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# Sunflower-Summer Legumes Intercropping Systems under Rainfed Conditions: Economic Analysis

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Studies pertaining to the economic efficiency of intercropping summer legumes in sunflower under rainfed conditions were carried out at University of Arid Agriculture, Rawalpindi. Intercropping systems gave higher gross income, net income and benefit cost ratio than the sole cropping of component crops. Amongst the varoius intercropping systems studied, sunflower-mungbean combination proved to be the best as it gave the highest per hectare gross income (Rs. 18431.04), net income (Rs.10723.04) and benefit cost ratio (2.39) and it was followed by sunflower-soybean and sunflower-mashbean intercropping systems, respectively.

***Key words***: *Helianthus annuus* L,*Glycine max* Merr, *Vigna radiata* Roxb, *V. mungo*, Net income, Benefit cost ratio.

## Introduction

The profitability of an intercropping system is determined by its ultimate economic returns. Willey and Osiru (1972) suggested that the intercropping of maize with legumes appeared to be more profitable; the economic returns can be greater if relatively higher value legumes suitable for intercropping are chosen. Long term returns generated by intercropping were higher than sole cropping (Singh and Jha 1984). Iqbal (1987) stated that alternate single rows pattern gave 36.05 % yield advantage in gram-lentil intercropping system compared to sole cropping of component crops. Gunasena *et al* (1979) found that maize-cowpea and maize-green gram intercropping combinations produced higher gross income than the respective crop grown in pure stand. Intercropping of groundnut in the interspaces of maize resulted in higher net profit (Pandey *et al* 1981). Similarly, Samui and Roy (1990) inferred that intercropping groundnut + sunflower in a 1:1 row proportion resulted in highest net returns. Also, Ujjinaiah *et al* (1991) concluded that intercropping sunflower and pigeonpea in a 1:1 row ratio gave the highest net returns. Under unfavourable weather conditions, groundnut may fail, but sunflower brings some returns, while under favourable conditions, both crops in combination bring still higher returns as compared to sole crops (Sindagi 1982). Umrani *et al* (1987) reported that intercropping sunflower and pigeonpea gave highest net returns and benefit cost ratio. Similarly, highest net returns and benefit cost ratio were obtained in groundnut-sunflower intercropping system (Koppalkar and Sheelavantar 1990). The present study was, therefore, designed to explore the economically best sunflower-summer legume intercropping system for rainfed conditions.

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## Materials and Methods

For estimating benefits from intercropping systems, sunflower (*Helianthus annuus* L.) hybrid SF-187, soybean (*Glycine max* Merr) ,variety NARC-2, mungbean (*Vigna radiata*), variety NCM-209 and mashbean (*Vigna mungo*), variety MASH-2 were grown in pure stands and in intercropping systems, where legumes were intercropped in sunflower in alternate rows at University of Arid Agriculture, Rawalpindi following recommended agronomic practices. The design employed for the experiment was Randomized Complate Block Design with four replications and a net plot size of 4.5 x 10 $m^2$ was maintained. All the crops included in the study were grown following recommended row spacing in the sole cropping. In the intercropping systems, simply a row of legume was added in the inter-row space of sunflower. In the sole cropping the fertilizer was applied at the recommended rate of individual crops while in the intercropping systems, the recommended dose of fertilizer for sunflower was added. All the crops were planted and harvested at the same time. Seed yield was obtained from an area of 18 $m^2$ plot $^{-1}$ and then converted to kg $ha^{-1}$. The yield was multiplied with the respective crop prices for the gross income, which was determined separately for each treatment. Total expenditure was also calculated separately for each treatment. Net income was calculated by subtracting total expenditure from the gross income. Benefit cost ratio was determined by dividing gross income with total expenditure and multiplied with 100.

## Results and Discussion

Economic analysis alongwith all relevant calculations presented in Table 1 revealed that various intercropping systems under study gave higher gross income, net income and benefit cost

**Table 1**

Economic analysis of sunflower-summer legumes intercropping systems.

| Treatments | Seed Yield (Kg ha$^{-1}$) | | | | Income (Rs/ha) | | | | Gross income (Rs/ha) | Total expenditure (Rs/ha) | Net income (Rs/ha) | BCR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sun flower | Soy bean | Mung bean | Mash bean | Sun flower | Soy bean | Mung bean | Mash bean | | | | |
| Sunflower alone | NS 1636.85 | - | - | - | 13094.80 | - | - | - | 13094.80 | 6734.80 | 6360.00 | 194 |
| Soybean alone | - | 1917.66 a | - | - | - | 13423.62 | - | - | 13423.62 | 7953.60 | 5470.02 | 169 |
| Mungbean alone | - | - | 725.28 a | - | - | - | 13780.30 | - | 13780.30 | 6262.50 | 7517.80 | 220 |
| Mashbean alone | - | - | - | 646.53 a | - | - | - | 12607.33 | 12607.33 | 6210.50 | 6396.83 | 203 |
| Sunflower + Soybean | 1536.03 | 841.92 b | - | - | 12288.24 | 5893.44 | - | - | 18181.68 | 8164.20 | 10017.48 | 223 |
| Sunflower + Mungbean | 1517.63 | - | 327.77 b | - | 12141.04 | - | 6227.63 | - | 18431.04 | 7708.00 | 10723.04 | 239 |
| Sunflower + Mashbean | 1484.80 | - | - | 280.55 b | 11878.40 | - | - | 5470.73 | 17349.13 | 7658.72 | 9690.41 | 227 |

Any two means not sharing a letter common in a column differ significantly at 5% level of probability. Market price of one kg seed; Sunflower: Rs. 8.00; Soybean: Rs. 7.00; Mung bean: Rs. 19.00; Mashbean: Rs. 19.50; BCR = Benefit Cost Ratio.

ratio per hactare than the sole cropping of component crops. Amongst the various intercropping systems studied, the maximum gross income of Rs.18431.04 was obtained in case of sunflower-mungbean intercropping system as against rupees 18181.68, 17349.13, 13780.30, 13423.62, 13094.80, and 12607.33 for sunflower-soybean, sunflower-mashbean, mungbean alone, soybean alone, sunflower alone and mashbean alone respectively. The results are closely related with earlier findings of Gunasena *et al* (1979) that maize-cowpea and maize-green gram intercropping combinations produced higher gross income than the respective crops grown alone.

The maximum net income of Rs. 10723.04 ha$^{-1}$ was obtained in case of sunflower-mungbean intercropping system as against Rs.10017.48, 9690.41,7517.80, 6396.83, and 5470.02 from sunflower-soybean, sunflower-mashbean, mungbean alone, mashbean alone, sunflower alone and soybean alone, respectively. The results support the conclusions drawn by other workers (Ujjinaiah *et al* 1991), who concluded that intercropping sunflower and pigeonpea in a 1:1 row ratio gave the highest net returns. In terms of percentage, there was 68.60, 57.51 and 52.36% increase in the net income per hectare from sunflower-mungbean, sunflower-soybean and sunflower-mashbean intercropping systems, respectively over sunflower alone. The results are in line with the findings of other researchers (Iqbal 1987), who inferred that alternate single rows pattern gave 36.05% yield advantage in gram-lentil intercropping system, compared to sole cropping of component crops.

The highest benefit cost ratio (BCR) of 2.39 was obtained in sunflower-mungbean intercropping system as against 2.27, 2.23, 2.20, 2.03 and 1.94 and 1.69 for intercropping systems comprising sunflower-mashbean, sunflower-soybean, mungbean alone, mashbean alone, sunflower alone and soybean alone, respectively. The findings are in agreement with the results of other studies (Koppalkar and Sheelavantar 1990) that highest benefit cost ratio was obtained in groundnut-sunflower intercropping system compared to sole cropping of component crops.

Rainfed farming is prone to high risks due to uncertain weather conditions. Intercropping not only minimizes the risk level, but also gives higher return simply by better management of the crops. For higher returns, the suitability of crops in an intercropping system depends upon its market prices. Under the prevailing market prices, mungbean has proved to be the most suitable summer legume to be intercropped with sunflower.

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