Indian Journal of Agronomy 47 (4) : 495–498 (December 2002)

Production potential and economics of niger (*Guizotia abyssinica*)-based cropping sequences under Eastern Ghat Highland Zone of Orissa

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Received : July 2001

ABSTRACT

A 2-year (1997–99) experiment with 6 niger [*Guizotia abyssinicia* (L.f.) Cass]- based cropping sequences showed that the maximum grain productivity was obtained in radish (*Raphanus sativus* L.)–niger cropping sequence. The niger seed-equivalent yield, gross returns and net returns (Rs 22,293/ha) and benefit : cost ratio (2.02) were maximum in French bean (*Phaselous vulgaris* L.)–niger sequence, followed by radish–niger in comparison to monocrop of niger (fallow –niger) and *sawan (Echinochloa colonum* L.)–niger, the traditional cropping sequence.

Key words : Production potential, Economics, Land-use-efficiency, Niger-based cropping sequence

Niger is a predominant oilseed crop of Eastern Ghat Highland Zone of Orissa, wherein the zone Koraput district alone accounts for one-fourth of total niger production of the country. The crop is sown in rainfed, unbunded sloppy uplands, during late rainy season, i.e. during August–September. Though Eastern Ghat Highland Zone receives monsoon rain from early June, the land is kept fallow for growing niger till the end of August, which results in low productivity and low land-use efficiency.

Growing minor millet preceding to niger crop during alternate years is the common practice which does not yield more net returns (Mohapatra *et al.,* 1994). The zone enjoys favourable climate for growing winter vegetable crops during rainy season. Hence the present experiment was conducted to assess the production potential and economic feasibility of growing a short-duration crop of pulse or vegetable before taking up niger in late rainy season.

MATERIALS AND METHODS

The experiment was conducted in farmer's field during the rainy season at Chalanput, Pakjholla and Tentuliguda villages of Koraput district (885 m above

mean sea level) for 2 years (1997–98 to 1998–99). Three replicated trials were laid out in each village. Six niger-based cropping sequences, viz. *Sawan*–niger, early rice (*Oryza sativa* L.), niger–finger millet or ragi, fallow, Frenchbean–niger, fallow–niger and radish–niger, were evaluated in randomized block design in a permanent layout at respective fixed locations. The soil was sandy loam, aeridic with pH 5.3–5.6. The soil was low in available N (261–274 kg/ha), low in available P (7.6–9.4 kg/ha). The mean rainfall of 858.8 mm was received during 1997 cropping season, i.e. from April to November (43.9, 32.5, 158.3, 160.8, 179.2, 168.3, 76.6 and 36.2 mm) and 1,527.1 mm during 1998 (60.4, 61.6, 192.5, 462.4, 189.7, 123.7, 180.6 and 256.2 mm) in respective months.

'SS 81-1' *sawan*, 'Heera' early rice, 'Kentuki Wonder' Frenchbean, and 'Pusa Chekti' radish maturing in 75, 78, 80 and 68 days, respectively, were sown by the first week of June with proper agronomic management practices. Niger 'Deomali' maturing in 115 days was sown after the harvest of preceding crop in the sequence during the last week of August. Ragi variety 'Neelanchal' maturing in 118 days was sown during the first week of June and was harvested the first week of October, thereby niger could not be grown as it was very late to grow rainfed niger as a second crop during October. In the fallow-niger sequence, the nigher crop was sown in second week of August, the optimum recommended sowing time for the zone.

Final crop yields (main and by-products) were recorded and their total gross return (Rs/ha), total production cost (Rs/ha) and net returns (Rs/ha) were calculated on the basis of prevailing market price of the produce. For comparison between cropping sequences, the yield of all the crops were converted into niger-equivalent yield on price basis. Land–use efficiency values were calculated by dividing the total duration of crop sequences with 365 and expressed in percentage. Production–efficiency values were calculated by dividing the total grain production/ha in a sequence with total duration of crops in that sequence (Tomar and Tiwari, 1990).

RESULTS AND DISCUSSION

Production potential

The radish–niger cropping sequence recorded the highest main product yield of 168.6 q/ha, followed by French bean–niger with 81.05 q/ha (Table 1). On niger seed-equivalent yield basis, the trend was reverse and Frenchbean–niger cropping sequence recorded the highest value of 26.12 q/ha among all the cropping sequences, followed by radish–niger sequence with 16.51 q/ha. Monocrop of niger gave the highest seed yield (3.70 q/ha), as it was sown by the second week of August and expressed more yield-attributing characters enjoying more days and more rainfall in the field than delayed sown crop as observed by Paikaray and Mishra (1999). But it gave the lowest niger seed-equivalent yield (3.7 q/ha) which indicates that growing any of the crops preceding to niger was found profitable than monocrop of niger in respect of niger seed-equivalent yield. Higher niger seed equivalent yield in

Frenchbean–niger and radish–niger cropping sequences may be attributed higher tonnage and better price of short-duration vegetable crops. Inclusion of vegetable crops in the cropping sequences resulted higher net return than cereal crops (Chaudhary *et al.*, 2000). Growing of these winter vegetables under rainfed situation during the rainy season is possible in the zone, as it is situated at 885 m above mean sea level.

Land-use efficiency was the highest in early rice niger–cropping sequence because it occupied the land for longer period of 202 days (Table 1).

Ragi–fallow and fallow–niger sequence had the lowest land- use efficiency. The production efficiency was highest (96.3 kg/ha/day) in radish–niger system because of higher tonnage of produce from this sequence in a short period.

Table 1. Yield of main product and other parameters under different niger-based cropping sequences

Cropping sequence	Yield of main product (q/ha)					Niger seed-equivalent yield (q/ha)			Duration (days)	Land-use efficiency (%)	Production efficiency (kg/ha/day)
	1997		1998		Pooled						
	Rainy season	Pre-winter	Rainy season	Pre-winter		1997	1998	Pooled			
Sawan–niger	8.42	2.81	9.1	2.63	11.48	5.08	5.18	5.13	190	52	60
Early rice–niger	17.2	1.68	16.8	1.51	18.61	6.86	6.93	6.70	202	55	9.2
Ragi–fallow	16.6		17.4		17.00	4.32	4.70	4.51	118	32	14.4
Frenchbean–niger	76.6	3.10	79.3	3.30	81.05	25.44	26.80	26.12	185	51	43.8
Fallow–niger		3.60		3.80	3.70	3.60	3.80	3.70	115	32	3.2
Radish–niger	159.8	3.40	170.2	3.70	168.60	16.71	16.31	16.51	175	48	96.3
CD (P=0.05)						0.46	0.24	0.53			

Table 2. Economics of different niger-based cropping sequences (pooled over 2 years)

Cropping sequence	Gross return (Rs/ha)	Production cost (Rs/ha)	Net returns (Rs/ha)	Benefit : cost ratio
Sawan–niger	6,542	4,450	2,092	0.42
Early rice–niger	8,797	5,800	2,997	0.52
Ragi–fallow	5,760	3,200	2,560	0.80
Frenchbean–niger	33,353	11,060	22,293	2.02
Fallow–niger	4,725	3,650	2,075	0.78
Radish–niger	21,038	9,725	11,313	1.16
CD (P=0.05)	347		114	

Sale price of different commodities (Rs) : Main product and by-product of rice 350 and 20, 420 and 25; of *sawan* 300 and 20, 350 and 25; of ragi 300 and 20, 350 and 25; of Frenchbean green pod 350 and nil, 400 and nil; of radish 100 and nil, 100 and nil; of niger, 1,200 and nil, 1,350 and nil during 1997–98 and 1998–99 respectively

Economics of cropping sequences

The net returns from Frenchbean–niger sequence (Rs 22,293/ha) was significantly more than all other sequences tested, followed by radish–niger sequence (Rs 113,13/ha). Higher net returns could be possible owing to inclusion of vegetables in these sequences. There was no significant difference between sawan–niger and fallow–niger, the 2 traditional cropping sequences in respect of net returns/ha. The fallow-niger had the least net returns of Rs 2075/-/ha.

Highest benefit : cost ratio (2.02) was obtained from Frenchbean–niger cropping sequence, followed by radish–niger sequence (1.16). The *sawan*-niger sequence recorded the lowest benefit : cost ratio of 0.42.

Thus, under Eastern Ghat Highland Zone of Orissa, Frenchbean–niger and radish–niger cropping sequences were found to be more remunerative as they gave higher crop yield with higher monetary returns.

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