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Response of forage cropping sequences to farmyard manure and fertilizer under irrigated condition

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ABSTRACT

A field experiment was conducted during 1990–91 to 1999–2000 to study the response of forage cropping sequences to farmyard manure (FYM) and various fertilizer levels under irrigated condition. The 10-year pooled data indicated the promising role of legume-based cropping sequence, i.e. sorghum [*Sorghum bicolor* (L.) Moench] in rainy season, berseem (*Trifolium alexandinum* L.) in winter and pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz] in summer season, and gave significantly maximum green forage, dry-matter and crude protein yields of 106.29, 20.90 and 2.56 tonnes/ha/year, respectively, along with gross monetary returns of Rs 40,000/ha year. An application of 75% recommended dose of NPK with 10 tonnes FYM/ha to each crop in the rainy and winter seasons gave significantly higher green forage, dry-matter and crude protein yields and also the gross monetary returns.

Key words : Cropping sequences, Fertilizer level, Yield, Forage crops

Continuous forage cropping with cereal after cereal has declined the productivity of forage and also adversely affected the physical properties of soil. The main reason of the declining productivity is that this cropping system has robbed the essential nutrients of the soil causing deficiencies of these nutrients. Inclusion of legumes in cropping system and use of farmyard manure (FYM) can minimize the use of chemical fertilizers and maintain the yield levels. The inclusion of legumes in cropping systems improves fertility status of soil and helps in increasing the yield of succeeding cereal crops (Balyan, 1997). Therefore the present experiment was undertaken to study the response of forage cropping sequences to FYM and various fertilizer levels.

MATERIALS AND METHODS

A field experiment was conducted in a permanent site at Forage Crops Research Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, during 1990–91 to 1999–2000. The soil was clay loam with low, medium and high in available N, P and K respectively. The experiment was laid out in factorial randomized block design, comprising 2 crop sequences and 4 fertilizer levels with 4

replications (Table 1). The recommended doses of fertilizer (N:P:K) of sorghum (100:50:50 kg/ha), pearl millet (60:30:30 kg/ha), oat (80:40:40 kg/ha) and berseem crops (20:90:40 kg/ha) were applied as per the treatment. Sorghum and pearl millet were harvested at 50% flowering stage with only 4 cut. The 2 cuts of oat (*Avena sativa* L.) were taken and in berseem 4 cuts were harvested at an interval of 25–30 days period. Gross returns were calculated by considering the sale price of green forage prevailing in the market during that period. The crude protein yield was calculated by multiplying crude protein (%) with dry-matter yield.

RESULTS AND DISCUSSION

Cropping sequence

Green forage, dry-matter and crude protein yields and gross monetary returns were differed significantly due to cropping sequences. The 10-year rainy season pooled data indicated the promising role of legume-based cropping sequence, i.e. sorghum in rainy season followed by berseem in winter and pearl millet in summer season, and gave significantly higher green forage, dry-matter and crude protein yields along with maximum gross monetary returns compared to pearl millet–oat–sorghum cropping sequence (Table 1). The increased benefits were 28.13% for green forage, 27.67% for dry matter, 91.75% for crude protein yield and 84.88% for gross monetary returns/ha/year. From these yield levels it may inferred that cereals are heavy feeders of nutrients than legumes and exhausted the fertility status of soil, while legume (berseem) sustained production owing to its nitrogen-fixing ability and adding more organic matter into the soil. The results are in harmony with those of Verma (1997).

Fertility levels

An application of 75% recommended dose of NPK rainy-season and winter crops + 10 tonnes FYM/ha to both rainy season and winter crops recorded maximum and significantly higher green forage, dry-matter and crude protein yields compared with other levels (Table 1). This fertilizer treatment also recorded the maximum and significantly higher gross monetary returns. It indicates that an application of FYM could save 25% NPK fertilizer. Similar findings were also reported by Patil (1997) and Shekel *et al.* (1997).

Interaction

The interaction effects owing to cropping sequences and fertility levels were found significant (Table 2). The significantly highest green forage, dry-matter, crude protein yields and gross monetary returns were obtained in crop sequence, viz. sorghum–berseem–pearl millet with application of 75 % recommended NPK to rainy-season and winter crops + 10 tonnes FYM/ha to both rainy-season and winter crops.

It was concluded that the cropping sequence involving sorghum in the rainy season followed by berseem in winter and pearl millet in summer season with application of 75% recommended NPK to rainy-season and winter crops + 10 tonnes FYM/ha to each crop in rainy season and winter season would be the better proposition

Table 1. Mean green forage, dry matter and crude protein yields and gross monetary returns as influenced by different treatments (pooled means of 10 years, i.e. 1990–91 to 1999–2000)

Treatment	Green forage yield (tonnes/ha)	Dry-matter yield (tonnes/ha)	Crude-protein yield (tonnes/ha)	Gross monetary returns (Rs/ha)
Cropping sequence				
C_1, Sorghum–berseem–pearlmillet	106.29	20.90	2.56	40,000
C_2, Pearl millet–oat–sorghum	82.95	16.37	1.33	21,636
CD = (P=0.05)	11.03	2.84	0.20	9,253
Fertilizer level				
F_1, 100 rec. NPK to rainy season and winter crops	92.45	18.02	1.78	29,882
F_2, rec. NPK to rainy season and winter crops + 10 tonnes FYM/ha to *kharif* only	90.31	17.87	1.90	29,549
F_3, 75% rec. NPK to rainy-season and winter crops + 10 tonnes FYM/ha to *rabi* only	93.04	18.02	1.88	30,132
F_4, 75% rec. NPK to rainy-season and winter crops + 10 tonnes FYM/ha to rainy-season and winter crops only	102.68	20.64	2.22	33,712
CD (P = 0.05)	4.46	1.09	0.14	1,459

Rec. recommended

Table 2. Mean green forage, dry matter and crude protein yields and gross monetary returns as influenced by interaction of cropping sequences and fertilizer levels (pooled means of 10 years, i.e. 1990–91 to 1999–2000)

Cropping sequences/ fertilizer levels	Green forage yield (tonnes/ha)		Dry-matter yield (tonnes/ha)		Crude protein yield (tonnes/ha)		Gross monetary returns (Rs/ha)	
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
F_1	103.38	81.52	20.26	15.79	2.31	1.25	38,650	21,114
F_2	101.81	78.81	20.01	15.72	2.51	1.29	38,539	20,559
F_3	103.09	82.99	19.80	16.24	2.40	1.37	38,706	21,558
F_4	116.87	88.49	23.54	17.74	3.01	1.43	44,110	23,314
CD (P=0.05)		8.70		2.28		0.21		5,382

Details of treatments are given in Table.

under irrigated condition. These cropping sequence would give not only the highest yields and returns but also successfully meet out the balanced fodder requirement of high-yielding dairy animals and thus can be considered more balanced and need based cropping sequence.

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