

**RESEARCH ARTICLE :**

# Adoption of sustainable cultivation practices followed by strawberry growers

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**SUMMARY :** Globally, strawberries are grown in huge quantities in Australia, the U.S.A. (California and Florida), Italy, Germany, Spain and France. Strawberry is important fruit crop of India and its commercial production is possible in temperate and subtropical climate. In India it is generally cultivated in the hills. Strawberry is also successfully cultivated in plains also in Maharashtra around Pune, Nashik and Sangali districts of Maharashtra. The present study on adoption of sustainable cultivation practices followed by strawberry growers was undertaken in Mahabaleshwar tehsil of Satara district region of western Maharashtra State with sample size of 110 respondents from 6 villages. Data were collected on personal, socio-economic, communicational and psychological profile of farmers and knowledge and adoption sustainable practices was certain by using exploratory design of social research. Data from the respondents were collected by personally interviewing with the help of present and well-structured interview schedule. About 61.82 per cent of the respondents have medium level of adoption about sustainable cultivation practices followed in strawberry cultivation.

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## BACKGROUND AND OBJECTIVES

In India area under fruit crops in 1991-1992 was 2874 ha which increases in 2013-2014 upto 88977 million tonnes. The growth rate of fruit crops production is 9.5 per cent in 2013-2014. (National Horticulture Database 2014). In Mahabaleshwar Tahsil area under strawberry cultivation was 850 ha. in which 1800 farmers were engaged which produces 20000 tonnes of strawberry which have an worth goes above 100 crore. The concept of sustainable development, therefore, helps us to understand our limitations in the world we

live in. It helps to understand that we cannot establish our authority on the earth and its resources. Also, we cannot exploit or overuse them in a way that they affect the need of generation to come, a hundred or thousand year later. The problem that we are facing today's world are complex, serious and we need to address them. The issue of sustainability raised in agricultural practices also.

## RESOURCES AND METHODS

For the present study, Satara district is purposively selected as it has highest area

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under strawberry cultivation. In Satara district, the highest area in under strawberry cultivation in Mahabaleshwar tahsil, hence, it was selected. The list of strawberry growers from the selected villages was obtained from Agricultural assistant and agricultural supervisors of the respective villages. Total 110 respondents were selected by proportionate random sampling method for the present study.

## OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

### Adoption of strawberry growers about sustainable cultivation practices:

The data in respect of the adoption level of strawberry growers about sustainable cultivation practices were collected and analyzed.

It is observed from Table 1 that a 61.82 per cent of strawberry growers had medium level knowledge, while 21.82 had low level of adoption. Only 16.36 per cent of strawberry growers had high level of adoption.

**Table 1: Distribution of the respondents strawberry growers by their level of adoption about sustainable cultivation practices**

Sr. No.	Adoption level	No. of the respondents (n= 110)	Percentage
1.	Low( upto 104 score)	19	21.82
2.	Medium ( 104 to 110 score)	67	61.82
3.	High ( 111 and above score)	24	16.36
	Total	110	100.00
	Mean=107.5	S.D.=3.19	

### Practice wise adoption level of the respondents about sustainable cultivation practices:

The information pertaining the adoption level of strawberry growers about the sustainable cultivation practices followed in strawberry cultivation given in Table 2 is discussed as under.

#### Land preparation :

The data reveals that, 16.36 per cent and 83.63 per cent of the respondents had completely adopted ploughing the land by bullock power and tractor power, respectively while 83.63 per cent and 16.36 per cent of the

respondents had no adoption of ploughing the land by bullock power and tractor power, respectively.

#### Method of planting :

It was observed that, cent per cent of the respondents had completely adopted of raised bed planting.

#### Cropping intensity :

It was observed that, majority of the respondents had had complete adoption about strawberry rotated with legumes (89.09 %), followed by vegetables (52.72 %), cereals (6.37 %) and all (0.90 %) for better soil fertility while the respondents had partial adoption about strawberry rotated with cereals (73.63 %), legumes (10.90 %), vegetables (19.09 %), and all (2.72 %). And the respondents had no adoption about strawberry rotated with all (96.36 %), vegetables (28.18 %) and cereals (20.00 %) for better soil fertility.

#### Planting :

It was observed from Table 2 that 10.90 per cent and 92.00 per cent of strawberry growers had complete adoption about planting distance  $4 \times 3$  m and  $4 \times 4$  m, respectively and 5.45 per cent and 2.72 per cent the respondents had partial adoption about planting distance  $4 \times 3$  m and  $4 \times 4$  m, respectively also 83.36 per cent and 13.63 per cent of strawberry growers had no adoption about planting distance  $4 \times 3$  m and  $4 \times 4$  m, respectively.

#### Planting time :

The data in Table 2 revealed that 69.09 per cent, 43.63 per cent and 94.54 per cent of the respondents had a complete adoption about planting time of March-April, September-October and November-December, respectively and 6.36 per cent, 25.45 per cent and 5.45 per cent of the respondents had a partial adoption about planting time of March-April, September-October and November-December, respectively also 21.80 per cent and 30.90 per cent of the respondents had a no adoption about planting time of March-April and November-December, respectively.

#### Planting distance :

It was observed from Table 2 that 73.36 per cent and 78.18 per cent of the respondents strawberry growers had complete adoption about spacing between plant to plant and row to row  $45 \times 60$  cm and  $50 \times 75$  cm,

respectively and 5.45 per cent and 11.81 per cent the respondents had partial adoption about spacing between plant to plant and row to row  $45 \times 60$  cm and  $50 \times 75$  cm, respectively also 20.90 per cent and 10.00 per cent of the respondents strawberry growers had no adoption about spacing between plant to plant and row to row  $45 \times 60$  cm and  $50 \times 75$  cm, respectively.

### Season of propagation :

The result presented in Table 2 shows that, majority of the respondents strawberry growers had complete adoption about soil should be well supplied with hoeing (82.27 %), moisture (79.09 %) and cent per cent of respondent had complete knowledge about weed free at seedling stage while 5.45 per cent of the respondents had partial adoption about moisture and hoeing while 15.45 per cent and 11.81 per cent the respondents had no adoption about soil should be well supplied with moisture and hoeing at seedling stage.

### Integrated nutrient management :

The data presented in Table 2 shows that 50.90 per cent of the respondents had complete adoption about amount of FYM compost used (15-25 tones/acre) while 20.90 per cent of the respondents had partial adoption about amount of FYM compost used (15-25 tones/acre). and 28.31 per cent of the respondents had no adoption about amount of FYM used (15-25 tones/acre).

It was revealed that, cent per cent of the respondents had complete adoption of application of FYM before sowing.

It was observed that, only 19.09 per cent of the respondents had complete complete adoption of vermicompost (5-10 tones/ha) applied to field while 3.63 per cent of the respondents had partial adoption vermicompost (5-10 tones/ha) applied to field while 77.27 per cent of the respondents had no adoption of vermicompost (5-10 tones/ha) applied to field.

### Green manuring crops :

It was revealed that, 6.36 per cent of the respondents had complete adoption of green manuring crop (*i.e.* dhaincha). while 20 per cent and 80 per cent of the respondents had partial and no adoption green manuring crop (*i.e.* dhaincha).

It was observed that, 29.09 per cent of the respondents had complete adoption of green manuring crop (*i.e.* sunhemp). while 6.36 per cent and 64.54 per

cent of the respondents had partial and no adoption green manuring crop (*i.e.* sunhemp).

It was revealed that, 2.72 per cent of the respondents had complete adoption of green manuring crop (*i.e.* cowpea). While 6.36 per cent and 93.36 per cent of the respondents had partial and no adoption green manuring crop (*i.e.* cowpea).

### Biofertilizers :

The data presented in Table 2 shows that 60.00 per cent and 42.00 per cent of the respondents had complete adoption of biofertilizer application like *Azotobacter* and rhizobium, respectively while 6.36 per cent and 8.18 per cent of the respondents had partial adoption of biofertilizer application like *azotobacter* and rhizobium, respectively and 24.54 per cent and 53.63 per cent of the respondents had no adoption of biofertilizer application like *azotobacter* and rhizobium, respectively.

### Mulching:

It was observes that, cent per cent of the respondents had complete adoption of plastic mulch and no adoption of trash mulch.

### Chemical fertilizers :

The present data reveals that, cent per cent of strawberry growers had complete adoption about straight fertilizers (urea), Mix fertilizers (DAP), complex fertilizers (19:19:19) but near about more than one third of the respondents (35.45 %) had complete adoption of fertilizer dose of strawberry while 19.09 per cent and 45.45 per cent the respondents had partial and no adoption of fertilizer, respectively.

- Integrated water management
- Integrated pest management
- Weed management

It was observed that, 71.80 per cent of the respondents had complete adoption of cultural method of weed management while 7.27 per cent and 20.90 per cent of the respondents had partial and no adoption of cultural method of weed management, respectively.

Majority of the respondents had complete knowledge about hand weeding (83.63 %).

It was revealed that, 60.00 per cent of the respondents had complete adoption of weed management by improved implements while 22.72 per cent and 1.81 per cent of the respondents had partial and no adoption of weed management by improved implements,

<b>Table 2 : Distribution of Practice wise adoption level of sustainable cultivation practices followed in strawberry cultivation (n=110)</b>							
Sr. No.	Statement	Adoption					
		Full		Partial		No	
		F	%	F	%	%	%
1	<b>Land preparation</b>						
1.1	Ploughing the land						
	By using bullock power	18	16.36	-	-	92	83.63
	By using tractor / power tiller	92	83.63	-	-	18	16.36
1.2	<b>Which is best method adopt for planting?</b>						
	Flat bed	-	-	-	-	-	-
	Raised bed	110	100	-	-	-	-
1.3	Do you have polyhouse for planting of strawberry?	11	10	-	-	99	90
2	<b>Nursery</b>						
	You have nursery to grow seedlings?	14	12.72	7	6.36	89	80.90
2.1	<b>Cropping intensity</b>						
2.2	<b>For better soil fertility strawberry should be rotated with;</b>						
	Legumes	98	89.09	12	10.90	-	-
	Cereals	7	6.36	81	73.63	22	20.00
	vegetables	58	52.72	21	19.09	31	28.18
	All	1	0.90	3	2.72	106	96.36
3	<b>Planting</b>						
3.1	<b>Do you know spacing of raised beds ?</b>						
	4×3 m	12	10.90	6	5.45	92	83.36
	4×4 m	92	83.63	3	2.72	15	13.63
3.2	<b>Which is the proper timing of planting?</b>						
	March-April	76	69.09	7	6.36	24	21.81
	September –October	48	43.63	28	25.45	34	30.90
	November-December	108	94.54	6	5.45	-	-
3.3	<b>What is a spacing between plant to plant and row to row ?</b>						
	45 × 60 cm	81	73.36	6	5.45	23	20.90
	50 × 75 cm	86	78.18	13	11.81	11	10
3.4	Do you know about propagation ?	110	100	00	-	-	-
	<b>Season of propagation</b>						
	After blooming season	91	82.72	9	8.18	10	9.09
3.5	<b>Do you know how to take care of young seedling ?</b>						
	<b>Soil should be well supplied with</b>						
	Moisture	87	79.09	6	5.45	17	15.45
	Hoeing	91	82.27	6	5.45	13	11.81
	Weed free	110	100	-	-	-	-
4	<b>Integrated nutrient management</b>						
4.1	Amount of FYM/compost to be used per ha						
	15-25 tonnes	56	50.90	23	20.90	31	28.81
4.2	<b>Time of application of FYM</b>						
	Before sowing	110	110	-	-	-	-
	After sowing	-	-	-	-	110	100
4.3	5-10 t/ha vermicompost applied to field	21	19.09	4	3.63	85	77.27
4.4	<b>Do you adopt green manuring crops to be grown?</b>						
	Dhaincha	7	6.36	22	-	88	80
	Sunhemp	32	29.09	7	6.36	71	64.54
	Cowpea	3	2.72	7	6.36	103	93.63
4.5	<b>Do you know the biofertilizer application?</b>						
	<i>Azotobacter</i>	66	60	7	6.36	27	24.54

Table 2 : Contd.....

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	Rhizobium	42	38.18	9	8.18	59	53.63
4.6	Which type of mulching you practice?						
	Trash mulch	-	-	-	-	110	100
	Plastic mulch	110	100	-	-	-	-
4.7	<b>Which chemical fertilizers are generally applied to strawberry?</b>						
	Straight fertilizer	110	100	-	-	-	-
	Urea						
	Mix fertilizer	110	100	-	-	-	-
	DAP						
	Complex fertilizer	110	100				
	19:19:19						
4.8	<b>Do you adopt fertilizer dose?</b>						
	120kgN:100kgP:75kgK/ha	39	35.45	21	19.09	50	45.45
5.	<b>Integrated water management</b>						
5.1	Do you adopt the different methods of irrigation?						
	Drip	110	100	-	-	-	-
	Furrow	-	-	-	-	110	100
	Any other	-	-	-	-	-	-
5.2	<b>Do you adopt the time interval for irrigation?</b>						
	Per day	91	82.27	-	-	-	-
	Weekly	19	17.27	-	-	-	-
	Fortnightly	-	-	-	-	-	-
6.	<b>Integrated pest management</b>						
6.1	<b>Do you adopt the different method of weed management?</b>						
	Cultural methods	79	71.81	8	7.27	23	20.90
	Hand weeding	92	83.63	18	16.36	-	-
	Mulching	110	100	-	-	-	-
	Use of improved implements	66	60	25	22.72	19	17.27
	Use of herbicide	7	6.36	2	1.81	101	91.81
6.2	<b>Do you adopt the application of weedicide?</b>						
	Glyphosate	26	26.63	34	30.90	50	45.45
6.3	<b>Do you adopt the different methods of IPM tools?</b>						
	Cultural methods	78	70.90	11	10	21	19.09
	Mechanical method	79	71.81	11	10.00	20	18.18
	Use of chemicals/pesticides	103	93.63	7	6.36	-	-
	Biological method	13	11.81	24	21.81	74	67.27
	Indigenous technical knowledge	21	19.09	11	10	78	70.90
	Fruit borer	91	82.72	8	7.27	11	10
6.4	<b>Do you adopt the application of pesticides ?</b>						
	Thrips – Emidachloprid/Rigent	73	66.36	5	4.54	32	29.09
	Red mites – Majester	89	80.90	3	2.72	18	16.36
	Cutworms – before planting dusting heptachlor in soil.	28	25.45	19	17.27	63	57.27
	Fruit borer – corazen	86	78.18	9	8.18	15	13.63
6.5	<b>Do you adopt the different tools of IDM?</b>						
	Use of disease free seed material	110	100	-	-	-	-
	Uproot and burn the disease affected plants	89	80.90	11	10	10	9.09
	Biological methods	12	10.90	14	12.72	84	76.36
	Use of chemicals	110	100	-	-	-	-
6.6	<b>Do you know the chemicals used for controlling diseases?</b>						
	Root rot – curzate	85	77.27	7	6.36	18	16.36
	Powdery mildew- index	76	69.90	7	6.36	27	24.54

Table 2 : Contd.....

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	Anthracnose- Taqat	79	71.81	12	10.90	19	17.27
	Leaf blight – curzate	66	60	21	19.09	23	20.90
6.7	<b>Do you adopt the proper time of harvesting?</b>						
	For local market fruit should be harvested when fully ripe	110	100	-	-	-	-
	For distant market fruit should be harvested still firm and colour not fully developed.	110	100	-	-	-	-
7.	<b>What management practices should be followed after harvesting to fetch good price in market?</b>						
	Sorting	98	89.09	7	6.36	5	4.54
	Grading	87	79.09	11	10	12	10.90
	Packing	34	30.90	54	49.09	22	20
	Storing	17	15.45	24	21.81	69	62.27

respectively.

It was revealed that, only 6.36 per cent of the respondents had complete adoption of use of herbicide for control of weeds while 1.81 per cent and 91.81 per cent had partial and no adoption of use of herbicide for control of weeds, respectively.

It was observed that, only 6.36 per cent of the respondents had complete adoption of use of glyphosate for control of weeds 1.81 per cent and 91.81 per cent of the respondents had partial and no adoption of glyphosate for control of weeds.

#### **Integrated pest management :**

It was observed that, 70.90 per cent of the respondents had complete adoption of cultural method of pest management while 10.00 per cent and 19.09 per cent the respondents had partial and no adoption of cultural method of pest management, respectively.

The data reveals that, 71.81 per cent and 93.63 per cent of the respondents had complete adoption of mechanical method and use of chemicals for controlling pest, respectively and 6.36 per cent and 21.81 per cent of the respondents had partial adoption of mechanical method and use of chemicals for controlling pest, respectively, also 18.18 of the respondents had no adoption of use of chemicals for controlling pest.

It was reveals that, 11.81 per cent of the respondents had complete adoption of biological method of pest management while 21.81 per cent and 67.27 per cent the respondents had partial and no adoption about biological method of pest management, respectively.

It was observed that, About 19.09 per cent of the respondents had their complete indigenous technical adoption while 10 per cent and 70.90 per cent the respondents had their partial and no indigenous technical

adoption for management of pest, respectively.

It was observed that, majority of the respondents had complete adoption chemical used in controlling pests *i.e.* red mites-majester (80.90 %), fruit borer-corazen (78.18 %) thrips-emidachlopid/rigent (66.36 %) and cutworms-before planting dusting heptachlor in soil (25.45 %), While some the respondents had partial adoption of chemicals used in controlling pests *i.e.* cutworms-before planting dusting heptachlor in soil (17.27 %), fruit borer-corazen (8.18 %), thrips-emidachlopid/regent (4.54 %) and red mites-majester (2.72 %) and few the respondents had no adoption about chemicals used in controlling pests *i.e.* thrips-emidachlopid/regent (29.09 %), red mites-majester (16.36 %), cutworms-before planting dusting heptachlor in soil (57.27 %) and fruit borer-corazen (13.63 %).

#### **Integrated disease management :**

It was observed that, cent per cent of the respondents had complete adoption of use of disease free seed materials different tools of integrated disease management followed by uproot and burn the disease affected plants and use of chemicals (80.90 %) while 10.90 per cent of the respondents had complete adoption of biological method of disease management and 12.72 per cent and 76.36 per cent of the respondents had partial and no adoption of biological method of disease management, respectively.

Majority of the respondents had complete knowledge about major diseases in strawberry field *i.e.* anthracnose (89.09 %), leaf blight (83.63 %), root rot (82.72 %) and powdery mildew (80.90 %), while some the respondents had partial knowledge about major diseases in strawberry field *i.e.* powdery mildew (19.09 %), root rot (17.27 %), leaf blight (16.36 %), and anthracnose (10.90 %).

It was observed that, number of the respondents had complete adoption about chemicals used in controlling diseases *i.e.* root rot – curzate (77.25 %), Antracnose-Taqat (71.81 %), powdery mildew-index (69.90 %) and leaf blight – curzate ( 60.00 %). While some of the respondents had partial adoption of chemicals used in controlling diseases *i.e.* leaf blight – curzate (19.09 %), Antracnose-Taqat (10.90 %), root rot – curzate (6.36 %) and powdery mildew-index (6.36 %) few the respondents had no adoption about chemicals used in controlling diseases *i.e.* root rot – curzate (16.36 %), powdery leaf blight – curzate (20.90 %), mildew-index (24.54 %) and Antracnose-Taqat (17.27 %).

### Proper time of harvesting :

It was revealed that all the respondents had complete adoption of proper time of harvesting *i.e.* for local market fruit should be harvested when fully ripe and for distant market fruit should be harvested still firm and colour not fully developed.

### Management after harvesting :

#### Sorting:

Present data reveals that, 89.09 per cent of the respondents had complete adoption about sorting while 6.36 per cent and 4.54 per cent of the respondents had partial and no adoption about sorting, respectively.

#### Grading:

Present data reveals that, 79.09 per cent of the respondents had complete adoption about grading while 10.00 per cent and 10.90 per cent of the respondents had partial and no adoption about grading, respectively.

#### Packing:

It was observed that, 30.90 per cent of the respondents had complete adoption about packing while 49.09 per cent and 20 per cent of the respondents had partial adoption and no about packing.

#### Storing:

The data reveals that, 15.45 per cent of the respondents had complete adoption about grading while 21.81 per cent and 62.72 per cent of the respondents had partial and no adoption about storing, respectively.

### Conclusion:

It was observed that, 83.63 per cent of respondents

had complete adoption of ploughing the land by using tractors/ power tiller. Cent per cent of respondents had adoption of raised bed for planting. About 90.00 per cent of respondents had no adoption of polyhouse for strawberry cultivation. Majority of respondents had no adoption of nursery grow seedlings. 89.09 per cent of respondents had complete knowledge about strawberry rotated with legumes.

It was observed that, 83.63 per cent of respondents had complete adoption of spacing of raised beds (4 × 4 m). About 94.54 per cent of respondents had complete adoption of proper timing of planting (November-December). About 82.27 per cent of respondents had complete adoption propagation after blooming season. Majority of respondents had adoption of soil should be well supplied with moisture, hoeing and weed free. About 50.90 per cent of respondents had adoption of amount of FYM used per acre. About 77.27 per cent of respondents had no adoption of application of vermicompost application. Majority of respondents had no adoption of green manuring crop (Dhaincha, sunhemp and cow pea) 60.00 per cent of respondents had complete adoption of biofertilizer application. Cent per cent of respondents had complete adoption of plastic mulch and fertilizers generally used in strawberry cultivation while about 50.00 per cent of respondent had no adoption of fertilizer dose. Cent per cent of respondents had complete adoption method of irrigation (drip). Majority of respondents (82.27 %) had complete adoption of the time interval of irrigation (per day). Majority of respondents had complete adoption of integrated weed management. Majority of respondents had complete adoption of integrated pest management. 80.90 per cent of respondents had adoption of majester for controlling of red mites. Majority of respondents had complete adoption of integrated pest management. 77.27 per cent of respondents had adoption of curzate for controlling root rot. Cent per cent of respondents complete adoption of proper time of harvesting. About 89.09 per cent of respondents had complete adoption of sorting while 62.27 per cent of respondents had no adoption of storing.

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