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Short Communication

Productivity, Biological Feasibility and Economical Viability of Clusterbean – Sesame Intercropping Systems in Arid Gujarat

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Mixed cropping is predominant in the arid and semi-arid tropics. Clusterbean (*Cyamopsis tetragonoloba* L. Taub.), a major rainfed crop of arid zone, is mostly grown mixed with pearl millet, moth bean and sesame, but the productivity is low. Plant population and spatial arrangement in intercropping have important bearing on productivity of component crops. Sesame (***Sesame indicum*** L.), being a short duration crop, fits well in sequential and intercropping systems for stepping up the production. The main limitation increasing productivity is inadequate nutrients in soils. Judicious use of chemical fertilizers along with organic manures is required to improve the soil health and sustainable production. Much information is available on cereal-legume intercropping, but is lacking for oilseed-pulse intercropping. Therefore the effects of fertilizer and farmyard manure (FYM) on clusterbean and sesame under sole and intercropping systems were studied.

A field experiment was laid out at the research farm, Central Arid Zone Research Institute, Regional Research Station, Bhuj-Kachchh, during rainy (kharif) season of 2005 to 2007. The soil of the experimental site was gravelly-sand to loamy-sand with shallow depth (15-25 cm), EC ranged from 2 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}. 15 treatments having combinations of intercropping systems, viz., sole sesame, sole clusterbean, sesame + clusterbean (2:1), sesame + clusterbean (1:1) and sesame + clusterbean (1:2) row proportion and fertilizer levels i.e., control, 40 kg N ha^{-1} and 20 kg N + 5 t FYM ha^{-1} applied to the crops were tested in randomized block design with 3 replication thrice in 4.0 x 4.5 m net plots having crops at 45 x 15 cm spacing. The crops were sown in the last week of June in all 3 years. A common recommended dose of phosphorus and potassium was applied to all plots at the time of sowing. The cultivars used in the study were 'GUJ–1' (sesame) and 'RGC–936' (clusterbean) and recommended. The remaining agronomic practices were followed as recommended for the region. The total rainfall received during the crop period was 238 mm in 2005, 689 mm in 2006 and 702 mm in 2007. The total system productivity was calculated by converting the seed yield of sesame in to clusterbean equivalent yield on the basis of existing market price of the crops. Biological and economical parameters like production efficiency, land-equivalency ratio, relative net return and income-equivalency ratio, were calculated on mean data of 3 years and further computed by using the prevailing rates of produce and agro-inputs.

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

The clusterbean seed yield was higher under the sole cropping (Table 1). Clusterbean + sesame grown in 2:1 row ratio gave significantly higher clusterbean seed yield (553 kg ha^{-1}) than clusterbean + sesame (1:1), 494 kg ha^{-1} and clusterbean + sesame (1:2), 438 kg ha^{-1}. The row ratio (2:1) could recover maximum of its sole crop yield (78%) due to higher density of main crop and complementary effect of intercrop due to its better manifestation of growth and yield attributes under the system.

Application of 20 kg N with 5 t FYM ha^{-1} recorded the highest seed yield of clusterbean (Table 1), 33% higher over the control. This might be

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Table 1. Effect of intercropping and nutrient management on seed yield of clusterbean and sesame, biological and economical parameters of intercropping systems (mean of 3 years)

Treatment	Seed yield (kg ha^{-1})		System productivity (kg ha^{-1})	Land equivalent ratio	Relative crowding coefficient	Relative net return
	Clusterbean	Sesame				
Cropping system						
Clusterbean sole	709.6	–	710	1.00	1.00	1.00
Sesame sole	–	215.4	608	1.00	1.00	1.00
Clusterbean + sesame (1:2)	437.7	152.2	867	1.32	3.86	1.22
Clusterbean + sesame (1:1)	494.4	136.2	879	1.33	3.96	1.24
Clusterbean + sesame (2:1)	553.2	129.4	919	1.38	5.31	1.29
CD (P=0.05)	48.7	9.4	33			
Fertility level						
Control	442.3	126.2	799	1.21	2.35	1.13
N_{40}	564.4	145.9	976	1.48	8.17	1.38
N_{20} + FYM @ 5 t ha^{-1}	588.5	158.3	1036	1.56	13.4	1.46
CD (P=0.05)	22.5	11.6	57			

due to increased availability of nutrients to the crop. 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).

The seed yield of sesame was significantly higher when grown with clusterbean under 1:2 row ratio than rest of the systems (Table 1). Fertilizers significantly influenced the seed yield (Table 1). The integrated application of 5 t FYM with 20 kg N ha^{-1} improved sesame seed yield by 16% and 24% over 40 kg N ha^{-1} alone and control, respectively. These findings support the results of Singh (2002) and Imayavaramban *et al.* (2002).

Intercropping over their respective sole crops significantly increased the yields (Table 1) due to additional yield of intercrop and better utilization of resources, than sole crop stand. Clusterbean + sesame under 2:1 gave significantly higher productivity (29% over sole clusterbean). In case of fertility level, the application of 20 kg N with 5 t FYM ha^{-1} gave significantly higher total system productivity and biomass production over 40 kg N ha^{-1} alone and absolute control. Kumar (2002) observed similar findings.

All the intercropping systems had land equivalent ratio greater than unity (Table 1) and was maximum under clusterbean + sesame (2:1) followed by clusterbean + sesame (1:1) and clusterbean + sesame (1:2) row ratio, indicated better land use efficiency by the systems. All the intercropping treatments having higher relative crowding coefficient values, indicating complimentary relationship (Table 1). The highest land equivalency ratio (1.56) and relative crowding co-efficient (13.4) were under 20 kg N with 5 t FYM ha^{-1}.

The intercropping systems were more remunerative than the sole clusterbean (Table 1), with clusterbean + sesame (2:1) row being most remunerative with higher net return (1.29). All cropping systems with 20 kg N + 5 t FYM ha^{-1} resulted in higher net returns.

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