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Perception and Adoption Level of Improved Off-season Tomato Cultivation Practice among Farm Women of Odisha

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Abstract

Study was undertaken in the selected villages of Keonjhar district of Odisha to assess the impact of Krishi Vigyan Kendra (KVK) intervention on the perception and adoption level of off-season tomato cultivation practices among the farm women. Profitability of small holder farm women can be improved by diversification through high value crops like vegetables during the off-season. The study area comes under North Central Plateau agro-climatic zone of the state which offered ample opportunities for the production of vegetables like tomato, cole crops, radish, coriander during the wet season, when the market demand for these vegetables are very high in comparison to the normal season. Realizing the potential of off-season vegetable production in improving the livelihoods of farming community, KVK, Keonjhar popularized this profitable venture through training and demonstration and after five years of intervention, the study for assessing the impacts revealed that the farmwomen of the KVK adopted villages had higher perception and adoption level on the important technologies of off-season tomato cultivation in comparison to the KVK non-adopted villages. However, their perception and adoption need to be improved in the areas like integrated nutrient and pest management practices in general and bio-fertiliser and bio-pesticide application, use of pheromone traps, selection of suitable safer insecticides and micronutrient application in particular. The personal and psycho-sociological attributes like participation level in training & demonstration, extension contact, exposure to best practices, farming experience, mass media exposure, progressiveness, scientific orientation, institutional orientation, education, social participation, communication behaviour and risk orientation had positive and significant association with the extent of adoption.

Keywords: Perception, adoption, off-season tomato cultivation

1. Introduction

Vegetable based farming is rapidly emerging as one of the important production systems in India as this enterprise produces a much higher income than any other type of farming in a shorter period of time. With a uniform market demand throughout the year vegetable farming has tremendous potential to become the viable livelihood option for large number of small and marginal farmers of the country. Vegetables are important sources of vitamins, minerals and micronutrients, dietary fiber, antioxidants and provide farmers with higher income per hectare in comparison to cereal, pulses, oil seeds and other crops. In the recent

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years off-season vegetable production in the hilly and inland regions of the country is assuming greater importance as there is always a better profitability than the conventional on-season vegetable farming. Off-season vegetable farming refers to the production of vegetables in unusual seasons by adopting suitable technologies and farm inputs to meet the market demand throughout the year (Kunwar et al., 2015). Farmers in hilly areas earn additional remuneration through off-season cultivation of tomato under protected cultivation with in a small piece of land (Bharat and Sharma, 2014). Keonjhar is a tribal dominated district situated in the northern part of the state of Odisha and due to conducive climate, favorable topography and varied agro-ecological situation it is highly suitable for diversified farming. Vegetable based farming is one of the predominant farming systems and off-season cultivation of tomato during wet season is a common practice and involvement of farm women in off season tomato cultivation has been quite encouraging. Farmers growing tomatoes during the kharif season have received high profits in comparison to growing tomatoes in the rabi season (Zaman et al., 2010). Karim et al. (2009) estimated the benefit cost ratio for off-season tomato production from Jessore district of Bangladesh and reported that it was as high as 4.2.

Since the ancient time women continue to perform a number of farm operations starting from sowing to harvesting and post harvesting and contribute significantly for increasing the agricultural production. Besides their active involvement in farm operation they also influence the decision making process and play a pivotal role in the adoption and rejection of a specific technology. However, Kimaro et al., 2015 reported that women are less involved in vegetables cultivation and their participation in could be improved through adequate training and awareness. Training has been reported to improve knowledge and change the farmers' attitude in crop pest management (Gautam et al., 2017). As agriculture is becoming more and more technology intensive, technological empowerment of farm women is absolutely essential for improving its productivity, profitability, stability and sustainability. Studies also reveal that fruits and vegetables offer immense scope to increase income levels of smallholders and improve the productivity of scarce resources (Subramanian et al., 2000 and Joshi et al., 2003). Adoption of improved vegetable production technologies can lead to dramatic improvements in yield and economic well-being (Weinberger and Genova, 2005). However, a majority of farmers in developing countries have not been able to adopt newly developed technologies because of their limited resources and limited access to relevant information regarding the technology (Ghimire and Huang, 2015). In order to adequately address this issue, a good extension service delivery and strong linkages between farmers, extension, research and education are prerequisites (Rivera et al., 2009). The successful development, dissemination, and adoption of improved technologies for smallholders depend on more than careful planning of research and the use of appropriate methodologies in extension (Cramb, 2003). Tendler (1993) observed that an emphasis on farmer-oriented, participatory research and extension with close coordination draws good results in technology adoption. Farmers' decisions to adopt improved vegetable farming technologies depend on complex factors and one of the factors is farmers' perception of the characteristics of the new practice in comparison with the existing practice (Pinthukas, 2015).

Efforts has been made since the year 2006 by Krishi Vigyan Kendra (KVK), Keonjhar, a district level farm science centre dedicated to bridge the gap between technology generation and technology adoption through front line extension service like capacity building, technology assessment and demonstration to increase the productivity of off-season tomato so that it will be a profitable venture for the small holder farming community. After five years of intervention it was essential to assess the perception level and extent of adoption of improved off-season tomato cultivation technique. Extent of adoption of demonstrated technology was also ascertained using the PRA technique, interview schedules, and group dynamics method to have reliable and valid information (Singh et al., 2008). The findings of the study will not only be helpful to assess the impact of KVK interventions but also to know the level of perception and extent of adoption of improved off-season tomato cultivation in relation various socio-economic parameters.

2. Materials and Methods

The study was undertaken during 2011 in four villages of Sadar block of Keonjhar district of Odisha (21.6289° N, 85.5817° E), India with two villages each from the KVK adopted areas (Basudevpur and Bhalupali) and non-adopted areas (Tikarpara and Dhatika). The study area was purposively selected considering the higher concentration of tomato cultivation during *kharif* season (June to November). The study was carried out by using formal survey method and random sampling procedure was adopted in selecting 60 respondents each from adopted and non-adopted villages (30 from each village). Eighteen important technologies for off-season tomato cultivation were selected and grouped into four major technology categories *viz.* general production technology, integrated nutrient management, integrated pest and disease management and harvesting/ post harvesting. Farm women were directly asked about their perception level of each technological practices as per the pre-structured questionnaire schedule. One score was given to the farm women expressing the meaning of each practice and zero to non-expression. The extent of adoption of off-season tomato cultivation technique was measured by means of "adoption index". The adoption of each technology practice was measured on a three point scale. '3' scores was given for full adoption, '2' scores for partial adoption and '1' score for non-adoption. The sum of the scores of all the selected practice was taken as the

adoption score for each respondent. The index was calculated using the formula, Adoption Index = (Total obtained score/ Total obtainable score)×100 (Roy Burman et al., 2009). As scientific off-season tomato cultivation includes a number of individual technologies, technology wise adoption pattern was also studied and described as full, partial and non-adoption of individual technology. Correlation analysis was conducted to study the relationship of the independent variables like personal attributes, social characteristics, economic profile and psychological characteristics with the adoption behaviour. by estimating the Karl Pearson correlation coefficient (Malgady and Krebs, 1986).

3. Results and Discussion

3.1. Meaning perception of off-season tomato cultivation technology

It could be observed from Table 1 that majority of the farm women (more than 81.67%) of the KVK adopted villages had correct perception about the general production technology practices of off-season tomato cultivation. However, in the non-adopted villages some of the respondents (51.67 to 68.33%) had fair meaning perception about nursery raising technique, transplanting & spacing, water management and weeding and interculture. This findings are supported by the results of Neelu et al., 2018 who reported that there was a vast gap in the knowledge of preparation of nursery beds among the farm women who had less exposure to training and extension activities. Their meaning perception on selection of suitable variety and staking was found to be low. On integrated nutrient management (INM) techniques except bio-fertilizer application the perception level of the farm women of the adopted villages was found to be very much encouraging with 61.67 to 91.67% of the respondents had correct perception on micronutrient application, balanced fertilizer application and manuring. The overall perception of the farm women on INM was low in the non-adopted villages. Though, the perception level of the respondents in the KVK adopted villages about the IPDM practices is quite satisfactory as 51.67 to 76.67% of the participating farm women had basic understanding about different components of IPDM, still more focus is required

Table 1: Distribution of respondents in terms of their meaning perception of various packages of off-season tomato cultivation

Sl. No.	Recommended practice	Correct perception of meaning of the practice			
		Adopted village		Non adopted village	
		Frequency	%	Frequency	%
A. General production technology					
1.	Suitable variety	49	81.67	21	35.00
2.	Nursery raising techniques	51	85.00	31	51.67
3.	Transplanting & spacing	52	86.67	36	60.00
4.	Weeding and Interculture	60	100.00	41	68.33
5.	Staking	60	100.00	24	40.00
6.	Water management	60	100.00	40	66.67
B. Integrated nutrient management					
7.	Manuring	55	91.67	41	68.33
8.	Balanced fertilizer application	42	70.00	14	23.33
9.	Micronutrient(Boron) Application	37	61.67	8	13.33
10.	Bio-fertilizer application	22	36.67	-	-
C. Integrated pest and disease management					
11.	Seed/ seedling treatment	46	76.67	14	23.33
12.	Use of pheromone trap	31	51.67	-	-
13.	Use of neem based products	46	76.67	22	36.67
14.	Application of bio-pesticides	33	55.00	12	20.00
15.	Boarder/ Trap cropping	41	68.33	21	35.00
16.	Use of safer insecticides	36	60.00	11	18.33
D. Harvesting and post-harvesting					
17.	Harvesting	60	100	52	86.67
18.	Sorting and grading	60	100	36	60.00

to improve their perception on this important technology. In contrast the meaning perception about the major components of crop protection practices was found to be very low in the non-adopted villages. The finding derived ample support from Choudhary et al., 2013 who reported that before the project, the knowledge level was about dose and time of application of FYM, chemical fertilizers, and their integrated use ranged from 25 to 41% and knowledge level on plant protection technology was only 24% among the farmers, whereas knowledge level of farmers was increased significantly (INM technology knowledge ranged between 55 and 88%, crop management technology knowledge level ranged between 64 and 81%, post harvest management knowledge ranged between 59 and 80%) after the implementation of farm extension project. Further, Sharma et al., 2008 and Dubey et al., 2008 have reported that an improvement in knowledge and perception level of farmers on farm technologies following appropriate extension technological interventions. Nirmala, 2015 also reported that farm women possessed low knowledge and perception with regard to IPM which indicated that farm women require more outreach programs in IPM. However, Atry Samee et al., 2009 has reported that level of knowledge on sustainable practices play significant role in extent of adoption of IPM practices. Training of farmers enhances adoption of Integrated Pest Management practices (IPM) in vegetable crops, reduce the quantity of pesticide use, frequency of spraying and the habit of mixing different pesticides (Gautam et al., 2017).

3.2. Extent of adoption of off-season tomato cultivation technology

3.2.1. Overall adoption

The distribution of respondents according to their extent of overall adoption of recommended off-season tomato cultivation has been presented in Table 2. It is evident from table 2 that 46.67% of farm women of the KVK adopted villages had medium level adoption and 35% of the respondents had high level adoption of improved off-season tomato production technology justifying the significant impact of KVK interventions on the adoption of scientific off-season tomato cultivation. Whereas, only 18.33% of the farm women were found to be the low adopters of the technology.

However, in the non-adopted villages 53.33 and 31.67% of the participating farm women had low and moderate level of adoption, respectively and only 15% respondents had high level of adoption. The results are in close conformity with the findings of Choudhary et al., 2016 who reported that 39.00 % of the tomato growers of the selected study area had low level of adoption followed by 32.00% had medium and only 10.00% had high. Saxena et al., 2003 also revealed that around 28% of the respondents had high level of adoption of scientific tomato production technology.

Table 2: Distribution of respondents according to their over all extent of adoption of recommended off-season tomato cultivation practice

Adoption category	Adoption Index	KVK adopted Village		KVK non adopted village	
		No.	%	No.	%
Low	< 38.88	11	18.33	32	53.33
Medium	38.88 – 51.85	28	46.67	19	31.67
High	> 51.85	21	35.00	9	15.00

3.2.2. Technology-wise adoption

Technology wise adoption rate of the respondents are depicted in Table 3 and it can be observed that more than 60% farm women of the KVK adopted villages fully adopted the general production technology of off-season vegetable farming with higher adoption rate in water management (85.00%), weeding and interculture (78.33% full and 21.37% partial) and selection of suitable variety (71.67%). Similarly, very encouraging level of adoption was noticed in the INM technologies with maximum adoption rate in manuring (56.67% full and 43.33% partial), balanced fertilizer application (45% full and 55% partial) and micronutrient application (40% full and 28.33% partial). The adoption rate was quite low in bio-fertiliser application technique as only 11.67 and 21.67% of the respondents, adopted this technology fully and partially, respectively.

The study indicated a moderate level of adoption IPDM technology as 51.67% of the respondents fully adopted boarder cropping and trap cropping and 43.33 and 46.67% farm women practiced seed/ seedling treatment and used neem based products, respectively for minimizing the pest incidence. It was observed that 28.33% of the respondents fully adopted and 43.33% partially adopted the judicious application of safer insecticides. While, none of the respondents use pheromone traps, few of them are applying biopesticdes and the low adoption of these technologies are mainly attributed to unavailability of these two IPM products in the local market. Hence it is observed that sincere efforts are to be made for increasing the adoption level of balanced fertilizer application, micro-nutrient and bio-fertilizer application, seed treatment and plant protection measure. The present findings derived ample support from the observations of Meena and Punjabi, 2012 who found that the perception and adoption of farmers towards utilization of micro-elements (5.18%) was poor as limited numbers of farmers using these inputs on their fields. Choudhary et al., 2013 reported that technology adoption level after project completion improved immensely with 35% farmers sincerely started following soil testing, while adoption rate on INM technology with regard to dose and time of FYM application, dose and time of basal and top-dressed chemical fertilizers, and their integrated use with organics varied between 66 and 70%. Besides, crop management practices were adopted by 61 to 75% of farmers, while postharvest management technology was followed by 61% of farmers.

Table 3: Distribution of respondents according to the practice-wise extent of adoption of off-season tomato cultivation

Sl. No.	Recommended practice	KVK adopted villages						KVK non-adopted villages					
		FA		PA		NA		FA		PA		NA	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
A. General production technology													
1.	Suitable variety	43	71.67	-	-	17	28.33	18	30.00	-	-	42	70.00
2.	Nursery raising techniques	37	61.67	14	23.33	9	15.00	9	15.00	15	25.00	36	60.00
3.	Transplanting & spacing	41	68.33	10	16.67	9	15.00	12	20.00	22	36.67	26	43.33
4.	Weeding and Interculture	47	78.33	13	21.67	-	-	16	26.67	21	35.00	23	38.33
5.	Staking	36	60.00	-	-	24	40.00	8	13.33	-	-	52	86.67
6.	Water management	51	85.00	-	-	9	15.00	31	51.67	-	-	29	48.33
B. Integrated nutrient management													
7.	Manuring	34	56.67	26	43.33	-	-	18	30.00	42	70.00	-	-
8.	Balanced fertilizer application	27	45.00	33	55.00	-	-	6	10.0	54	90.0	-	-
9.	Micronutrient (Boron) Application	24	40.00	17	28.33	19	31.67	-	-	8	13.33	52	86.67
10.	Bio-fertilizer application	7	11.67	13	21.67	40	66.67	-	-	-	-	60	100
C. Integrated pest and disease management													
11.	Seed/ seedling treatment	26	43.33	12	20.00	22	36.67	-	-	8	13.33	52	86.67
12.	Use of pheromone trap	-	-	-	-	60	100.00	-	-	-	-	60	100.00
13.	Use of neem based products	28	46.67	14	23.33	18	30.00	-	-	12	20.00	48	80.00
14.	Application of bio-pesticides	4	6.67	7	11.67	49	81.67	-	-	-	-	60	100.00
15.	Boarder/ Trap cropping	31	51.67	-	-	29	48.33	9	15.00	-	-	51	85.00
16.	Use of safer insecticides	17	28.33	26	43.33	17	28.33	-	-	12	20.00	48	80.00
D. Harvesting and post-harvesting													
17.	Harvesting	51	85.00	-	-	9	15.00	42	70.00	-	--	18	30.00
18.	Sorting and grading	23	38.33	-	-	37	61.67	-	-			60	100.00

3.3. Adoption level in relation to different socio-economic characteristics

The results of the correlation analysis indicated that (Table 4) out of 19 characteristics selected for the study participation in training & demonstration, extension contact, exposure to best practices, mass media exposure, progressiveness, scientific orientation, farming experience and institutional orientation had positive and significant association with the extent adoption at one percent level of probability. The psycho-socio-economical characteristics like education, social participation, and communication behaviour and risk orientation were registered to have positive and significant correlation with the adoption level at five percent probability.

However, the attributes like infrastructure/ equipment availability, farm income, access to credit, motivation and decision making behaviour, age, farming experience, family size and land holding did not influence the adoption behaviour of farm women significantly. The non-significant negative relationship between farm size and extent of adoption may justify the higher scope of intensification and diversification of the small holders. The findings derive ample support from the results of Kunwar et al., 2015 who reported that farming experience, access to extension services, training received and education level are the factors that significantly influence the adoption of off-season vegetable production technology by the farm households' in Nepal. Johnson and Manoharan, 2007 revealed that extension contact, mass media exposure, scientific orientation, progressiveness and social participation had positive and significant association with the extent of adoption of improved cultivation practices among the cashew growers. Further Farhad and Kashem, 2004 found that there was positive significant relationship between education and attitude of rural women towards using IPM

Table 4: Relationship between socio-economic and psychological parameters and adoption of off-season tomato production technology

Sl. No.	Socio-economic parameters	Correlation coefficient (r) value
A. Personal attributes		
	Age	-0.124^{NS}
	Education	0.312*
	Farming experience	0.387**
	Family size	0.087^{NS}
B. Social characteristics		
	Institutional orientation (membership in group)	0.367**
	Social participation	0.283*
	Mass media exposure	0.487**
	Extension contact	0.614**
	Participation in training & demonstration	0.693**
	Exposure to best practices	0.574**
C. Economic profile		
	Land holding	- 0.164^{NS}
	Infrastructure/ Equipment availability	0.187^{NS}
	Farm income	0.116^{NS}
	Access to credit	0.076^{NS}
D. Psychological characteristics		
	Scientific orientation	0.385**
	Communication behaviour	0.237*
	Risk orientation	0.272*
	Motivation	0.087^{NS}
	Decision making behaviour	0.162^{NS}
	Progressiveness	0.432**

practices in vegetable cultivation. Level of education impacted significantly on the awareness level and effectiveness of technology adoption in vegetable farming. (Elizabeth and Zira, 2009). Vidogbéna et al., 2015 opined that the negative perception was strongest among vegetable farmers with little or no experience in a farming trial and those living far from extension services.

4. Conclusion

The farmwomen of the KVK adopted villages had higher perception and adoption on the major technologies of off-season tomato cultivation indicating the substantial impact of KVK interventions. But their perception and adoption has to be improved in the areas like bio-fertiliser and bio-pesticide application, use of pheromone traps, selection of safer insecticides and micronutrient application. Similarly, in the non-adopted villages the knowledge and perception level about off-season tomato cultivation need to be improved through some interventions for maximizing the productivity and profitability of this enterprises.

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