Research Paper

Constraints Analysis in Adoption of Vegetable Production Technologies in Malkangiri District, Odisha

S. R. Dash, P. J. Mishra , N. Bar, K. K . Biswas and R. R. Pani

1   Senior Scientist, Krishi Vigyan Kendra, Malkangiri , OUAT, Bhubaneswar ,
2   Dean, Extension Education, OUAT, Bhubaneswar
3   Senior Scientist , Krishi Vigyan Kendra,   Kandhamal , OUAT, Bhubaneswar ,
4, , Branch Manager, SBI, Orkel , Malkangiri
5 Young Professionals, OLM. Mission Shakti.   Malkangiri
*Corresponding author: Samir Ranjan Dash

ABSTRACT
The study aims to explore farmers' practice and   perceived constraints in vegetable farming as well as to identify farmers' perception and their adaptability to improve their income from vegetable farming. It also aims to select and determine factors influencing farmers' perception and adaption level of vegetable production technologies. The present study was conducted during 2021-22 in Kalimela and Malkangiri   block of Malkangiri district, comprising 160 number of farmers, comprising of marginal, small, medium and large farmers from four adopted villages of Krishi Vigyan Kendra, Malkangiri to analyze the problem and constraints like socio-economic, organizational, and technological in the adoption of vegetable cultivation. The study revealed that mean score for all these constraints were higher among   small farmers as compared to marginal, medium and large farmers for vegetable production in the district. It was evident from the study that the major constraints like lack of   technical knowledge on IPM and INM, lack of innovativeness, lack of entrepreneurial ability, poor marketing and storage facilities, less scope for post harvest technologies , lack of effective supervision and monitoring by extension workers were faced by the vegetable growers. The study has confirmed that inadequate marketing networks, low market price at the time of harvest , inadequate crop insurance , poor knowledge about plant protection measures , lack of technical knowledge, poor sources of information and lack of commitment to farming as enterprise are also contributing to low production and low rate of adoption of improved technologies in vegetable production system.
Key words: Vegetable production,   Adoption, Constraints, Socio economic and Organizational support.

I.   INTRODUCTION

Technological change has been the major driving force for increasing agricultural productivity and promoting agriculture development. Any development intervention for rural people should be compatible with their existing livelihood strategies and ability to adapt. Due to the horticulture sector's significant contribution to the state's GDP, it requires special attention in order to achieve higher levels of rural prosperity. In India more than 40 different kinds of vegetables belonging to different groups, viz., solanaceous, cucurbitaceous, leguminous, cruciferous (cole crops), root crops and leafy vegetables are being grown in tropical, subtropical and temperate regions. India, with its wide diversity of climate and soil, has vast potential for growing different types of vegetables round the year. The most important aspect of vegetable cultivation is that it absorbs woman labour to a greater extent compared to other crops. It is not out of place to mention that in many cases housewives entirely manage the vegetable production system up to harvesting and marketing. Smallholders dominate both Indian agriculture and vegetable production system . Across all production sectors, more than 80 per cent of farms are growing high-value crops such as vegetables (Birthal and Joshi, 2007). Modern farming methods matter for smallholder agricultural productivity and food security. Adoption of improved agricultural technologies has been associated with higher earnings and lower poverty (Kassie et al. 2011), improved

nutritional status (Kumar and Quisumbing, 2010), lower staple food prices (Karanja et al. 2003) and increased employment opportunities as well as earnings for landless labourers. (Binswanger and von Braun, 1991).

The adoption of technologies for sustainable farming systems is a challenging and dynamic issue for farmers, extension services, agri-business and policy-makers. The agricultural sector needs to employ a wide range of evolving technologies and farm practices across many different farming systems and structures to meet a variety of changing and heterogeneous demands from consumers. Several factors are influencing the adoption of technologies for sustainable farming systems such as research and development efforts, the trend towards better education and training of farmers, the shift in the focus of quicker means of disseminating and sharing information, availability of financial resources, pressures from consumers and these factors are contributing towards facilitating the adoption of sustainable farm technologies. Many policies, including those relating to agriculture, environment, and research and development, are providing a combination of incentives and disincentives to technology adoption. However, the combination of the many different economic, structural, behavioral and policy factors in a wide range of different situations means that there is no simple or unique explanation as to what leads farmers to adopt particular technologies. The adoption of technologies for sustainable farming systems will be facilitated by a wider participatory approach involving a range of stakeholders. These stakeholders should include farmers, the agri-food industry, consumer groups and credit institutions with an interest for sustainable farming. Malkangiri district comes under South Eastern Ghat Zone of Odisha, the most undeveloped and tribal dominated aspirational district of Odisha but known for its rich agro- biodiversity. Total area covered under vegetable production is 16936 ha in the district and the major vegetables grown mainly in rabi season are   tomato , brinjal, cucurbits like cucumber, pumpkin   and cole crops like cabbage, cauliflower knoll khol and leafy vegetables etc.

II.   OBJECTIVES

The present investigation was under taken to assess the extent of adoption level and constraints faced by the vegetable growers about   recommended technologies of vegetable production .The present study was also designed to assess the contribution of socio-economic attributes of the farmers influencing adoption behavior   and to assess the of various constraints faced by the vegetable growers for scientific vegetable cultivation   and also to find out the strategies for researchers to increase the production and productivity of vegetables in the district. Despite rapid area expansion and adoption of vegetable farming by the farmers in the district, there exist huge gaps in between yield at farmer's field and the potential yield. The gaps are attributed to several problems and constraints faced by the farmers sand such problems and constraints need to be addressed with appropriate strategy to expand vegetable production for doubling the farmer' s income and to provide livelihood support to the farm families .

III.   MATERIALS AND METHODS

The district Malkangiri is a tribal (57.3%) dominated district of the state Odisha , with   (61%) of the people remaining under poverty line   and   low literacy rate (30.53%) (Priyambada , 2017*)   . The present study was undertaken to assess the extent of adoption level of the farmer's about   recommended technologies of   vegetable cultivation in Malkangiri district during rabi season in the year 2021-22.   The two blocks Malkangiri and Kalimela are purposefully selected under study as demonstrations on various high value horticultural crops   were conducted in   these   blocks in previous two   years by Krishi Vigyan Kendra ,Malkangiri and these blocks are irrigated   and most of the farmers are growing vegetables . The ex -post facto research design was used for the study and Multi-stage stratified sampling procedure was employed for selection of vegetable growers. A sample size of 160   vegetable growers randomly selected from four villages   namely MV2, MV-9 of Malkangiri block and   MPV-67, MV-90 of Kalimela block were selected as the respondents. The socioeconomic variables like age, education, land holding, occupation, farming experience**,** extension contact, economic motivation and annual income were selected as the independent variables and adoption level as dependant variable for the study. To collect data semi- structured interview schedule was developed and it was pre- tested and modified accordingly for assembling the relevant data. Percentage and frequency were used to measure the constraints of adoption perceived by the vegetable farmers. The other selected   independent variables were measured by using already developed scales by the earlier researchers. The data were collected through personal interview method using a pretested semi-structured interview schedule. Primary data obtained by well structure questionnaire was used for analyzing the constraints. The selection of sample based on the criteria that farmers having aptitude for year round vegetable cultivation with market oriented behavior to earn their livelihood can be considered as respondents for the study and then appropriate statistical procedure was employed to analyze the data for assessing the effect of different types of constraints on adoption behavior of the respondents. The constraints faced by   vegetable growers differ from individual to individual depending upon their socio-economic status, communication behavior, livelihood requirement, scopes and opportunities of marketing etc. The constraints were classified into three categories namely socio-economic, organizational and

technological constraints measured with the help of a 3 points continuum scale as Strongly Agreed (3), Agreed (2), Disagreed (1) and accordingly each respondent were given score as per their preference to various constraints and mean weighted score was worked out for each statement under above mentioned three categories. The index values of observations were measured with the help of mean score, weighted mean score and mean score percentage. Finally the data were tabulated and analyzed by using frequency, percentage, mean, SD and Pearson's coefficient of correlation "r" and Chi-square test , (Statistical significance was set at $p < 0.05$) to draw the inferences.

IV.   RESULTS AND DISCUSSION

The selected vegetable growers were asked to indicate the socio economic status   and the adoption of different recommended technologies through a structured schedule and the information collected by interviewing the selected growers and tabulated them to identify the individual's socio economic characteristics and the level of adoption of different practices. The results obtained from the present investigation as well as relevant discussion have been summarized under following heads.

Table -1: Socio demographic characteristics of the respondents   (n-160)

Variables	No. of participants	
Age (in years)	Frequency (F)	Percentage (%)
Up to 35 years	42	26.25
36 to 55 years	104	65.00
55 years and above	14	8.75
Education		
Illiterate	27	16.88
Primary level	68	42.50
Middle level	45	28.12
High School	12	7.50
College and above	8	5.00
Land holding (ha)		
Landless	00	0.00
Marginal (< 1.0 ha)	36	22.50
Small (1.0-2.0 ha)	82	51.25
Semi Medium (2.0-4.0 ha)	26	16.25
Medium (4.0-10.0 ha)	16	10.00
Large (> 10.0 ha)	00	0.00
Occupation		
Agriculture and allied sector	82	51.25
Skilled workers	24	15.00
Unskilled and Daily wages	36	22.50
Other	18	11.25
Farming experience (in years)		
Low (less than 3 years)	42	26.25
Medium (3 to 5 years)	51	31.87
High (more than 5 years)	67	41.88
Extension contact		
Low	65	40.63
Medium	74	46.22
High	21	13.13
Economic Motivation		
Low	34	21.25
Medium	88	55.00
High	38	23.75
Average annual income(Rs.)		
Up to 25000/-	28	17.50
25001/- to 50000/-	74	46.25
50000 /- to 100000/-	42	26.25
Above 1.0 lakh	16	10.00

The socio-demographic details of the study participants are given in Table 1. The majority of the respondents (65.0 %) were   in the age group of 36-55 years in the range of minimum of 25 years and a maximum of 68 years. Majority of the respondents were upto primary (42.5 %) followed by middle level educated (28.12%). This was due to that the selected study area was tribal villages and the respondents don't have awareness about education and most of the population does not have access to education with very poor economic status.   According to the land holding most of the respondents (51.25%) were small farmer followed by marginal farmers with agriculture and allied sector as their primary occupation for livelihood.   Majority (41.8 %) of the respondents   had more than five years of farming experience followed by (31.87) medium farming experience.   Majority of the respondents (46.2 %) were medium level of extension contact and economic motivation (55%). Among the respondents   (46.25 %) were found to have annual income within the range 25001 to 50000 ,   as they were mostly small and marginal farmers and their primary occupation was agriculture and allied sectors only without any other source of family income.

Package of Practice wise adoption

Agricultural technology is a broad phrase that refers to seed, genetic material, farming techniques and agricultural inputs that have been developed to make agriculture more efficient. "Effectiveness" encompasses a wide range of outcomes, including productivity,   profitability health, welfare and sustainability.   The agricultural technologies surveyed here can be categorized into broad categories, which are presented in Table 2. A total fourteen recommended   practices were taken for the present study and adoption level was measured for each specific practice.

Table 2 : Recommended package and practice wise adoption of vegetable production technology (n=160)

Sl no.	Cultivation Practices	Full Adoption		Partial Adoption		Non Adoption	
		Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
1	Suitable high yielding Variety	35	21.87	102	63.75	23	14.38
2	Seed rate	102	63.75	25	15.62	33	20.63
3	Seed treatment	55	34.37	75	46.87	30	18.75
4	Proper Time of sowing	60	37.5	78	48.75	22	13.75
5	Land preparation	110	68.75	26	16.25	24	15.00
6	Method of sowing and maintain spacing	95	59.37	47	29.37	18	11.25
7	Optimum plant population	74	46.25	69	43.12	17	10.63
8	Fertilizer and Micro Nutrient application	78	48.75	45	28.12	37	23.13
9	Irrigation management schedule	36	22.5	86	53.75	38	23.75
10	Timely Intercultural operation	38	23.75	78	48.75	44	27.50
11	Ned based Plant protection measure	34	21.25	76	47.5	50	31.25
12	Weed Management	48	30.0	102	63.75	10	6.25
13	Time of harvesting and Post harvest management	105	65.62	45	28.12	10	6.25
14	Grading and sorting at farm gate	35	21.87	102	63.75	23	14.38

It was revealed from the Table 2 that the majority of the respondents (85.62 %) were adopting suitable vegetable varieties like Hybrid and improved varieties as these varieties are giving good yield and the quality vegetables fitting to the consumers' preference   and market demand. Majority (46.87%) of the respondents had medium level of adoption on Seed treatment followed by (34.37%) percent high level of adoption.   A high level of adoption was observed in use of optimum seed rate (79.37%) to maintain optimum plant population in field .The adoption level was very low in practices like plant protection measures,   irrigation management and weed management among the respondents. The findings were in concurrence with the findings of (Singh and Chaudhury, 1995) and   (Katar et al. 2011).

Majority of the respondents were adopting optimum seed rate and maintaining optimum plant population as optimum plant population is the key attributing factor related to yield in vegetable Time of harvesting of green vegetables and cole crops were the major factor for fetching good market price and it was found that most of the respondents had shown medium level of adoption of optimum time of plucking the vegetables to get more return from market . From the above table it could be revealed that (63.75%) percentage of the respondents had shown medium level followed by (21.87%) fully adoption   the practices like primary grading and sorting at farmers field and storing the vegetables in plastic crates and sending them to nearby urban and peri- urban market .

The major differences were observed between recommended package of practices and farmer's practices were   regarding, plant protection measures, weed management, followed irrigation management practices and by soil test based fertilizer application. The results were in conformity with the finding of (Chaudhary et al. 2018) and (Tiwari et al. 2003).

It was also observed that farmers were unaware about plant protection measure (31.25%), weed management (6.25 %), and irrigation management (23.75%). The findings were corroborated with the findings of (Ratna et al. 2010) and (Jasinski and Haley, 2014).

Table 3 : Over all adoption level of recommended practices of vegetable cultivation
(n=160)

Category	Frequency (f)	Percentage (%)
Low (Mean – SD)	41	25.6
Medium (Mean ± SD)	85	53.1
High (Mean + SD)	34	21.3

The distribution of the respondents according to their overall adoption beahviour of recommended practices of vegetable cultivation is given below in Table 3. The adoption of improved technologies is considered as a major factor in the success of the green revolution experienced by Asian countries (Ravallion and Chen, 2004). So emphasis was given on stategy to increase adoption rate of agricultural technologies as viable means to boost farm output and decrease poverty among the farming communities. However, many technologies that appear to be advantageous have a poor adoption rate. It was revealed from this study that majority of the respondents (53.1 %) were found to possess medium level of adoption followed by (25.6 %) of low level of adoption of practices of high value vegetable cultivation. As the farmers were conducting participatory demonstration under the guidance of KVK scientists and due to regular training and capacity development programmes conducted in the operational areas and majority (53.1 %) of farmers had medium level adoption. It can be concluded from these findings that majority of the respondents adopted recommended practices and this may be probably because the respondents might be convinced about the benefits of the recommended technologies of vegetable production .The results of the study were in line with the findings reported by (Waghmod et al. 2020 and (Birthal and Sant , 2004).

Correlation analysis of the selected dependent and independent variables of the vegetable growers

Attempt was also made in the study to assess the influence of socio-economic variables with adoption level of vegetable growers. The correlation coefficients indicating the nature and degree of association between adoptions with the selected independents variables has been calculated and analysis made with Pearson's co-efficient of correlation has been reflected in Table 3.

Table 4: Influence of socio-economic variables on adoption level of vegetable growers

(n=160)

Variables	Value of Correlation coefficient (r)
Age (X_1)	0.185
Education (X_2)	0.341*
Land holding (X_3)	0.481*
Occupation (X_4)	0.395
Farming experience (X_5)	0.289
Extension contact (X_6)	0.425*
Economic Motivation (X_7)	0.268
Annual Income (X_8)	0.312*

*** Significant at 0.05 level**

The data in the Table 4 revealed that some of the selected socio-economic variables covered under study had significantly and positively influenced the adoption level of the respondents. The correlation coefficient, "r" value indicated that the variables like education, land holding , extension contact and annual income of the respondents were the important variables accelerating the adoption level of the respondents towards adopting the recommended package and practices of vegetable cultivation. The variables like education land holding, extension contact and annual income were found to have highly significant and

positive relationships with adoption. Similar findings were also reported by (Veeresh et al. 2020) and (Meghwal and Jadav, 2021)

CONSTRAINTS ANALYSIS

In innovation-diffusion process   the factors like suitability and compatibility, cost of technology, availability of inputs and economic factors of farmers and marketing facilities and incremental return from the technology are   at the individual level in determining adoption decisions. Farmers have a number of challenges when it comes to adopting new technologies and advances. The extent to which the farmer finds the new technology complex and difficult to comprehend, the ease with which the outcomes of an adoption can be observed, the financial cost, the farmer's beliefs and opinions about the technology, the farmer's level of motivation the farmer's perception of the new technology's relevance and the farmer's attitudes toward risk and change are among the factors identified. (Guerin and Guerin, 1994). Despite rapid area expansion and adoption of vegetable farming by the farmers in the district, there exist huge gaps in between yield at farmer's field and the potential yield. The gaps are attributed to several problems and constraints faced by the farmers. Such problems and constraints need systematic analysis to draw a decision on an appropriate strategy and for evolution of a proper policy .It is therefore highly imperative to analyze the constraints and problems perceived by the farmers to realize the available potential production and income.

Table 5 : Constraints related to technical aspects (n=160)

Types with major constraints	Strongly Agreed Farmers	Agreed Farmers	Disagreed Farmers	MS	Index	Rank
Lack of scientific knowledge on package and practices	84	58	18	2.41	0.80	III
Lack of suitable location specific technology	75	54	31	2.28	0.76	V
Inadequate capacity development programme	76	55	29	2.29	0.76	V
Inadequate technology demonstration	78	65	17	2.38	0.79	IV
Lack of knowledge in integrated nutrient management	102	46	12	2.56	0.85	II
Lack of knowledge in integrated plant protection management	110	38	12	2.61	0.87	I
Lack of knowledge on post harvest management	56	84	20	2.23	0.74	VI
Lack of farm mechanisation	48	86	26	2.14	0.71	VII

*(Index = (MS (Mean Score) / 3) *100, where, 3 is the maximum attainable score for each statement)*

Majority of the respondents   stated that lack of knowledge in integrated plant protection management and nutrient management , Lack of Technical know how about   high value vegetable cultivation   and post harvest management were   perceived as the main constraints faced by the vegetable growers. Similar finding were reported by (Sahu et al . 2016).

Table 6   : Constraints related to Socio economic aspects (n=160)

s with major constraints	gly Agreed Farmers	ed Farmers	reed Farmers	MS	ndex	Rank
of awareness on improved technology / less mass media exposure	95	42	23	2.45	0.82	II
of innovativeness	86	56	18	2.43	0.81	III
of education	112	38	10	2.64	0.88	I
of suitable cultivable land	45	28	87	1.74	0.58	VII
cost of seed and other inputs	88	42	30	2.36	0.79	IV
responsiveness	45	65	50	1.97	0.66	VII
of entrepreneurship ability	84	46	30	2.34	0.78	IV
of achievement motivation	42	90	28	2.09	0.70	VII
source of information	76	58	26	2.31	0.77	VI

The results of present study concluded that lack of education , lack of awareness on improved technology with less mass media exposure , overall poor knowledge about current advances technologies and

lack of innovativeness among the respondents were the serious socio economic constraints pertaining to adoption of improved technologies . (Raghuraja et al . 2021) stated that , the high production costs of horticulture crops was the major constraint followed by poor follow up of activities by the extension personnel and less subsidies are the major constraints expressed by the National Horticulture Mission beneficiaries

Table 7: Constraints related to Organizational support (n=160)

Types with major constraints	Strongly Agreed Farmers	Agreed Farmers	Disagreed Farmers	MS	Index	Rank
Poor linkage with line departments	45	81	34	2.07	0.69	VI
Less credibility of the extension workers	34	104	22	2.08	0.69	VI
Non availability of credit facility	102	46	12	2.56	0.85	II
Non availability of quality input	84	56	20	2.40	0.80	V
Inadequate marketing net work	105	42	13	2.58	0.86	I
low price at the time of harvest of vegetables/ market surplus	98	46	16	2.51	0.84	III
Lack of effective supervision by the extension workers	36	98	26	2.06	0.69	VI
Lack of crop insurance facility	98	41	21	2.48	0.83	IV
Inadequate storage facility	102	45	13	2.56	0.85	II
Poor transportation facility	32	54	74	1.74	0.58	VII

From the above table 7 it was concluded that majority of the respondents   stated   inadequate marketing , credit and storage   facility , and low price at the time of harvest of vegetables/ market surplus were   the most important constraints faced by the vegetable growers. The positive effect of credit on technology adoption is consistent with earlier theoretical and empirical work and access to credit is a variable factor that has received increased empirical attention in recent years. Market price is a key determinant of sustained adoption is the profitability of agricultural enterprises. The changing prices for agricultural products are shown to be a major factor in agricultural technology adoption (Kijima et al. 2011). Agricultural credit can positively influence adoption, but researchers should measure whether farmers are credit constrained, rather than simply whether or not they have access to credit. (Ruzzante et al.   2021).   The results of present study concluded that absence of   marketing , credit and storage facility was considered as the major constraint, while lack of knowledge current advance technologies were also serious constraints pertaining technical guidance . The findings are in corroborated with the findings of (Pandit and Basak , 2013) and (Sohi et al. 2021) .It is also evident from the study that among the three major types of constraints identified, technological and socio-economic constraints were mostly faced by the vegetable growers. Similar findings were reported by (Poshiya and Tiwari , 2019) and   (Mohanty et al. 2013).

Table 8: Relationship between Farmers Land Hooding and adoption level

(n=160)

Category of farmers	Distribution of respondents according to level of adoption			Chi- square statistics
	High (f)	Medium (f)	Low (f)	
Marginal	14	14	8	(χ^2,14.573)
Small	10	32	40	
Semi Medium	7	11	8	(p= 0.0238) significant
Medium	3	5	8	

The Chi- square statistics is 14.573, The *p*- value is 0.0238. The result is signifiacant at P < 0.05

A chi –square test of independence was performed to examine the relation between   farmers according to their land holding or farm size and their adoption level   .   The relation between these variables was significant as (*p* <0 .05). . The study revealed that there was a significant difference between adoption level among   marginal and small farmers as compared to Semi medium   and medium and farmers for vegetable production in the district. So it was concluded that small and marginal farmers have perceived more constraints relating to adoption of new technologies in vegetable production and this was due to poor economical status ,

less land holding, less economic motivation poor infrastructure facility available and poor institutional support and less risk taking ability of small and marginal farmers   . It was   confirmed that inadequate marketing networks, lack of awareness on improved technologies, lack of economic motivation, poor sources of information and lack of commitment to farming as enterprise are also contributing to low adoption in case of marginal and small farmers. The study revealed that mean score for all these constraints were higher among small and marginal farmers as compared to semi medium land medium farmers for vegetable production in the district.   The findings were corroborated with the findings of (Mohanty et al. 2013).

Table -9: Important suggestion by the respondents   to   improve vegetable Production

Sl no	Suggestion	Mean score	Rank
1	Capacity building programs and more number demonstrations for vegetable farmers on scientific and effective vegetable production.	1.78	IV
2	Provide quality seed and other inputs and ensuring availability at local traders	1.92	III
3	Technical guidance on plant protection measures and nutrients management	2.41	I
4	Provision of marketing and storage facility	2.08	II

The suggestions were collected from the respondents about the measures should be taken to address the different constraints faced by the farmers and described in Table :8. It was evident from the table that the majority of the respondents stated that more emphasis should be given on Technical guidance to the farmers on plant protection measures   and   nutrients management and Provision of marketing and storage facility, followed by ensuring   timely availability of quality seed and other critical inputs in local traders .

V.   CONCLUSION

On the basis of the findings and their logical interpretation, it can be concluded that majority of the vegetable growers faced medium to high constraints regarding all the aspects under study. On the basis of above results and discussion, it is evident from the study that the major constraints like, poor knowledge of IPM and INM , lack of innovativeness, lack of entrepreneurial ability, lack of low responsiveness, absence of credit facility , non availability storage facilities, lack of knowledge about post harvest technologies, difficulty faced by vegetable growers in marketing   along with not getting remunerative price of the produce   and lack of effective supervision and monitoring by extension workers are faced by the growers. The study has confirmed that inadequate marketing networks, inadequate   credit and storage facilities, lack of crop insurance facility were all validated constraints   perceived by the farmers. The other constraints identified under this study like poor knowledge of the farmers on improved technologies particularly on crop protection and poor sources of information or extension contact of the respondents were also contributing to low productivity and net return . Thus there is a need to organize more number of awareness and capacity development programmes for farmers , timely awareness for inclusion under crop insurance and introduction of post harvest technologies to encourage the farmers for vegetable production , so that the farmers become more economically independent. Moreover it will improve nutritional and financial status of farm family thus indirectly betters the socio-economic status of   vegetable growers of the Malkangiri district.

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