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Competition functions and economic viability of intercropping of sorghum (*Sorghum bicolor*) and blackgram (*Phaseolus mungo*) in drylands

A. RAFEY AND N. K. PRASAD

Birsa Agricultural University, Kanke, Ranchi, Bihar 834 006

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ABSTRACT

Association of 100% population of sorghum [*Sorghum bicolor* (L.) Moench] and 75% of blackgram (*Phaseolus mungo* L.) accounted for maximum land-equivalent ratio (1.33) as well as grain yield (4.38 tonnes/ha) and gave maximum monetary advantage (Rs 2,960/ha) and net return (Rs 8,437/ha), i.e. 17.6% and 370.0%, more net return than sole sorghum and sole blackgram respectively. The net return/ Re investment from this treatment was Rs 2.42/ha. The relative net returns from this association over sole sorghum (Rs 1.12) and sole blackgram (Rs 2.44) were also highest. However, this treatment was very close to the stand of each component species with 100% population for all the parameters of evaluation.

The plateau region of Bihar is traditionally a monocropped area due to low irrigation facility and poor water-holding capacity of the soil. Intercropping of drought-resistant crops in particular is the only way to increase the cropping intensity. Benefits from intercropping have been found in this area (Rafey and Prasad, 1991). Since an information on intercropping of sorghum [*Sorghum bicolor* (L.) Moench] with blackgram (*Phaseolus mungo* L.) is meagre, the present experiment was conducted under dryland condition of Bihar.

MATERIALS AND METHODS

An experiment was conducted at Ranchi during the monsoon seasons of 1986–88 to evaluate a sustainable intercrop system of sorghum and blackgram. The soil was clay loam (Alfisols) with 24.5% clay, having low water- holding capacity (23.5% at 1/3 bar and 9.5% at 15 bars). It was low in total N (430 kg/ha) and available P (11.5 kg/ha), medium in exchangeable K (147.0 kg/ha) and the pH was 6.0. The treatment consisted of sole 'CHS 5' sorghum and sole 'T 9' blackgram with 100% plant population. For intercrop association, 2 populations of sorghum (100% and 75%) and 5 populations of blackgram (50%, 75%, 100%, 125% and 150%) as 10 intercrop associations in 1 : 1 row ratio and 2 sole stands having 12 treatments were put under randomized block design, replicated thrice.

The nutrients as 80 kg N + 40 kg P_2O_5 + 30 kg K/ha were applied in each sole stands as well as in each intercrop association. The pooled grain yields for 3 years were statistically analysed. These yields were further computed for different parameters of competition functions, viz. partial and total land-equivalent ratios as suggested by Willey (1979). The yields were then evaluated on the basis of different economical in-

dices, e.g. monetary advantage (value of combined intercrop yields x LER−1/LER), net return, increase or decrease in net return from intercrops over sole stands of both the component species as proposed by Jain and Rao (1980).

The total rainfall recorded during the crop period from June to October in 1986, 1987 and 1988 was 1,266.4, 954.2 and 1,012.0 mm respectively.

RESULTS AND DISCUSSION

Yield advantage

The trends in grain yield and performance of different treatments during 1986, 1987 and 1988 were almost similar. The pooled data (Table 1) of 3 years indicated significant variations in yields of both the species due to intercropping. Intercropping of 100% population of sorghum with 75% of blackgram accounted for an overall maxi-

Table 1. Biological and economical parameters of sorghum and blackgram intercropping systems

Treatment	Yield (tonnes/ha)	LERs	SERb	LER	Monetary advantage (Rs/ha)	Net return (Rs/ha)	Net return (Rs/Re)	RNR (Rs) over	
								Sole sorghum	Sole blackgram
S_{100}	4.22					7,178	2.12		
B_{100}	0.77					1,795	0.64		
$S_{100}B_{50}$	4.14 (3.87 + 0.27)	0.92	0.35	1.27	2,401	7,841	2.27	1.06	2.31
$S_{100}B_{75}$	4.38 (4.10 + 0.28)	0.97	0.36	1.33	2,960	8,437	2.42	1.12	2.44
$S_{100}B_{100}$	4.33 (4.05 + 0.28)	0.96	0.36	1.32	2,862	8,274	2.34	1.10	2.40
$S_{100}B_{125}$	4.04 (3.77 + 0.27)	0.89	0.35	1.24	2,136	7,475	2.09	1.03	2.23
$S_{100}B_{150}$	4.13 (3.87 + 0.26)	0.92	0.34	1.26	2,316	7,627	2.11	1.06	2.26
$S_{100}B_{50}$	3.71 (3.45 + 0.26)	0.82	0.34	1.16	1,405	6,758	1.97	0.96	2.07
$S_{75}B_{75}$	3.76 (3.51 + 0.26)	0.83	0.32	1.15	1,340	6,810	1.97	0.97	2.09
$S_{75}B_{100}$	3.68 (3.30 + 0.29)	0.81	0.35	1.16	1,399	6,652	1.90	0.95	2.05
$S_{75}B_{125}$	3.59 (3.30 + 0.29)	0.78	0.38	1.16	1,378	6,448	1.82	0.93	2.01
$S_{75}B_{150}$	3.52 (3.25 + 0.27)	0.77	0.35	1.12	1,047	6,194	1.72	0.91	1.95
CD (P = 0.05)	(0.625 + 0.159)				853		0.31		

50,75,100,125, and 150 are the plant population (%) of crops; S, sorghum; B, blackgram; LERs and LERb, partial land-equivalent ratio of sorghum and blackgram; LER, land-equivalent ratio; RNR, relative net return respectively

Figures in parentheses are the individual yield the of sorghum and blackgram

mum grain yield. However, this association was found significantly on a par with all the populations of blackgram with 100% sorghum, including the yield of sole stand of sorghum. The yield of blackgram in intercrops was more or less alike. An overall decrease in yields of sorghum (13.9%) and blackgram (66.2%) was recorded as compared to their respective sole stands. Rafey and Prasad (1992) also reported reduction in yields of maize and pigeonpea almost in same proportion due to intercropping as compared with their respective pure stands.

Competition functions

The partial land-equivalent ratio (Table 1) of 100% sorghum under all the intercop associations indicated a minor reduction in its yield as compared to sole seeding, while the partial land-equivalent ratio of blackgram showed a marked reduction in its yield compared with sole stand. However, an overall increase in land-equivalent ratio with maximum under 100% sorghum and 75% blackgram was recorded which was very closely followed by 100% population of both crops.

Economic viability

The monetary advantage (Table 1) based on land-equivalent ratio indicated a definite benefit from intercropping over sole stands of both the components. The maximum monetary advantage (Rs 2,960) was recorded from the association of 100% sorghum and 75% blackgram which was very close to 100% population of both the crops (Rs 2,862). The same association gave maximum net return (Rs 8,437/ha) with 17.6 and 370.0% more net return than sole sorghum and blackgram respectively, but this association was statistically similar to the associations of 100% population of both, 100% population of sorghum with 50% and 150% populations of blackgram. The association of 100% sorghum and 75% blackgram also accounted for maximum net return/Re investment followed by 100% of both the species. The relative net return further established the fact that 100% sorghum and 75% blackgram was the best intercrop association, giving maximum relative net return of Rs 1.12 and Rs 2.44 over sole sorghum and blackgram respectively.

Hence it appeared that intercropping of sorghum and blackgram with 100% population of sorghum and 75 or 100% population of blackgram is biologically and economically more sustainable intercrop systems for dryland conditions of plateau region.

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