced into India a long back itself. The cultivation of pearl millet for forage purpose has recently been emphasized due to its profuse tillering, multi cut nature, absence of toxic 'prussic acid' and good performance even on poor soils. Pearl millet, popularly known as poor man's crop, is favourably productive under optimum management.

However, the production potential depends on physiological growth stage and cutting at optimum stage during the growing season. Multi cut nature of the crop ensures the forage supply over a long period of time, reduced cost of cultivation and many other benefits. This behaviour of the crop, therefore, can be modified by manipulating the harvesting stage and fertilization practices to derive maximum benefits. The projected demand for green and dry fodder for the year 2010 is estimated at about 1250 and 1050 M.T., respectively. The available forage supply accounts for only 46.6 per cent of the total demand and annual deficit of concentrate is about 44.0 per cent, whereas, for green forage and dry roughage is about 36 per cent. At present, only 3.7 per cent of country's total cultivated land is used for forage production (Chhabra and Dinh, 2002).

The forage pearl millet being a cereal crop, is a heavy feeder and more responsive to nutrients. The required amount of nutrients may be supplied through both organic manures and inorganic fertilizers to increase the productivity and to maintain soil fertility in a sustained manner. Farm yard manure (FYM) is well recognized and considered as balanced bulky organic manure which increases the moisture retention of the soil and helps in dissolution of nutrients. FYM although not useful as a sole source of nutrients, is good complimentary and supplementary source to mineral fertilizer. Nitrogen is an essential major nutrient for plant growth, which is closely associated with vegetative growth and development of plants; it plays an important role in plant metabolism by virtue of being an essential constituent of structural component of the cell wall and many metabolically active compounds. It is also a constituent of chlorophyll, which is important for harvest of solar energy (Bray, 1983). The beneficial effect of *Azospirillum* on plant is associated not only with the process of nitrogen fixation and improved nutrition of plants, but also with synthesis of complex biologically active compounds such as pyridoxine, biotin, gibberellins and other compounds which stimulates the germination of pearl millet seeds and accelerate plant growth under favourable environmental conditions. The judicious combination of organic and inorganic fertilizers with suitable biofertilizer,

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therefore, appears be the better way to maintain long term soil fertility and sustained productivity of forage pearl millet. A study was therefore, conducted to evolve a suitable nutrient management option through conjoint use of FYM, nitrogen and biofertilizer for higher productivity and profitability besides improveing fertility of soil.

Materials and Methods

A field experiment was conducted at C.P. College of Agriculture, S.D. Agricultural University, Sardar Krushinagar, Gujarat during *Kharif* 2007. The experimental site is situated at 24°19' North latitude, 72°19' East longitudes with an elevation at 154.1 meters above mean sea level, representing the North Gujarat Agro-Climatic Zone. The climatic condition of this region is sub tropical. The soil of the experimental field was loamy sand in texture, low in organic carbon (0.33 %) and available nitrogen (172 kg ha^{-1}) medium in available phosphorous (43 kg ha^{-1}) and available potassium (250 kg ha^{-1}) with pH 7.4. A total rainfall of 574.3 mm in 26 rainy days was received during crop growth period of July to August. The experiment was laid out in factorial randomized block design with three factors with four replications. Treatments comprised of two levels of FYM *viz*., 0 t ha^{-1}(M_1) and 10 t ha^{-1} (M_2), three levels of nitrogen *viz*., 80 kg ha^{-1}(N_1), 100 kg ha^{-1}(N_2), and 120 kg ha^{-1} (N3) and two levels of biofertilizer *viz*., without inoculation (I_0) and with inoculation of *Azospirillum* (I_1), thus making twelve treatment combinations. Recommended dose of P and K were applied @ 50: 40 kg ha^{-1} respectively, as basal at the time of sowing. Forage pearl millet var. AFB-2 was sown on 11th July, 2007 with recommended seed rate of 12 kg ha^{-1} with row spacing of 30 cm.

Results and Discussion

Effect of FYM

Application of FYM @ 10 t ha^{-1} significantly increased the green forage yield by 7.43 per cent (Table 1) as compared to no FYM (44.4 t ha^{-1}). FYM improved the physical condition of the soil including water holding capacity and aeration to the soil bedsides serving as a store house for plant nutrients. Thus, it provided a favourable environment to increase the green forage yield. The findings are in close conformity to those of Gill *et al*. (1988) and Kumar and Sharma (2002) in fodder sorghum.

Organic carbon, available nitrogen and available phosphorus (Table 1) status of soil at harvest of the crop were increased significantly by 13.8, 8.5 and 9.3 per cent, respectively, with application of FYM 10 t ha^{-1} over no FYM. The increase in organic carbon and available nitrogen status was solely attributed to the decomposition of FYM and N bearing organic compound in applied FYM, while the enhanced P availability was the combined effect of organic anions and released organic acids which increased

Table 1. Effect of FYM, nitrogen and *Azospirillum* on green forage yield, organic carbon, available nitrogen and phosphorus of soil at harvest.

Treatment	Green forage yield (t ha^{-1})	Organic carbon (%)	Available Nitrogen (Kg ha^{-1})	Available Phosphorus (Kg ha^{-1})
FYM (t ha^{-1})				
M_0: 0	44.4	0.29	155.1	43.66
M_1: 10	47.7	0.33	168.3	47.72
C.D. at 5 %	2.42	0.02	9.20	0.72
Nitrogen (kg ha^{-1})				
N_1: 80	42.2	0.28	147.4	44.38
N_2 : 100	47.9	0.32	162.6	46.12
N_3 : 120	48.0	0.34	175.0	46.57
C.D. at 5 %	2.97	0.02	11.26	NS
Azospirillum inoculation				
I_0:Without inoculation	44.7	0.3	156.1	44.73
I_1:With inoculation	47.4	0.32	167.3	46.65
C.D. at 5%	2.42	0.02	9.20	0.72
Interaction: M x N x I	Sig.			

the availability of phosphorus nutrients from the native as well as from applied fertilizer on decomposition of FYM. The results are in accordance with those of Agarwal and Kumar (1996).

Effect of Nitrogen

The increasing levels of nitrogen up to 100 kg ha^{-1} significantly increased the green forage yield (Table1) and further increase in the dose of nitrogen (120 kg N ha^{-1}) could not bring any significant improvement as indicated by Randhawa *et al*. (1989). The increase in green forage yield with 100 kg N ha^{-1} was 13.57 per cent as compared to 80 kg

N ha^{-1}. Nitrogen application tended to put more vegetative growth, better root development and efficient photosynthesis and finally produced more green forage yield. These results are in close conformity with those of Manohar *et al.* (1992) Jakhar *et al.* (2003) and Tiwana and Puri (2005).

Organic carbon and available nitrogen in soil increased remarkably with corresponding increase in nitrogen levels from 80 to 120 kg ha^{-1} (Table 1). Organic carbon and available nitrogen in surface soils at harvest of crop recorded with 100 kg N ha^{-1} was 0.32 per cent and 162.6 kg ha^{-1} which was significantly higher over treatment where N was applied at the rate of 80 kg ha^{-1}. Further increase in N application at 120 kg ha^{-1} failed to give significant improvement in the soil properties. But, the improvement in soil properties with 120 kg N ha^{-1} was significantly higher than 80 kg N ha^{-1}. Application of nitrogen in soil could maintain higher soil organic carbon because of increased plant dry matter enhancing total microbial bio mass activity, and ultimately soil microbial biomass carbon in the soil, organically bound nutrients and exchange reactions contributing towards better availability of nutrient element present in the soil. These results are in accordance with that of Agarwal and Kumar (1996).

Effect of* Azospirillum *inoculation

The green forage yield was significantly increased by seed inoculation with *Azospirillum*. The increase in green forage yield with *Azospirillum* inoculation was 6.04 per cent as compared to no inoculation (Table 1). The increased yield probably might have resulted from stimulation in germination and increased utilization of the nitrogen fixed by *Azospirillum* inoculation. These results are in close conformity with that of Jadhav *et al*. (1991).

Seed inoculation with *Azospirillum* culture had significant effect on organic carbon, available nitrogen and phosphorus in soil as compared to control. The magnitude of enhancement in soil organic carbon, available nitrogen and phosphorus was to the tune of 6.66, 7.17 and 4.29 per cent, respectively, over no inoculation (Table 1). This might have taken place due to increase in active population of the soil microorganisms that improved nitrogen fixation in the soil and ultimately increased the biomass carbon and available nutrient status of the soil.

Interaction effect of levels of FYM, nitrogen and* Azospirillum *inoculation

Green forage yield of pearl millet was significantly increased with conjoint use of nitrogen, FYM and seed inoculation with *Azospirillum* (Table 2).

Table 2. Effect of FYM, nitrogen and *Azospirillum* on green forage yield and economics of forage pearl millet.

Treatment No.	Treatment	Green Forage yield (t ha ^{1})	Net return (Rs. ha ^{1})	BCR
T_1	$M_0N_1I_0$	39.5	21109	2.47
I_2	$M_0N_1I_1$	43.7	24188	2.81
T_3	$M_0N_2I_0$	45.9	25758	2.97
T_4	$M_0N_2I_1$	46.2	25923	2.98
I_5	$M_0N_3I_0$	44.8	24838	2.83
T_6	$M_0N_3I_1$	46.6	26180	2.97
T_7	$M_1N_1I_0$	41.7	21698	2.26
T_8	$M_1N_1I_1$	43.9	23261	2.41
T_9	$M_1N_2I_0$	47.7	26038	2.68
I_{10}	$M_1N_2I_1$	52.0	29285	3.01
I_{11}	$M_1N_3I_0$	48.7	26677	2.72
I_{12}	$M_1N_3I_1$	52.1	29204	2.96
C.D. at 5%		4.1		

Application of N at 80 kg ha^{-1} with and without FYM and *Azospirillum* inoculation gave statistically lower yield than rest of the treatment combinations. Maximum green forage yield (52.03 t ha^{-1}) was observed by the treatment combination $M_1N_2I_1$ (10 t FYM + 100 kg N ha^{-1} + *Azospirillum* inoculation) and the magnitude of increase was 31.6 per cent over application of N at 80 kg ha^{-1} without FYM and *Azospirillum* inoculation. Similarly, economic analysis (Table 2) revealed that the treatment combination $M_1N_2I_1$ (10 t FYM + 100 kg N ha^{-1} + *Azospirillum* inoculation) resulted in higher net return of Rs.29285 ha^{-1} with benefit cost ratio of 3.01. This treatment was closely followed by FYM @ 10 t ha^{-1} with 120 kg N ha^{-1} and seed inoculation with *Azospirillum* with net returns of Rs.29204 ha^{-1}.

It can be concluded from the study that application of nitrogen at 100 kg ha^{-1}, FYM 10 t ha^{-1} with seed inoculation of *Azospirillum* recorded higher green forage yield, net returns and BC ratio of pearl millet.

References

Agarwal, R.K. and Kumar, P. 1996. Integrated use of farm yard manure and fertilizer N for sustained yield of pearl millet (*Pennisetum glaucum* L.) in an arid region. *Ann. Arid Zone*, **35**: 29-35.

Bray, C.M. 1983. Nitrogen Metabolism in Plants. Longman Publishing, London. 183-202pp..

Chhabra, A. and Dinh, K.V. 2002. Environmental animal interaction and their impact of dairying in India. *Indian Dairyman,* **54**: 38-43.

Gill, A.S., Abichandari, C.T. Maurya, R.K. and Manohar, N.D. 1988. Nitrogen fertilization on fodder sorghum. *Indian J. Agric. Res.,* **22**: 171-175.

Manohar, S.S., Singh, G.D. and Rathore, P.S. 1992. Response of fodder Pearl millet (*Pennisetum glaucum* L.) to levels of Nitrogen, Phosphorous and Zinc. *Indian J. Agron.,* **37**: 362-364.

Kumar, S. and Sharma, B.L. 2002. Effect of FYM, Nitrogen and *Azospirillum* inoculation on yield and quality of fodder sorghum. *Forage Res.,* **28**: 165-168.

Jadhav, A.S., Shaikh, A.A. and Harinarayana, G. 1991. Response of rain fed Pearl millet (*Pennisetum glaucum* L.) to inoculation with Nitrogen fixing bacteria. *Indian J. Agric. Sci.,* **61**: 268-271.

Jakhar, S., Sharma, H.S. and Kantwa, S.R. 2003. Effect of Nitrogen and Sulphur on quality and nutrient content fodder Pearl millet. *Ann. Agric. Res.*, **24**: 169-171.

Randhawa, N.S, Singh, J. and Sidhu, M.S. 1989. Response of fodder Pearl millet genotypes to Nitrogen under irrigated conditions. *Forage Res.,* **15**: 128-131.

Tiwana, V.J. and Puri, K.P. 2005. Effect of Nitrogen levels on the fodder yield and quality of Pearl millet varieties under rain fed conditions. *Forage Res.,* **31**: 142-143.

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