

Productivity and economics of *Solanum viarum*-based intercropping system

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ABSTRACT

A field experiment was conducted during 1995–96 and 1996–97 to study the performance of various intercrops in *Solanum viarum* Dunal-based intercropping system and find out the effect of intercrops on yield of main crop vis-a-vis economics of the cropping system. The mean dry berry yield of 3.93 tonnes/ha obtained with *S. viarum* + clusterbean [*Cyamopsis tetragonoloba* (L.) Taubert] system was more than yields realized in pure crop of *S. viarum* (3.63 tonnes/ha). Highest base crop equivalents were also realized with this cropping system (5.54 tonnes/ha), followed by 4.40 tonnes with *S. viarum* + French bean (*Phaseolus vulgaris* L.), 4.16 tonnes with *S. viarum* + soybean [*Glycine max* (L.) Merr.], 3.83 tonnes with greengram (*Phaseolus radiatus* L.) and 3.73 tonnes with *S. viarum* + cowpea [*Vigna unguiculata* (L.) Walp.]. Mean maximum land-equivalent ratio (1.75), net income (Rs 25,581) and income-equivalent ratio (1.61) were also found with *S. viarum* + clusterbean system.

Key words : *Solanum*-based intercropping, Productivity, Economics

In recent years *Solanum viarum* Dunal (syn. *S. khasianum* var. *chatterjeeanum* Sen Gupta) has become an important steroid-yielding crop. As the modern medicine depending more and more on use of steroids, the large-scale cultivation of *Solanum* for production of its berries containing solasodine has become reality and accordingly it is being grown on large scale in Jalagaon area of Maharashtra and northern parts of Karnataka under contract

farming system. To use land efficiently and to generate additional returns to farmers, intercropping can be followed, as the pure crop of *Solanum* is yielding moderate returns at prevailing prices. It has been amply showed that inclusion of legumes in the cropping system helps not only increase the soil fertility but also enhance the yields of base crop (Balyan, 1997). With this background various legume intercrops were tried to find out the productivity and

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economics of *Solanum*-based intercropping system vis-a-vis to identify the suitable and profitable intercrop that can be grown in *Solanum*.

MATERIALS AND METHODS

The field experiment was conducted during 1995-96 and 1996-97 at Hessaraghatta, Bangalore. The soil was sandy clay loam with medium inorganic carbon content (0.5%) and available potassium (140 kg K/ha). However, phosphorus content was low (10 kg P/ha) and the pH of the soil was 6.8. Seven treatments comprising pure crop of *Solanum* and 6 intercrop treatments [cowpea, greengram, clusterbean, soybean, radish (*Raphanus sativus* L.) and French bean] were laid out in randomized complete-block design with 3 replications. After incorporating recommended doses of NPK fertilizers, 2-month-old *Solanum*, *viarum* seedlings were transplanted at 120 cm apart in August in both the years. After few days of transplanting, the seeds of intercrops were sown in 1:3 ratio between *Solanum* rows. For all intercrops, recommended doses of fertilizers were applied. Intercrops were harvested as and when they attained maturity. After drying the *Solanum* berries under the sun for 10-15 days in the field, yields/plot were recorded. The biological advantages of each treatment in terms of land-equivalent ratio (LER) and income equivalent ratio (EER) showing the absolute value of the genuine yield advantage was calculated as suggested by Willey (1979).

Besides these, base crop equivalents were computed after working out the gross

income for each intercropping system. This indicates the quantity of economic yield of main crop that could be bought from additional income generated out of growing intercrop.

RESULTS AND DISCUSSION

Economic yields and land-utilization efficiency

When clusterbean and French bean were intercropped, the dry berry yields of *Solanum* were almost at par or more than the yields realized under pure cropping system (Table 1). Radish as an intercrop severely reduced the yield of *Solanum* (1.45 and 1.08 tonnes/ha). During the first year greengram and French bean were failed to establish due to occurrence of heavy rains in the initial period of crop growth. However, the little biomass produced which has been incorporated into soils might have contributed for yield improvement in *Solanum*. In the second year, even these crops performed moderately and not only gave optimum yield as pure crops but also helped in improving *Solanum* yields. Data on crop equivalents showed that *Solanum* + clusterbean intercropping resulted in maximum base crop equivalent, followed by *Solanum* + French bean, *Solanum* + soybean, *Solanum* + greengram, *Solanum* + cowpea and *Solanum* + radish. Balyan (1997) reported that maize-grain equivalent was increased by 5.6 q/ha when clusterbean was included as an intercrop. He attributed the improvement in grain equivalent owing improvement in moisture-retention capacity of the soil under this intercropping system. This might be due to erect growing habit

Table 1. Economic yields of *Solanum viarum* and intercrops, base crop equivalents and land-equivalent ratio in *Solanum*-based intercropping system

Intercropping system	Dry berry yield of <i>Solanum</i> (tonnes/ha)			Yield of intercrops*			Base crop equivalents (tonnes/ha)			Land-equivalent ratio		
	1995–96	1996–97	Mean	1995–96	1996–97	Mean	1995–96	1996–97	Mean	1995–96	1996–97	Mean
<i>Solanum</i> pure crop	3.36	3.90	3.63				3.36	3.90	3.63	1.00	1.00	1.00
<i>Solanum</i> + cowpea (tonnes/ha)	2.53	3.84	3.17	1.05	2.57	1.81	2.85	4.61	3.73	1.15	1.67	1.41
<i>Solanum</i> + greengram (q/ha)	2.99	3.74	3.37	**	4.17	4.17	2.99	4.66	3.83	0.89	1.58	1.24
<i>Solanum</i> + cluster bean (tonnes/ha)	3.55	4.30	3.93	2.95	3.50	3.23	5.03	6.05	5.54	1.59	1.90	1.75
<i>Solanum</i> + soybean (q/ha)	3.43	3.84	3.64	5.20	5.79	5.50	3.95	4.42	4.16	1.55	1.67	1.61
<i>Solanum</i> + radish (tonnes/ha)	1.45	1.08	1.27	14.46	12.13	12.30	2.90	2.29	2.60	1.23	1.00	1.12
<i>Solanum</i> + French bean (tonnes/ha)	3.51	3.90	3.71	**	2.93	2.93	3.51	5.37	4.40	1.04	1.71	1.71
CD (P=0.05)	NS	1.47					1.59	1.99		0.85	NS	

*Units of yields for intercrops are presented in the parentheses against each treatment; **intercrops failed to establish to give economic yield due to heavy rains

Table 2. Economics of *Solanum viarum*-based intercropping system

Intercropping system	Net returns (Rs/ha)			Land-equivalent ratio**		
	1995-96	1996-97	Mean	1995-96	1996-97	Mean
<i>Solanum</i> pure crop	13,178	18,578	15,878	1.00	1.00	1.00
<i>Solanum</i> + cowpea (tonnes/ha)	1,756	19,416	10,586	0.13	1.05	0.67
<i>Solanum</i> + greengram (q/ha)	5,521	17,191	11,536	0.42	0.93	0.73
<i>Solanum</i> + clusterbean (tonnes/ha)	20,731	30,431	25,581	1.57	1.64	1.61
<i>Solanum</i> + soybean (q/ha)	14,629	19,319	16,974	1.11	1.04	1.08
<i>Solanum</i> + radish (tonnes/ha)	3,513	-2,519	498	0.27	-0.14	0.03
<i>Solanum</i> + French bean (tonnes/ha)	5,128	23,678	14,403	0.40	1.27	0.91
CD (P = 0.05)						

*Intercrops failed to establish due to heavy rains (only main crop returns); **LER computed based on net income realized

coupled with production of low leaf size in clusterbean as compared to other intercrops introduced in the study, resulting in loss of less water and thus offering less competition to main crop.

Average LER was increased, the highest being in *Solanum* + clusterbean, followed by *Solanum* + clusterbean, *Solanum* + French bean and *Solanum* + soybean; and the least LER was observed with *Solanum* + radish system (1.12). Willey (1979) observed that higher land-equivalent ratio in legume-non-legume intercropping system was mainly due to impact of legume component.

Economics

The highest net returns could be realized with *Solanum* + clusterbean intercropping system, followed by *Solanum* + soybean system (Table 2). The non-establishment of French bean during the first year resulted in lower mean values. If one considers the net

income realized during the second year in this system (Rs 23,678), it stood next only to *Solanum* + clusterbean system, indicating that it can also be viable intercropping system. Soybean as an intercrop found to be marginally beneficial by yielding about Rs 1,000 net income. Based on the gains observed in terms of income or LER, land-utilization efficiency and base crop equivalents, it could be inferred that *Solanum* + clusterbean intercropping would be helpful in augmenting the monetary income of farmers compared to growing *Solanum* alone.

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