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Productivity, Profit and Soil Fertilityof Pulse Based Cropping Systems in Rainfed Uplands

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Abstract

An experiment was made with different pulse based cropping systems in rainfed uplands of western Orissa during 2006 and 2007. Out of eight promising sequences of the region cowpea- sweet potato is the most remunerative (Rs 26,988/ha) followed by black gram-toria (Rs 13,440/ha). While analyzing the seasonal performance of first crop, cowpea (green) appeared to the best yielder 57.5 q/ha and with respect to second crop sweet potato (fresh) was the best (50.4 q/ha). The added total nitrogen of soil over the initial at the end of second year was maximum (0.007%) with sesamum-fieldpea system.
Key words : Pulse, Productivity, Net profit, Total nitrogen, Cropping system.

The daily dietary habit of people of western Orissa is taking dal with rice makes pulse crops quite valued in their cropping system. Pulse crops play an important role with respect to rainfed agro-eco situation, soil fertility restoration and agricultural economy of the state. Usually pulses are being taken up during winter season, however some of them have been successfully grown in rainy season also. Practically there has been stagnation in pulse yield over decades in the state and in the country (1). Keeping these in view an attempt was made in this field trial to identity the appropriate pulse based cropping system for the region after examining the seasonal productivity performance, economics and nitrogen build up in the soil.

Methods

An experiment was conducted during 2006 and 2007 in a randomized block design with three replications under rainfed upland situation at Krishi Vigyan Kendra, Sonepur, Subarnapur. The soil of the experimental plot was clay loam in texture having pH 6.4, organic carbon 0.46% and initial total nitrogen 0.032%. The available nitrogen, P_2O_5 and K_2O were 118, 12.74 and 898 kg/ha respectively. The days taken to harvest the crop, nutrient applied and variety taken are shown in the Table 1. The spacing adopted was based on recommendation of the variety. The seasonal productivity of the system, mean net profit, benefit cost ratio and final total nitrogen restoration over the initial at the end of second year of cropping were recorded.

Results and Discussion

Among all eight cropping sequences tried green gram-toria cropping pattern took minimum number of days (160) (Table 1). This was closely followed by black gram-toria (165) and paddy-khesari (170) system. However maximum number of days were taken by paddy-arhar (250) followed by cowpea-sweet potato (215) system.

The seasonal productivity performance of the first crop grown in the sequence recorded that cowpea crop was a good promising green legume vegetable with a yield level of 57.5 q/ha (fresh green weight), which was followed by ragi (17.7 q/ha) and early paddy (15.8 q/ha) for which there is a local demand because of *Navarna* festival. The lowest yield was obtained from sesamum (2.7 q/ha) although it has privileged as an oilseed crop in rainy season.

In rainfed agro-eco situation the second crop could be grown under limited soil moisture condition. The feasibility of second crop tried in the system showed that sweet potato with a yield of 50.4 q/ha (fresh weight) was invariably a good crop under

Table 1. Details of cropping sequence with variety used, cropped days taken and nutrient applied in the system during 2006-2007. C_1 = First crop, C_2 = Second crop.

Treatment	Cropping sequence	Variety used	Cropped days	Total cropped days	Nutrient applied (kg/ha) C_1	Nutrient applied (kg/ha) C_2
T_1	Paddy	Heera	95	200	N : P_2O_5 K_2O	N : P_2O_5 K_2O
	Bengalgram	Anegiri	105		40 : 20 : 20	20 : 40 : 20
T_2	Paddy	Heera	95	170	40 : 20 : 20	12 : 25 : 12
	Khesari	Sonepur Sel	75			
T_3	Paddy	Heera	95	250	40 : 20 : 20	20 : 40 : 20
	Arhar	UPAS-120	155			
T_4	Ragi	Bhairabi	85	190	40 : 20 : 20	12 : 25 : 12
	Horsegram	Urmi	105			
T_5	Cowpea	Pusa Dophasali	85	215	25 : 50 : 25	40 : 20 : 20
	Sweet Potato	Pusa Safeda	130			
T_6	Sesamum	Uma	110	195	30 : 15 : 15	20 : 40 : 20
	Field Pea	Rachana	85			
T_7	Blackgram	PU-30	85	165	20 : 40 : 20	30 : 15 : 15
	Toria	Parvati	80			
T_8	Greengram	PDM-54	80	160	20 : 40 : 20	30 : 15 : 15
	Toria	Parvati	80			

rainfed condition of Sonepur owing to well drained loamy texture of soil and intermittent rainfall in winter give chance for better tuber enlargement (1). Under abiotic stressed environment toria yielded 3.0–3.2 q/ha in these crop series. The system as a whole cowpea-sweet potato sequence was best with 13.3 q/ha green gram equivalent yield, followed by paddy-arhar and black gram-toria.

The economic assessment indicates that cowpea-sweet potato system could give highest net profit Rs 26,988 per hectare with a benefit cost ratio of 4.0 followed by black gram-toria, Rs 13,440 per hectare and 3.2 B : C (2, 3).

After the harvest of second crop of the sequence the total nitrogen build up in soil was examined in second year. It was observed that all the pulse based crop series have added some amount of nitrogen at the end of two years of cropping in the same piece of land, the legume crop as second crop in the sequence

Table 2. Productivity of individual crops, green gram equivalent yield , mean net profit, benefit cost ratio and total N of soil added over initial status of cropping sequences. *Fresh green weight. C_1 = First crop, C_2 = Second crop. Prevailing local market rate of produce (two year average) : Paddy (Rs 650/q), Bengal gram (Rs 2,000/q), Khesari (Rs 1,500/q), Arhar (Rs 2,500/q), Green gram (Rs 2,700/q), Black gram (Rs 2,600/q), Toria (Rs 1,500/q), Field pea (Rs 1,650/q), Ragi (Rs 600/q), Horse gram (Rs 1500/q), Sesamum (Rs 2,000/q), Cowpea (fresh) (Rs 350/q), Sweet potato (fresh) (Rs 300/q).

Treatment details	Crop productivity (q/ha) C_1	Crop productivity (q/ha) C_2	Greengram equivalent yield of the system in total (q/ha)	Mean net profit of the total system (Rs/ha)	B : C of the system	Added total N of soil over the initial (0.032%) at the end of second year (%)
Paddy-Bengal gram	15.8	3.2	6.2	9127	2.2	+ 0.003
Paddy-khesari	14.6	3.8	5.6	8632	2.3	+ 0.002
Paddy-arhar	15.5	4.1	7.5	11846	2.5	+ 0.004
Ragi-horse gram	17.4	3.5	5.8	9.034	2.4	+ 0.001
Cowpea-sweet potato	57.5*	50.4*	13.3	26988	4.0	+ 0.002
Sesamum-field pea	2.7	5.7	5.5	7855	2.1	+ 0.007
Blackgram-toria	5.8	3.0	7.3	13440	3.2	+ 0.001
Green gram-toria	5.4	3.2	7.1	12915	3.1	+ 0.002
CD (P = 0.05)	5.46	2.45	0.18	521	0.17	—

could augment more total nitrogen as compared to non-legume crop in the sequence. It might be due to non-legume crop exhaused the added nitrogen of the soil by the first pulse crop of the system. Sesamum-field pea system could add highest total nitrogen (+ 0.007%) over the initial status in the entire crop sequences, which was closely followed by paddy-arhar (0.004%) sequences.

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