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Imparting Stability to Pearl Millet-Clusterbean Intercropping System Through Adopting Suitable Variety

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Abstract: Intercropping helps to stabilize farmers' income under dryland conditions. Pearl millet and clusterbean intercropping proved advantageous because of difference in their growth and feeding habits. However, the sustainability of the system depends on suitable variety of intercrop. In order to identify suitable variety of clusterbean for intercropping in pearl millet, a field experiment was conducted consecutively for eight years (1986 to 1994) with nine treatments involving five sole intercropping treatments at a row ratio of 2:2 in RBD having four replications on sandy loam soil (Typic Ustipsamments) of AICRP for Dryland Agriculture, Sardar Krushinagar. The results revealed that intercropping of clusterbean variety Malosan (net profit, Rs. 2416 ha^{-1}) or HG 75 (net profit, Rs. 2316 ha^{-1}), with pearl millet was superior to rest of the treatments in respect of equivalent yield, net profit, CBR and LER.

Key words: Pearl millet, clusterbean, intercropping.

Intercropping is an important tool for assured income in dryland conditions of North Gujarat agroclimatic zone, which is characterized by aberrant weather conditions and low water retention capacity of sandy to sandy loam soils. Pearl millet+clusterbean is one of the best systems under such situation because of differential growing habit of both these crops (Anonymous, 1984). This is also evident from the wider adoption of this system by the farmers of this region (Anonymous, 1987). However, no information is available pertaining to suitable variety of clusterbean for intercropping in pearl millet. Therefore, present study was undertaken to find out most suitable variety of clusterbean for intercropping in pearl millet for this region.

Materials and Methods

A field experiment on intercropping in pearl millet (GHB 30) with four clusterbean varieties (HG 75, HG 7-42-1, IC 9065 and Malosan) was conducted on sandy loam soil (Typic Ustipsamments) during *kharif* seasons of 1986 and 1994 (except drought year of 1987) at AICRP for Dryland Agriculture Centre, Sardar Krushinagar, in RBD with four replications. There were nine treatments, viz., T1: pearl millet sole, T2: HG-75 sole, T3: HG-7-4/P2-1 sole, T4: IC 9065 sole, T5: Malosan sole, T6: GHB-30 + HG-75 (2:2), T7: GHB-30 + HG-7-4/P2-1 (2:2), T8: IC 9065 (2:2) and T9: GHB- 30 + Malosan (2:2). Both the crops were sown at a distance of 45 x 15 cm. The soil of the experimental plot

was low in available N (160 kg ha^{-1}). Pearl millet crop was fertilized with 50 kg N ha^{-1} through urea as basal and 25 kg N ha^{-1} as top dressing. In the case of clusterbean, 30 kg N ha^{-1} as urea was applied at the time of sowing only. All the biometric observations were recorded at the time of harvest. The yield data were subjected to statistical analysis. LER and CBR were worked out using the following methods:

LER = (Yield of main crop/Yield of main crop in sole) + (Yield of intercrop/Yield of intercrop in sole)

CBR = Gross realization/cost of cultivation

Results and Discussion

In general, most of the biometric observations (Table 1) were favourably influenced by the intercropping treatments as compared to their respective sole treatments. Increase in height of pearl millet plant in intercropping system could be due to initial fast growth rate owing to no competition for sunlight, moisture and nutrient by clusterbean and ultimately this had also reflected on the number of leaves/plant, number of effective tillers/plant and bolder seeds in intercropping treatments as compared to pearl millet sole crop. However, these positive effects could not replenish the loss in yield due to area occupied by clusterbean and hence, lower grain yield on unit area basis in intercropping was recorded in comparison to sole pearl millet. Similar pattern was also observed in the case of clusterbean. Here, increase in height of clusterbean in intercropping system seems to be due to initial slow growing habit, which might have subjected the crop to shadow effect of pearl millet plants. So, for getting better light interception at later growth stages, the clusterbean plants might have been forced to increase the height in intercropping treatments. This clearly shows the better adaptability of clusterbean crop in intercropping system. The magnitude of reduction in yield of clusterbean was higher as compared to depression in yield of pearl millet under intercropping system. This implies that adverse effect of pearl millet on clusterbean was more pronounced than clusterbean on pearl millet. Total dry

Table 1. Effect of different treatments on biometric observations (Mean of 8 years)

Treatments	Pearl millet				Clusterbean			
	Plant height (cm)	Effective tillers/ plant	Leaves/ plant	100 grain weight (g)	Plant height (cm)	Pods/ plant	Seeds/ pod	100 seed weight (g)
T1	137.73	1.35	7.95	5.90	–	–	–	–
T2	–	–	–	–	71.73	18.72	7.61	28.83
T3	–	–	–	–	69.53	18.40	7.54	30.38
T4	–	–	–	–	72.28	18.98	7.81	31.05
T5	–	–	–	–	75.41	14.49	7.46	32.13
T6	141.62	1.62	8.18	6.01	72.86	18.31	7.39	29.14
T7	141.33	1.57	7.88	5.91	74.77	19.61	7.39	31.42
T8	143.04	1.67	8.47	6.09	77.60	19.29	7.31	29.21
T9	139.93	1.45	8.18	6.20	81.60	17.93	7.34	33.83

matter production was invariably higher in intercropping than in sole systems of both the crops. This also proves the compatibility of both the crops under intercropping system.

The grain and straw yields of pearl millet fluctuated considerably over the years. A minimum grain yield (61 kg ha^{-1}) was obtained in 1992 with pearl millet sole treatment and maximum (2922 kg ha^{-1}) was recorded in 1990 with the said treatment. During the last three years (1992-1994), yield of pearl millet was below average, as crop was affected by ergot and smut diseases due to humid weather at later growth stages, as a result of high rainfall (1518.7, 859.2 and 1626.1 mm) during these years. However, this variation in yield of clusterbean was not as that of pearl millet, which showed higher stability of this crop than pearl millet under erratic weather conditions of North Gujarat agroclimatic zone.

The equivalent yield in terms of pearl millet grain (Table 2) was calculated using main and by-products of base and intercrops at prevailing market price. The effect of different treatments was significant on equivalent yield during 6 years out of 8 years of experimentation. In the years of normal rainfall, all the intercropping treatments were at par with pearl millet sole. However, in the later two years, clusterbean sole treatments were superior to pearl millet sole because of the reasons mentioned earlier. In pooled analysis, pearl millet sole as well as pearl millet + clusterbean treatments were at par with each other, but both of them were significantly superior to clusterbean sole. This clearly suggests better economical viability of intercropping or pearl millet sole over clusterbean sole system. The data further revealed that treatment effect was not consistent which is evident from significant Y x T interaction.

Table 2. Year wise equivalent yield (kg ha^{-1}) in terms of pearl millet grain under different treatments

Treatments	Years								Pooled
	1986	1988	1989	1990	1991	1992	1993	1994	
T1	1319	1293	1518	3483	2462	631	263	697	1458
T2	757	555	469	1585	1282	1029	818	832	916
T3	825	633	484	1514	1329	700	893	842	906
T4	984	629	479	1561	1505	683	915	801	944
T5	1001	657	283	1210	1298	413	781	705	793
T6	1314	1250	1201	2270	2336	714	556	775	1301
T7	1161	1282	1350	2352	2091	535	541	835	1268
T8	1285	1439	1327	2386	1947	543	517	757	1275
T9	1253	1372	1323	2204	2507	552	608	792	1326
CD at 5%									
: T	NS	465	436	366	774	NS	210	86	337
: Y x T	–	–	–	–	–	–	–	–	379
C.V.%	28.26	26.03	26.34	10.06	23.41	54.18	18.08	6.11	24.16
Rainfall (mm)	184.5	407.0	778.0	895.4	288.4	1518.7	859.2	1626.1	
Rainy days	12	25	26	41	20	34	20	49	

Table 3. Economics and land equivalent ratio (LER) of different treatments

Treatment	Mean equivalent yield (kg ha^{-1})	Gross realization (Rs. ha^{-1})	Total expenditure (Rs. ha^{-1})	Net profit (Rs. ha^{-1})	CBR	LER
T1	1458	5832	3500	2332	–	1
T2	916	3664	2475	1189	–	1
T3	906	3624	2475	1149	–	1
T4	944	3776	2475	1301	–	1
T5	793	3172	2475	697	–	1
T6	1301	5204	2888	2316	1:1.8	1
T7	1268	5074	2888	2184	1:1.7	1
T8	1275	5100	2888	2212	1:1.7	1.03
T9	1326	5304	2888	2416	1:1.8	1.07

Prices (Rs. kg^{-1}) :	Grain	By-product
Pearl millet	4.00	0.40
Clusterbean	6.00	0.50

LER = Land Equivalent Ratio; CBR = Cost Benefit Ratio.

However, when the data were pooled over the years, either intercropping or pearl millet sole was found superior to clusterbean sole. This shows the stability of the system over the years. Among the clusterbean varieties tested, higher yields in intercropping treatments were obtained with either Malosan or HG-75 variety in most of the years, and in the pooled analysis. Further, these two varieties of clusterbean are widely grown by the farmers of North Gujarat and this will certainly facilitate wider adaptability of intercropping system.

The data on economics of different treatments (Table 3) revealed that highest gross income of Rs. 5832 ha^{-1} was realized with pearl millet sole and was followed by pearl millet + clusterbean var. Malosan (Rs. 5304 ha^{-1}) and pearl millet + clusterbean var. HG-75 (Rs. 5204 ha^{-1}). Net income values also indicated that intercropping of pearl millet with either Malosan (T9) or HG-75 (T6) variety of clusterbean was more profitable than that from rest of the treatments. LER in treatments T9 and T6 was more than one and CBR was 1:1.8. Similar increase in net income with intercropping of pearl millet + clusterbean have been reported by Singh *et al.* (1989).

Thus, for stable income, so as to minimise the risk involved in dryland agriculture of North Gujarat agroclimatic zone, intercropping of pearl millet as main crop with either Malosan or HG-75 variety of clusterbean (2:2) in recommended.

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