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Comparative evaluation of mesta based intercropping systems for higher productivity and profitability at Coastal region of Odisha

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Abstract

A two year field experiment was conducted with mesta (roselle) and other crops at experimental Farm, Jute Research Station, Kendrapara, Odisha to find out the suitable and profitable intercrop combination of mesta in the coastal zone of Odisha. Nine treatments viz: T₁- Sole Mesta, T₂- Sole Maize, T₃- Sole Groundnut, T₄ Sole greengram, T₅- Sole Blackgram, T₆-Mesta+Maize (2:1), T₇-Mesta+Groundnut(2:2), T₈-Mesta+Greengram (2:2) and T₉-Mesta+Blackgram(2:2).were studied under randomized complete block design, replicated thrice. Intercropping system did not pose any adverse impact on growth and development of mesta crop. All the growth parameters viz, plant height basal diameter, leaf area and biomass production of the crop under intercropping system were at par with the performance of sole crop. Significantly maximum mesta equivalent yield of 41.8q/ha was recorded, when mesta was intercropped with greengram and it was followed with groundnut and blackgram as intercrops (41.6q/ha and 41q/ha) respectively. The B:C ratio ranged from 1.74 to 2.82 under intercropping system indicating suitability of growing short duration legumes and pulse along with mesta in the coastal region of Odisha.

Keywords: Mesta, intercropping, mesta equivalent yield, Net return, B:C ratio

Introduction

Mesta is one of the most important bast fibre crop of economic importance after jute. It grows profusely and thrive under adverse conditions, where jute is difficult to grow. It is tougher and stronger than jute fibre but is somewhat coarser and less supple. It is the nearest ally of jute and plays an effective role in supplementing the short supply of jute industry. Mesta fibre is blended with jute fibre and used for making of cordage, rope, twines, hessian, sacking and geotextile etc [Da-CostaRocha *et al.*, 2014]^[6]. Internationally, this crop is known as Kenaf, but in India, it can be grouped into two species of mesta namely, roselle (*Hibiscus sabdariffa* L.) and kenaf (*Hibiscus cannabinus* L.) that are being cultivated for bast fibre production [Shil,2019]. The seedlings, leaves and fruits are used to make sauces, jellies and wines (Wilson and Menzel, 1964 and 1967)^[14, 15]. In southern India, pickles prepared out of these are most popular (Singh, 1997)^[12]. The fibre content and other chemical properties make it a commercial crop next to jute and cotton. Of late, mesta is receiving increasing global attentions as a source of good quality paper pulp due to increasing shortage of hard wood. Despite the importance of mesta as a cash crop, the crop is still produced by traditional methods, under uncertain and fluctuating rainfall conditions. Due to these conditions, mesta yield are still far below the potential of this crop, for which mesta grower seldom gets a fair price of their produce. Hence, introduction of intercrops in mesta crop could serve as an insurance against the crop loss. It is a traditional but a very useful approach for increasing the production as well as farmers income.

Ahmad *et al.*,2013^[2], reported that mixed, inter or multiple cropping may ensure proper utilization of resources towards increased production per unit area and time on a sustainable basis. Roselle, being a long duration dry region crop, growing of legume following this crop will prove beneficial both in terms of yield and soil enrichment through N fixation and microbial activity. There are several reports indicating that increasing the N content in a non legume plant due to association leguminous intercrops [Eskandari *et al.*, 2009. Anil *et al.*, 1998]^[7, 3].

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Hence, the study on intercropping not only provides a concise summary of the well established advantages of intercropping, but also gives an insight into the ecological dynamics, genetic variables and microbial relationship augmenting plant growth and total system production. However, reports are still meagre, suggesting intercropping in mesta cultivation. Keeping these facts under consideration, a two year study was conducted, with an objective to evaluate the performance of different mesta based intercroppings and to find out the suitable intercrops for mesta under coastal region of Odisha.

Materials and Methods

The experiment was conducted during *kharif* seasons in 2021, 2022 at Jute Research Station, Kendrapara (19° 34' N latitude and 86° 30' E longitudes). The soil of the experimental field was sandy loam with pH 6.6, organic carbon 6g/kg and available N, P and K 310, 28.7 and 266kg/ha, respectively. The average rainfall received during the cropping year was 1236.5mm. The experiment was carried out in a randomized block design, with nine treatments, replicated thrice. Mesta variety AMV 5 was sown at the spacing of 25 × 10 cm. Manures and fertilizers were used as per recommendations. The crop was sown on 20.05.2021 and 24.5.2022 in two consecutive years respectively. The treatments were described as follows: T₁- Sole Mesta, T₂- Sole Maize, T₃- Sole Groundnut, T₄- Sole greengram, T₅- Sole blackgram, T₆- Mesta+Maize(2:1), T₇-Mesta+Groundnut(2:2), T₈-Mesta+Greengram(2:2) and T₉-Mesta+Blackgram(2:2). All agricultural practices were done in main and intercropped according to need of crop. Observations on biological parameters were recorded at the time of harvest, following standard procedures. Economics of each treatment was calculated based on nearest market price of produce.

Results and Discussion

Effect of intercropping on growth of mesta

Pooled data on growth parameters like plant height, basal diameter, leaf area index, total dry weight and green biomass produced by plants, as influenced under sole and intercropped situations are presented in Table 1.

Results showed that, there was no significant difference for all the said parameters of mesta both under sole and intercropped situations. This might be due to short architecture of associated intercrops: ground nut and legume crops (greengram and blackgram), which did not offer any significant competition to growth of mesta. Similar findings were reported by Sarkar *et al* (2013) in jute under intercropping with legumes. As the tall statured crop, maize was grown in replacement series with mesta, it also did not interfere with the crop growth of main crop. Hence, intercropping of roselle with different crops viz. maize, ground nut, greengram and blackgram did not have any

adverse impact on growth of main crop. Intercropping with groundnut accelerates the growth and biomass production due to complementary resource use was also reported by Suresh *et al*, 2018 [13].

Effect of intercropping on yield of mesta fibre and intercrops

Sole crop of mesta significantly produced highest fibre yield as compared to other intercropping treatments. Higher plant density in this treatment might have contributed to maximum fibre yield. Lesser yield was obtained under intercropping due to replacement of mesta rows by the intercrops. However, all the intercropping systems recorded significantly higher mesta equivalent yield as compared with sole mesta crop. Similar findings were reported by Singh *et al*, 2013, under mesta and pigeonpea intercropping system.

Maximum mesta equivalent yield of 41.8q/ha was recorded, when mesta was intercropped with greengram and it was followed with groundnut and blackgram as intercrops (41.6q/ha and 41q/ha) respectively, owing to higher market price of these component crops. Although, mesta +maize intercropping system recorded lowest MEY (35.3q/ha) among the intercropped treatments, however, it was significantly higher than both sole crop of mesta and maize. Hence, maize can also be considered as a suitable intercrop option for mesta after legume crops. These findings are in accordance with the result of experiments conducted at Amadalavalsa, Andhra Pradesh: intercropping of roselle with maize increased the economic yield of the system under rainfed condition with maximum system yield (in roselle equivalent yield) [AINPJAF, 2008] [1]. Intercropping mesta with maize, groundnut, greengram and blackgram increased the profitability of mesta cultivation as these intercropping systems recorded additional net return of Rs 29560 to 67887/ha over sole mesta crop. Among the intercropping systems, mesta +groundnut (2:2), mesta +greengram(2:2) and mesta+blackgram 2:2, systems were found to be most productive and profitable as 28-51.4% higher MEY (35-41.8q/ha) was obtained compare with sole mesta crop (27.6q/ha). Hence these crops have the potential of insurance crop and provide assured income to the farmers. Ghorai, 2010 [8] also reported similar findings in jute-greengram intercropping.

Economics of mesta under intercropping systems

Maximum net return was recorded with mesta+greengram(2:2) intercropping system (Rs 86287/ha), followed by mesta+blackgram(2:2) intercropping system (Rs 83666/ha). Although, sole crop of greengram, blackgram and groundnut recorded higher benefit cost ratio than their respective intercropping with mesta crop, however the B:C ratio was nearly doubled under intercropping system of mesta (B:C ranged from 1.74 to 2.86) against the sole mesta (B:C =1.2) (Table 2).

Table 1: Growth parameters of mesta as influenced by intercropping systems

Treatment	Height(cm)	Basal girth(cm)	LAI	Green biomass(gm ⁻²)	Dry biomass(gm ⁻²)
T ₁	349.3	1.76	5.5	86	26.6
T ₂					
T ₃					
T ₄					
T ₅					
T ₆	339.3	1.69	5.7	80	24.7
T ₇	343.7	1.73	5.24	85	25.1
T ₈	343.3	1.70	5.18	87	24.5
T ₉	350	1.68	5.6	88.3	27.1

Table 1: Yield and economics of mesta and intercrops as influenced by intercropping systems

Treatment	Fibre yield(q/ha)	Sole crop yield(q/ha)	Inter crop yield(q/ha)	MEY*(q/ha)	Net return (Rs/ha)	B:C Ratio
T ₁	349.3	-	-	27.6	18400	1.26
T ₂	-	9.2	-	17.5	6000	1.12
T ₃	-	16.9	-	34.5	60472	2.21
T ₄	-	10.4	-	22.9	48164	2.93
T ₅	-	10.5	-	20.5	40547	2.62
T ₆	339.3	-	5.2	35.3	47960	1.74
T ₇	343.7	-	10.5	41.6	73493	2.22
T ₈	343.3	-	7.6	41.8	86287	2.82
T ₉	350	-	7.5	41	83666	2.76
SEm(±)				1.72		
CD(0.05)				3.64		
CV(%)				7.4		

*MEY=Mesta Equivalent yield

Conclusion

Intercropping of mesta with short statured legumes like greengram and blackgram and pulses groundnut proved to be more superior in terms of growth, yield and economics of the main crop. It increased the system yield to the tune of 40% over the sole crop situation, owing to higher market price of these crops. Higher system yield could be achieved with the selection of appropriate crops, planting geometry of component crops. Results showed compatibility of mesta crop with greengram or groundnut to be raised as an intercrop. In addition growing of food and fibre crops together may result in better income of the farmers as compared to sole mesta crop. Hence, intercropping of mesta with short duration pulses viz. greengram and blackgram and oilseed like groundnut helped to enhance the total productivity and profitability of mesta cultivation under coastal region of Odisha.

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