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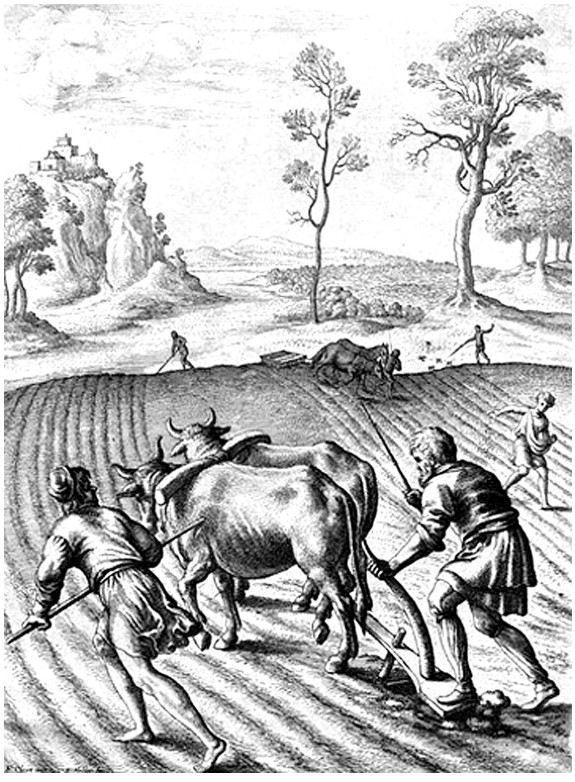

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Agro-economic Advantages of Different Canola-based Intercropping Systems

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Abstract: Agro-economic advantages of different intercropping systems i.e. canola+one row of wheat, canola+two rows of wheat, canola+one row of gram, canola+two rows of gram, canola+one row of lentil, canola+two rows of lentil, canola+one row of linseed and canola+two rows of linseed were compared with sole cropping of canola for two consecutive years under field conditions. Canola seed yield equivalent, land equivalent ratio, area-time equivalent ratio and net income values of canola+one row of wheat intercropping system was higher than the other intercropping systems and sole cropping of canola.

Key words: Agro-economic advantages, canola-based intercropping systems

Introduction

Intercropping not only enhances the farm productivity but also provides security against the potential risks of monoculture. It helps in providing the diversified needs of the small farmers (Faris ***et al.***, 1976) who, in general practice subsistence farming. Thus it is imperative to look for such intercropping systems which have the potential of raising minor crops successfully in association with other crops of Pakistan like canola. Intercropping in canola has been reported to increase bio-economic efficiency of a farm determined in terms of canola seed yield equivalent, land equivalent ratio (Khan ***et al.***, 1988), area-time equivalent ratio and net field benefits (Bajwa ***et al.***, 1992) substantially over the monocropping of canola. Thus keeping in view, the importance of intercropping in intensive agriculture of Pakistan, the present study was planned to assess the agro-economic advantages of some canola-based intercropping systems under agro-climatic conditions of Faisalabad.

Materials and Methods

The present study was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad during winter season of 1999-2000 and repeated in the same season in 2000-2001. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Intercropping systems were: no intercropping (sole canola), canola+one row of wheat, canola+two rows of wheat, canola+one row of gram, canola+two rows of gram, canola+one

row of lentil, canola+two rows of lentil, canola+one row of linseed and canola+two rows of linseed. Plot size was 2.4 × 5.1 m^2. For the monoculture of gram, lentil and linseed the net plot sizes were also 2.4 × 5.1 m^2 but for wheat, it was 2.5 × 5.1 m^2. Seed bed preparation was uniform for both sole cropping and intercropping. The same varieties of canola (Hyola-401), wheat (Inqlab-91), gram (Bittal-98), lentil (Masoor-93) and linseed (Chandni) were used during both the years. Canola was sown on 14th October with a single row hand drill in 60 cm spaced paired row strips (60/20 cm). Intercrops were sown on 23rd October along with monoculture of wheat, gram, lentil and linseed. All the crops except wheat thinned twice to maintain optimum plant population. A basal dose of 90 kg N and 60 kg P_2O_5 ha^{-1} was applied in all the treatments. Three irrigations were applied at different growth stages of canola. All other agronomic practices were kept normal and uniform for all the treatments. Both sole and intercrops were harvested manually and tied into separate bundles. The sun dried crops were threshed manually. Canola seed yield equivalent was computed by converting the yields of intercrops into the seed yield of canola, based on the market price of each intercrop (Anjeneyulu ***et al.***, 1982). Land equivalent ratio (LER) and area-time equivalent ratio (ATER) were computed using the formulae described by Willey (1979) and Hiebsch (1980), respectively.

Results and Discussion

Canola seed yield equivalent (CSYE)

Canola seed yield equivalent is the seed yield of canola plus yield of an intercrop transformed into canola seed yield. CSYE of all intercropping systems was higher than seed yield of the monocropped canola, which indicates advantage of intercropping in canola over the sole canola. The maximum CSYE was obtained from canola+one row of wheat followed by canola+two rows of wheat, canola+one row of linseed, canola+one row of gram, canola+two rows of linseed, canola+one row of lentil, canola+two rows of gram and canola+two rows of lentil. Singh ***et al.*** (1992) and Khan and Saeed (1997) reported considerable increase in wheat grain yield equivalent (WGYE) due to intercropping. The difference among CSYE of different intercropping systems were attributed to the variable price and yield of the component crops (Table 1).

Land equivalent ratio

Land equivalent ratio (LER) is the relative area of sole crop required to produce the yield achieved in intercropping (Khan ***et al.***, 1988). It is usually stipulated that the level of management must be the same for intercropping as for sole cropping. LER values were greater than one in all the intercropping systems except canola+one row of gram and canola+two rows of gram, indicating the yield advantage of intercropping over sole cropping of canola. Based on two years average data, total LER ranged between 1.00-1.24 ha^{-1} in different intercropping systems. It means that maximum agronomic advantage of intercropping over monocropping is 24% in these

Table 1: Canola seed yield equivalent, land equivalent ratio, area-time equivalent ratio and net income as affected by different canola-based intercropping systems

Treatments	Canola seed yield equivalent (kg ha^{-1})			Land equivalent ratio			Area-time equivalent			Net income (Rs. ha^{-1})
	1999-2000	2000-2001	Mean	1999-2000	2000-2001	Mean	1999-2000	2000-2001	Mean	2 years average
Intercropping systems										
I_1=Canola alone	3361	3295	3328	1.00	1.00	1.00	1.00	1.00	1.00	36512
I_2=Canola+one row of wheat	3697	3632	3665	1.24	1.24	1.24	1.16	1.16	1.16	43126
I_3=Canola+two rows of wheat	3540	3475	3508	1.21	1.21	1.21	1.14	1.14	1.14	40830
I_4=Canola+one row of gram	3416	3355	3386	1.00	1.01	1.00	0.95	0.96	0.96	36944
I_5=Canola+two rows of gram	3371	3305	3338	1.00	1.00	1.00	0.95	0.95	0.95	35944
I_6=Canola+one row of lentil	3380	3313	3347	1.03	1.04	1.04	0.98	0.99	0.99	36505
I_7=Canola+two rows of lentil	3369	3303	3336	1.03	1.03	1.03	0.98	0.98	0.98	36551
I_8=Canola+one row of linseed	3372	3403	3438	1.10	1.10	1.10	1.06	1.05	1.06	37706
I_9=Canola+tow rows of linseed	3391	3328	3360	1.07	1.08	1.08	1.02	1.03	1.03	36531

canola-based intercropping systems. In other words, it is possible to harvest yield from one ha of intercropping equivalent to that from 1.00-1.24 ha of sole cropping of canola. Singh and Gupta (1994) and Patrick ***et al.*** (1995) also reported higher LER for intercropping than that for sole cropping.

Area-time equivalent ratio

Since LER does not take into account the time for which land is occupied by the component crops of an intercropping system, area-time equivalent ratio (ATER) was also determined. On the basis of two years average data, ATER values indicated an advantage of 16, 14, 6 and 3% in canola+one row of wheat, canola+two rows of wheat, canola+one row of linseed and canola+two rows of linseed, respectively. While, other four treatments showed disadvantages by 0.01-0.05%. Higher value of ATER in intercropping treatments compared with monoculture of canola might be attributed to efficient utilization of natural (land solar radiation) and added (fertilizer, water) resources. Higher ATERs have also been reported in corn+cowpea (Allen and Oburo, 1983), wheat+methra and wheat+linseed (Khan and Saeed, 1997), associations compared with monocultures of the component crops.

Net income

All the intercropping systems gave higher net income than monoculture of canola except canola+two rows of gram and canola+one row of lentil. Canola+one row of wheat gave the maximum net income followed by canola+two rows of wheat, canola+one row of linseed, canola+one row of gram, canola+two rows of linseed and canola+two rows of lentil, against the minimum in canola+two rows of gram.

It is evident from the above discussion that intercropping in canola can go a long way in enhancing the agro-economic advantages to farmer under Faisalabad conditions if the component crops (especially wheat) grown in independent strips and are properly managed.

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