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Agro-Economic Relationship of Component Crops in a Mash Sesamum Intercropping System

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Abstract: A field study comprising of intercropping treatments viz. mash alone, sesamum alone, mash intercropped with one, two, three and four rows of sesamum, was conducted during the year 1998 and 1999. Mash was planted in the pattern of 100 cm apart four row strips (20/100 cm) while sesamum was intercropped between the mash strips according to the treatments. Mash yield was reduced by 16.60, 35.10, 48.40 and 59.46% by sesamum intercropping in the pattern of one, two three and four rows, respectively. However, at the cost of this much reduction in mash yield, an additional harvest of 6.22, 7.85 and 9.82 q ha^{-1} of sesamum, respectively was obtained which compensated more than the losses in mash production. The best intercropping system appeared to be mash + four rows of sesamum in all respects.

Key words: Sesamum, treatments, pattern, mash, strips, intercropping, production

INTRODUCTION

Multiple cropping, an effective and the most potential way of increasing crop production per unit area and time, is being looked upon as an excellent strategy for intensifying land use and for absorbing excess farm labour. Some minor crops do not produce reasonable yields and income per hectare in pure stand. However, there is a perspective possibility of increasing their production and returns per unit area through an intercropping technique. Intercropping has been reported to be beneficial and productive by many research workers. Gunasena *et al.* (1979) concluded that although the total yield of different intercropping systems was higher than that of their monocropping but the yield of both the component crops tended to decrease, while intercropping combinations showed compatible LER and gave more gross income than monoculture of respective crops. According to Rathore *et al.* (1979) maize intercropped with mash gave significantly higher returns over sole crop of maize. Pandey et *al.* (1981) reported that intercropping, of mung or sesamum decreased maize yield but increased net profit. Chaudhry and Singh (1982) concluded that intercropping of green gram, moth bean, black gram, cowpeas, soybean, peas or gram in cotton, castor, pearl millet, pigeon pea, sugarcane, rice, sesamum and maize had no adverse effect on the yield of main crops and gave reasonably higher additional seed yields. Ahmed (1984) stated that various yield parameters of maize were significantly affected by, different legume intercropping systems. Likewise, sesamum-mash and mung intercropping was reported to be better than sesamum alone by Arunachalam and Vankatesan (1984). Narwal and Malik (1985)observed that pod per plant and grain yield of leguminous intercrops were reduced. They also, observed maximum LER from sunflower-green gram mixture. Reduction of 1000-grain weight of pulses due to intercropping in rabi sorghum was reported by Kalbhor and Gaikward (1986). Keeping all this in view, the present study was designed to determine the productive potential of mash-sesamum intercropping system when grown in association with each other in different proportions at uniform plant population of mash on a uniform soil fertility under Faisalabad conditions.

MATERIALS AND METHODS

Studies reported herein were conducted at Agronomic Res. Farm Ayub Agricultural Research Institute, Faisalabad during the years 1998 and 1999. The experiment was quadruplicated in RCBD with a net plot size measuring 4.8 x 7 m. The experimental treatments comprised mash alone, sesamum alone, mash + one row of sesamum, mash + tow rows or sesamum, mash + three rows of sesamum and mash + four rows of sesamum. Mash was planted in 100 cm spaced four-row strips with 20 cm space between the rows of each strip (20/100 cm), while sesamum was interplanted between the mash strips according to the respective treatments. Mash cultivar (Mash-133) and sesamum cultivar (T-5) were sown on July 12 and 18 during the year 1998 and 1999, respectively. A basal dose of 50 kg P_2O_5 and 25 kg N ha^{-1} was applied at the time of sowing. Both the component crops were thinned at 4-5 leaf stage maintaining a plant to plant distance of 10 cm. All other agronomic practices were kept normal and uniform for all the treatments. Both the crops were harvested on October, 9 in 1998 and October, 16 in 1999. Observations on desired parameters were recorded by using standard procedures. Land equivalent ratio (LER) and benefit cost ratio (BCR.) were also calculated. The data obtained were subjected to Fisher's Analysis of Variance techniques and treatment means were compared by using Duncan's New Multiple Range Test at 0.05 probability level (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Data on different growth and yield parameters of the component crops (Table la) revealed that mash yield was affected significantly by sesamum intercropping in both the years of study. There was progressive decrease in mash yield with each successive increase of intercrop row from one to four which amounted to 1.56, 3.30, 4.55 and 5.59 q ha^{-1} in 1998 and 2.97, 4.42, 5.87 and 6.62 q ha^{-1} in 1999. However, at the cost of this much reduction in mash yield, an additional sesarnum. yield ie. 6.22, 7.85, 8.70 and 9.83 q ha^{-1} in 1998 and 4.55, 5.88, 7.22 and 9.09 q ha^{-1} during 1999 was obtained in the respective intercropping treatments which compensated more than the losses in mash production.

Regarding the sesamum intercrop (Table 1b) there was consistent decrease in sesamum yield ha^{-1} with successive decrease in the intensity of intercropping over sesamum alone in both the years. In 1998, significantly the highest yield of 10.57 q ha^{-1} was obtained from sesamum alone closely followed by that intercropped with the pattern of four rows (9.83 ha^{-1}) as against the minimum of 6.22 q ha^{-1}, for one row pattern. By contrast in 1999, although the yield pattern was similar to that observed in 1998 but the difference between sesamum alone and mash + four rows of seasum treatments was non significant which yielded 9.86 and 9.09 q ha^{-1} respectively, as against the minimum of 4.55 q ha^{-1} for the treatment of mash + one row of sesame. These results are in agreement with those of Gunasena *et al.* (1979), Pandey *et al.* (1981) and Arunachalam and Venkatesan (1984) and are partially in agreement with those of Chaudhry and Singh (1982) who reported that different intercrops did not affect the yield of main crops but gave additional seed yield.

Plant density m^{-2} of mash crop recorded at harvest was not influenced significantly by sesamum intercropping in both the years, which ranged between 23.83 and 24.40 in 1988 and 20.90 and 22.02 plants m^{-2} in 1999. This remained so because of maintaining a constant number of rows and seeding at uniform rate.

Plant density m^{-2} of sesamum recorded at harvest was found to be highly variable in all the intercropping treatments in both the years, which was attributed to initially different intensities of sesamum intercrop in all the treatments. In 1999, the difference between sole sesamum and mash + four rows of sesamum intercropping system was non-significant and had 20.13 and 19.49 plants m^{-2}, respectively. Results reported by Ahmed (1984) are in accordance with these findings.

The results regarding plant height indicated that the growth of mash plants growing in association with sesamum, in independent strips was not influenced in terms of plant height by the associated sesamum, crop probably because of the minimum intercrop competition as a result of leguminous nature of mash crop.

Average height of sesamum plants which ranged from 1.39 to 1.57 in 1998 and 1.43 to 1.56 m in 1999, was not affected significantly indicating that growth behavior of sesamum plant is mainly controlled and regulated by its genetic constitution rather than a change in the environment, as a result of different mash - sesamum intercropping systems. These results are contradictory to those of Ahmed (1984) who observed variable plant heights.

Mash intercropped with sesamum produced significantly less number of branches plant^{-1} as against the highest of mash grown alone. It was so because of the mutual competition between both the component crops.

By contrast, the number of branches plant^{-1} of sesamum intercrop varying from 7.20 to 7.33 in 1998 and 6.29 to 7.47 in 1999 was not affected significantly by mash association in both the years because sesamum is a tall crop and was less affected by mash crop.

There was a linear decrease in leaf area plant^{-1} of mash with each addition of intercrop row from one to four. However, the difference between mash alone and mash + one row of sesamum treatment was nonsignificant because of the least competition between the component crops.

Sesamum intercropped in mash under the pattern of mash + one row of sesamum produced significantly more leaf area plant^{-1} than other intercropping patterns including sole cropping of sesamum which gave significantly the lowest leaf area plant^{-1} because of higher density per unit area. It was further observed that there was a progressive decrease in leaf area plant^{-1} with successive increase in the rows of intercropped sesamum from one to four being the lowest in case of monocropped sesamum which was attributed to comparatively higher plant density per unit area.

Sesamum intercropping affected the number of pods plant^{-1} of mash, decreased linearly with each successive increase in the intercrop row from I to 4. The same trend was noted in 1999 but the differences among the intercropped treatments were non-significant.

Significantly higher number of pods plant^{-1} of sesamum was recorded in case of monocropped sesamum

Table 1a: Means comparison of FYD and yield components of mash as affected by different mash-sesamum intercropping systems

	Grain yield (q ha^{-1})		Plant^{-2}		Plant height (cm)		Branches plant^{-1}	
Treatment	1998	1999	1998	1999	1998	1999	1998	1999
1 Mash alone			NS	NS	NS	NS		
	9.40a	10.03a	24.04	21.80	44.42	36.26	8.77a	9.40a
2 Sesamum alone	-	-	-	-	-	-	-	-
3 Mash + one row of sesamum	7.84b	7.06b	23.96	22.02	43.92	35.25	5.56b	7.82a
4 Mash + two row of sesamum	6.10c	5.61c	23.87	21.29	42.65	39.45	6.13c	8.17b
5 Mash + three row of sesamum	4.85d	4.16d	23.83	20.90	42.52	35.25	5.66c	8.01b
6 Mash + four row of sesamum	3.81c	3.41d	23.85	21.20	41.22	35.50	5.17d	7.12b

	Leaf area/ Plant (cm)		1000-Grain wt. (g)		Pods plant^{-1}	
Treatment	1998	1999	1998	1999	1998	1999
1 Mash alone			NS	NS		
	241.68a	236.51a	47.20	46.77	18.15a	15.50
2 Sesamum alone	-	-	-	-	-	-
3 Mash + one row of sesamum	231.58ab	228.45ab	47.17	45.62	16.20b	13.27
4 Mash + two row of sesamum	221.81b	210.95b	48.42	46.52	15.20b	12.17
5 Mash + three row of sesamum	210.80bc	208.61b	48.15	45.97	15.54c	10.70
6 Mash + four row of sesamum	199.00C	206.14b	46.60	44.90	11.42d	10.10

Table 1b: Means comparison of FYD and yield components of sesamum as affected by different mash-sesamum intercropping systems

	Grain yield (q ha^{-1})		Plant^{-2}		Plant height (cm)		Branches plant^{-1}	
Treatment	1998	1999	1998	1999	1998	1999	1998	1999
1 Mash alone	-	-	-	-	-	-	-	-
2 Sesamum alone							NS	NS
	10.57a	9.86a	21.67a	20.13a	1.57	1.56	7.20	7.12
3 Mash + one row of sesamum	6.22e	4.55c	8.36e	8.71d	1.50	1.49	7.15	7.47
4 Mash + two row of sesamum	7.85d	5.88bc	13.23d	12.68c	1.39	1.52	7.38	7.07
5 Mash + three row of sesamum	8.70c	7.22b	16.56d	16.05b	1.49	1.43	7.31	7.31
6 Mash + four row of sesamum	9.83b	9.09a	20.13b	19.49a	1.53	1.51	7.14	6.29

	Leaf area/ Plant (cm)		1000-Grain wt. (g)		Pods plant^{-1}	
Treatment	1998	1999	1998	1999	1998	1999
1 Mash alone	-	-	-	-	-	-
2 Sesamum alone			NS	NS		
	523.50c	520.50d	3.52	3.66	58.52a	54.25a
3 Mash + one row of sesamum	622.75a	607.00a	3.40	3.86	59.02a	52.00ab
4 Mash + two row of sesamum	590.25ab	587.50b	3.61	3.66	56.87a	47.25b
5 Mash + three row of sesamum	581.00b	574.25b	3.25	3.59	49.80b	46.25b
6 Mash + four row of sesamum	560.75bc	556.75c	3.47	3.41	51.30	46.50b

Means not sharing a letter differ significantly at 0.05 level of probability (DMRT). NS Non-significant

Table 2: Land equivalent ratio of mash-sesamum intercropping system

	LER of mash		LER of sesamum		Total LER (mash+s samum)	
Intercropping	1998	1999	1998	1999	1998	1999
1 Mash + one row of sesamum	0.83	0.70	0.59	0.46	1.42	1.16
2 Mash + two row of sesamum	0.65	0.59	0.74	0.59	1.39	1.18
3 Mash + three row of sesamum	0.52	0.41	0.82	0.73	1.34	1.14
4 Mash + four row of sesamum	0.41	0.34	0.93	0.92	1.34	1.26

Table 3: Economic analysis of mash-sesamum intercropping systems

Intercropping	Income of mash (Rs. Ha^{-1})	Income of sesamum(Rs. Ha^{-1})	Gross Income (Rs. Ha^{-1})	Total Expenditure (Rs. Ha^{-1})	Cost benefit ratio (CBR)	Net Income (Rs. Ha^{-1})
1 Mashalone	5640	-	5640	2368.11	2.36	3253.89
2 Sesamum alone	-	12684	12684	2746.11	4.61	9934.89
3 Mash + one row of sesamum	4704	4764	12168	2896.31	4.20	9271.69
4 Mash + two row of sesamum	3660	9420	13080	3131.11	4.17	9948.89
5 Mash + three row of sesamum	2910	10440	13350	3319.11	4.02	10030.89
6 Mash + four row of sesamum	2286	11796	14082	3523.91	3.99	10558.09

than the intercropped treatments with the exception of the treatment where only one row of sesamum was intercropped with which it was at par. These findings are in conformity with those of Narwal and Malik (1985).

As regards 1000-grain weight of mash crop, there were nonsignificant differences among all the intercropping treatments including mash alone. The average 1000-grain weight, however, varied from 46.60 to 48.42 grams in 1998 and 44.90 to 46.77 grams in 1999. The results are dissimilar to those of Kolbhor and Gaikward (1986) who observed reduction in 1000-grain weight due to intercropping.

The yield advantage of an intercropping system is also expressed in terms of land equivalent ratio (LER). Data in this regard (Table 2) indicated that there were substantial yield advantages in case of all the intercropping systems over monocropping of the component crops in both the years. In 1998, the level of yield advantage under the various patterns of intercropping varied from 34 to 42% being the highest in case of mash + one row of sesamum intercropping system (42%) as against the lowest of 34% for mash + four rows of sesamum. intercropping system. By contrast in 1999 the level of yield advantage was low which ranged between 14 and 26% being the highest for mash + four rows of sesamum intercropping system. Results reported by Narwal and Maslik (1985), Gunasena *et al.* (1979) are corborated with these findings.

The feasibility and economic position of an intercropping system is determined by the net monetary gains. Table 3 revealed that all the intercropping systems under study gave substantially higher net income ha^{-1} than mash monocropping. The highest net income of Rs. 10558.09 ha^{-1} was obtained from mash + four rows of sesamum intercropping system as compared to Rs. 10030.89, 9948.89 and 9271.69 ha^{-1} for mash with three, two and one row of sesamum intercropping patterns, respectively being the lowest of Rs. 3253.89 ha^{-1} in case of mash alone. The benefit cost ratio (BCR) was also much higher in case of intercropping systems than monocropped mash being the highest of 4.20 for mash + one row of sesamum intercropping system as against the lowest of 2.36 for mash monocropings. While sesamum alone also, proved good due to higher market value. The results are supported by the findings of Gunasena *et al.* (1979) and Pandey *et al.* (1981).

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