

# Knowledge and Adoption of Intercrop in Sugarcane from Kolhapur District

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**Abstract** – The extension research was conducted in college development block of agriculture college, Kolhapur in the year 2016. From this study it was indicated that almost all respondents were aware of all technologies recommended by M.P.K.V., Rahuri. With respect to intercropping in sugarcane, respondents were preferred the vegetable crop as intercrop (60.00 per cent). Majority of the respondents mentioned there was no any harmful effects of intercrop on main crop followed by intercrops helps in maintain soil fertility. It was observed that most of the respondents remarked constraints of increase in earthing-up period (98.00 per cent) and first earthing-up and intercultural operations are not possible (94.00 per cent).

**Keywords** – Sugarcane, Intercrop, Knowledge and Adoption.

## I. INTRODUCTION

Sugarcane an important agro-industrial crop plays a pivotal role in Indian economy since it provides raw material to the second largest agro-based industry after cotton. It is major commercial crop of the country and occupies 5.2 m ha area. According to the Indian Sugar Mill Association (ISMA) area under sugarcane crop in 2015-16 was 53.58 lakh hectares in India [1]. Similarly, Maharashtra, have a 10.6 lakh ha area during same year [2]. Kolhapur district is said to be a major sugarcane growing district having 1,46,295 ha area and average productivity 93.2 t/ha[3]. In view of changing market scenario, consumers' preferences and global competitions, new income generating opportunities need to be created through crop diversification sugarcane in 'Produce to Product Chain'. This would help in increasing the land utilization efficiency, reducing the production cost, economizing the use of market purchased costly inputs and making plant-ratoon system sustainable. This in turn raises the socio-economic status of small and marginal resource constrained respondents and generates employment especially for rural women and youths. Land being inelastic, sugar industry can no longer stay with extensive cultivation of sugarcane for its future growth. Therefore, importance of intercropping and crop diversification has been recognized profitable and economical for combating the future problems. As sugarcane is planted in wide rows (75-80 cm) and grows slowly with lateral spread in its early stages of growth and therefore, the inter row spaces remain vacant for three to five months depending on the season of planting [4]. In theory, sugarcane is a crop that offers unique possibilities for intercropping. The plant cane crop takes two to three months to become established during which time food

crops can be planted in the interline spaces, to make better use of incident solar energy and rainfall [5]. There is a variety of choices for making a selection of suitable crops which varies from place to place depending upon the season, geographical regions and agro climatic conditions prevailing in different sugarcane growing areas [6]. Since increasing the area under these crops is not possible due to limited availability of agricultural land, the only option is to increase the cropping intensity and crop productivity on the available land. The productivity of land could be enhanced substantially by growing intercrops in the space left between sugarcane rows. Keeping the idea in view, this research was undertaken to study knowledge and adoption of intercropping in sugarcane by the respondents and constraints faced and suggestions made by the respondents.

## II. METHODOLOGY

The study was conducted purposively in the Hatkanangle, Radhanagari and Bhudharghar tahsils of Kolhapur district which comes under College Development Block, Agriculture College, Kolhapur during the year 2016-2017. Ten villages having maximum area under sugarcane from each tahsils were selected purposively and list of the sugarcane growers was obtained from concern Agriculture Assistant of College Development Block.

**Table 1: Selection of villages**

Sr. No.	Tahsils		
	Hatkanagale	Radhanagari	Bhudharghar
1	Padali	Kapileshwar	Gargoti,
2	Talsande	Titve	Salpewadi,
3	Wathar	Chandre	Shindewadi,
4	Ghunaki	Waghapur	Phanaswadi,
5	Alate	Arjunwada	Ambawane,
6	Male	Turambe	Kalnawadi,
7	Sajani	Mangoli	Khanapur,
8	Kabnoor	Talashi	Hanbarwadi
9	Sambhapur	Kasarwada	Sonali
10	Top	Admapur	Shindewadi

From each selected villages, 5 respondents were selected randomly. The respondents were interviewed with the help of structured interview schedule personally. In all 150 respondents were interviewed for this study. The extent of adoption of innovations/recommendations was studied. The constraints in adoption of technologies and suggestions of respondents for efficient use of innovations were also studied. Ex-Post Facto Design was used. The

data were tabulated and processed through the primary and secondary tables. The statistical tools like frequency, percentages, and means of the averages was used for interpreting the data and inferences are drawn.

### III. RESULTS AND DISCUSSION

#### Sugarcane Cultivation

From Table 2 it is found that three-fourth (76.00 per cent) of the respondents preferred pre-seasonal season for sugarcane plantation. It may be due to the flood situation and *adsali* season mostly affected by that situation. It was also observed that respondents from river basin do not follows the *adsali* and prefers only *preseasonal* and *suru* seasons. Till today majority of farmers preferred *Co-86032* cultivar of sugarcane. Nearly 44.00 percent of respondents grow sugarcane crop since 10 to 20 years and half per cent of respondents obtained annual income upto Rs.1.5 lakh rupees from sugarcane crop. Only 5.33 per cent of respondents were obtained income of Rs. 5.01 lakh and above. It may be due to the more area under sugarcane crop.

**Table 2. Distributions of respondents according to sugarcane cultivation**

Sr. No.	Information of Sugarcane cultivation	No. of respondents(N=150)	
		Number	Percentage
1	<b>Season</b>		
	Adsali	28	18.67
	Preseasonal	114	76.00
	Suru	21	14.00
	Ratoon	2	1.33
2	<b>Varieties</b>		
	Phule -265	24	16.00
	CoM- 86032	105	70.00
	Co-92005	60	40.00
3	<b>Production (t/ha.)</b>		
	Less than 100	61	40.67
	101 – 150	53	35.33
4	<b>Experience (yrs)</b>		
	Up to 5	22	14.67
	6 to 10	29	19.33
	10 to 20	65	43.33
	21 to30	22	14.67
5	<b>Income from sugarcane(Rs.)</b>		
	Up to 1.5 lakh	74	49.33
	1.51-3.00 lakh	52	34.67
	3.01- 5.00 lakh	16	10.67
	5.01 and above	8	5.33
		<b>150</b>	<b>100.00</b>

#### Intercrop Cultivation

Regarding intercrops grown in sugarcane, majority of respondents (65.33 per cent) were taken intercrops in *rabi* season followed by *kharif* (22.00 per cent) and *summer* (14.00 per cent). Respondents were preferred the vegetable (68.00 per cent) as a intercrops in sugarcane. This results were agrees with the findings of [7] in Mauritius. Nearly

the 38.00 respondents taking intercrop since 6 to 10 years. Three-fifth of respondents (60.00 per cent) had income up to Rs. 25,000/- from intercrop followed by Rs. 25001/- to 35,000/- (28.00 per cent). More than 60.00 per cent of respondents taking intercrops for domestic purpose followed by surplus income in short period (49.33 per cent), secondary income source (48.00 per cent) and fulfilment of sugarcane cultivation cost (38.00 per cent). The table 3 indicates distribution of respondents according to intercrop grown by them.

**Table 3. Distribution of respondents according to intercrop cultivation**

Sr. No.	Information of Sugarcane cultivation	No. of respondents (N=150)	
		Number	Percentage
1	<b>Season</b>		
	Kharif	33	22.00
	Rabi	98	65.33
	Summer	21	14.00
2	<b>Intercrops</b>		
	i. Cereals(Wheat, Maize)	45	30.00
	ii. Pulses(Gram, Masura)	51	34.00
	iii. Oil seeds – (Ground nut, Soybean and Sesamum)	48	32.00
	iv. Vegetables(Onion, Cabbage, Methi Coriander)	102	68.00
3	<b>Experience (yrs)</b>		
	Up to 5	57	38.00
	6 to 10	56	37.33
	10 to 20	32	21.33
	21 to30	5	3.33
	31 and above	0	0.00
		<b>150</b>	<b>100.00</b>
4	<b>Income from intercrop(Rs.)</b>		
	Up to 25000/-	90	60.00
	25001 to 35,000/-	42	28.00
	35001- 45,000/-	8	5.33
	45,001/- and above	10	6.67
		<b>150</b>	<b>100.00</b>
5	<b>Purpose</b>		
	Secondary income source	72	48.00
	Fulfilment of sugarcane cost	57	38.00
	Domestic use	92	61.33
		74	49.33

#### Knowledge and Adoption of Sugarcane Cultivation

Almost all respondents were adopted ridges –furrow method for planting, chemical fertilizer, use of straight fertilizers and inter-culturing operations. Majority of the respondents adopted fertilizer application by broadcasting method (98.00 per cent), ridges – furrows of 120 cm (89.33 per cent) and four splits of N-fertilizer (90.67 per cent).

#### Knowledge and Adoption of Intercrops

Table 5 indicated that almost all farmers had knowledge about technology of various intercrops. In relation to complete adoption, all respondents were mentioned there was no any extra provision of intercultural operations, irrigation management, crop protection, harvest time and marketing in local market. In short, all intercrops can be yielded successfully on same intercultural and irrigation

management of sugarcane. More than 75.00 per cent of respondents adopted seed as source of propagation of intercrops, placement of seeds/ seedlings at centre of ridges and furrows and intercrops fulfilled their life cycle on fertilizers which were given to sugarcane that means saving of fertilizers can be possible. Most of the respondents 98.00 per cent were not adopted biological

seed treatments and separate irrigation and fertilizer management of intercrops.

**Table 4. Distributions of respondents according to their knowledge and adoption about sugarcane cultivation**

Technologies	Knowledge (N=150)				Adoption (N=150)			
	Complete	%	No	%	Complete	%	No	%
<b>Method of cultivation</b>								
Ridges & Furrows	150	100.00	-	-	150	100	0	0.0
Paired row planting	150	100.00	-	-	35	23.3	115	76.6
Use of seed sets								
Single eye bud	150	100.00	-	-	21	14.00	129	86.00
Double eye bud	150	100.00	-	-	113	75.33	37	24.67
Triple eye bud	150	100.00	-	-	3	2.00	147	98.00
Seedlings	150	100.00	-	-	11	7.33	139	92.67
<b>Spacing(cm)</b>								
Between setts								
30	150	100.00	-	-	118	78.67	32	21.33
60	150	100.00	-	-	29	19.33	121	80.67
90	150	100.00	-	-	0	0.00	150	100.00
Between seedlings								
30	150	100.00	-	-	9	6.00	141	94.00
60	150	100.00	-	-	3	2.00	147	98.00
90	150	100.00	-	-	0	0.00	0	0.00
Between ridges								
120	150	100.00	-	-	134	89.33	16	10.67
150	150	100.00	-	-	13	8.67	137	91.33
180	150	100.00	-	-	3	2.00	147	98.00
Paired row (cm)								
120	150	100.00	-	-	21	14.00	129	86.00
150	150	100.00	-	-	1	0.67	149	99.33
180	150	100.00	-	-	13	8.67	137	91.33
240	150	100.00	-	-	0	0.00	150	100.00
<b>Reason for paired row</b>								
Intercrop	150	100.00	-	-	35	23.33	115	76.67
White woolly aphid protection	150	100.00	-	-	11	7.33	139	92.67
Aeration	150	100.00	-	-	23	15.33	127	84.67
<b>Seed treatment</b>								
Chemical treatment	150	100.00	-	-	53	35.33	97	64.67
Biological	150	100.00	-	-	36	24.00	114	76.00
Precaution during seed treatment								
In shade	150	100.00	-	-	30	20.00	120	80.00
10 min. soak in Chemicals	150	100.00	-	-	66	44.00	84	56.00
30 min. for biological	150	100.00	-	-	52	34.67	98	65.33
first chemical then biological	150	100.00	-	-	56	37.33	94	62.67
<b>Fertilizer management</b>								
Types of fertilizer								
Chemical	150	100.00	-	-	150	100.00	0	0.00
Biological	150	100.00	-	-	4	2.67	146	97.33
Roughages	150	100.00	-	-	66	44.00	84	56.00
Concentrated	150	100.00	-	-	21	14.00	129	86.00
Use of fertilizers								
Straight	150	100.00	-	-	106	70.67	44	29.33
Mixed	150	100.00	-	-	85	56.67	65	43.33
Compound	150	100.00	-	-	5	3.33	145	96.67
<b>Method of fertilizer application</b>								

Technologies	Knowledge (N=150)				Adoption (N=150)			
	Complete	%	No	%	Complete	%	No	%
Broadcasting	150	100.00	-	-	147	98.00	3	2.00
Crow bar	150	100.00	-	-	1	0.67	149	99.33
Drip	150	100.00	-	-	2	1.33	148	98.67
<b>Use of straight fertilizer</b>								
Urea	150	100.00	-	-	150	100.0	-	-
SSP	150	100.00	-	-	150	100.0	-	-
MOP	150	100.00	-	-	150	100.0	-	-
<b>Urea in split</b>								
2	150	100.00	-	-	3	2.00	147	98.00
4	150	100.00	-	-	136	90.67	14	9.33
6	150	100.00	-	-	11	7.33	139	92.67
<b>SSP in splits</b>								
2	150	100.00	-	-	107	71.33	43	28.67
4	150	100.00	-	-	43	28.67	107	71.33
6	150	100.00	-	-	0	0.00	150	100.00
<b>MOP in splits</b>								
2	150	100.00	-	-	92	61.33	58	38.67
4	150	100.00	-	-	55	36.67	95	63.33
6	150	100.00	-	-	3	2.00	147	98.00
<b>Mixed fertilizer in split</b>								
2	150	100.00	-	-	13	8.67	137	91.33
4	150	100.00	-	-	47	31.33	103	68.67
6	150	100.00	-	-	12	8.00	138	92.00
<b>Use of micronutrient</b>								
Ferrous sulphate	150	100.00	-	-	102	68.00	48	32.00
Zinc sulphate	150	100.00	-	-	100	66.67	50	33.33
Boron	150	100.00	-	-	43	28.67	107	71.33
Magnesium sulphate	150	100.00	-	-	86	57.33	64	42.67
Sulphur	150	100.00	-	-	92	61.33	58	38.67
<b>Irrigation management</b>								
Application method								
Ridges-Furrows	150	100.00	-	-	150	100.0	0	0.00
Drip	150	100.00	-	-	2	1.33	148	98.67
Raingun	150	100.00	-	-	0	0.00	150	100.00
<b>Intercultivation</b>								
Interculture operations	150	100.00	-	-	150	100.0	0	0.00
Weeding								
2	150	100.00	-	-	15	10.00	135	90.00
4	150	100.00	-	-	115	76.67	35	23.33
6	150	100.00	-	-	20	13.33	130	86.67
Weed management by chemical method	150	100.00	-	-	85	56.67	65	43.33
<b>Selection of herbicides</b>								
Pre-emergence	150	100.00	-	-	37	24.67	113	75.33
post-emergence	150	100.00	-	-	62	41.33	88	58.67
Age of crop at post emergence								
60	150	100.00	-	-	60	40.00	90	60.00
90	150	100.00	-	-	75	50.00	75	50.00
120	150	100.00	-	-	40	26.67	110	73.33
<b>Earthing- up</b>								
First	150	100.00	-	-	35	23.33	115	76.67
Second	150	100.00	-	-	150	100.0	0	0.00
<b>Crop protection</b>								
Chemical method	150	100.00	-	-	125	83.33	25	16.67
Biological	150	100.00	-	-	3	2.00	147	98.00
<b>Harvesting</b>								
In time	150	100.00	-	-	103	68.67	47	31.33
after time	150	100.00	-	-	47	31.33	103	68.67
<b>Production (t/ha)</b>								
<b>Adsali</b>								
Less than 100	150	100.00	-	-	1	0.67	149	99.33

101 – 150	150	100.00	-	-	15	10.00	135	90.00
More than 151	150	100.00	-	-	12	8.00	138	92.00
<b>Preseasonal</b>								
Less than 100	150	100.00	-	-	50	33.33	100	66.67
101 – 150	150	100.00	-	-	26	17.33	124	82.67
More than 151	150	100.00	-	-	38	25.33	112	74.67
<b>Suru</b>								
Less than 100	150	100.00	-	-	8	5.33	142	94.67
101 – 150	150	100.00	-	-	12	8.00	138	92.00
More than 151	150	100.00	-	-	1	0.67	149	99.33
<b>Ratoon</b>								
Less than 100	150	100.00	-	-	2	1.33	148	98.67
101 – 150	150	100.00	-	-	0	0.00	150	100.00
More than 151	150	100.00	-	-	0	0.00	150	100.00

**Table 5. Distributions of respondents according to their knowledge and adoption about intercrop**

Technologies	Knowledge				Adoption n(N=150)			
	Complete	%	No	%	Complete	%	No	%
<b>Method of propagation</b>								
Seed	150	100.00	-	-	116	77.33	34	22.67
Seedlings	150	100.00	-	-	60	40.00	90	60.00
<b>Seed treatment</b>								
Chemical	150	100.00	-	-	31	20.67	119	79.33
Biological	150	100.00	-	-	3	2.00	147	98.00
<b>Placement of seed/seedlings</b>								
Centre of ridges	150	100.00	-	-	115	76.67	35	23.33
Pairedrow	150	100.00	-	-	35	23.33	115	76.67
<b>Fertilizer management</b>								
Separate provision	150	100.00	-	-	26	17.33	124	82.67
Sufficient fertilizers of sugarcane	150	100.00	-	-	124	82.67	26	17.33
<b>Inter cultivation</b>								
Separate provision	150	100.00	-	-	0	0.00	150	100.00
Sufficient of sugarcane	150	100.00	-	-	150	100.00	0	0.00
<b>Irrigation management</b>								
Separate provision	150	100.00	-	-	0	0.00	150	100.00
Sufficient of sugarcane	150	100.00	-	-	150	100.00	0	0.00
<b>Crop protection</b>								
Separate provision	150	100.00	-	-	0	0.00	150	100.00
Sufficient of sugarcane	150	100.00	-	-	150	100.00	0	0.00
Extra provision for vegetable	150	100.00	-	-	23	15.33	127	84.67
<b>Harvesting time</b>								
In time	150	100.00	-	-	150	100.00	0	0.00
after time	150	100.00	-	-	0	0.00	150	100.00
<b>method of harvesting</b>								
Cutting	150	100.00	-	-	46	30.67	104	69.33
Uprooting	150	100.00	-	-	50	33.33	100	66.67
Picking	150	100.00	-	-	102	68.00	48	32.00
<b>Marketing</b>								
Local market	150	100.00	-	-	150	100.00	0	0.00
Weekly bazar	150	100.00	-	-	37	24.67	113	75.33

### **Opinion about Intercrops**

It is observed from table 6 that the all the respondents agreed with intercropping gave extra income. Majority of the respondents mentioned there was no any harmful effect of intercrop on main crop (98.67 per cent), intercropping helps in maintain soil fertility (96.67 percent), availability of fresh

vegetables (94.67 per cent), intercropping gives income in short period (91.33 per cent).

Opinion of the respondents about intercropping in sugarcane is fulfils the expenditure cost of sugarcane (81.33 per cent), daily economic need of family (73.33 per

cent), weed irradiations (61.33 per cent) and availability of green fodder (56.00 per cent).

**Table 6. Distributions of respondents according to their opinions about intercrop**

Opinions	No. of respondents (N=150)	
	Number	Per cent
Extra income	150	100.00
No any effect on main crop	148	98.67
Increases soil fertility	145	96.67
Availability of fresh vegetables	142	94.67
Income in short period	137	91.33
Fulfilment of expenditure cost of main crop	122	81.33
Fulfilment of daily economic need of family	110	73.33
Weed eradication	92	61.33
Availability of green fodder	84	56.00

### Constraints

It is observed that most of the respondents were facing constraints namely increase in earthing-up period (98.00 per cent), first earthing-up and intercultural operations are not possible (94.00 per cent each), possibility of pest and disease attack (82.67 per cent) and lack of post emergence herbicide in sugarcane (73.33 per cent).

**Table 7. Constraints faced by the respondents**

Constraints	No. of respondents (N=150)	
	Number	%
Increase period of earthing-up	147	98.00
First earthing-up is not possible	141	94.00
Obstacles in interculturing operations	141	94.00
Possibility of pest and disease attack	124	82.67
Post emergence herbicides are not possible to apply.	110	73.33
Lack of labour	92	61.33
Spacing of emitters changes according to intercrop	78	52.00

### Suggestions

Majority of the respondents suggested growing of short duration intercrop (88.00 per cent), short duration varieties of sugarcane is needed in *adsali* planting (80.67 per cent), availability of common agril. intercultural implements (79.33 per cent) and need of mechanization (46.00 per cent).

**Table 8. Suggestions made by respondents for effective intercrop in sugarcane**

Suggestions	No. of respondents (N=150)	
	Number	Per cent
There should be short duration intercrop crop	132	88.00
There should be short duration sugarcane variety in <i>adsali</i> season	121	80.67
Common agril. Implements should be available to interculture operations for sugarcane & intercrop	119	79.33
Technology regarding weed control should be developed	92	61.33
Instead of labour, there should be mechanization	69	46.00

## CONCLUSIONS

- Most of the farmers were grown sugarcane in pre-seasonal season followed by *adsali* (18.67 per cent) with majority of farmers preferred *COM-86032* cultivar of sugarcane followed by *Co-92005* (40.00 per cent) and *Phule-0265* (16.00 per cent).
- Majority of respondents (65.33 per cent) were taken intercrops in *rabi* season. Majority of respondents were preferred the vegetable (68.00 per cent) and obtained income up to Rs. 25,000/- from intercrop (60.00 per cent).
- All respondents were mentioned there was no any extra provision of intercultural operations, irrigation management, crop protection, harvest time and produce marketing in local market.
- All the respondents agreed with intercrops gave extra income.
- Most of the respondents were remarked constraints of increase in earthing-up period (98.00 per cent) and first earthing-up and intercultural operations are not possible (94.00 per cent).
- Majority of the respondents suggested growing of short duration intercrop (88.00 per cent), need of short duration varieties of sugarcane in *adsali* planting (80.67 per cent), and common agril. intercultural implements (79.33 per cent) and need of mechanization (46.00 per cent).

## RECOMMENDATION

It was observed that majority of respondents grows vegetables and nourishes it without affecting sugarcane crop in which they earn extra income and minimize the production cost of sugarcane therefore, it is recommended that intercrop of vegetable specially onion are beneficial in *preseasonal* sugarcane crop. For that State Agricultural Department and Krishi Vigyan Kendra should emphasize on adoption of onion crop in sugarcane crop as an intercrop.

## REFERENCES

- [1] Anonymous, 2015a. Economic Survey of Maharashtra 2014-15. Directorate of Economics and Statistics, Planning Department, Government of Maharashtra, Mumbai : 78-79.
- [2] Anonymous, 2015b. Sugar industries in India. Indian Sugar Mills Association report May-2015.
- [3] Anonymous, 2016. Estimated area, production and productivity of Sugarcane in Kolhapur district. Districts of India.
- [4] Parsons M.J. 2003. Successful intercropping of sugarcane. Proc S Afr Sug Technol Ass (2003) 7: 77-98
- [5] Saxena MC (1972). Concept of parallel multiple cropping. Proceedings of a Symposium on multiple cropping, New Delhi. Indian Society of Agronomy.
- [6] Pandey MB and Shukla SK (2000). Quality and productivity of promising sugarcane (*Saccharum officinarum*) genotypes under various planting seasons and nitrogen levels in sub-tropical India. Indian J Agron 45(3): 617-623.
- [7] Ng Kee Kwong KF, Umrit G and Deville J (1996). Nitrogen fertilization of sugarcane in an intercropping system with maize and potato in the humid tropical climate of Mauritius. Experimental Agriculture 32(2): 213-218.