EFFECT OF INTEGRATED DOSES OF NITROGEN FERTILIZER AND BIOFERTILIZER ON YIELD OF FODDER CROP MAIZE (CV. AFRICAN TALL)

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Abstract:

The use of inorganic fertilizer has become an essential part of crop production, and a balanced form of fertilizer use is always a prerequisite to obtaining a higher yield. However, these fertilizers are costly and also pollute the environment through the process of denitrification and volatilization and soil water through leaching wherein only 50 percent of available nitrogen is being used and rest 50 percent goes as waste and is an environmental hazard. Hence, a strategy for integrated nutrient supply is evolved by using a judicious combination of chemical fertilizer, organic manure, and biofertilizers (Panwar et al. 2001). Therefore a combined effect of chemical fertilizer along with biofertilizer on percentage increase in yield of fodder crop maize (cv. African Tall) and saving of nitrogenous fertilizer due to the use of biofertilizer was studied under present investigation

Keywords: Nitrogen fertilizer, Biofertilizer, Yield, Maize, Integrated dose.

Introduction:

Fertilizers used to supply N, P, and K play a crucial role in plant production. Proper soil and crop husbandry linked up with the input of chemical fertilizer is a common practice to push up and stabilize the yield of crop plants (Wasnik, 1992 and Umesha and Purushottam, 1996 Singh et al. 1998).

In recent times fertilizers are responsible for a 50 percent increase in crop yield. Due to the progressive intensification of agriculture and the production of great yielding varieties, fertilizer consumption has increased very much, accounting for 23.6 metric tonnes of nutrients every year through crop removal. Overuse in certain potential areas and suboptimum use in large areas are crucial issues, and indiscriminate use of chemical fertilizer is creating lots of problems, primarily soil degradation, and pollution. Therefore emphasis should be to reduce the use of inorganic fertilizers and to improve fertilizers' use efficiency. Hence, comes the integrated concept of nutrient supply, where efficient use of chemical organic and biological sources is practiced (Surekha and Rao 1995). The use of inorganic fertilizers has become an essential part of crop production, and a balanced form of fertilizer use is always a prerequisite to obtaining higher yield. However, these fertilizers are costly and also pollute the environment; hence a strategy for integrated nutrient supply is evolved by using a judicious combination of chemical fertilizer, organic manure, and biofertilizer (Panwar et al. 2001). A combined effect of chemical fertilizer along with biofertilizer was studied by several

workers (Mohan and Pradhan 2001, Gautam and Pant 2002, Mahajan et al. 2002). Hence attempts were made during the present study to observe the effect of integrated fertilizer dose (nitrogenous fertilizer along with biofertilizers) on the productivity of forest crops maize (cv. African Tall). This study also includes an investigation on the percentage increase in the yield of fodder crops and the saving of nitrogenous fertilizer due to the use of biofertilizer.

Materials and Methods:

During the present investigation, the fodder crop maize (cv. African Tall) recommended by Mahatma Phule Krushi Vidyapith Rahuri, Maharashtra, was selected for treatment with an integrated dose of nitrogenous fertilizer and biofertilizers. The fodder crop was cultivated at Maharashtra Sheli va Mendhi Vikas Prakshetra Bilakhed Chalisgaon (MS) during the summer season in 2000-2001. The soil was analyzed by government soil analyzing laboratory, Jalgaon (2000) of its nutrient content before sowing. The soil was deficient in phosphorous, moderate in nitrogen and potash with an average pH of 7.8.

A piece of land measuring about 360 sq. m. (15m x 24m) was prepared by plugging and cross ploughing while making the land compost prepared on-farm was added at the rate 3000 kg/ ha. The land was then divided into 24 plots, each with an area of 15 sq m for sowing the crop. The plots were arranged in a randomized block design. The crop planted in rows by hand. Each plot bearing ten rows spaced 30.5 cm apart. All crops were raised under irrigated conditions. The seed rates were used as per the recommendations. Nitrogenous fertilizer was used in the form of urea while biofertilizer Azospirillum.

Crop received eight fertilizers treatment through urea and biofertilizers alone or in combination were N0, N30, N60, N90 N120 i.e. 0,30,60,90,120 kg/ha BF (biofertilizer alone), Bf + N30 and Bf+N60 kg/ha. The plot which did not receive fertilizer was treated as a control plot. The biofertilizers were used at a rate of 2 kg./ha fifty percent of the dose of fertilizer nitrogen was applied as basal dose and remaining half after a month of crop growth. In comparison, biofertilizer (Bf) were applied directly to the seeds at a rate of 2 kg/ha the crop was cultivated under the irrigated condition, and the use of insecticide and pesticide were evolved.

The crop was harvested from three replicas every time at the performing stage from the net size of the plot harvested was 13.72 m2. The weight of the green fodder obtained from each plot was measured, and the samples of green fodder were immediately brought to the laboratory for analysis. The sample was chopped into 2 to 3cm pieces and dried in an electric oven at 75± 5^0c till constant weight for dry matter (DM) determination. The dried sample was ground to a fine powder and is used for the estimation of crude protein (CP). Nitrogen (N) content was determined in duplicate by the Microkjeldahl method (Bailey, 1967). The value of crude protein (CP) was expressed as N x 6.25.

Result and discussion:

African Tall variety of Maize, which was cultivated during this yield trial, grew luxuriously with abundant foliage fertilizer nitrogen (N) application produced succulents in plants with lushness in the foliage. Azospirillum was used as a biofertilizer and as a source of nitrogen was used during the present study to test its efficacy when applied alone and in combination with nitrogenous fertilizer (Urea) to harvest maximum

green fodder over control. Application of azospirillum promotes root growth and nitrogen fixation in the soil, which helps in increasing fodder yield. (Tomar and Agrawal 1993).

The percent dry matter in the foliage was 25.4% on plants, which received 30 kg N/ha. It decreased to 23.7% due to the application of 120 kg N/ha. A maximum percent dry matter (25.7%) was observed when the crop received in the N30+Bf combination. Use of fertilizer nitrogen alone and in a combination of biofertilizer (Bf) increased N content in foliage from 1.92% on control plots receiving no fertilizer to 2.72 on plots which received maximum fertilizer nitrogen (120 kg/ha) and 2.47% on plots which received integrated doses of N60+ Bf (Table 2).

Table 2 also gives the yield of green fodder, dry matter, and crude protein under the influence of integrated fertilizer dose treatments. The application of nitrogen significantly increased the yields. On control plots, the crop yielded 40055, 9934, and 1192 kg/ha Gf, DM, and CP, respectively. The yields gradually increased with the application of fertilizer N and reached as high as 75346, 17857, and 3036 kg/ha, respectively. The use of biofertilizer alone yielded 46238, 11374, and 1443 kg/ha GF, DM, and CP, respectively, while it gradually increased in combination with fertilizer nitrogen to 61780, 15383 and 2375 kg/ha respectively. This was also evident from the value of 'F' given in table 2. An increase in forage production of Maize and *Sorghum* due to the application of two biofertilizers, i.e., Azotobactor and Azospirillum along with different levels of nitrogen was observed by Singh et al. (1989) and Sadhu et al. (1991).

Table 3 gives an account of the effect of integrated dose on the percent increase in yield over control and respective nitrogen levels. It was found that a minimum 15 percent increase in yield over control was recorded from plots which were provided biofertilizer alone and a maximum 88 percent increase in yield over control in plots of which received 120 kg/ha nitrogen fertilizer. The results are comparable to those reported by Biswas et al. (2001). The results in the percent increase in the yield over respective nitrogen level accounted to 15 percent for the biofertilizer (Bf) plots, and a maximum of 25 percent in the plots provided N60 + Bf fertilizer dose. The above results indicate that the green fodder yield obtained at 90 kg/N/ha (62320 kg/ha) was at par with that recorded with integrated dose N 60 + Bf (61780 kg/ha). Thus saving of 30 kg/ha of fertilizer nitrogen could be achieved through the use of biofertilizer. This fact supported the findings by Dalavi et al. (1993) and Kalaghatagi et al. (1996).

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Table 1

Details of the cultivation practices and harvesting of fodder crop Maize (Cv. African tall) during 2000-2001

Crop	Cultivar	Duration	Seed rate (Kg/ha)	No of harvest	Fertilizer treatment (kg/ha)
Maize	African tall	22 feb. 2000 to 12 may 2000	70	1 cut	N0, N30, N60,N90, N120, Bf, N30+Bf, N60+Bf.

Table 2

Effect of integrated fertilizer dose on the yields of green fodder, dry matter and crude protein from Maize (cv. African Tall)

Duration 22 Feb. 2000 to 12 May 2000

Date of Harvest	Type of cut and age of the crop (in days)	Fertilizer treatment (Kg/ha)	Green Fodder		Yield (Kg/ha)		
			% DM	N% of DM	Green fodder	Dry matter	Crude protein
12 may 2000	1 cut (80)	N0	24.8	1.92	40055	9934	1192
		N30	25.4	1.98	47360	12029	1487
		N60	24.4	2.13	49513	12081	1608
		N90	24.0	2.34	62320	14957	2187

		N120	23.7	2.72	75346	17857	3036
		Bf	24.6	2.03	46238	11374	1443
		N30+Bf	25.7	2.24	54824	14090	1972
		N60+Bf	24.9	2.47	61780	15383	2375
C.D. (P= 0.05)					1442	1710	213
F value	Replicate				NS	NS	NS
	Treatment				567.39**	19.92**	71.86**

*Significant, ** highly significant, NS – non-significant

Table 3

Effect of Integrated fertilizer doses on yields from Maize (cv. African Tall)

Treatment	Green fodder yield (kg/ha)	% increase in yield		Dry matter yield (kg/ha)	Crude protein yield (kg/ha)
		Over control	Over respective N level		
N0	40055	-	-	9934	1192
N30	47360	18	-	12029	1489
N60	49513	23	-	12081	1608
N90	62320	55	-	14957	2187
N120	75346	88	-	17857	3036
Bf	46238	15	15	11374	1443
N30 + Bf	54824	36	16	14090	1972
N60 + Bf	61780	54	25	15383	2375