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Studies on Determining a Suitable Canola-Wheat Intercropping Pattern

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ABSTRACT

A field study to determine the feasibility of canola based wheat intercropping pattern was carried out at Agronomic Research Area, University of Agriculture, Faisalabad during 1998-99. The treatments were canola alone, wheat alone, canola + one row of wheat, canola + two rows of wheat and canola + three rows of wheat. The results revealed that various growth and yield components were significantly influenced by different intercrossing patterns, where canola + one row of wheat produced the highest canola seed yield (1217 kg ha^{-1}) among intercropping treatments. Similarly, net income, cost benefit ratio and land equivalent ratio (LER) were also higher at Rs.22486.98, 2.46 and 1.17 respectively, in canola + one row of wheat planting.

Key Words: Intercropping; Canola; Cost benefit ratio; Land equivalent ratio

INTRODUCTION

Intercropping is an advanced agro-technique and is considered to be an effective and potential mean of increasing crop production per unit area and time, particularly for farmers with small holdings. Generally farmers use marginal lands which lead to lower yields of oilseeds. Thus, Pakistan is deficient in edible oil and wheat grains (Anonymous, 1999), and spends its precarious foreign exchange resources on the import of these commodities. Thus, there is need to develop the best cropping pattern to increase the production of canola and wheat crop concomitantly. Kalra and Gangwar (1980) reported that intercropping helps in increasing farm income on sustained basis. While Mandal *et al*. (1985) revealed that intercropping of wheat, mustard and chickpea alone or wheat in combination with mustard and chickpea reduced number of fruiting branches per plant, number of pods per plant and 1000-seed weight. Sharma *et al*. (1986) observed that plant density was affected significantly by intercropping of wheat and mustard. Similarly Das *et al*. (1992) found that highest land equivalent ratio (LER) was obtained by intercropping wheat and rape in a 1:1 row ratio. Singh and Pal (1994) reported that intercropping of wheat and mustard reduced the seed yield than their pure stands. Whereas, Ayisi *et al*. (1997) concluded from their experiment on canola-soybean intercropping that seed oil content increased compared with sole cropping. Likewise, Verma *et al*. (1997) reported that intercropping of wheat and Indian mustard gave maximum net return, benefit-cost ratio and land equivalent ratio. The present study was therefore undertaken to evaluate the feasibility of different canola-wheat intercropping patterns under the agro-ecological conditions of Faisalabad.

MATERIALS AND METHODS

A field study to examine the comparative productive efficiency and feasibility of different canola-wheat intercropping patterns was carried out at the Agronomic Research Area, University of Agriculture, Faisalabad during 1998-99 on a sandy clay loam soil. The experiment was laid out in a randomized complete block design with three replications having a net plot size of 1.6 m x 5.0 m. The experimental treatments were: canola alone, wheat alone, canola + one row of wheat, canola + two rows of wheat and canola + three rows of wheat. The canola (cv. Rainbow) was sown on October 27, 1998 in a paired rows pattern with 20 cm between the paired rows and 60 cm between the rows of different pair using the seed rate of 5 kg ha^{-1}. Wheat (cv. Punjab-96) was intercropped between the strips on the same day with single row hand drill. The crops were fertilized @ 90 kg N and 60 kg P_2O_5 ha^{-1}. All the phosphorus and 1/3 nitrogen was applied at the time of sowing as basal dose, 1/3 N was applied with first irrigation and remaining 1/3 N was applied at flowering stage. The crops were kept free of weeds by giving two hoeings with `Kasola'. The canola crop was thinned twice (first at 6" height and second at 12" height) to minimize intra-row competition. All other agronomic practices were kept uniform for all the treatments. Both the crops were harvested from total combined net area of 120 m^2 on April 20, 1999.

Data on different growth and yield parameters were recorded by busing standard procedures. The seed oil content was determined by NMR technique (Robertson

& Morrison, 1979). Data collected were statistically analysed by using the Fisher's analysis of variance technique and treatment means were compared by using least significant difference (LSD) test at 5% probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Table I presents the data on growth, yield and yield components of canola as affected by various wheat intercroppings.

The data regarding number of plants m^{-2} shows a highly significant effect of different intercropping patterns on the parameter under discussion. Maximum number of plant m^{-2} (10) were recorded in case of canola planted alone and differed significantly from rest of all the treatments. However, the intercropping patterns showed statistically the similar results. The higher number of plants m^{-2} of canola planted alone could be because of competition free environments. These results are in accordance with those of Sharma *et al*. (1986) who also reported that different intercropping patterns reduced plant density as compared to sole cropping.

The different intercropping patterns also had a highly significant effect on a number of fruiting branches per plant. Maximum number of fruiting branches per plant (18.30) were found in case of canola planted alone and differed significantly from rest of the other planting patterns. However, the minimum number of fruiting branches (14.10) were recorded in case of canola planted with three rows of wheat and remained statistically on a par with canola planted with two rows of wheat. The reason for decrease in the number of fruiting branches per plant in different intercropping systems could be because of competition between both crops for nutrients and moisture. These results are favoured by the findings of Mandal *et al*. (1985).

The data pertaining to number of pods per plant reveals that significantly maximum number of pods per plant (421.1) were obtained with canola planted alone and differed significantly from the rest of other treatments. However, the intercropping treatments with two and three rows of wheat produced minimum number of pods $plant^{-1}$. The decrease in number of pods per plant of canola was due to mutual competition among the two crops for different soil resources. Mandal *et al*. (1985) also reported that intercropping with wheat decreased the number of pods per plant of mustard and chickpea.

The parameter 1000-seed weight was also significantly influenced by different intercropping patterns. Maximum 1000-seed weight (2.97 g) was obtained in case of canola planted alone. Among the different intercropping patterns, the increasing number of intercrop rows decreased 1000-seed weight. Maximum 1000-seed weight of canola planted alone may be due to competition free environment and having more feeding area than the rest of intercropping treatments. These findings are in line with those of Khan (1984).

The data concerning seed yield of canola reflects the significant effect of intercropping patterns on the parameter under question. Maximum seed yield of 1495.0 kg ha^{-1} was recorded in canola planted alone

Table I. Impact of intercropping wheat on different growth, yield and yield components of Canola

Treatments	No. of plants m^{-2}	No. of fruiting branches $plant^{-1}$	No. of pods $plant^{-1}$	1000-seed weight (g)	Seed yield (kg ha^{-1})	Seed oil content (%)
Canola alone	10.0 a*	18.3 a	421.1 a	2.97 a	1495.0 a	44.0 a
Canola + one row of wheat	7.7 b	16.8 b	391.7 b	2.82 b	1217.0 b	41.6 ab
Canola + two rows of wheat	6.0 b	14.6 c	342.2 c	2.80 b	850.3 c	40.3 b
Canola + three rows of wheat	6.3 b	14.1 c	344.4 c	2.67 c	704.2 c	39.8 b

*Means followed by different letters differ significantly at the 0.05 probability level

Table II. Economic analysis of different Canola-wheat intercropping patterns

Treatments	Gross income (Rs. ha^{-1})	Total expenditure (Rs. ha^{-1})	Net income (Rs. ha^{-1})	Cost benefit ratio	Land equivalent ratio (LER)
Canola alone	32320.76	14116.89	18203.87	2.29	-
Wheat alone	32265.50	15213.38	17052.12	2.12	-
Canola + one row of wheat intercropping	37851.47	15364.49	22486.98	2.46	1.17
Canola + two rows of wheat intercropping	34451.41	15994.39	18457.02	2.15	1.05
Canola + three rows of wheat intercropping	34127.53	16434.49	17693.04	2.08	1.02

Price/40 kg, Canola: Seed yield = Rs.825, Straw/stover = Rs.5.00; Wheat: Grain yield = Rs.240, Straw = Rs.50

which differed significantly from rest of the treatments. However, canola planted with two and three rows of wheat produce the minimum seed yield. These results confirm the findings of Singh and Pal (1994).

Canola seed oil contents were also affected by different intercropping patterns. Maximum seed oil content (44%) were obtained with canola planted alone and remained statistically on a par with canola + one row of wheat which produced 41.6% seed oil content. However, minimum seed oil content (39.8%) were recorded in a three rows wheat intercropping pattern. These findings are however, contrary to the findings of Ayisi *et al*. (1997) who reported lowest seed oil content in sole cropping system.

As regards monetary gains, highest net income of Rs.22,486.98 ha^{-1} was achieved in case of canola with one row of wheat arrangement as against Rs.18,457.02 and Rs.17,693.04 ha^{-1} for canola with two and three rows of wheat intercropping patterns, respectively (Table II). Similarly, highest benefit cost ratio of 2.46 was recorded in case of canola with one row of wheat followed by 2.15 and 2.08 in canola with two and three rows of wheat arrangement respectively. Maximum LER (1.17) was also obtained in case of canola with one row of wheat intercropping pattern as against 1.05 and 1.02 for two and three rows of intercropping pattern respectively while, total net returns of Rs.18203.87 ha^{-1} was found in case of canola planted alone. Verma *et al*. (1997) reported the similar findings that intercropping of wheat and Indian mustard gave maximum net return, benefit cost ratio and land equivalent ratio.

CONCLUSION

Canola-wheat intercropping can successfully be practised without too much inter-crop competition. Meanwhile, canola + one row of wheat intercropping pattern appeared to be not only a productive practice but also highly profitable as compared to other intercropping patterns and sole cropping of either component crop.

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