

## **Productivity and economics of cotton (*Gossypium hirsutum* L.) based intercropping system under rainfed conditions of north Saurashtra agro climatic zone of Gujarat**

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**ABSTRACT :** The pooled results of 3 years over locations indicated that seed cotton yield was not significantly reduced due to intercropping with any intercrops. Sole cotton recorded comparatively higher seed cotton yield (888 kg/ha) and reduction in seed cotton yield was higher with intercropping of oilseeds crops (23.76 to 26.91%) than pulse crops (7.88 to 18.80%). Among intercrop yields, difference was found non significant. However intercropping of cotton with sesame (1503 kg/ha) followed by greengram (1287 kg/ha) produced significantly higher seed cotton equivalent yield to the tune of 69.25 and 44.93 per cent over sole cotton (888 kg/ha), respectively and also obtained higher monetary advantages in terms of net returns (Rs.20744/ha and Rs.15389/ha) and B: C ratio (2.51 and 2.06) as compared to other intercropping systems and sole cotton (Rs.8057/ha and 1.65).

**Key words :** Cotton, economics, *Gossypium hirsutum*, intercropping, productivity, rainfed

Cotton is an important commercial crop grown extensively in Gujarat. It provides 85 per cent raw material to textile industry besides earning valuable foreign exchange by exporting of raw material and finished goods. Cotton is the main crop of north Saurashtra agro climatic zone of Gujarat and grown as sole crop under rainfed conditions. Intercropping is the best mechanism for exploiting the environment, minimizing risk and ensuring subsistence farming. Intercropping was originally practiced as an insurance against crop failure under rainfed conditions. At present, the main objective of intercropping is to get higher productivity/unit area. This system uses resources efficiently and improved productivity. Intercropping of different short duration pulse crops and oilseed crops in cotton, is of significance because of higher profit and stabilized yield advantage, especially under adverse weather conditions. Intercropping in cotton with oilseed and pulse crops in medium black soil under rainfed conditions increased the net returns. Short duration crops like green gram, black gram, cowpea, sesame, groundnut and soybean may prove compatible with cotton and can give additional yield and returns. Cotton has slow initial growth and when grown at wide

row, spacing can be utilized for intercropping. An intercrop having different growth habit and canopy can easily be accommodated with least competition. Hence, a field experiment was undertaken to study the effect of intercropping of different pulse and oilseed crops with cotton.

### **MATERIALS AND METHODS**

Field experiment was conducted simultaneously for 4 consecutive years (2001-2002 to 2004-2005) at Dry Farming Research Station, Jamkhambhalia (Dist: Jamnagar), Dhari (Dist: Amreli) and Nanakandhasar (Dist: Surendranagar) under rainfed conditions. The soils of Jamkhambhalia, Dhari and Nanakandhasar were medium black, non saline, low in organic carbon and available phosphorus and medium to high in potash. The experiment was laid out in randomized block design with 3 replications with a gross plot size of 6.00 x 4.80 m and net plot size of 5.4 x 2.4 m. The treatments comprised of 7 cropping systems *viz.*, sole cotton (G.Cot.Hy. 8) and its intercropping with groundnut (GG 20), soybean (GS 1), blackgram (T 9), cowpea (GC 2), greengram (K 851) and sesame (G.Til 2). Keeping the recommended planting geometry of

120 x 30 cm was followed for sole cotton. All the treatments were tried in additive series version of intercropping. The intercrops were accommodated in the inter rows of cotton in 1:1 row proportion following the intra row spacing of their respective sole crops. Recommended dose fertilizer 80-00-00 kg NPK/ha was applied to cotton, while the intercrops were also fertilized with 50 per cent of the recommended dose of respective sole cropping. The total rainfall received during the crop growth period was 765, 499 and 280 mm with 24, 24 and 18 rainy days at Jamkhambhalia, and 1053, 509 and 541mm with 24, 27 and 27 rainy days at Nanakandhasar in the years of 2001, 2003 and 2004, respectively and 452,482 and 435 mm with 19,17 and 23 rainy days in the years of 2001, 2002 and 2003, respectively at Dhari while remaining year of these locations, experiment was vitiated due to mid season dry spell after sowing of crops. Pooled analysis of seed cotton, intercrop yield and seed cotton equivalent yield were worked out over the individual years of each location and over locations. Economics of each intercropping system was worked out over pooled mean of 3 locations considering prevailing market rates of inputs and produce of each crop during the period of experimentation.

## RESULTS AND DISCUSSION

**Seed cotton yield:** Pooled data of three years of three locations (Table 1) indicated that seed cotton yield was not affected significantly by intercropping with different oilseed and pulse crops except at Jamkhambhalia, where sole cotton (574 kg/ha) being *at par* with cotton intercropped with greengram (503 kg/ha), recorded significantly higher seed cotton yield as compared to other intercrops. On the basis over locations pooled results, seed cotton yield was recorded comparatively higher under sole cotton (888kg/ha), however, it was not significantly reduced by intercropping with different oilseed and pulse crops. However, reduction in seed cotton yield was higher with intercropping of oilseeds crops (23.76 to 26.91%)

than pulse crops (7.88 to 18.80%). Less adverse effect of pulse crops on cotton might be attributed to the lack of perceptible degree of competition between them due to short duration, growth habit and short stature of the intercrop. Aladakatti *et al.*, (2011) noticed the similar effect when cotton was intercropped with oilseed crops.

**Intercrops yield:** Data pertaining to intercrops yield (Table 1) revealed that the intercrops yield was more significantly influenced at Jamkhambhalia and Nanakandhasar as compared to Dhari. This might be due to higher and well distribution of rainfall. In Jamkhambhalia, the yield was significantly higher in cowpea (824 kg/ha) followed by sesame (540 kg/ha) in comparison to other intercrops whereas, at Nanakandhasar, the yield was significantly higher in greengram (514 kg/ha) followed by blackgram (488 kg/ha) and sesame (442 kg/ha) in comparison to other intercrops. At Dhari and over locations pooled results, differences were found non significant among intercrops yields. However, on the basis of over locations pooled results cowpea intercropped with cotton recorded higher yield (601kg/ha) followed by sesame (579kg/ha) and blackgram (558kg/ha). It indicated that cowpea, blackgram, greengram and sesame were most compatible intercrops with cotton as compared to groundnut and soybean.

**Seed cotton equivalent yield:** The data presented in Table 1 revealed that seed cotton equivalent yield was significantly affected due to different intercropping systems at Jamkhambhalia, Dhari and over locations pooled results. Cotton + sesame (1:1) recorded significantly highest seed cotton equivalent yield (1246, 2026 and 1503 kg/ha) followed by cotton + greengram (934, 1793 and 1287 kg/ha) as compared to sole cotton (574, 1123 and 888 kg/ha) and other intercropping systems at Jamkhambhalia, Dhari and over locations pooled results, respectively. While, at Nanakandhasar a similar trend was observed even though, the results were non significant. On the basis of over

**Table 1.** Seed cotton yield, intercrops yield and seed cotton equivalent yield as influenced by intercropping systems under rainfed conditions (Pooled over locations of 3 years data)

Treatments	Seed cotton yield (kg/ha)				Pod/grain yield of intercrops (kg/ha)				Seed cotton equivalent yield (kg/ha)			
	Jam Khambhalia	Dhari	Nana Kandhasar	<b>Pooled</b>	Jam Khambhalia	Dhari	Nana Kandhasar	<b>Pooled</b>	Jam Khambhalia	Dhari	Nana Kandhasar	<b>Pooled</b>
Sole cotton	574	1123	968	<b>888</b>	-	-	-	-	574	1123	968	<b>888</b>
Cotton + groundnut	331	1002	679	<b>671</b>	441	821	387	<b>550</b>	644	1644	964	<b>1084</b>
Cotton + soybean	200	1008	741	<b>650</b>	283	491	219	<b>331</b>	302	1246	841	<b>796</b>
Cotton + blackgram	407	1297	748	<b>817</b>	493	694	488	<b>558</b>	712	1712	1126	<b>1183</b>
Cotton + cowpea	277	1197	730	<b>735</b>	824	584	395	<b>601</b>	744	1473	984	<b>1067</b>
Cotton + greengram	503	1300	633	<b>812</b>	521	591	514	<b>542</b>	934	1793	1135	<b>1287</b>
Cotton + sesame	371	1082	578	<b>677</b>	540	756	442	<b>579</b>	1246	2026	1237	<b>1503</b>
S.Em.+	35	96	76	<b>61</b>	97	162	38	<b>69</b>	101	96	137	<b>76</b>
P=0.05	101	NS	NS	<b>NS</b>	299	NS	113	<b>NS</b>	313	296	NS	<b>233</b>
C.V. (%)	26.14	14.40	20.65	<b>14.21</b>	14.64	21.16	17.77	<b>22.56</b>	16.04	11.10	14.69	<b>11.74</b>

**Table 2.** Economics of cotton based intercropping systems on the basis of pooled results of 3 locations under rainfed conditions

Treatment	Seed cotton equivalent yield (kg/ha)	Fodder yield of intercrops (kg/ha)	Cotton stalk yield (kg/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Benefit: cost ratio
Sole cotton	888	-	1987	20477	12420	8057	1.65
Cotton+ groundnut	1084	1073	1431	26814	15782	11032	1.70
Cotton+ soybean	796	934	1751	18841	13992	4849	1.35
Cotton+ blackgram	1183	978	1840	27455	13911	13544	1.97
Cotton+ cowpea	1067	963	1478	24751	14138	10613	1.75
Cotton+ greengram	1287	1079	1936	29850	14461	15389	2.06
Cotton+ sesame	1503	1147	1571	34438	13694	20744	2.51

Price: Seed cotton	: Rs. 22.50/kg	Black gram fodder	: Rs. 00.40/kg
Cotton stalk	: Rs. 00.25/kg	Cowpea fodder	: Rs. 00.40/kg
Groundnut fodder	: Rs. 02.00/ kg	Green gram fodder	: Rs. 00.40/kg
Soybean fodder	: Rs. 00.50/ kg	Sesame fodder	: Rs. 00.20/kg

locations pooled results, intercropping of cotton with sesame (1:1) and greengram (1:1) produced higher seed cotton equivalent yield to the tune of 69.25 and 44.93 per cent, respectively as compared to sole cotton. It was perhaps due to better performance and yield of component crops as well as higher market price of intercrops. These results confirm the finding of Rekha *et al.* (2008) and Patel *et al.*, (2010).

**Economics:** Economics of the intercropping systems on the basis of over location pooled results (Table 2) revealed that cotton + sesame (1:1) and cotton + greengram (1:1) intercropping system resulted higher gross returns of Rs. 34438 and 29850/ha, net returns of Rs. 20744 and 15389/ha with a benefit cost ratio of Rs. 2.51 and 2.06, respectively as compared to other intercropping systems and sole cotton (Rs. 20477, 8057/ha and Rs. 1.65). Similar results were also reported by Solunke *et al.*, (2011)

Based on the results, it could be concluded that the farmers of north Saurashtra agro climatic zone growing hybrid cotton (G.Cot.Hy. 8) at a distance of 120 cm are advised to adopt intercropping system with sesame (G.Til 2) or green gram (K 851) in the row proportion of 1: 1

for getting higher yield and net returns under rainfed conditions.

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