

Intercropping Studies in Kharif Sorghum Under Rainfed Condition

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Abstract: The study was conducted on medium deep black soil of at Main Agril. Research Station of Dharwad (India) during kharif season of 1998, 1999 and 2000 revealed that sorghum grain equivalent yield (SEY) was found to be significantly higher with sorghum + pigeonpea intercropping system in 3:3 row proportion (128.67 q/ha) compared to other intercropping systems. Sole sorghum recorded least SEY (53.54 q/ha). Net monetary return (Rs/ha) was influenced by treatments during all the three years of investigation. Highest net monetary return (Rs/ha) was recorded by Sorghum + Pigeonpea (22,716 Rs/ha) with 3:3 row proportion followed by Sorghum +Groundnut (19,861 Rs/ha) with 2:4 row proportion, Sorghum +Groundnut (16,133 Rs/ha) with 3:6 row proportion. All the sorghum based intercropping systems with legume crops proved their superiority over the sole cropping of sorghum.

Introduction

Intercropping of two or more crops has been recognized in India and elsewhere since many centuries and the Indian farmers are practicing this system in some or the other form. The practice aims at ensuring stable returns against total crop failure under aberrant weather conditions or pest epidemics. Increasing total productivity per unit land area, equitably and judiciously utilizing land resources and farming inputs including labour are the other advantages of intercropping. Modifications in respect of technique and pattern of planting of associated crops have developed in to intercropping for the substantial yield advantages under dry land agriculture. The advantages are more pronounced during subnormal seasons than normal seasons. In addition economic gains are greater and water use efficiency is better due to intercropping system.

Sorghum (*Sorghum bicolor* (L) Moench) is the major staple food crop of millions of people in the semiarid tropics. In India it ranks third after

rice and wheat. It is mainly used for human consumption and also to feed cattle, poultry and birds. In India sorghum is cultivated over 11.0 m. ha producing 9.5 m. tonne of grain with productivity of 850 kg per ha.

Normally, low canopy crops like pulses and oilseeds are grown as intercrops with sorghum because of their short duration, high protein and oil content and soil improver capacity. Among them soybean and groundnut have great potential even for small farmers with limited resources to fit in their cropping system. In south India these are introduced in a specially evolved low cost technology system called 'combined crop canopy system'. Under this, low profile canopy crops like, soybean/groundnut/pigeonpea are cultivated as intercrops. Therefore, it is desirable to know the suitability of soybean and groundnut and other legume crops in sorghum based cropping system with different row proportions.

Kawamoto *et al.* (1982) reported that mixture of sorghum with soybean gave most

efficient canopy structure, which led to better utilization of light and eventually leading to highest yield of dry matter. Component crops in Sorghum + Pigeonpea intercropping system are in some way able to use resources rather differently, so that when grown together they complement each other and make better use of resources than when grown separately (Willey and Natarajan, 1978).

An attempt has been made in this paper to analyze the maximum profit from the intercropping of low profile canopy crops with sorghum.

Material and Methods

The experiment was conducted on medium deep black soil of main research station, Dharwad during *kharif* season of 1998, 1999 and 2000. Soil had a pH of 8.0, EC 0.3 dSm⁻¹, Organic carbon 0.59% and 160.3, 26.8, 310.5 kg ha⁻¹ of available N, P₂O₅ and K₂O, respectively. The experiment was laid out in a randomized block design with 17 treatments and replicated thrice. The treatments included sorghum + soybean, sorghum + groundnut intercropping systems with 1:2, 2:1, 2:4, 3:3, 3:6 and 6:3 row proportions and sorghum + pigeonpea in 3:3 proportion and four sole crops i.e. sorghum, soybean, groundnut and pigeonpea with recommended spacing. The duration of the genotypes of different crops used is as follows: sorghum-CSH-14 (110 days), soybean-JS-335 (90 days), groundnut-JL-24 (105 days) and pigeonpea-Maruti (180 days). Sowing was done on 23rd June 1998, 29th June 1999 and 12th July 2000 with recommended dose of fertilizers in 5.4 X 5.0 m. plots. Sole crop and intercrop yield of all crops and cropping systems were recorded and sorghum equivalent yield was calculated. Monetary returns were calculated by taking market rates for each commodity.

Sorghum grain equivalent was calculated using the following formula suggested by Verma, and Modgal. (1983)

Sorghum grain equivalent yield (SEY)

$$= \sum_{i=1}^n (Y_i \times e_i)$$

Y = Economic yield of 1 to 'n' number of crops (q/ha)

e = Sorghum equivalent factor which can be calculated as Pe/Pc where, Pe = price of a unit weight of concerned crop, Pc = price of unit weight of intercrops

i = 1 to 'n' number of crops.

Benefit : Cost ratio was calculated using the formula,

$$B:C \text{ ratio} = \frac{\text{Net income in Rs/ha}}{\text{Cost of cultivation in Rs/ha}}$$

Results and Discussion

Mean data of all the three years presented in table 1 reveal that grain yield of sorghum was reduced considerably in intercropping system compared to sole crop. Similarly, intercrop yield was also reduced to a considerable extent compared to the respective sole crop yield during all the three years.

There were significant differences in the sorghum grain equivalent yield (q/ha) due to intercropping systems (Table 2). From the mean data of all the three years, sorghum + pigeonpea in 3:3 row proportion recorded significantly higher SEY (128.67 q/ha) compared to other systems, but was on par with that of sorghum + groundnut in 2:4 row proportion (110.08 q/ha) and sorghum + groundnut in 3:6 row proportion (101.30 q/ha). Least SEY was recorded by sole sorghum (53.54 q/ha). Among the sorghum + soybean intercropping systems, 3:6 row proportion recorded higher SEY (80.48 q/ha). Among the sorghum + groundnut intercropping system, 2:4 row proportion recorded the superior SEY (110.08 q/ha) compared to other row proportions.

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Table1. Effect of intercropping in kharif Sorghum with different legume crops on yield

| | Treatments | 1998 | | 1999 | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|-------|-------|-------|
| | | Main | Inter | Main | Inter |
| | | crop | crop | crop | crop |
| <p>Ramteke <i>et al.</i> (1995) also recorded higher sorghum equivalent yield with sorghum +soybean (skip row) intercropping system compared to sole Sorghum or intercropping with groundnut or Greengram. Wanjari <i>et al.</i> (1994) also reported higher sorghum grain equivalent yield in sorghum + soybean (3:3) intercropping system, compared to sorghum + pigeonpea (3:3) or sorghum + greengram (3:3). It was also observed that higher sorghum equivalent yield were noticed in all intercropping and mixed cropping situations over sole cropping of sorghum. Highest sorghum grain equivalent yield (52.82 q/ha) was recorded by sorghum + soybean in paired rows (Dubey <i>et al.</i>, 1995).</p> <p>Net monetary return (Rs/ha) was influenced by treatments during all the three years</p> | Sorghum+ Soybean (1:2) | 50.11 | 11.97 | 37.74 | 4.93 |
| | Sorghum+ Soybean (2:1) | 62.27 | 4.19 | 37.71 | 2.59 |
| | Sorghum+ Soybean (2:4) | 41.72 | 13.94 | 37.56 | 8.78 |
| | Sorghum+ Soybean (3:3) | 45.42 | 9.62 | 46.89 | 3.81 |
| | Sorghum+ Soybean (3:6) | 51.02 | 15.18 | 32.89 | 7.78 |
| | Sorghum+ Soybean (6:3) | 59.37 | 6.16 | 44.63 | 3.07 |
| | Sorghum+ Groundnut (1:2) | 45.67 | 9.50 | 37.74 | 16.67 |
| | Sorghum+ Groundnut (2:1) | 55.42 | 5.05 | 38.07 | 4.33 |
| | Sorghum+ Groundnut (2:4) | 57.01 | 10.49 | 47.22 | 16.67 |
| | Sorghum+ Groundnut (3:3) | 55.42 | 8.87 | 47.00 | 8.30 |
| | Sorghum+ Groundnut (3:6) | 55.42 | 10.49 | 31.89 | 13.60 |
| | Sorghum+ Pigeonpea (3:3) | 50.02 | 13.94 | 42.33 | 5.56 |
| | Sorghum+ Pigeonpea (3:6) | 45.89 | 17.98 | 42.19 | 13.17 |
| | Sorghum+ Pigeonpea (6:3) | 51.11 | 39.99 | 9.86 | |
| <p>of investigation. Highest net monetary return (Rs/ha) was recorded by Sorghum +Pigeonpea (22,716 Rs/ha) with 3:3 row proportion followed by Sorghum +Groundnut (19,861 Rs/ha) with 2:4 row proportion, Sorghum +Groundnut (16,133 Rs/ha) with 3:6 row proportion. All sorghum based intercropping systems proved their superiority over the sole cropping of sorghum.</p> <p>Similar results were reported by Dube <i>et al.</i> (1992). Gole and Bhide also reported a more remuneration with intercropping of Sorghum +Soybean than pure crop of sorghum. Benefit: Cost ratio was also superior in case of sorghum based intercropping systems in all the three years of study than sole crop of sorghum. Pal <i>et al.</i> (1991) observed the similar trend.</p> | Sole Sorghum | 20.82 | 20.12 | 16.64 | |
| | Sole Pigeonpea | 14.81 | | 15.81 | |

Table 2. Effect of intercropping in with different legume crops on kharif sorghum grain equivalent yield and economics

| Treatments | Sorghum grain equivalent yield (q/ha) | | | | Net | |
|-------------------------|---------------------------------------|--------|--------|--------|--------------|-----------|
| | 1998 | 1999 | 2000 | Mean | Income (Rs.) | B:C Ratio |
| Sorghum+Soybean (1:2) | 93.57 | 55.49 | 72.22 | 71.38 | 8634 | 1.94 |
| Sorghum+Soybean (2:1) | 72.20 | 46.43 | 83.61 | 68.43 | 7986 | 1.88 |
| Sorghum+Soybean (2:4) | 92.82 | 69.16 | 83.60 | 78.54 | 10424 | 2.13 |
| Sorghum+Soybean (3:3) | 84.66 | 60.61 | 81.15 | 72.15 | 8781 | 1.95 |
| Sorghum+Soybean (3:6) | 126.14 | 60.89 | 84.05 | 80.48 | 10909 | 2.18 |
| Sorghum+Soybean (6:3) | 74.78 | 55.68 | 74.86 | 70.76 | 8569 | 2.94 |
| Sorghum+Groundnut(1:2) | 88.75 | 117.75 | 93.23 | 93.23 | 14700 | 2.29 |
| Sorghum+Groundnut(2:1) | 87.33 | 58.85 | 74.36 | 74.36 | 10266 | 1.92 |
| Sorghum+Groundnut(2:4) | 105.56 | 127.24 | 113.60 | 110.80 | 19861 | 2.75 |
| Sorghum+Groundnut(3:3) | 80.22 | 86.84 | 91.30 | 91.31 | 14646 | 2.23 |
| Sorghum+Groundnut(3:6) | 73.66 | 97.17 | 101.30 | 101.30 | 16133 | 2.42 |
| Sorghum+Groundnut(6:3) | 79.57 | 69.02 | 82.35 | 82.35 | 12689 | 2.14 |
| Sorghum+Pigeonpea (3:3) | 121.03 | 115.94 | 146.51 | 128.67 | 22716 | 2.82 |
| Sole Sorghum | 59.41 | 49.66 | 61.23 | 53.54 | 5254 | 1.65 |
| Sole Soybean | 95.29 | 35.50 | 60.30 | 72.14 | 10281 | 2.32 |
| Sole Groundnut | 104.86 | 76.99 | 87.88 | 90.32 | 12926 | 2.21 |
| Sole Pigeonpea | 97.09 | 88.50 | 100.68 | 94.80 | 12860 | 2.19 |
| SEm \pm | 03.37 | 04.43 | 03.39 | 10.11 | | |
| CD at 5% | 09.73 | 10.61 | 09.76 | 29.13 | | |

Note: Sorghum grain Rs 250/q. Soybean Rs.800/q, Groundnut Rs.1000/q, Pigeonpea Rs.1500/q and 1quintol (q) =1000 kgs.

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