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COMPATIBILITY OF PIGEONPEA AND GREEN GRAM INTERCROPPING SYSTEMS IN RELATION TO ROW RATIO AND ROW SPACING

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ABSTRACT

Field experiment to see the compatibility of pigeonpea and greengram intercropping in different row spacing and row ratio was conducted during *kharif* 1999 and 2000. Pigeonpea as sole crop at 45 cm gave 7.0 to 22.5 and 16.6 to 68.5 per cent more yield and net return ha^{-1}, respectively during the two seasons as compared to other row spacings. Intercropping of greengram in 1 : 2 ratio at 75 cm row spacing in pigeonpea was found most profitable combination as reflected by higher MAI (4926). Pigeonpea having 1.94 to 3.25 more competitive ratio proved to be more competitive than greengram (0.31 to 0.53) in intercropping system.

INTRODUCTION

Adoption of multiple cropping systems coupled with increased irrigation facilities in Haryana, increased the cropping intensity of the State from 136 in 1979 - 80 to 167 per cent in 1992 - 1993 (Anonymous, 1996). However, during last two decades the area as well as production of pulses in the state has decreased due to one or the other reasons. Pigeonpea, the main rainy season pulse crop of high potential, thrives well in low irrigated situations. It is widely spaced crop and its initial lateral growth for 60 to 70 days remains quite slow and grand growth begins after that (Dhingra *et al.*, 1980). Thus the left over inter space can be utilized by inclusion of short duration inter crops. This system in addition to weed's suppression also increases productivity per unit area. The intercropping of short duration crops like moongbean and urdbean has been reported profitable in comparison to sole crop (Parlawar *et al.*, 1998). Looking this point the study to find out the best planting pattern in pigeonpea + greengram for obtaining higher yield under different crop geometry was carried out and the data were analysed to compare different competitive functions (Willey, 1979).

MATERIAL AND METHODS

The field experiment was conducted at student farm of department of agronomy of CCS Haryana Agricultural University, Hisar during rainy seasons of 1999 and 2000. The soil of experimental field was sandy loam having 0.38 per cent organic carbon, 124.4 kg ha^{-1} available nitrogen, 20.6 kg ha^{-1} available phosphorus and 469 kg ha^{-1} available potassium. The pH was 8.0 while, EC was 0.93 ds/m. The treatments comprised of 4 row spacings i.e. 45, 60, 75 and 90 cm in sole pigeonpea and different cropping systems (Table 1). Greengram was planted in 1 : 1 and 1 : 2 row ratio in pigeonpea planted at 60, 75 and 90 cm whereas in 45 cm only 1 : 1 row ratio system was adopted. Sole greengram were planted at 30 cm row spacing. Pigeonpea and green gram was planted on 19-06-1999 and 23-06-2000 during 1st and 2nd year, respectively. The extra plants of both the crops were thinned out to maintain 10 cm plant-to-plant spacing. Fertilizer was placed at plough sole layer @ 20 kg N and 40 kg P_2O_5 ha^{-1} just before planting of crop. The rainfall received during the crop period was 160.8 and 88.6 mm in 1999 and 2000, respectively. The pigeonpea and greengram were harvested on 06-12-99 and 27-09-1999 and 30-11 -2000 and 22-09-2000, respectively during the two seasons.

The different competitive functions as

suggested by Willey (1979) like income-equivalent ratio (IER), competitive ratio (CR), aggressivity (A) were computed using the equations *viz.*, Lp = Ypg/Ypp, Lg = Ypg/Ygg where Lp and Lg are partial land equivalent ratio of pigeonpea and greengram, respectively and Ypp, Ypg and Ygg and Ygp are yields of pigeonpea and greengram, respectively in intercropping system. Monetary advantage index (MAI) = value of combined yield of intercrop X (LER -1)/LER, Kpg = (Ypg x Zgp)/ (Yp_p - Ypg) Zpg, Kgp = (Ypg x Zpg)/(Ygg - Ygp) Zgp, CRp = (LERp/LERg) (Zgp/Zpg), CRg = (LERg/LERp) (Zpg/Zgp), Apy = (Ypg/ Ypp x Zpg) - (Ygp/Ygg x Zgp), Agp = (Ygp/ Ygg x Zgp) - (Ypg/Ypp x Zpg) where Zpg and Zgp are proportion of intercrop area allocated to pigeonpea and greengram, respectively. Area time equivalent ratio (ATER) was calculated by using the formulae ATER = (LpTp + LgTg/T) where Tp and Tg are duration of pigeonpea and greengram and T is the total duration of intercropping system.

RESULTS AND DISCUSSION

The different economic and competitive functions of the treatments were calculated on the basis of mean values of grain yield of pigeonpea and greengram of 1999 and 2000 because the trend of grain yield of main and intercrop followed the similar pattern during both the years of experimentation.

Grain yield: The grain yield of sole pigeonpea decreased with the increase in row spacing from 45 cm to 90 cm (Table 1). Among different intercropping systems, the highest grain yield of pigeonpea was recorded in PP (60 cm) + GG (1 : 1). The inclusion of either one or two rows of greengram did not influence the grain yield of pigeonpea much under different intercropping systems. Planting of two and single row of intercrop in pigeonpea planted at 75 and 90 cm row spacing, respectively yielded higher than sole crop.

Sole greengram produced the highest seed yield as compared to intercropping systems (Table 1). Greengram produced the highest seed yield in PP (75 cm) + GG (1 : 2) ratio and minimum being in narrow spaced pigeonpea i.e. PP (45 cm) + GG (1 : 1). Moreover, inclusion of two rows of greengram proved superior as compared to single row of greengram irrespective of the row spacing in pigeonpea.

Competitive ratio and aggressivity: Pigeonpea proved more competitive than green gram as reflected by higher competitive ratio of pigeonpea, which ranged from 1.94 and 3.25 in different intercropping systems. Pigeon pea planted at wider row spacing in 1 : 2 system resulted in lower competition than intercropped at closer spaced pigeonpea (45 cm). The negative agressivity of greengram under all intercropping systems reflected the poor competitiveness of greengram than pigeonpea, which had positive aggressivity in all the intercropping systems (Table 1). Longer duration of pigeonpea and rapid growth after harvest of greengram resulted in no competition for natural resources viz. light, moisture, nutrient and space in pigeonpea and resulted in less yield loss as compared to its sole crop in the respective spacings.

The intercropping of greengram either one or two rows in between two rows of pigeon pea irrespective of row spacing were advantageous because the product of relative crowding coefficient was more than 1 due to their complementary relationship (Table 1). The crowding coefficient of two intercropping systems was not calculated because pigeonpea yield was more in these intercropping systems as compared to sole pigeonpea which resulted in its negative value. Similar negative values of crowding coefficient have also been reported by Willey, 1979. Monetary advantage index clearly reflected that planting of single row of greengram irrespective of row spacing in pigeonpea was less remunerative than two

Table 1. Grain yield, economics and biological parameters of pigeonpea + greengram as affected by spatial arrangement and different intercropping systems

Treatments	Row ratio	Grain yield (kg ha^{-1})		Net return Rs. ha^{-1}	IER	MAI	ATER	Ap*	Am**	CRp*	CRm	Kp	Km	K
		PP*	GG**											
Sole cropping														
PP (45 cm)	-	1797	-	7197	-	-	-	-	-	-	-	-	-	-
PP (60 cm)	-	1680	-	6174	-	-	-	-	-	-	-	-	-	-
PP (75 cm)	-	1534	-	4848	-	-		-	-	-	-	-	-	-
PP (90 cm)	-	1467	-	4272	-	-	-	-	-	-	-	-	-	-
GG (30 cm)	-	-	1223	1457	-	-	-	-	-	-	-	-	-	-
Intercropping systems														
PP (45 cm) + GG	1 : 1	1596	493	9617	1.34	2162	1.14	0.96	-0.96	2.22	0.45	7.94	0.67	5.36
PP (60 cm) + GG	1 : 1	1618	584	10934	1.77	3341	1.25	0.97	-0.97	2.00	0.50	26.10	0.91	23.85
PP (60 cm) + GG	1 : 2	1553	765	11844	1.92	4203	1.31	1.85	-1.85	2.92	0.34	24.46	3.34	81.71
PP (75 cm) + GG	1 : 1	1513	622	10358	2.14	3453	1.30	0.95	-0.95	1.94	0.51	72.05	1.03	25.31
PP (75 cm) + GG	1 : 2	1538	814	12278	2.53	4926	1.41	2.03	-2.03	2.98	0.33	***	3.98	***
PP (90 cm) + GG	1 : 1	1479	650	10192	2.39	3531	1.32	0.96	-0.96	2.00	0.53	***	1.13	***
PP (90 cm) + GG	1 : 2	1411	716	10262	2.40	3641	1.32	2.02	-2.02	3.25	0.31	50.40	2.82	142.35

* Pigeonpea
** Greengram
*** Values not calculated because of higher yield of pigeonpea in sole crop as compared to intercrop.

rows of greengram (Table 1) and highest being in pigeonpea (75 cm) + GG (1 : 2) intercropping system. Hence it can be concluded that this system is more remunerative than other systems, tested.

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