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## Effect of biofertilizers and inorganic fertilizers on the fodder yield of bajra (Co.8)

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**Abstract :** Field experiments were conducted at the Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore, for three years from 1993 to 1996 to study the effect of biofertilizers, viz., Azospirillum and Phosphobacterium, either individually or in combination (mixture) along with 100, 75 and 50 per cent recommended dose of N alone, P alone and N & P together, in fodder bajra (*Pennisetum americanum* L.) cultivar Co-8, under irrigated condition in a clay loam soil. The results revealed that soil application of Azospirillum + Phosphobacterium as biofertilizer mixture (each at 2000 g/ha) along with 75 per cent of recommended dose of N and P fertilizers recorded increased plant height, more number of tillers and economically higher green and dry fodder yields. The N and P use efficiency was also better under this treatment. There was a saving of 25 per cent recommended dose of N and P fertilizers due to the addition of biofertilizer mixture with a higher net return of Rs. 3,247 ha<sup>-1</sup> and a benefit cost ratio of 1.39. (**Key Words :** Bajra, Fodder and Biofertilizer)

Forage crop is gaining importance as a commercial crop in the irrigated lands, especially near the urban centres, in view of the development of dairying and /or goat farming activities. Since fertilizer alone accounts for more than 40 per cent of the cost of production of forage crops, it is very much necessary to find ways to economise fertilization, without reduction in the productivity of forage crops. Keeping this in mind, a study was conducted to find out the effect of biofertilizers on the fodder yield of bajra (Co.8) under irrigated conditions. Application of nitrogen (Verma *et al.*, 1993) and phosphorus fertilizers (Kailash Chand *et al.*, 1993) has been found to increase the fodder yield of cereal forages and grass-legume mixtures. Combined effect of VAM and rhizobium was found to be better than their individual effect in increasing the fodder yield of *Stylosanthes guianensis* (Girija Devi *et al.*, 1993). However, information on the individual or combined effect of biofertilizers such as azospirillum and phosphobacterium with the inorganic fertilizers is very much lacking. Hence the present investigation was contemplated.

### Materials and Methods

Field experiments were conducted for three years from September 1993 to October 1996 in clay loam soil under irrigated conditions with different treatments (Table 1) using fodder bajra (Co.8) as test crop. Fertilizers at 100, 75, 50 and 0 per cent recommended dose of N alone, P alone and N and P together were tried in combination with biofertilizers viz., azospirillum and phosphobacterium, either alone or a mixture, to find out whether there is any saving in fertilizer use. The initial soil available N,

P and K were 280 kg, 14 kg and 680 kg/ha, respectively with an EC of 0.4 dSm<sup>-1</sup> and pH of 7.2.

The recommended dose of fertilizer for fodder bajra was 40:20 NP kg/ha. The N & P were applied as basal as per the treatments. The data on plant height, number of tillers per plant, the green and dry fodder yields were recorded from a net plot of 5 x 4 m<sup>2</sup>. The dry weight of the fodder was obtained by drying the plant samples first under shade and then in a hot air oven at 75°C till a constant weight was obtained. Clark (1990) worked out the nitrogen use efficiency (NUE) and phosphorus use efficiency (PUE) of the fodder bajra for different treatments using the formula proposed.

$$\text{NUE} = \frac{\text{Green fodder yield (kg/ha)}}{\text{Applied N through fertilizer (kg/ha)} + \text{Soil available N (kg/ha)}}$$

$$\text{PUE} = \frac{\text{Green fodder yield (kg/ha)}}{\text{Applied P through fertilizer (kg/ha)} + \text{Soil available P (kg/ha)}}$$

For treatments T1 to T4, P was applied in common as recommended. Similarly in treatment T5 to T8, N was applied in common as recommended. The spacing adopted for bajra was 30 x 40 cm. The crop was grown in ridges and furrows.

### Results and Discussion

#### Growth and yield

Application of biofertilizer mixture of azospirillum + phosphobacterium along with N and

**Table 1.** Effect of treatments on the plant height, number of tillers per plant and yield of fodder bajra (Co.8)

Treatments	Plant height (cm)	Number of tillers per plant	Fodder yield (t/ha)	
			Green fodder	Dry fodder
T1 Azospirillum + 100% N	170.9	3.7	36.4	6.2
T2 Azospirillum + 75% N	166.1	3.1	34.3	5.4
T3 Azospirillum + 50% N	2162.6	2.6	30.3	4.8
T4 Azospirillum + 0% N	158.2	2.5	22.0	3.6
T5 Phosphobacterium + 100% P	165.9	2.7	32.6	5.4
T6 Phosphobacterium + 75% P	160.7	2.5	30.3	4.8
T7 Phosphobacterium + 50% P	155.0	2.5	27.3	4.2
T8 Phosphobacterium + 0% P	151.1	2.3	21.6	3.3
T9 Azospirillum + Phosphobacterium + 100% N&P	175.9	4.2	40.7	7.0
T10 Azospirillum + Phosphobacterium + 100% N&P	172.9	3.7	38.8	6.7
T11 Azospirillum + Phosphobacterium + 100% N&P	169.7	3.3	35.4	5.7
T12 Azospirillum + Phosphobacterium + 100% N&P	165.8	2.2	25.4	4.0
T13 No biofertilizer+100% N&P	168.4	2.4	30.6	4.8
T14 No biofertilizer + 75% N&P	165.1	2.5	28.3	4.4
T15 No biofertilizer + 50% N&P	161.4	2.5	27.3	4.3
T16 No biofertilizer + 0% N&P	156.6	2.3	20.5	3.5
SE	3.5	0.4	1.4	0.7
CD(P=0.05)	10.7	1.2	4.3	2.2

100,75 and 50% refers to the recommended dose of fertilizers

**Table 2.** Effect of treatments on the nitrogen and phosphorus use efficiency and economics of fodder bajra (Co.8)

Treatments	N use efficiency	P use efficiency	Net return (Rs/ha)	BC ratio
T1 Azospirillum + 100% N	113.8	1070.6	2412	1.28
T2 Azospirillum + 75% N	110.7	1009.4	1858	1.22
T3 Azospirillum + 50% N	100.9	890.6	736	1.09
T4 Azospirillum + 0% N	78.7	647.9	-1600	0.81
T5 Phosphobacterium + 100% P	101.9	958.8	1272	1.15
T6 Phosphobacterium + 75% P	94.7	1044.8	670	1.08
T7 Phosphobacterium + 50% P	85.3	1136.7	-142	0.98
T8 Phosphobacterium + 0% P	67.5	1542.9	-1678	0.79
T9 Azospirillum + Phosphobacterium + 100% N&P	127.1	1196.5	3652	1.43
T10 Azospirillum + Phosphobacterium + 100% N&P	125.1	1337.2	3247	1.39
T11 Azospirillum + Phosphobacterium + 100% N&P	118.0	1475.0	2556	1.32
T12 Azospirillum + Phosphobacterium + 100% N&P	90.6	1811.4	-280	0.97
T13 No biofertilizer+100% N&P	95.5	899.1	722	1.09
T14 No biofertilizer + 75% N&P	91.2	975.2	197	1.02
T15 No biofertilizer + 50% N&P	90.8	1135.4	226	1.03
T16 No biofertilizer + 0% N&P	73.2	1464.3	-1650	0.79

NUE and PUE were worked out based on the mean green fodder yield.



P fertilizers at all levels viz., 100, 75 and 50 per cent of recommended dose had increased the plant height, number of tillers, green and dry fodder yield of fodder bajra (Table 1) compared to the application of biofertilizer individually along with either N alone or P alone at all the levels of recommended fertilizer dose (100%, 75% and 50%).

The highest green and dry fodder yields were obtained in bajra due to application of biofertilizer mixture (azospirillum + phosphobacterium) along with 100 per cent recommended dose of N&P fertilizers together (T9). However, it was on par with green and dry fodder yields obtained due to the application of same biofertilizer mixture along with 75 per cent recommended dose of N&P fertilizers (T10), resulting in a saving of 25 per cent recommended dose of N & P fertilizers. The higher green and dry fodder yields of bajra in the above treatments (T9 and T10) may be attributed to better growth of plants on two grounds viz., enhanced availability of N through N fixation by azospirillum on the one hand and enhanced availability of applied P as well as soil P through better P mobilization by the effect of phosphobacterium on the other. This suggested that biofertilizers when applied as mixture are having better synergistic effect than applying them individually.

#### *Nitrogen use efficiency (NUE) and phosphorus use efficiency (PUE)*

The NUE of bajra in general was higher at higher levels of N alone and P alone and N&P together (Table 2). That is the NUE was higher at higher levels (100 and 75 per cent levels) compared to lower levels (50 per cent and zero level) of N alone, P alone and N&P together, irrespective of the biofertilizer application. The NUE was decreased drastically in the absence of applied N and P, irrespective of biofertilizer application either alone or as mixture. In treatments where N and P were not applied (T4, T8 and T12) but biofertilizer alone was applied, the N use efficiency was dismally low, with the lowest NUE under azospirillum alone (T4) and phosphobacterium alone (T8). However, the NUE was better when biofertilizers were applied as mixture (T12) compared to their individual applications. This again indicated that biofertilizer mixture has a better synergistic effect compared to their individual application in terms of NUE.

The NUE was the highest when biofertilizers were applied as mixture along with 100 per cent recommended dose of N&P fertilizer (T9). However, it was on par with that of 75 per cent recommended dose of fertilizers under the same biofertilizer mixture (T10). The higher N use efficiency in treatments T9

and T10 may be attributed to more availability of nutrients due to the symbiotic and/or synergistic effects of biofertilizer mixture.

The PUE was highly influenced by the N levels and it increased with increasing level of applied N and decreasing level of applied P. The overall PUE was considerably higher in bajra due to the application of biofertilizer mixture of azospirillum + phosphobacterium, that too in the presence of applied N&P, at all levels of N&P (100, 75, 50 and zero per cent), compared to the individual application of either azospirillum or phosphobacterium with either N alone or P alone, irrespective of the levels of N alone or P alone (Table 2). This suggested that application of phosphobacterium along with azospirillum has better PUE than applying phosphobacterium alone. This may be attributed to better P mobilizing effect of phosphobacterium.

#### *Economics*

Considering the net return and BC ratio, soil application of azospirillum and phosphobacterium as mixture along with 75 per cent recommended dose of N&P fertilizers (T10) is better than their individual application along with either N alone or P alone at same levels of recommended dose (T2 and T6). Under the above treatment (T10) fodder bajra gave a net return of Rs. 3247/ha with a cost benefit ratio of 1.39 (Table 2).

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