

## Wheat-Soybean Intercropping Studies under Different Row Proportions

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### ABSTRACT

A field experiment was conducted at Agricultural College Farm, Dharwad, during *rabi* 1988 to study the performance of soybean with wheat under different row proportions. Intercropping of soybean with wheat affected the growth and yield of soybean significantly compared to sole soybean. Among different row proportions of wheat and soybean, total grain yield of soybean was significantly higher with 1:2 and 3:1 proportions. Further, 1:2 (Rs. 6398/ha) and 3:1 (Rs. 6314/ha) proportions have also recorded higher gross returns than the remaining treatments.

In India, there is a shortage of pulse production. The per capita availability of pulse in India is only 35 g/day as against the recommended 85 g by nutrition experts. Therefore, greater emphasis is now being laid on introduction of pulse in regular cropping system. It has been proved that intercropping gives stabilized yield advantage, especially under adverse weather conditions. Soybean is an important pulse crop which has unmatched yield potential especially during *kharif* season. However, sufficient information is not available with regard to its cultivation during *rabi* season and also as an intercrop with winter cereals. A recent study by Halwankar *et al.* (1989) has shown that soybean could be cultivated profitably even during *rabi* season. Since soybean can better fit in as an intercrop in winter cereals like wheat it may help

the farmers to get additional pulse yield without much reduction in the main crop.

With this background, a field experiment was conducted to study feasibility of growing soybean as an intercrop with wheat with suitable row proportion to get higher total yield and monetary returns.

### MATERIAL AND METHODS

An experiment was conducted at Agricultural College Farm, Dharwad, during *rabi* 1988. The soil of the experimental plot was clayey in texture. The experiment was conducted in a randomised block design with 14 treatments replicated thrice. The treatments consisted of different row proportions of wheat and soybean. Recommended doses of fertilizer were applied to the respective crops. Wheat (Kiran) and soybean (Monetta) were sown in 22.5cm

row spacing and a intra spacing of 10 cm was maintained for soybean within a row. The gross plot size was 3.15 m × 3.0 m. There was hardly any rainfall during the cropping season extending from November to February. So, two irrigations were given one at sowing and another a week after sowing. A dry spell prevailed throughout the cropping season. Soybean and wheat were harvested at 90 and 102 days after sowing, respectively.

## RESULTS AND DISCUSSION

**Performance of soybean in cropping system :** Intercropped soybean recorded significantly lower grain yield than sole soybean which was 30% of the sole crop yield (Table 1). This reduction may be attributed to interspecies competition wherein wheat due to its adaptation to the season fared better and competed vigorously with soybean for growth resources. As a result, the soybean produced significantly lower dry matter (2.31 g/plant), number of pods (7.25/plant) and grain yield (0.74 g/plant) than sole soybean ultimately resulting in low grain yield. This is in conformity with Chan *et al.* (1980), McBroom *et al.* (1981) and Reinbott *et al.* (1987). The straw yield also followed same trend as that of grain yield.

**Performance of soybean in different wheat row proportions :** With the increase in wheat rows from one to four, the soybean yield decreased significantly from 246 to 112 kg/ha. This could be partly attributed to decreased soybean population with corresponding increase in wheat population and partly to accumulated effects of yield attributes which recorded lower values with the increase in number of wheat rows.

**Performance of soybean in different soybean row proportions :** Grain yield of soybean increased significantly from 113 kg/ha with one row to 176 kg/ha with two rows and to 233 kg/ha with three rows. The increase in soybean yield is due to increase in soybean population and corresponding decrease in interspecies competition as evidenced by significant and improved yield attributes viz., dry matter, number of pods and grain yield per plant.

**Interaction of wheat and soybean row proportions on soybean yield :** The variation in row proportions caused significant variation in soybean grain yield. The yield of soybean was higher in 1:3 and 2:3 proportions followed by 2:2 and 1:2 row proportions thus indicating superior performance of soybean whenever it formed more than 50% of the total population, which again may be due to reduced interspecies competition. Similar trend was noticed with respect to straw yield.

**Soybean equivalent yield and gross returns :** The soybean equivalent yield was higher (14.22 q/ha) with 1:2 proportions resulting in a gross return of 6398 Rs/ha than with other proportions (Table 2). However, except 2:1 and sole soybean all other combinations including sole wheat were on par with each other in soybean yield equivalent. This is mainly due to poor performance of soybean under intercropping situation in winter season particularly under inadequate moisture conditions which was further aggravated by wheat component as it is adapted to receding soil moisture conditions. Similarly, Trilok Singh *et al.* (1981) and Nathusingh and Sandhu (1985) also noticed no

Table 1. Yield and yield components of soybean as influenced by wheat row proportions

Row proportions of wheat (W) and soybean (S)	Total dry matter (g/plant)	Number of pods/plant	Grain weight (g/plant)	100 seed weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
1 : 1	2.04	6.10	0.63	6.18	196	188
1 : 2	2.22	6.80	0.81	6.30	228	216
1 : 3	2.89	9.33	1.06	6.62	314	394
2 : 1	1.88	6.86	0.53	6.31	123	129
2 : 2	2.10	6.06	0.67	6.70	245	248
2 : 3	3.35	9.13	1.18	6.04	255	279
3 : 1	1.69	5.60	0.49	6.06	62	55
3 : 2	2.37	7.53	0.77	5.86	134	115
3 : 3	2.50	8.20	0.78	5.91	195	158
4 : 1	2.14	6.60	0.57	6.04	71	42
4 : 2	2.20	6.93	0.67	6.06	98	90
4 : 3	2.40	7.86	0.77	6.18	168	134
Sole soybean	8.06	27.06	1.73	6.12	581	596
S.Em. $\pm$	0.28	1.14	0.09	0.33	20	23
C. D. at 5%	0.82	3.32	0.26	N.S.	59	66
<i>Cropping system :</i>						
Sole	8.06	27.06	1.73	6.12	581	596
Intercropping	2.31	7.25	0.74	6.19	174	171
S.Em. $\pm$	0.31	1.27	0.09	0.37	23	25
C. D. at 5%	0.65	2.63	0.20	N.S.	47	52
<i>Wheat row proportion (W) :</i>						
1	2.38	7.41	0.83	6.37	246	266
2	2.44	7.35	0.79	5.35	207	219
3	2.18	7.11	0.68	5.94	130	109
4	2.24	7.13	0.68	6.09	112	89
S.Em. $\pm$	0.16	0.66	0.05	0.19	12	13
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	34	38
<i>Soybean row proportion (S) :</i>						
1	1.93	6.29	0.55	6.15	113	104
2	2.22	6.83	0.74	6.23	176	167
3	2.78	8.63	0.94	6.19	233	241
S.Em. $\pm$	0.14	0.57	0.04	0.16	10	11
C. D. at 5%	0.41	1.67	0.13	N.S.	30	33
<i>Interaction (W x S)</i>						
S.Em. $\pm$	0.28	1.14	0.08	0.33	20	23
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	59	66

N. S. - Not significant

Table 2. Grain yield of wheat and soybean, total seed yield in gross returns of wheat + soybean intercropping in different row proportions

Row proportions of wheat (W) and soybean (S) W : S	Grain yield of soybean (q / ha)	Grain yield of wheat (q / ha)	Total seed yield (q / ha) soybean based	Gross returns (Rs / ha)
1 : 1	1.96	13.59	13.59	6116
1 : 2	2.28	13.95	14.22	6398
1 : 3	3.14	10.80	12.39	5575
2 : 1	1.23	12.07	11.57	5205
2 : 2	2.45	12.59	13.23	5952
2 : 3	2.55	11.70	12.56	5652
3 : 1	0.62	15.67	14.03	6314
3 : 2	1.34	13.46	12.86	5786
3 : 3	1.95	12.07	12.29	5531
4 : 1	0.71	14.07	12.75	5739
4 : 2	0.98	15.07	13.88	6247
4 : 3	1.68	12.86	12.69	5711
Sole soybean	5.81	—	5.81	2613
Sole wheat	—	14.95	12.80	5759
S.Em. $\pm$	0.20	0.92	0.79	—
C. D. at 5%	0.59	2.68	2.31	—

Price : Wheat grain Rs. 3.85 / kg

Soybean grain Rs. 4.50 / kg

significant variation in total grain yield under wheat legume intercropping.

The reduced dry matter, pod number and grain weight per plant and test

weight and grain yield of soybean indicate that soybean seems to be sensitive to moisture stress condition particularly as a intercrops better adopted for receding soil moisture condition.

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