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Short Communication

Production Potential of Clusterbean-Sesame Intercropping System as Influenced by Fertility Levels under Arid Condition of Kachchh

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Multiple cropping in the form of intercropping is predominant in arid and semi-arid regions. Clusterbean is a major rainfed crop of arid zone and is mostly grown, as a mixed crop with pearl millet, moth bean and sesame. Intercropping may be a feasible and viable agronomic practice for improving productivity of pulses and oil-seeds. Plant population and spatial arrangement in intercropping have important bearing on component crops and their productivity. The greatest limitation in increasing productivity of these crops is inadequate nutrient availability as the soils of the region are poor in fertility. Thus, balanced fertilization along with sound crop husbandry offers scope for increasing crop productivity. A lot of information is available on cereal-legume intercropping system, but it lacks for legume-oilseed intercropping especially in arid Gujarat. The present study was carried out to understand comparative performance, competition relations, nutrient uptake and economics of the intercropping system involving clusterbean and sesame.

A field experiment was laid out at the research farm, CAZRI, RRS, Kukma, Bhuj during rainy (kharif) seasons of 2005-2007. The soil of the experimental site was gravelly sand to loamy sand with shallow depth (15-25 cm), EC value ranged from 2.00 to 6.38 dS m^{-1} and pH from 8.4 to 9.2. The soil contained 0.25% organic carbon, 7.35 kg P_2O_5 and 215 kg K_2O ha^{-1}. Treatments consisting of 15 combinations of cropping systems, viz. sole sesame (GUI-I), sole clusterbean (RGC-936), clusterbean + sesame (1:2), c1usterbean+sesame (1:1) and clusterbean + sesame (2:1) row proportion and fertilizer levels i.e., control, 40 kg ~ and 20 kg N + 5 tonne farmyard manure (FYM) applied to the crops were tested in factorial randomized block design and replicated thrice. The net plot size 4.0 x 4.5 m and the crop spacing were 45 x 15 cm. The crops were sown in the last week of June in all the 3 years of experimentation. A uniform dose of phosphorus and potash were applied to the crops at the planting time. The remaining agronomic practices were followed as per recommended for the region. The total rainfall received during the crop period was 238.2 mm in 2005, 689.4 mm in 2006 and 701.6 mm in 2007. The clusterbean-equivalent yield was calculated by converting the seed yield of sesame in to clusterbean yield on the basis of existing market price of the crops. N was estimated by micro Kjeldahl method. Net monetary returns and benefit: cost ratio were computed using the prevailing rates of produce and agro-inputs.

Cropping seasons of 2006 and 2007 were quite normal and higher yields were obtained due to adequate and well distributed rainfall. However, the yield of both the crops was slightly low in 2007 as compared with 2006 because of continuous rainfall during maturity stage. In 2005, the yields of both the crops were adversely affected due to low and erratic distribution of rainfall.

In clusterbean the plant growth, yield attributes, i.e., pods/plant, seeds/pod, 1000-seed weight and harvest index were significantly higher under intercropping systems than sole cropping. Intra-plant competition in sole cropping of clusterbean might be the reason for low plant height, pods/plant, seeds/ pod 1000-grain weight and harvest index. Clusterbean intercropped with sesame in 2:1 row ratio, recorded higher growth and yield attributes than other treatments. Among the intercropping treatments, clusterbean with sesame under 2:1 row ratio could recover maximum of its sole crop yield (78) due to higher plant density of the main crop and complementary effect of intercrop. Leading

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to better manifestation of growth and yield attributes under the system. The pooled data of three years (Table 1) indicate that among different intercropping systems, clusterbean+sesame grown in 2:1 row ratio gave significantly higher seed yield (589 kg ha^{-1}) of clusterbean than 1:1 (493 kg ha^{-1}) and 1:2 (433 kg ha^{-1}). Fertilizer and FYM application significantly influenced plant growth, yield attributing parameters harvest index (HI), biological yield and seed yield of clusterbean. The highest clusterbean seed yield (644 kg ha^{-1}) was obtained under 20 kg N + ~ FYM Am (Table 1). Application of 20 kg + 5 t FYM ha^{-1} recorded the highest number of pods/plant, seeds/pod, 1000-seed weight, biological yield and seed yield of clusterbean. The application of 20 kg N+5 t FYM ha^{-1} increased seed yield of clusterbean by 33 over the control, possibly due to increased availability of nutrients in the soil. Similar beneficial effects of FYM on crop yields were reported in soybean - based and other cropping systems by Nambiar (1994) and Bobde *et al*. (1998).

Sesame crop also performed better under intercropping system than under sole stand. The plant height, dry matter production, yield attributes, seed yield and biological yield of sesame were significantly higher when intercropped with clusterbean under 1:2 row ratio than rest of the system (Table 1). Application of fertilizers influenced the plant growth, yield attributes and seed yield significantly. The highest biological (801 kg ha^{-1} and seed yields (173 kg ha^{-1}) of sesame were recorded when 20 kg N was applied with FYM @ 5 t ha^{-1}. The integrated nutrient supply system of FYM at 5 t with 20 kg N ha^{-1} improved the plant growth, yield attributes, HI, biological yield and seed yield of sesame and the increase in seed yield was 16 and 24 over N40 alone and control, respectively (Table 1). These findings support the results of Singh (2002) and Imayavaramban *et al.* (2002).

All intercroppings, irrespective of row ratios of intercrops had higher clusterbean equivalent yield (CEY) compared with sole clusterbean due to additional yield of sesame (Table 1). The clusterbean and sesame (2:1) intercropping yielded 29% higher average CEY than clusterbean sole cropping. Kumar (2002) observed similar trend. The differential behavior in CEY was due to productivity of crops in intercropping systems and their relative market prices.

The total uptake of N by clusterbean + sesame intercropping under row ratio of 2:1 was the maximum, being significantly higher over rest of the intercropping systems (Table 1). The highest N uptake (55.7 kg ha^{-1}) was recorded with 20 kg + 5 t FYM ha^{-1} followed by N40 alone (53.3 kg ha^{-1}) and absolute control (46.7 kg ha^{-1}). Addition of 5 t FYM ha^{-1} resulted in 8.5 to 9.8 higher uptake of N by the cropping

Table 1. Biological yield, seed yield, CEY, total N uptake and economics of clusterbean + sesame intercropping system as influenced by varying fertility levels (mean of 3-years-data)

Treatment	Biological yield (kg ha^{-1})		Seed yield (kg ha^{-1})		CEY (kg ha^{-1})	Total N uptake (kg ha^{-1})			NMR	B: C ratio
	CB	S	CB	S		CB	S	C		
Cropping system										
Clusterbean sole	2922	-	710	-	710	55.1	-	55.0	5,945	1.68
Sesame sole	-	1240		215	608	-	22.2	22.2	2,851	1.37
Clusterbean + Sesame (1:2)	1671	805	433	156	867	32.6	14.8	47.0	7,172	1.77
Clusterbean + Sesame (1:1)	1852	736	493	126	879	36.0	13.6	49.5	6,918	l.75
Clusterbean + Sesame (2:1)	2076	691	589	102	919	39.7	13.0	52.7	7,440	1.80
CD (P= 0.05)	211	58	79	22	33	3.7	l.1	3.0	431	0.04
Fertility level										
Control	1798	701	446	124	799	34.0	12.7	46.7	6,479	l.74
40 kg N	2009	756	579	153	976	39.4	13.9	53.3	9,131	1.93
20 kg N + 5 t FYM ha^{-1}	2122	801	644	173	1036	41.0	14.8	55.7	11,171	2.14
CD (P= 0.05)	107	39	56	18	57	1.4	0.8	2.1	948	0.07

system over N40 alone, possibly due to higher availability of nutrients supplied by FYM.

All intercropping systems were more remunerative than the sole clusterbean with monetary benefit of Rs. 6,918 to Rs 7,440 ha^{-1}. However, planting of clusterbean+sesame (2:1) row proportion was more remunerative as it had higher net monetary return (Rs. 7440 ha^{-1} and benefit: cost ratio (1.80). The highest benefit: cost ratio (2.14) and net monetary return (Rs. 11,171 ha^{-1} over the control (Rs. 6,479) were accrued with the application of 20 kg + 5 t FYM ha^{-1}.

It is concluded that an intercropping of clusterbean+sesame (row ratio of 2:1) with the application of 20 kg + 5 t FYM ha^{-1} may be followed for higher yield and monetary returns in the arid tract of Gujarat.

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