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Production potential of forages in rice (*Oryza sativa*)–based cropping system

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ABSTRACT

A field experiment was conducted during the rainy season (*kharif*) of 1991 and 1992 to study the feasibility of growing fodder plants on the rice (*Oryza sativa* L.) field bunds. Planting of some forage species on rice-field bunds did not cause significant reduction in the rice yield during both the years, but contributed a bonus yield of 1.05-5.64 tonnes/ha green fodder. The yield of perennial forage species, *subabul* (*Leucaena leucocephala*, was highest in second year (4.12 tonnes/ha), while that of annual species sunnhemp (*Crotalaria juncea* L.) was in first year (4.18 tonnes/ha).

Rice (*Oryza sativa* L.) field bunds comprise about 5–10% of the total land area. Such portion serves as a major source of feed especially during the wet season where paddies are normally planted to rice. Native or indigenous grasses such as *Cynodon dactylon* (L.) Pers. commonly grown on bunds, are used as fodder along with rice residues which are of poor quality. This is probably the reason of poor health and production of livestock in rice tracts. The good-quality forage crops like stylo is being successfully grown in rice bunds in south-east countries and white clover, lucerne, medics and red clover are grown in temperate rice field bunds. So replacing weeds in rice field bunds by high-yielding forage species that thrive from wet to dry condition will increase and improve forage quality which can be an additional source of forage.

Therefore an attempt was made for working out the feasibility of growing some forage species on rice bunds, so as to yield nutritious additional forage production without any detrimental effect on the rice yield.

MATERIALS AND METHODS

The experiment was conducted at Jhansi during the rainy season (*kharif*) of 1991 and 1992. The soil was sandy loam in texture, low in organic carbon (0.49%) and nitrogen (208.2 kg/ha), low in available phosphorus (12.32 kg) and high in potassium (472.2 kg/ha). Eight treatments comprising 7 fodder species, viz common sesban (*Sesbania sesban* Merr.), 'K 8' *subabul* [*Leucaena leucocephala*, 'T 7' pigeonpea [*Cajanus cajan* (L.) Millsp.] sunnhemp (*Crotolaria juncea* L.), mesta (*Hibiscus cannabinus* L.), 'K 16' ricebean [*Vigna umbellata* (Thunb.) Ohwi & Ohasi] and *Setaria* [*Setaria sphacelata* (Schum.) Stapf & Hubb. ex Moss] on rice field bunds and 'Jaya' rice alone (without forage plantation on bunds) were conducted in randomized block design with 4 replications.

The rice field bunds were 0.5 m wide at base and 0.3 m high with top width of 0.4 m

in 5 m x 4 m size plot. It was assumed that 7% of area is occupied by bunds of submerged paddy field and this base was taken into account for computation of fodder yield per hectare, as suggested by Tengaco and Carangal (1990).

The recommended fertilizers dose of 60 kg N/ha through urea + 60 kg P_2O_5/ha through single superphosphate + 60 kg K_2O/ha through muriate of potash were applied to rice at transplanting and remaining 60 kg N/ha was top-dressed at panicle-initiation stage. Forage crops planted on rice field bunds did not receive any fertilizer.

A single cut each of pigeonpea, sunnhemp and mesta, 2 cuts each of common sesban and *subabul* and 3 cuts of *Setaria* grass and rice bean were taken during the crop periods of both the years.

The total rainfall received during crop period in 1991 and 1992 was 916.8 and 769.0 mm respectively.

RESULTS AND DISCUSSION

Grain and straw yields

Grain yields of rice did not show significant differences in the grain yield obtained from different treatments (Table 1). However, the trend in the mean grain yield was observed as rice + mesta (4.91 tonnes/ha) > sole rice (4.77 tonnes/ha) > rice + common sesban (4.67 tonnes/ha). In the treatment where *subabul* was raised on bunds, there was non-significant decrease (0.24 tonnes/ha) in the grain yield.

Differences in straw yields were statistically significant in the first year only and that was due to significant reduction in straw yield in the treatment where *subabul* and mesta were raised on bunds. However, the order of average yield was sole rice (3.36 tonnes/ha) > rice + sunnhemp (5.33 tonnes/ha) > rice + pigeonpea (5.22 tonnes/ha) and minimum in rice + *subabul* (4.47 tonnes/ha).

Forage production

Green and dry-matter yields of forage species were significant in both the years. But perennial fodder components, i.e. *subabul* and *Setaria* grass gave better production in second year with yield levels of 4.12 and 5.64 tonnes/ha respectively.

Table 1. Grain and straw yield of rice under different cropping systems

Cropping system	Grain yield (tonnes/ha)			Straw yield (tonnes/ha)			Rice-equivalent yield (tonnes/ha)*
	1991	1992	Mean	1991	1992	Mean	
Rice sole	4.55	4.98	4.77	5.27	5.44	5.36	4.77
Rice + common sesban	4.20	5.13	4.67	4.07	5.68	4.88	5.86
Rice + *subabul*	4.07	4.35	4.21	3.96	4.98	4.47	5.44
Rice + pigeonpea	4.27	4.85	4.56	5.00	5.44	5.22	5.36
Rice + sunnhemp	4.67	5.14	4.91	5.00	5.65	5.33	6.04
Rice + mesta	4.27	4.93	4.60	3.70	5.37	4.54	6.72
Rice + rice bean	4.40	4.74	4.57	4.87	5.17	5.02	6.01
Rice + *setaria* grass	4.33	4.76	4.55	4.74	5.36	5.05	5.90
CD (P = 0.05)	NS	NS		0.72	NS		

* Mean data of 2 years

NS, Non-significant

Value of fodder (Rs/tonne) : common sesban, 300; *subabul*, 300; pigeonpea, 300; sunnhemp, 250; rice bean, 30

Table 2. Green-forage, dry-matter and crude protein yields from various fodder crops raised on rice field bunds

Cropping system	Green-forage yield (tonnes/ha)			Dry-matter yield (tonnes/ha)			Crude protein yield (kg/ha)		
	1991	1992	Mean	1991	1992	Mean	1991	1992	Mean
Rice sole									
Rice + common sesban	2.30	1.65	1.98	0.51	0.35	0.43	115.4	80.2	97.8
Rice + *subabul*	1.66	4.12	2.89	0.50	0.99	0.75	102.8	202.8	152.7
Rice + pigeonpea	1.93	1.41	1.67	0.66	0.33	0.50	127.1	63.1	95.1
Rice + sunnhemp	4.18	2.25	3.22	1.12	0.48	0.80	88.5	38.8	63.7
Rice + mesta	4.13	2.93	3.53	1.18	0.41	0.80	82.8	29.0	55.9
Rice + rice bean	3.04	1.05	2.05	0.52	0.19	0.36	124.2	46.3	85.3
Rice + *setaria* grass	1.11	5.64	3.38	0.19	1.02	0.61	8.6	49.01	28.9
CD (P = 0.05)	0.76	0.84		0.33	0.22		47.1	40.19	

However, better yield potential of annual forage components was obtained in first year. This was due to the fact that in first year perennial could get established and in second year started their produce.

The mean data of 2 years (Table 2) revealed that maximum green-forage yield was received when mesta was planted on rice bunds, followed by *Setaria* grass and sunnhemp.

Significant differences in dry-matter yields in both the years were observed (Table 2). The dry-matter yields of sunnhemp and mesta were at par, followed by *subabul* and *Setaria* grass. The minimum dry matter (0.36 tonne/ha) was obtained when ricebean was grown on rice bunds.

Crude protein yield

The difference in crude protein yield was significant in both the years. The mean data revealed that the maximum crude protein yield was recorded from *subabul*, followed by common sesban. The minimum crude potein in yield was observed with *Setaria*, which was due to lower protein content (%) in *Setaria*.

Thus, it could be concluded that in lowland rice growing area, perennial forage species like *subabul* and *Setaria*, and annual species like common sesban and rice bean may be planted to get the nutrious additional forage yield without adversely affecting the rice crop.

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