

Feasibility of Relay Cropping Berseem with Autumn Planted Sunflower

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ABSTRACT

An experiment, into feasibility of relaying berseem with autumn planted sunflower for increasing per unit area income, was conducted during 1997-98, 1998-99 and 1999-2000 at Agronomic Research Area, Ayub Agricultural Research Institute, Faisalabad. Relay cropping of berseem with sunflower efficiently increased per unit area income. Growing berseem as a relay crop in sunflower planted at 90 cm apart rows resulted in the highest gross income of Rs. 44939/- and net income of Rs. 27646/- per hectare. Relay cropping of berseem increased per unit area gross income by 71% as compared with sole crop of sunflower and by 10% in comparison with sole conventional sown berseem crop. Land equivalent ratio was increased to 1.66 in relay cropping over mono culture and the maximum land equivalent ratio of 1.73 was found in case of berseem relayed in sunflower sown at 90 cm inter row spacing. Moreover, the highest benefit cost ratio of 2.60 was found from the same treatment.

Key Words: *Helianthus annuus* L.; *Trifolium alexandrinum*; Relay Cropping; Economic return; Pakistan; Seed yield

INTRODUCTION

Edible oil consumption in Pakistan is increasing at the rate of 50-60 thousand tons per annum; whereas, its production is lagging far behind. A big crunch of foreign exchange is being incurred annually on its import (Butt, 2001). Sunflower (*Helianthus annuus* L.) can play important role in edible oil Production (Rashid & Iqbal, 2001). Sunflower seed contains 40-45% oil of best quality which can be directly used for cooking purposes without any further processing.

Area under sunflower is hardly increasing and the edible oil situation in Pakistan is becoming more and more gruesome. Due to small land holding and subsistence farming it is becoming almost impossible to bring more area under oilseed crops especially sunflower. Oil seed crop production can be enhanced either by developing and providing best agronomic package of technology or by growing more number of crops from the same piece of land under the existing available resources which is so called inter or relay cropping.

One of the best scopes of increasing area under sunflower is to adjust it in sunflower-berseem relay cropping system. Average of last ten years data revealed that only in Punjab an area of about 72 thousands hectare comes under berseem (Anonymous, 1994). In central Punjab, almost every farmer grows berseem for his own farm and milch animals. If sunflower is planted in that very land during 1st week of September and berseem is broadcast in it during last week of September at the time of 1st irrigation to sunflower, will not only increase per unit area income of the farmers but it will also increase sunflower

seed production considerably for adding edible oil production to cope with the domestic needs to greater extent.

It has been evidenced by various workers that per unit area income is significantly enhanced by planting various crops as relay crops in sunflower. Ibrar *et al.* (1999) obtained significantly higher gross income, net income and benefit cost ratio from inter cropping treatments than sole cropping of component crops. Samui and Roy (1990) from an experiment inferred that inter cropping groundnut with sunflower in a 1:1 row proportion resulted in the higher net returns. Similarly, Ujjinaiah *et al.* (1991) concluded that inter cropping sunflower and pigeon pea in a 1:1 row ratio gave the highest net returns in comparison with component sole crops. In an investigation, Chattha *et al.* (1995) obtained an additional income of Rs.10842/- per hectare by inter cropping four rows of mung bean in strip planted sunflower as compared with sequence crop. Venkates *et al.* (1980) found that inter cropping of sunflower or sesamum in groundnut gave higher yields compared with in pure stand.

MATERIALS AND METHODS

The trial was laid out on well-prepared soil using randomized complete block design. It was replicated thrice maintaining a net plot size of 9 x 9 m. Sunflower was sown during last week of August by hand drill according to the treatments. Seed of sunflower was used at the rate of 7.50 kg ha⁻¹. In all four irrigations were applied to sunflower. First irrigation was given 30 days after sowing, 2nd at button stage, 3rd at flowering and the 4th irrigation at grain filling

was applied. Berseem seed @ 20 kg ha⁻¹ was broadcast in the last week of September at first irrigation to sunflower as relay as well as a sole crop. Fertilizer @ 90-75-25 and 25-50-0 NPK kg ha⁻¹ was applied to sunflower and berseem, respectively. Fertilizer to sunflower was applied at sowing; whereas, to berseem it was given at 1st irrigation to it. All the other agronomic practices were kept uniform. Yield and income data recorded were subjected to analysis of variance (Steel & Torrie, 1980) and Land Equirealant Ratio (LER) was calculated using the following formula:

$$LER = \frac{\text{Yield of intercrop}}{\text{Yield of sole crop}}$$

$$\text{Cost Benefit Ratio} = \frac{\text{Total income}}{\text{Total Expenditure}}$$

The treatments in detail are given as under:

- T₁ = Sunflower planted alone at 75 cm apart rows.
 T₂ = Sunflower planted alone at 90 cm apart rows.
 T₃ = Sunflower planted alone at 100 cm apart rows.
 T₄ = Sunflower as in T₁ + berseem.
 T₅ = Sunflower as in T₂ + berseem.
 T₆ = Sunflower as in T₃ + berseem.
 T₇ = Berseem alone.

RESULTS AND DISCUSSION

Yield analysis. Seed yield of sunflower as well as that of berseem was significantly decreased in each combination as compared with sole crop treatments (Table I). Row to row distance also affected yield of both the crops. Maximum sunflower seed yields of 1064.69 kg ha⁻¹ was obtained from sunflower sown at 75 cm inter row spacing as a sole crop and was followed by sunflower sown at 75 cm apart rows and berseem relayed in it with the seed yield of 1042.09 kg ha⁻¹; whereas, the lowest sunflower seed yields of 903.47 and

904.08 kg ha⁻¹ were harvested from sunflower sown at 100 cm apart rows alone and berseem relayed in it, respectively. Maximum berseem fodder yield of 45.21 t ha⁻¹ was obtained from berseem alone followed by 37.98 and 37.09 t ha⁻¹ when it was relayed with sunflower sown at 100 and 90 cm row spacings, respectively. The lowest berseem fodder yield of 35.6 t ha⁻¹ was harvested from berseem relayed in sunflower planted at 75 cm apart rows. LER of all the relay cropping treatments was more than sole cropping treatments (Table II). Thus, the maximum LER of 1.73 was found in case of berseem relayed in sunflower sown at 90 cm apart rows.

The results are in conformity with those of Chattha *et al.* (1983) who have reported significant effect of inter row spacing on sunflower seed yield. Similarly, findings of Bhatti *et al.* (1995) also support the results of this study which concludes that inter cropping of corn and mung with soyabean significantly depressed the performance of soyabean resulting in reduction in seed yield.

Economic analysis. Gross income per unit area as an average of three years of investigation was significantly increased when berseem was relayed with sunflower in each treatment (Table II). The highest income of Rs.44939/- ha⁻¹ was obtained from berseem relayed in sunflower sown at 90 cm inter row spacing. It was followed by berseem relayed in sunflower sown at 100 cm inter row spacing with gross income of Rs.44366.54 ha⁻¹. Growing of sunflower alone at 100 cm inter row spacing gave the lowest monetary returns of Rs.11282/- ha⁻¹. Maximum cost benefit ratio of 2.60 was found in case of berseem relayed with sunflower sown at 90 cm apart row and was followed by berseem relayed with sunflower sown at 100 cm apart rows with BCR of 2.57 (Table III). The lowest BCR of 1.66 was observed in case of sunflower planted alone at 100 cm apart rows.

The results are in support of those reported by Ujjinaiah *et al.* (1991) who concluded that inter cropping

Table I. Sunflower seed and berseem fodder yield as affected by relay cropping

Treatments	Sunflower (kg ha ⁻¹) seed yield				Berseem (kg ha ⁻¹) fodder			
	1997-98	1998-99	1999-00	Mean	1997-98	1998-99	1999-00	Mean
Sunflower planted alone at 75 cm apart rows	819.00	1383.33 a	991.75 a	1064.69 a	-	-	-	-
Sunflower planted alone at 90 cm apart rows	827.12	1375.00 a	796.32 bc	999.48 b	-	-	-	-
Sunflower planted alone at 100 cm apart rows	716.01	1278.00 c	716.07 c	903.47 c	-	-	-	-
Sunflower as in T ₁ + berseem	835.35	1386.67 a	901.26 ab	1042.09 a	42.37 c	13.71 c	35.6 b	30.56 c
Sunflower as in T ₂ + berseem	784.73	1335.00 b	830.06 abc	983.26 b	59.68 bc	14.58 c	37.01 b	37.09 b
Sunflower as in T ₃ + berseem	740.29	1260.00 c	711.95 c	904.08 c	61.08 b	15.02 b	37.85 b	37.98 b
Berseem alone	-	-	-	-	73.32 a	17.41 a	44.90 a	45.21 a
LSD at 5 %	N.S	34.42	1.324	17.872	11.564	3.878	6.935	7.459

Table II. Economic analysis of sunflower – berseem relay cropping

Treatments	Gross returns (Rs. ha ⁻¹)				Expenditure (Rs. ha ⁻¹)			
	1997-98	1998-99	1999-00	Mean	Sunflower	Berseem	Total	Net income
Sunflower planted alone at 75 cm apart rows	10236.04 d	17291.67 c	12350.00 d	13292.57 c	6795.60	-	6795.60	6496.97
Sunflower planted alone at 90 cm apart rows	10201.00 d	17187.50 c	9916.26 e	12434.94 c	6795.60	-	6795.60	5639.34
Sunflower planted alone at 100 cm apart rows	8950.12 e	15979.17 c	8917.50 f	11282.26 d	6795.60	-	6795.60	4486.67
Sunflower as in T ₁ + berseem	36925.52 c	44083.33 b	33516.10 a	39481.38 b	6795.60	10497.50	17293.10	22188.28
Sunflower as in T ₂ + berseem	48101.87 a	53145.83 a	33569.55 a	44939.08 a	6795.60	10497.50	17293.10	27645.98
Sunflower as in T ₃ + berseem	47387.40 ab	531.00 a	32612.22 b	44366.54 ab	6795.60	10497.50	17293.10	27073.44
Berseem alone	45825.00 bc	43533.33 b	28182.17 c	39180.17 b	-	15338	15338	23842.17
LSD at 5 %	3839.97	721.23	633.57	1731.59	-	-	-	-

Table III. Land Equivalent Ratio (LER) and Benefit Cost Ratio (BCR) of sunflower – berseem relay cropping

Treatments	Land equivalent Ratio			BCR
	Sunflower	Berseem	Total	
Sunflower planted alone at 75 cm apart rows	1	-	1	1.96
Sunflower planted alone at 90 cm apart rows	0.94	-	0.94	1.83
Sunflower planted alone at 100 cm apart rows	0.85	-	0.85	1.66
Sunflower as in T ₁ + berseem	0.98	0.68	1.56	2.28
Sunflower as in T ₂ + berseem	0.92	0.82	1.73	2.60
Sunflower as in T ₃ + berseem	0.85	0.84	1.68	2.57
Berseem alone		1	1	2.55

sunflower and pigeon pea gave the highest net returns. Similarly, Ibrar *et al.* (1999) found 58-60% increase in net income per hectare from sunflower mung bean inter cropping system.

From this study, it can be concluded that berseem as rabi fodder can successfully be relayed in autumn planted sunflower and it will ensure a considerable increase in per unit area income.

REFERENCES

- Anonymous, 1994. *Area, production and yield of fodder crops in Punjab*. pp: 182-3 Punjab Development Statistics, Bureau of Statistics, Government of the Punjab
- Bhatti, M.S., A. Rashid, M.S. Iqbal and M.Z. Khan, 1995. Efficiency of soyabean inter cropping with corn and mung. *J. Agric. Res.*, 33: 7-14
- Butt, M.A., 2001. Growing Oilseed crops (Urdu). pp: 3-4. Directorate of Agriculture Information, Punjab-Lahore
- Chattha, A.A., H.M. Akram, K. Jamil, A. Yar and A. Ali, 1995. Agro. economic exploitation of sunflower and mung bean inter cropping. *J. Agric. Res.*, 33: 311-5
- Chattha, A.A., M. Arshad and S. Ahmad, 1986. Effect of inter cropping mung bean and sunflower in sugarcane. *J. Agric. Res.*, 24: 103-7
- Ibrar, R., S. Ahmad and M.A. Malik, 1999. Sunflower summer legumes inter cropping systems under rain fed conditions: An economic analysis. *J. Agric. Res.*, 37: 231-6
- Rashid, A. and M.S. Iqbal, 2001. Growing oil seed crops (urdu), pp: 5-12 Directorate of Agriculture Information, Punjab-Lahore
- Samui, R.C. and A. Roy, 1990. Possibilities of increasing production of oil seed through inter cropping system. *J. Oil Seed Res.*, 7: 14-21
- Steel, R.G.D. and J.H. Torrie, 1980. *Principles and Procedures of Statistics: A Biometrical Approach*, 2nd Ed., pp: 107-9. Mc Graw Hill Co. Inc. New York, USA
- Ujjinaiah, U.S., B.G. Rajash Kumar, N. Venugopal and K. Seenappa, 1991. Sunflower-pigeon pea inter cropping. *J. Oil Seed Res.*, 8: 72-8
- Venkates, Warlu, M.S., R.S. Rao., M.S.S. Rajan and G.H.S. Reddy, 1980. Agronomic strategy to increase oil and protein yield. *Indian Agron. J.*, 25: 562-3

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