

Intercropping System in Double Rowed Sisal (*Agave sisalana*) Plantation

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Abstract

A field experiment was conducted during 2012-13 at the experimental farm (22.0411 N, 84.2951 E, 267 m AMSL) of Sisal Research Station (of CRIJAF), Bamra, Sambalpur, Odisha to study the suitability of legume intercrops in the double rowed sisal (*Agave sisalana*) plantation. Short duration varieties of legume intercrops such as cowpea (cv. VRCP-4), green gram (cv. Pant Mung 5), black gram (cv. Pant Urd 31), moth bean (cv. RMO 40) and pigeon pea (cv. ICPL 87) were grown during the *kharif* season within the sisal plantation. The growth and fibre yield of sisal was significantly influenced due to legume intercrops and the highest leaf length (92.4 cm) and fibre yield (303 kg/ha) was obtained in pigeon pea intercropping system. Growth of all the legume intercrops were satisfactory, but due to excess of soil moisture due to intermittent rain, proper flowering and pod formation was not occurred in moth bean variety. The satisfactory yield of pigeon pea, cowpea (as vegetable), green gram and black gram were added to the sisal equivalent yield of the intercropping system. The sisal equivalent yield from the system was the highest in case of pigeon pea (723 kg/ha) followed by cowpea and black gram. It was inferred that the vacant space in between the double rowed sisal plantation for the initial three years period could be utilized for growing short duration varieties of annual legume intercrops like pigeon pea, cowpea, black gram etc. during the *kharif* season.

Keywords: Sisal, Intercropping, Double row, Legume

Sisal is a xerophytic, monocarp, semi-perennial leaf fibre producing plant. A healthy sisal plant produces about 200-250 leaves during its 10-12 years life span. Different species of *Agave* (family: Asparagaceae; APG-III System, 2009) namely *Agave sisalana*, *Agave cantala*, *Agave vera-cruz*, *Agave amaniensis*, *Agave angustifolia* and *Agave fourcroyodes* can produce hard fibre from its leaf (Kirby, 1963). However, among the different species, *Agave sisalana* alone contributes nearly 85% of the total sisal fibre production of the World (220.2×10^3 t). Sisal fibre is used for various diversified purposes globally and also very commonly used in the shipping industry for mooring small & medium craft, lashing, and handling cargo. Traditionally, in India sisal is not grown by organized sectors in numbers, whereas, it is scattered over isolated areas predominantly as live-fence or grown by the tribal for their own household consumption of natural fibres. However, in recent times, renewed interest has been noticed among the organized as well as semi-organized sectors or even individuals to venture into the production of sisal primarily for its quality fibre having great demand in the country.

Improved agro-production technology for growing sisal for fibre has been standardized in India, in which 'double row planting system' is recommended for multiple benefits. The recommended spacing of sisal in double row planting system [4 m + 1 m \times 1 m (4000 plants/ha)] keeps a large amount of land area unutilized in between the rows during the initial three years growth period of sisal as harvesting of leaves are not recommended during this phase of three years (harvest

holiday). As there will not be any economic return from the ‘harvest holiday’ phase of sisal plantation, most of the small and marginal farmers are not attracted towards or continue with the sisal plantation which otherwise is remunerative in long run and environmentally suitable in the changing and irregular global climatic situation. Therefore, the inter-row space may be utilized by practising intercropping in double row planting system in sisal. There is virtually no report of field trials regarding feasibility or suitability of crops as intercrops in sisal plantation. Some preliminary work conducted at Dehradun showed that sisal alone should not be grown on boulder waste lands for protection against grazing, erosion control and economic fibre production, but it should always be supplemented with bhabar/ sabai grass (*Eulaliopsis binata*) which is also suitable for erosion control & rehabilitation and is of commercial use. The benefit cost ratio was always higher from the sisal growing system with bhabar/ sabai grass than sisal alone (Gupta *et al.*, 1989). In spite of the above referred report on intercropping in sisal, it can be said that sufficient and detail work on these aspects of sisal-intercropping is truly lacking. Therefore, a field experiment was designed to study the feasibility of growing intercrops especially annual legume intercrops in double rowed sisal plantation.

Materials and Methods

The field experiment was conducted during 2012-13 at the research farm (22.041151°N, 84.295076°E, 267 m AMSL) of Sisal Research Station (of CRIJAF), Bamra, Sambalpur, Odisha with Randomized Block Design (RBD) with 6 treatments and 5 replications. The treatments were as follows:

T₁: Sisal + cowpea (cv. VRCP 4 or Kashi Kanchan); T₂: Sisal+ Moth bean/ Matki (cv. RMO 40); T₃: Sisal + Green gram (cv. Pant Mung 5); T₄: Sisal + Black gram (cv. Pant Urd 31); T₅: Sisal + Pigeon pea (cv. ICPL 87 or Pragati) and T₆: Sole sisal (*Agave sisalana*). Characteristics of the selected legume varieties are depicted below (Table 1).

Table 1. Characteristics of legume crop varieties grown as intercrops with sisal

Crop	Variety	Characteristics
Cowpea <i>Vigna unguiculata</i> (L.) Walp.	VRCP-4 (Kashi Kanchan)	Suitable for June-Aug sowing, first harvest 45-50 days, colour- green, pod length 10-11 inch
Green gram <i>Vigna radiata</i> (L.) Wilczek	Pant Mung 5	Days to maturity 60-65 days, suitable for all seasons, resistant to YMV, yield 12-15 q/ha
Black gram <i>Vigna mungo</i> (L.) Hepper	Pant Urd 31	Days to maturity 75 days, suitable for <i>kharif</i> season, resistant to YMV, yield 10 q/ha
Moth bean <i>Vigna aconitifolia</i> (Jacq.) Marechal	RMO 40	Days to maturity 60-64 days, first early variety, erect growth, suitable for low rainfall area.
Pigeon pea <i>Cajanus cajan</i> (L.) Millsp.	ICPL 87 (Pragati)	Short statured (80-90 cm plant height), short duration (110 days), tolerant to <i>fusarium</i> wilt, 100 seed weight 8.6 g, seed yield 11.4 q/ha

Seeds of all the selected varieties of the identified annual legumes were planted in line in between the rows of sisal plantation as intercrops. Standard agronomic management practices were followed and the intercrops were raised as per their specific requirement as mentioned in the guidelines for the selected variety. Biometrical observations regarding growth of all the component crops were recorded at regular interval. The yield and yield parameters were also recorded at harvest.

Results and Discussion

Effect of legume intercrops on growth and yield of sisal

Growth and fibre yield of sisal were significantly affected due to different legume intercrops (Table 2). The highest leaf length of sisal was recorded with sisal + pigeon pea intercropping system (92.4 cm) followed by the sisal leaf length obtained in sisal + moth bean (88.2 cm) and sisal + black gram (87.4 cm). The highest sisal yield was obtained in sisal + pigeon pea treatment (302.5 kg/ha) followed by the fibre yield of sisal + cowpea intercropping system (259.6 kg/ha). The lowest sisal fibre yield was recorded in sole sisal (159 kg/ha). In the initiation year of the experiment (2011), the fibre yield of sisal did not vary significantly with different legume intercropping with sisal (Sarkar *et al.*, 2013).

Table 2. Effect of legume intercrops on growth and yield of sisal

No.	Treatment	Leaf length (cm)	Leaf number (000)/ha	Weight of harvested leaf (t/ha)	Fibre yield (kg/ha)
T ₁	Sisal + cowpea	87.3	51.30	8.64	259.6
T ₂	Sisal + moth bean	88.2	49.17	7.88	255.2
T ₃	Sisal + green gram	85.1	48.71	8.04	222.7
T ₄	Sisal + black gram	87.4	47.89	8.11	250.2
T ₅	Sisal + pigeon pea	92.4	45.08	9.95	302.5
T ₆	Sisal (sole)	76.7	37.58	7.15	159.2
	CD (5%)	6.50	6.29	1.64	56.25

Table 3. Growth and yield of legumes when grown as intercrops in double rowed sisal plantation

No.	Treatment	Pod length (cm)	No. of Seeds/pod	100 seed weight (g)	Seed yield (g/m ²)
T ₁	Sisal + cowpea	-	-	-	70.58*
T ₂	Sisal + moth bean	-	-	-	-
T ₃	Sisal + green gram	8.17	8.94	3.18	10.93
T ₄	Sisal + black gram	3.98	6.06	3.08	11.45
T ₅	Sisal + pigeon pea	5.36	4.44	7.96	68.44
T ₆	Sisal (sole)	-	-	-	-

* harvested as green vegetable

The cowpea intercrop was harvested in tender green condition which has demand and also fetched good value in the local markets as vegetable. The vegetative growth of moth bean was profuse, but due to heavy intermittent shower resulting excess of soil moisture, sufficient flowering and pod setting had not occurred in the moth bean variety chosen as the same was better suited for low rainfall condition. However, suitable and specific variety of moth bean may perform better in such condition. Other legumes namely, green gram, black gram and pigeon pea grown well. Green gram pod length was 8.17 cm with 3.18 g of 100 seed weight. The black gram growth and yield were also satisfactory (Table 3). Pigeon pea produced pod of 5.36 cm length and the number of seeds per pod was 4.44 with 7.96 g of 100 seed weight.

Table 4. Effect of legume intercrops on sisal equivalent yield in double rowed sisal plantation

No.	Treatment	Sisal fibre yield (kg)	Yield of intercrops (kg)	Sisal equivalent yield of intercrops (kg)	Total sisal equivalent yield (kg)
T ₁	Sisal + cowpea	259.6	245.4	89.2	348.8
T ₂	Sisal + moth bean	255.2	-	-	255.2
T ₃	Sisal + green gram	222.7	74.2	72.3	295.0
T ₄	Sisal + black gram	250.2	77.8	62.8	312.9
T ₅	Sisal + pigeon pea	302.5	391.1	420.6	723.1
T ₆	Sisal (sole)	159.2	-	-	159.2

Based on the selling price of the legumes and sisal fibre, the sisal equivalent yields were calculated (Table 4). The sisal equivalent yield from the system was the highest in case of pigeon pea (723 kg/ha) intercrop followed by cowpea (349 kg/ha) and black gram (313 kg/ha) intercrops. It was reported from Odisha that early duration pigeon pea variety (UPAS 120) was better as intercrop with finger millet (Padhi *et al.*, 2010).

Conclusion

Therefore, it may be inferred that the vacant space in between the double rowed sisal plantation may be utilized for the initial three years period for growing short duration varieties of annual legume intercrops like pigeon pea, cow pea and black gram etc. during the *kharif* season.

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