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Extent of Adoption of Tomato Cultivation Practices among Farmers under Shade Nets in Kolar District of Karnataka

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ABSTRACT

Indian agriculture is severely affected from climate change, fragmentation of cultivable land, water scarcity, rapid urbanization, declining crop production and productivity, crash in market price, declining biodiversity, ever increasing population, increased demand for food especially vegetables. Protected cultivation has offered a new dimension to produce more in a limited area. The study was undertaken during the year 2016-17 in Kolar district. From each taluk respondents were selected by using purposive sampling procedure to constitute a sample size of 80 for the study. The study found that no one respondent raised nursery for seedlings. In case of cultural practices, with respect to ploughing, nearly two third partially adopted the recommended number of ploughings, no one adopted digging practice, whereas more than half of the respondents partially adopted the recommended size of bed and nearly half of the respondents belonged to partial adoption category of bed treatment for tomato cultivation. Variables such as annual income, extension participation, exhibited positive and significant relationship with adoption behaviour of respondents.

Keywords: Adoption, Correlation, Shade net, Tomato

INTRODUCTION

Agriculture is basically climate/season based and highly dependent on environment and it is very difficult to get favourable climatic conditions for crop growth and development as per crop need. Hot and humid climatic conditions characterized in rainy and post rainy season is most favourable for both crop and crop enemies. To raise a healthy disease free crop, spring-summer seasons are considered as most suitable. But, fast climatic changes happening across the globe has changed climatic characteristics of a season, which has resulted in untimely rains and other fluctuations in the spring-summer season, posing the challenge to develop climate resilient technologies. Not even that, with time extreme hot and cold temperature stresses have been noticed in geographically varied locations where it was not supposed to be earlier based on various geographical factors deciding the climatic conditions of that area. Therefore, there is need to develop suitable technologies to sustain these challenges which may come up in the form of various biotic and abiotic factors (Singh, 2014). Protected cultivation technology offers the options to manipulate the climatic conditions and various other related stresses. Being a tricky technology highly depending upon intelligent implementation of protected structures for vegetable cultivation by having a knowhow on "*What, When, Where and Why*" *to* implement offers the basic benefit of extra protective shelter restricting or minimizing

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the exposure of the crops to various adverse factors. Even though the application of chemicals for controlling biotic stresses is also low under protected structures which gives a high quality safe vegetables for human consumption. By using protected structures, it is also possible to raise an offseason and long duration vegetables of high quality (Chandan *et al.*, 2015).

Vegetable farming in agri-entrepreneurial models targeting various niche markets of the big cities is inviting regular attention of the vegetable growers for diversification from traditional ways of vegetable cultivation to the modern methods (Singh *et al.*, 2015). Under the new era of Foreign Direct Investment (FDI) in retail, these kinds of models posses high potential for enhancing the income of farmers opting for quality and offseason vegetable cultivation through protected cultivation (Singh *et al.*, 2011). In 1965, Indo-American Hybrid Seeds (Pvt) Ltd., Bangalore first introduced greenhouse technology in India in commercial production of seeds, ornamental plants and cut flowers. During 1990, with support of Agricultural and Processed Food Products Exports Development Authority (APEDA), Ministry of commerce, Govt. of India, and several polyhouses are established by private entrepreneurs at Bangalore, Pune, Hyderabad and New Delhi. Defence Agricultural Research Laboratory (DARL), DRDO, at Pithoragarh and Chamoli districts successfully developed polyhouse vegetable production technology for capsicum, tomato, pea, brinjal etc in winter season. In recent years protected cultivation has offered new dimension to produce more in a limited area in Kolar district. An attempt has been made to analyse the adoption behaviour of farmers about tomato cultivation practices so that suitable training programmes and suggestions can be offered for its scaling to non-traditional region of the state.

METHODOLOGY

The study was undertaken during the year 2016-17 in the selected three taluks of Kolar district of Karnataka state. Based on maximum number of shade net structures under protected cultivation, Kolar, Malur and Mulbagal taluks were selected for the study. From each taluk 32, 28 and 20 respondents were selected by using purposive sampling procedure to constitute a sample size of 80 for the study. Majority of the farmers are growing capsicum and tomato under protected cultivation (Shade net). In the present study adoption referred to the acceptance and practice of some or all the recommended protected cultivation practices of capsicum and tomato crops by the respondent. The scores for each one of the individual practices adopted were arrived at considering the relative importance of the items in consultation with specialist of Indian Institutes of Horticultural Research, Bangalore. The answers elicited from the farmers were compared and quantified by giving score of 2, 1 and 0 for full adoption, partial adoption and non adoption, respectively. The full adoption was referred as the completely adopting recommended practices in their protected cultivation structure (Shade net) and partial adoption is the slightly deviation from the recommended practices/dosage. The non adoption is the adopting the cultivation practices other than recommended practices/dosage. Based on the total scores, the respondents were grouped into three categories as low, medium and high by using mean and standard deviation as a measure of check as suggested by Sengupta (1967) and followed by Singh (2010). Karl Pearson correlation coefficient was calculated to find out the relationship of adoption with socio personal and economic variables.

RESULTS AND DISCUSSION

Adoption behaviour of farmers about tomato crop cultivation practices under protected cultivation

Pursuant to Table 1 it can be seen that none of the respondent raised nursery for seedlings. The probable reason might be lack of extension functionaries' effort from respective departments. Most of the farmers were using *'Abhinava'* as a tomato hybrid which is high yielding, resistance to leaf curl disease and nematode infestation from Syngenta private seed company. In case of cultural practices, with respect to ploughing, nearly two third (62.50%) of the respondents partially adopted the recommended number of ploughings (2-3 times). On the other hand, none of the respondents adopted the digging practice, whereas more than half (53.75%) of the respondents partially adopted the recommended size of bed (1 meter width, 15 cm height and 0.5 meter between the rows) and nearly half (48.75%) of the respondents

Table 1: Distribution of respondents according to adoption behaviour of farmers about tomato crop cultivation practices under protected cultivation (n=80)

S.No.	Package of practices	Recommended dosage/acre	FA		PA		NA	
			F	%	F	%	F	%
I	**Nursery Raising**							
1.	Seed rate	200 gm	0	0	0	0	80	100
2.	Growing media	Coco peat	0	0	0	0	80	100
3.	Depth of sowing	0.5 cm	0	0	0	0	80	100
II	**Cultural practices**							
1.	Ploughing	2-3 times	30	37.50	50	62.50	0	00.00
2.	Digging		0	0	0	0	80	100
3.	Bed preparation	1 meter width and 15 cm height and 0.5 meter between the rows	25	31.25	43	53.75	12	15.00
4.	Bed treatment	Formaldehyde @ 4%	29	36.25	39	48.75	12	15.00
5.	FYM application	80 tons	24	30.00	56	70.00	0	0
6.	Mulching							
a.	Residue mulching		3	3.75	0	0	77	96.25
b.	Plastic mulching	400 gauge of 100 micron and 5 cm diameter of holes	19	23.75	45	56.25	16	20.00
III	**Transplanting**							
1.	Selection of cultivars	Naveen and Sun 7611	0	0	0	0	80	100
2.	Age of Seedlings	35-40 days	23	28.75	57	71.25	0	0
3.	Seedling rate	18000-20000	19	23.75	61	76.25	0	0
4.	Seedling treatment	Imidachlopride@ 0.1ml/ltr	21	26.25	45	56.25	14	17.50
5.	Spacing	60X45cm	31	38.75	49	61.25	0	0.00
6.	Seedling treatment one day after transplanting	Copperoxychloride @ 0.3%	11	13.75	56	70	13	16.25
IV	**Fertilizer management**							
1.	Inorganic Fertilizers	60:60:60	13	16.25	54	67.50	13	16.25
2.	Organic fertilizers	200 kg (Neem Cake)	26	32.5	40	50.00	14	17.50
3.	Biofertilizers							
3.1	*Tricoderma viridae*	2 kg	6	7.5	38	47.50	36	45.00
3.2	*Psuedomonas*	2 kg	4	5.00	46	57.50	30	37.50
V	**Pruning**	28 DAP @ interval of 3-4 days	37	46.25	29	36.25	14	17.5
VI	**Training**	30 DAP	22	27.5	42	52.50	16	20.00
VII	**Deleafing**	70DAP	3	3.75	17	21.25	60	75.00
VIII	**Drip irrigation and Fertigation**							
1.	Irrigation	Half an hour per day	24	30.00	56	70.00	0	00.00
2.	Fertigation	3rd week after transplanting and twice in a week	21	26.25	47	58.75	12	15.00
3.	Recommended fertilisers							
a.	19:19:19	15 kg	18	22.50	46	57.50	16	20.00

Table 1 contd....

S.No.	Package of practices	Recommended dosage/acre	FA		PA		NA	
			F	%	F	%	F	%
IX	**Integrated Pest Management**							
1.	Cultural method	Summer ploughing/soil solarisation	68	85.00	0	0	12	15.00
		Burning of previous crop plant residues	57	71.25	0	0	23	28.75
		Crop rotation	80	100	0	0	0	0
		Growing of trap crops like Marigold, Bhindi etc.,	46	57.50	0	0	34	42.50
2.	Mechanical method	Nylon mesh	75	93.75	0	0	5	6.25
		Removal of infested parts of the plants (viral diseases)	74	92.50	0	0	6	7.50
		Light traps (6 traps/acre)	26	32.50	40	50.00	14	17.50
		Pheromone Traps (4-5)	10	12.50	60	75	10	12.50
3.	**Chemical methods**							
a.	Mites	Dicofol @ 2 ml/litre	21	26.25	33	41.25	26	32.50
b.	Thrips	Acephate @ 1.5 g/litre	23	28.75	45	56.25	12	15.00
c.	Fruit borer	Corboryl @ 0.1%	21	26.25	46	57.50	13	16.25
d.	White flies	Imidacloprid @ 0.4%	17	21.25	49	61.25	14	17.50
e.	Root knot nematode	Corbofuran @ 20 kg/acre	22	27.50	45	56.25	13	16.25
4.	**Biological method**							
a.	Nematodes	Neem cake @ 800 kg/ acre 4-5 days before transplanting to the beds	35	43.75	32	40.00	13	16.25
b.	Aphids and mites	Pongamia oil @ 5-8 ml/L	19	23.75	48	60.00	13	16.25
X	Harvesting	75-85 DAP	29	36.25	38	47.50	13	16.25

FA=Full Adoption, PA=Partial Adoption, NA=Non Adoption, F=Frequency, %= Per cent

belonged to partial adoption category of bed treatment (@ 4% formalin for tomato cultivation). The majority (70.00%) of the respondents partially adopted the recommended FYM application (80 tons). In case of mulching, more than three fourth (96.25%) of the respondents did not use crop residues as a mulching and more than half (56.25%) of the respondents partially adopted the recommended plastic mulching (400 gauge of 100 micron and 5cm diameter of holes). The probable reason might be that, low education leads to less knowledge and high cost involved in cultural practices of tomato under shade net.

In case of transplanting, none of the respondents cultivated any recommended tomato cultivars (Sun 7611 and Naveen) under shade net, majority (71.25, 76.25, 56.25 and 61.25%) of the respondents partially followed the recommended age of the seedlings (35-40 days), seedling rate (18000-20000), seedling treatment (Imidachlopride @ 0.1 ml/L) and spacing (60X45 cm) respectively. Nearly three fourth (70.00%) of the respondents partially followed the drenching of one day transplanted seedlings (Copper oxychloride @ 0.3%). The possible reason for this might be that, lack of knowledge about recommended practices. Majority (67.50% and 50.00%) of the respondents partially adopted the recommended dosage of inorganic fertilizers (60:60:60) and organic fertilizers (200 kg Neem Cake) respectively. In case of bio fertilizers, 47.50 per cent and 57.50 per cent of the respondents partially adopted the recommended dosage of bio fertilizers respectively. The probable reason might be that, lack of knowledge about fertilizer management, non availability and high cost. Regarding training and pruning, more than half (46.50%) of the respondents fully adopted the recommended days

for pruning (28 DAP @ interval of 3-4 days) and more than half (52.50%) of the respondents partially adopted the recommended days of pruning (30 DAP @ interval of 8-10 days). Whereas, three fourth (75.00%) of the respondents did not adopt the de-leafing practice. The lack of information and technical knowledge regarding the pruning besides higher labour cost, complexity in practice and lack of skill to practice might have favoured the situation. With regard to irrigation and fertigation, nearly three fourth (70.00%) of the respondents partial adopted the recommended duration for irrigation (Half an hour a day). On the other hand, nearly two third (58.75%) of the respondents partially adopted the recommended time for fertigation (3rd week after planting and twice in a week) and 57.50 per cent of the respondents partially adopted the recommended dosage of water soluble fertilizers (19:19:19 @ 4 kg). The lack of technical information about irrigation, fertigation and high cost may be the reason for above research findings.

The results of Integrated Pest Management (IPM) as evident from the Table shows that majority (85.00%) of the respondents had full adoption of summer ploughing practice. On the other hand, nearly three fourth (71.25%) of the respondents adopted the recommended burning of previous crop plant debris, whereas, cent per cent respondents fully adopted the recommended crops for rotation like marigold, cauliflower etc and more than half (57.50%) of the respondents fully adopted the recommended trap crops like marigold, sweet corn, bhindi etc. The past farming experience and lower cost is the probable reason for above findings. Regarding mechanical method, three fourth (75.00%) of the respondents had partially adopted the recommended pheromone traps (4-5 traps) for pest control, whereas overwhelming (93.75%) of the respondents fully adopted the recommended nylon mesh for pest control. In case of removal of infested parts of the plants, 92.50 per cent of the respondents were in full adoption category and 50 per cent of the respondents partially adopted the recommended light traps (6 light traps/acre). The possible reason might be lack of scientific information and skill training about IPM practices.

Majority (41.25%) of the respondents had partially adopted the recommended plant protection chemicals such as Dicofol @ 2 ml/L for mites management, whereas more than half (56.25%) of the respondents partially adopted the recommended plant protection chemicals such as Acephate @ 1.5 g/L for thrips control. On the other hand, more than half (57.50%) of the respondents partially adopted the recommended chemicals such as Carboryl @ 0.1 per cent for fruit borer management and nearly two third (61.25%) of the respondents partially adopted the recommended chemicals such as Imidacloprid @ 0.4%, meanwhile, more than half of the (56.25%) of the respondents partially adopted the recommended chemical such as Carbofuran (20 kg) for nematode management. The possible reason might be lack of scientific information and higher plant protection chemicals and labour cost. In case of biological method, nearly half (43.75%) of the respondents had fully adopted the recommended bio pesticide such as neem cake (800 kg) for nematode control, whereas nearly two third (60.00%) of the respondents partially adopted the recommended bio pesticide such as Pongamia oil (5-8 ml/L) for aphids and mites control. Above all, non availability of biocontrol agents as expressed by respondents might be the possible reason for lesser adoption. Nearly half (47.50%) of the respondents partially adopted the recommended days for harvesting of capsicum (75-80 DAP).

Relationship between socio-economic profile of respondents and extent of adoption

Table 2 shows that, variables such as annual income, extension participation, exhibited positive and significant relationship with adoption extent of respondents at 1 per cent level of significance. Whereas, age, education, farming experience, size of land holding, social participation, mass media utilization, information seeking behaviour, risk orientation, management orientation, scientific orientation and source of finance exhibited positive and significant relationship at 5 per cent level of significance. Results are in support of that of Roy *et al.* (2015). With respect to relationship of independent variables with extent of adoption of tomato, variables like annual income, extension participation, exhibited positive and significant relationship at 1 per cent level of significance. On the other hand, age, education, farming experience, size of land holding, social participation, mass

Table 2: Relationship between socio-economic profile of respondents and extent of adoption of capsicum and tomato cultivation practices

Independent variable	Karl Pearson's 'r' value	
	Adoption of capsicum cultivation practices under shade net	Adoption of tomato cultivation practices under shade net
Age	0.328*	0.428*
Education	0.227*	0.316*
Farming experience	0.308*	0.472*
Size of Land holdings	0.377*	0.325*
Annual income	0.421**	0.259**
Social participation	0.165*	0.229*
Extension Participation	0.281**	0.245**
Mass media utilization	0.220*	0.216*
Information seeking behaviour	0.120*	0.138*
Risk orientation	0.563*	0.407*
Management orientation	0.458*	0.585*
Scientific orientation	0.310*	0.452*
Source of finance	0.125*	0.258*

media utilization, information seeking behaviour, risk orientation, management orientation, scientific orientation and source of finance exhibited positive and significant relationship in case of capsicum cultivation practices at 5 per cent level of significance.

CONCLUSION

The protected cultivation is one of the interventions for climate smart agriculture. The study found that majority of the respondents belonged to partial adoption category with respect to adoption behaviour of tomato and capsicum crop cultivation practices under shade net and no one farmer adopted the recommended tomato cultivar under shade net. This bring to focus that it is of utmost importance to design more number of extension activities like demonstrations, study tours, exposure visits to convince the farmers about cultivation practices of capsicum for full adoption under shade net technology.

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