

Cotton based cropping systems in Maharashtra: Economic analysis and future needs

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ABSTRACT: Experiments on cotton based cropping patterns were conducted during 2009-2010 and 2010-2011 crop seasons at farmers' fields in Zari taluka of Yavatmal district (Maharashtra). In both years, monoculture of cotton was more or less equally profitable compared to intercropping with pigeon pea and with addition of mix crops of green gram, pearl millet, maize and sesame. Net profit was highest (Rs. 25400/ha) with intercropping in 2009-2010 and with mix cropping (Rs. 46625) in 2010-2011. These findings having bearing on economy and family livelihood should be considered while recommending cropping pattern to farmers especially those having small and medium size of land holdings.

Key words: Cereals, cotton, family livelihood, inter/mix cropping, profitability, pulses, sesame

In global scenario, India has the largest area under cotton in the world and ranks third in production with average yield of 300-400 kg/ha against the world average of 580 kg/ha (Singh and Grover, 2014). Maharashtra state occupies 39.4 m ha with 12.2 per cent area in Yavatmal district where productivity of seed cotton is 150-200 kg/ha. Currently, Zari taluka in Yavatmal district is known for its quality fibre (medium long staple of 25-32 mm) because of suitable soil (medium and deep clay black soil), adequate annual rainfall (900-1100 mm) and easy availability of hybrid seed of high yield potential. After the introduction of *Bt* cotton in the state in general, a sizable area under cotton is converted to oilseeds and pulses (Sabesh *et al.*, 2014). However, there is no change in cotton cultivation practices in Zari taluka.

Currently, farmers' suicide rate in the district is high. Main reasons for the unfortunate incidents are crop failure, indebtedness/loan, high farm input costs, low Minimum Support Price (MSP) fixed by the government, volatility in market price, private purchasing by traders/

brokers at low rates, lack of credit facilities, inadequate irrigation and poor extension activities (Gahukar, 2010). During the era of green revolution in the late sixties, intensive farming including monoculture of cotton became popular because of high crop productivity and superior fibre quality (staple length >30 mm). Growing cotton on same land for years however, resulted in a comparative decline in productivity. On the contrary, other systems of sustainable agriculture have supported rural livelihood efficiently and economically. In fact, intercropping and mix cropping are old traditional ways of farming in India and are being employed by farmers. Moreover, these patterns have been recommended by government institutions (Singh *et al.*, 2009) because of certain advantages such as, reliable crop productivity, enhanced nutrient use efficiency and microbial activity, insurance against the risk of crop failure due to erratic rainfall or drought and low requirement of farm inputs (Lithourgidis *et al.*, 2011). Considering food habits and economic status of local communities in Yavatmal district, it was

necessary to suggest profitable system in cotton zone. Experimentation was therefore undertaken on cotton based cropping systems with an objective to assess economic parameters and suggest improvement in the currently adopted agricultural practices.

MATERIALS AND METHODS

In Zari taluka, nine villages from the area under the project "Convergence of Agricultural Practices in Maharashtra" were selected randomly during 2009-2010 and 2010-2011. In each village, farmers were guided about cropping patterns, planting and crop management. Farmers showing interest in the project were finally selected. At seedling stage, 3 cotton fields (each of 1 ha) were selected for experiments. The crops included cotton as sole crop with square planting system (90 x 90 cm) with single plant/hill, intercropped with pigeon pea (30 cm distance between 2 hills; 2 plants/hill; 6 rows of cotton followed by 2 rows of pigeon pea). Green gram, sesame, maize and pearl millet were broadcast at random in rows of pigeon pea. The crop varieties were selected by concerned farmers as per their farming experience, marketing facilities and selling rates, need of food and money. Recommended cultural operations were followed and harvesting/picking was done whenever necessary (depending upon family needs and marketing). There were 3 replications of 9 treatments in 2009 and first 4 treatments in 2010 as follows.

- T1= cotton,
 T2= cotton + pigeon pea (intercrop) (6:2),
 T3= cotton + pigeon pea (intercrop) (6:2) + green gram (mix crop),
 T4= cotton + pigeon pea (intercrop) (6:2) + green gram + sesame + maize + pearl millet (mix

crops),

- T5= cotton + pigeon pea (intercrop) (6:2) + green gram + pearl millet (mix crops),
 T6= cotton + pigeon pea (intercrop) (6:2) + green gram + sesame (mix crops),
 T7= cotton + pigeon pea (intercrop) (6:2) + green gram + maize + pearl millet (mix crops),
 T8= cotton + pigeon pea (intercrop) (6:2) + green gram + sesame + pearl millet (mix crops),
 T9= cotton + pigeon pea (intercrop) (6:2) + green gram + sesame + maize (mix crops).

Farm expenses included cost of seed, fertilizers and pesticides, charges for transportation and marketing, cultural operations, plant protection and labour wages for harvesting/picking. For calculating income, prevailing market rates were considered, e.g. cotton: Rs. 3150/q in 2009 and Rs. 4300/q in 2010, pigeon pea: Rs.45/kg in 2009 and Rs. 40/kg in 2010. For other crops same price was prevailing in both years, e.g. green gram: Rs. 30/kg, sesame: Rs.60/kg, maize; Rs. 25/kg, pearl millet: Rs. 20/kg,

RESULTS AND DISCUSSION

The data presented in Table 1 revealed that among nine treatments in 2009, maximum yield of 14.46 q/ha of seed cotton was obtained from monoculture resulting in maximum profit of Rs.24200/ha followed by cotton- pigeon pea combination (yield of 12.07 q/ha and profit of Rs. 18945/ha). In cotton fields with intercrop and mix crop, profitability varied from Rs.11503 to Rs.16943/ha. In case of pigeon pea, maximum yield of 159 kg/ha was obtained in cotton plot with pigeon pea only. This combination gave a net profit of Rs. 6392/ha. In mixed cropping, net profit from pigeon pea crop varied from Rs. 3294 to 5798, the maximum being in plot with cotton + pigeon pea + green gram. If only mixed crops

are compared, the maximum profit of Rs. 1721/ha was possible with T4 (cotton + pigeon pea + green gram + sesame + maize + pearl millet). Finally, total net profit of Rs. 25400/ha was from intercropping system followed by monoculture (Rs.24200). However, differences in all parameters were not significant. Therefore, from the economic point of view, all systems were equal (Singh *et al.*, 2009).

Compared to 2009, the 2010 season was better for crop growth and development due to regular rains received up to the end of the crop season. This has favoured productivity in all crops. In a comparison of 4 treatments, the cotton yield was highest in monoculture (14.13 q/ha) with consequent significantly greater net profit of Rs. 38363. The intercropping gave lesser profit than mixcropping (Table 2). As expected, maximum profit from pigeon pea (Rs. 7617/ha) was from intercropping pattern and profit from mixcropping was Rs. 3588/ha when green gram was included. The combination of cotton + pigeon pea + green gram + sesame + maize + pearl millet resulted in significantly highest net profit of Rs.

46625/ha (Gahukar, 2010).

In Maharashtra, current recommendations include various cropping patterns, e.g. cotton: pigeon pea (6/12:2), cotton: soybean (6:2), cotton: sorghum: pearl millet: sorghum (6:1:2:1), cotton: green gram/black gram (1:1), cotton: groundnut/maize/cowpea (10:2). But farmers prefer monoculture of cotton as the soil is not ideally suitable for other crops, and crop management is easy though costly. Farmers can sell seed cotton just after crop season and expect higher MSP every year than preceding years. Meanwhile, traders lend money against cotton purchase during the period of distress/hardship. The economic parameters are hardly considered in planning crop cultivation by farming communities. For example, whenever seeds of certain hybrids are not available, farmers are willing to purchase seeds at any cost. The same story is for synthetic fertilizers and pesticides. From our investigation in few villages, we understood that farmers are unaware of alternatives, most probably due to poor extension activity. All these aspects have

Table 1. Yield of seed cotton, expenses incurred and profit earned in 2009-2010 crop season in Zari taluka, District Yavatmal, Maharashtra.

Treatment	Cotton*				Pigeon pea*				Other crops		Total	
	Yield (q/ha)	Income (Rs/ha)	Exp. (Rs/ha)	Profit (Rs/ha)	Yield (Rs/ha)	Income (Rs/ha)	Exp. (Rs/ha)	Profit (Rs/ha)	Income (Rs/ha)	Profit (Rs/ha)	Income Profit (Rs/ha)	Profit (Rs/ha)
T1	14.46	45549	21349	24200	-	-	-	-	-	-	45549	24200
T2	12.07	38020	19075	18945	159	7142	687	6392	-	-	45162	25400
T3	11.04	34776	19750	15026	145	6548	700	5798	1604	1204	42928	22078
T4	11.33	35689	20184	15505	125	5642	740	4892	2121	1721	43452	22128
T5	11.08	34902	19159	15743	127	5737	846	4987	2094	1694	42733	22328
T6	11.45	36067	19130	16937	110	4938	773	4188	1975	1575	42980	22677
T7	11.13	35059	18112	16947	90	4044	705	3294	1516	1116	40619	21402
T8	10.79	33988	22285	11503	104	4711	711	3961	1550	1150	40249	16653
T9	10.53	33169	20766	12403	114	5150	718	4400	2043	1643	40362	18478
SEm(+/-)	0.732	-	-	2461	-	-	-	-	-	-	-	331
F test (5%)	NS	-	-	NS	-	-	-	-	-	-	-	NS

Expenses include seed purchasing, plant protection, soil fertilization, cultural practices, transportation and marketing. Expenses of other crops = Rs. 400/ha. *Market rate for cotton= Rs. 3150/q and pigeon pea= Rs. 45/kg.

Table 2. Yield of seed cotton, expenses incurred and profit earned in 2010-2011 crop season in Zari taluka, District Yavatmal, Maharashtra.

Treat- ment	Cotton*				Pigeon pea*				Other crops		Total	
	Yield (Q/ha)	Income (Rs/ha)	Exp. (Rs/ha)	Profit (Rs/ha)	Yield (Rs/ha)	Income (Rs/ha)	Exp. (Rs/ha)	Profit (Rs/ha)	Income (Rs/ha)	Profit (Rs/ha)	Income (Rs/ha)	Profit (Rs/ha)
T1	14.13	66759	28396	38363	-	-	-	-	-	-	66759	38390
T2	12.60	54180	21269	32911	208	8336	719	7617	-	-	62516	40528
T3	12.39	53277	21209	32068	179	7166	809	6357	3988	3588	64431	42013
T4	11.39	48977	11386	37591	175	6999	795	6204	3230	2830	59206	46625
SEm(+/-)	0.697	-	-	1835	-	-	-	-	-	-	-	1750
F test (5%)	NS	-	-	S	-	-	-	-	-	-	-	S

Expenses include seed purchasing, plant protection, soil fertilization, cultural practices, transportation and marketing. Expenses of other crops= Rs. 400/ha. *Market rate for cotton= Rs. 4300/q, for pigeon pea= Rs. 40/kg.

shown a tremendous impact on family welfare. Sharp rise in prices of farm inputs including labour and *status quo* cotton market rates resulted in farmers' suicides. This is rather unbelievable and unimaginable that cash crop cultivation has resulted in human loss (Sabesh *et al.*, 2011).

From 2 years experimentation, it is concluded that based on net profit, cropping system involving cotton intercropped with pigeon pea and addition of green gram, sesame, maize and pearl millet mix crops proved significantly profitable. (Lithourgidis *et al.*, 2011). These experiments need to be repeated to confirm these results. However, market rates of pigeon pea are increasing every year making it most profitable crop compared to cotton alone. Therefore, current recommendation should be modified with more rows of pigeon pea in cotton or growing it as sole crop. Addition of pulses has other advantages for farming community. For example, farmers have experienced better family livelihood because plucking pods of green gram early in the crop season and pods of pigeon pea during later period of crop season, and consuming grains in various traditional recipes helped them in food security. Selling green maize cobs and sesame seeds in local markets

(both being in great demand) fetched them additional money for fulfilling other family needs. From this point of view, there is urgent need to integrate minor food crops in the adopted cropping pattern to support nutritional security and family finance of local communities (Gahukar, 2014).

Currently, cotton is cultivated in the region as sole crop and is intercropped with pigeon pea by a few farmers. Mix cropping is practically non-existent. One of the realities is that farmers are habituated to grow cotton as sole crop and do not know the advantages of other crops. In the present investigation, intercropping and mix cropping systems in cotton cultivation were profitable and have supported family livelihood. Therefore, farmers have to change their mind set in order to implement diversified cropping systems.

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