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Extent of adoption of recommended cultivation practices by capsicum growers

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Abstract
The study was conducted during 2018-19 in Mandya district of Karnataka State, India by randomly selecting 90 capsicum growers. A pre-tested interview schedule was used to collect the data through personal interview method. The data collected was tabulated and analyzed using percentages, correlation and regression. As high as 46.67 per cent of capsicum growers belonged to medium adoption category, 40.00 per cent to high adoption category and 13.33 per cent to low adoption category. As high as 62.22 per cent of capsicum growers grow / brought capsicum seedlings from the private nurseries and only 37.34 per cent prepared their own nursery beds for seedlings raising. The nursery raising practices seed bed preparation, application of FYM, application of fertilizers, recommended spacing and stopping irrigation one week before transplanting for hardening were partially adopted. On the other hand the nursery raising practices covering seed bed with dry fodder and irrigation were fully adopted. There was a positive and significant relationship between profile characteristics such as education, management orientation, extension contact, annual income, farming experience, extension participation, achievement motivation, land holding and scientific with adoption of improved cultivation practices by capsicum growers and contributed significantly for the adoption. On an average the cost of capsicum production was Rs. 1, 13, 157/-, the grass returns was Rs.3, 60, 750/- and net returns was Rs. 2, 47, 593 per ha. The return per rupee of expenditure was 2.19. The expenditure on plant protection chemical was ranked first, fertilizers ranked second, seeds/ seedlings, ranked third. Non-scientific price for capsicum in market, incidence of pests and diseases and no support price at the time of price fall were the important constraints. Minimum support price during price fall, crop loan at minimum interest rate and mechanism to control price fluctuation were the important suggestions of Capsicum growers to enhance the adoption of recommended Capsicum cultivation practices.

Keywords: Capsicum, benefit-cost ratio, adoption, economics, extent of adoption

1. Introduction
India is known as the “Land of Spices”. The history of Indian spices dates back to the beginning of the human civilization. Capsicum (*Capsicum annum*) is one of the most favored species of chilly and widely used as universal spice, named as a gifted plant of nature and king of cultivated crops. About 80 per cent of it is consumed as food and rest is used in commercial industry. Capsicum is a good source of vitamin C, A and E. Oleoresins and essential oils which are the active principals, providing characteristic pungency, flavor and aroma. India has the largest area under capsicum (46 thousand hectares) with a production of 32 thousand tones and productivity of 13.20 tones/ha (Anon., 2017) [2]. However its production and yield are much lower as compared with major capsicum growing countries of the world. In Karnataka it is grown in an area of 4130 hectares with a production of 81.67 thousand tones and occupies first position in India. In Karnataka it is growing in Mandya district in an area of 430 hectares with a production of 10370 tones and occupies first position.
Agricultural production depends on the extent to which farmer adopt new agricultural innovations, it is felt that large parts of gains from new farm technology still remain to be realized. Adoption of improved production practices is the key to higher production of capsicum and higher income to farmers. The technical knowledge of farmers appears to be the key link to higher level of adoption. The Government of Karnataka has taken measures to transfer of technologies through extension education processes including demonstrations, on-farm trainings, regular field visits and distributing extension literature. Once farmers acquire knowledge, they begin to use and apply new technologies and improved practices in their fields. Even among farmers, there is a great variation in their levels of knowledge, as well as their readiness to accept, try new methods and adopt improved production practices. The variation in rate and extent of adoption of improved practices in capsicum production need to be thoroughly understood. Hence, the present study was undertaken with following specific objectives. Further, it will helps in understanding and devising appropriate measures to tackle the problems more efficiently.

2. Material and Methods

The study was conducted during 2018-19 in Mandya district of Karnataka State, India. The district was purposively selected because it is the major capsicum growing district in Karnataka. In the district Pandavapura and Nagamangala taluks were purposefully selected since these are major capsicum growing taluks. In each selected taluk, three villages were randomly selected. In each selected village the list of Capsicum growing farmers was prepared in consultation with the officials of Horticulture department, Government of Karnataka. Thus, a total number of 90 respondents constituted the sample for the study. The schedule was developed in consultation with scientists and extension workers. A pre-tested interview schedule was used to collect the data through personal interview method. The data collected were tabulated and analyzed using percentages, correlation and regression.

3. Results

3.1 Overall adoption of recommended cultivation practices by capsicum growers

The data in Table-1 reveals that as high as 46.67 per cent of capsicum growers belonged to medium adoption category, 40.00 per cent to high adoption category and 13.33 per cent to low adoption category.

3.2 Adoption of specific recommended cultivation practices by capsicum growers

The data on adoption of specific recommended cultivation practices by capsicum growers is presented in table-2. The results reveals that as high as 62.22 per cent of capsicum growers grow / brought capsicum seedlings from the private nurseries and only 37.34 per cent prepared their own nursery beds for seedlings raising. The nursery raising practices seed bed preparation, application of FYM, application of fertilizers, recommended spacing and stopping irrigation one week before transplanting for hardening were partially adopted. On the other hand the nursery raising practices covering seed bed with dry fodder and irrigation were fully adopted.

Further, in the main field the recommended practices such as recommended varieties (67.78%), recommended spacing (86.67%), time of planting (73.33%), inter cultivation (98.89%), hand weeding (76.67%) and harvesting (97.78%) were fully adopted. On the other hand the recommended practices such as recommended quantity of FYM (70.00%), frequency of irrigation (53.33%), recommended quantity of fertilizers as basal dose, nitrogen (63.34%), phosphorus (60.00%) and potassium (60.00%), top dressing with nitrogen (55.56%), plant protection measures (68.89%) and pinching & tipping of flower buds at initial flowering stage (67.78%) were partially adopted.

3.3 Relationship between profile characteristics of capsicum growers and adoption of recommended capsicum cultivation practices

The data in Table-3 reveals that there was a positive and significant relationship at one per cent level of probability between education, management orientation, extension contact and annual income with their adoption of recommended cultivation practices by capsicum growers whereas, the variables such as farming experience, extension participation, achievement motivation, land holding and scientific orientation had positive and significant relationship at five per cent level with their adoption of recommended cultivation practices by capsicum growers.

3.4 Multiple regression analysis of independent variables with adoption of recommended capsicum cultivation practices by capsicum growers

The Table-4 explains the contribution of independent variables in extent of adoption of recommended cultivation practices by capsicum growers to their dependent variables. The results accounted that independent variables *viz*., education, land holding, annual income, extension contact, scientific orientation, achievement motivation, extension participation and management orientation had significantly contributed to the extent of adoption of recommended cultivation practices in Capsicum by Capsicum growers. The R2 value specified that all the 12 independent variables had contributed to the tune of 0.699 per cent of variation in extent of adoption of recommended cultivation practices by Capsicum growers.

3.5 Economics of capsicum cultivation

A close look at Table 5 reveals that on an average the cost of capsicum production was Rs.1,13,157/- the grass returns was Rs.3,60,750/- and net returns was Rs. 2,47,593 per ha. The return per rupee of expenditure was 2.19. The expenditure on plant protection chemical was (17.90%) ranked first, fertilizers (14.58%) ranked second, seeds/ seedlings (13.04%) ranked third, farmyard manure (9.95%) ranked fourth, land preparation (8.88%) ranked fifth, harvesting (7.51%) ranked sixth, inter cultivation (6.40%) ranked seventh, packing and transportation (6.14%) ranked eighth, pinching & tipping (5.74%) ranked ninth, sowing /transplanting (5.66%) ranked tenth and weeding (4.20%) ranked eleventh.

3.6 Constraints in capsicum production as expressed by capsicum growers

The major constraints perceived by Capsicum growers in production of capsicum (Table–6) were price fluctuation (Rank I), incidence of pests and diseases (Rank II), no support price at the time of price fall (Rank III), lack of credit facility on time (Rank IV), Non-availability of labour (Rank V), higher rate of farm inputs (Rank VI) and low quality seed material (Rank VII).

3.7 Suggestions of capsicum growers to enhance the adoption of recommended capsicum cultivation practices

The major suggestions of Capsicum growers to enhance the adoption of recommended capsicum cultivation practices (Table–7) were minimum support price during price fall (Rank I), crop loan at minimum interest rate (Rank II), mechanism to control price fluctuation (Rank III), more high yielding hybrids from public sector research institutions (Rank IV), farm inputs at subsidized price (Rank V) and cold storage facilities at local level (Rank VI).

4. Discussion

Capsicum growers were belonged to medium adoption category followed by high adoption category and low adoption category. This may be due to the fact that capsicum is a commercial and highly remunerative crop. Further, it requires high investment and requires highly skilled labour to do the practices. Therefore, the growers who were intended to grow capsicum seek as much information as possible from all the available resources. Upma Vashishtha *et al.* (2012) [11] depicts that majority of the respondents were in the medium adoption group, followed by low adoption group and remaining chilli growers were in the high level of adoption group. One of the reason for this may be strong conviction of

farmers towards the traditional practices, which they have been following for the last several years. Tushar Panigrahi *et al.* (2013) [11] reported that majority of Sweet Pepper producers, were in partial adoption followed by complete adoption. The probable reason might be that majority of the Sweet Pepper growers were in young category of age group, small size of land holding, seldom extension participation, low information seeking behavior, low exposure to demonstration, low exposure to training and low adoption.

As high as 62.22 per cent of capsicum growers grow / brought capsicum seedlings from the private nurseries and only 37.34 per cent prepare their own nursery beds for seedlings raisings. The nursery raising practices seed bed preparation, application of FYM, application of fertilizers, recommended spacing and stopping irrigation one week before transplanting for hardening were partially adopted. On the other hand the nursery raising practices covering seed bed with dry fodder and irrigation were fully adopted. This may be because of the reason that at local level private nurseries are being established and in the green houses seedlings were raised scientifically. Since the seedlings are mostly disease free cost effective and time saving the capsicum growers purchase seedlings from them. In the main field the recommended practices such as recommended varieties, recommended spacing, time of planting, inter cultivation, hand weeding and harvesting were fully adopted. Since these technologies are simple and being practice by the farmers from longtime. On the other hand the recommended practices such as recommended quantity of FYM, frequency of irrigation, recommended quantity of fertilizers as basal dose, nitrogen, phosphorus and potassium, top dressing with nitrogen, plant protection measures and pinching & tipping of flower buds at initial flowering stage were partially adopted. This may be attributed to the fact that these technologies are somewhat complicated and involves more cost. Sharma, (2002) [7] indicated that majority of chilly farmers did not prepare nursery for raising their seedlings and they purchased the seedlings from fellow farmers or nursery. The proportion of respondents who regularly uses manures and fertilizer was only 31 per cent. More than 60 per cent farmers followed time and method application of fertilizers but only 41 per cent farmers applied fertilizers with recommended doses. Reason may be due to wrong perception about fertilizers use, fertilizers' quality and not aware about soil test. Tushar Panigrahi *et al.* (2013) [10] reported that complete adoption was found in the majority of the sweet pepper growers in case of field preparation, time of sowing, seed rate, method of sowing, insect control, whereas, partial adoption was found in case of practices like improved varieties, seed treatment with fungicides, seed treatment with culture, recommended row to row spacing, deep sowing, recommended dose of chemical fertilizers, use of bio- fertilizers, irrigation management, weedicides, method of weed control, disease control, integrated pest management (IPM) and integrated disease management (IDM). Rathore *et. al.* (2016) [4] revealed that maximum adoption level was in sowing time practice, followed by irrigation, land preparation, seed rate, seed treatment and harvesting & drying respectively. While, practices like manure & fertilizers, soil treatment, spacing, high yielding varieties, weed management and plant protection were having less adoption level respectively. Further, adoption level was higher in case of the large farmers than marginal and small farmers. The large farmers had higher adoption level due to their better economic condition as well as, higher education level and therefore, it is suggested that marginal and small farmers should be well equipped and persuaded strategically for increasing the adoption level. Front line demonstrations may also be conducted on the fields of marginal and small farmers by the Krishi Vigyan Kendras.

There was a positive and significant relationship between profile characteristics such as education, management orientation, extension contact, annual income, farming experience, extension participation, achievement motivation, land holding and scientific orientation with their adoption of improved cultivation practices by capsicum growers and contributed significantly for the adoption. The results implies that farmers who are young aged, are resource rich, enthusiastic to try and adopt new ideas, will have more experience and will have sufficient knowledge regarding capsicum cultivation. Their age builds up their aspirations which motivate them to mentally accept things. Also, as age advances an individual will become more self-reliant who will be rational to assert their self-ability and identify their weakness and potentialities which encourages them to make rational decisions which hastens their adoption level. The significant relationship between adoption and education might be that, usually farmers who are having high educational qualification acquire more information from different sources and this can bring desirable changes in the adoption of innovations. It is also true that rationality in decision-making is a function of one's educational level and for adoption of any innovation, decision making is a key component. Further, farmers with better educational back ground will have good understanding capacity and are generally predisposed to acquire more information and utilize the same which speaks about the above quoted relationship. Sundar Barman *et al.* (2015) [8] found that socio-economic characteristics of farmers with the extent of adoption of improved cultivation practices of Bhut jolokia (Capsium Change) had negative association with the extent of adoption of improved cultivation practices in Bhut jolokia. It means that percentage of adopters was observed better among those farmers who were of young age. On the other hand, size of operational land holding, annual family income, training exposure and information source utilization had positive and significant association with the extent of adoption. It implies that with the increase in size of land holding under operation there is a increase in the rate of adopters of improved practices of Bhut jolokia. Again, with increase in income, there is an increase in the extent of adoption. Farmers with lower income have low investment capacity and low risk bearing ability. They cannot afford to spend money required for purchasing seedlings, plant protection chemicals, nutrients and growth regulators etc which are higher as compared to other field crops. A positive and significant association with "training exposure" implies that farmers who have attended more numbers of training have gained more knowledge and skill in Bhut jolokia farming and are more interested for adoption of the improved cultivation practices of the crop. Positive and significant correlation with "information source utilization" indicates that with increase in the sources of information utilized by the farmers, there is increase in the extent of adoption of improved cultivation practices of Bhut jolokia. Shilpa (2010) [6] reported that potato growers age, education, operational land holding, net income from potato crop, mass media exposure and extension contact had significant contribution with the level of adoption of recommended crop production technologies. The other variables of potato growers viz the type of family, size of family, area under potato crop and social participation had no significant contribution with the level of adoption.

On an average the cost of capsicum production was Rs.1, 13,

157/-, the grass returns was Rs.3, 60, 750/- and net returns was Rs. 2, 47, 593 per ha. The returns per rupee of expenditure was 2.19. The expenditure on plant protection chemical was ranked first, fertilizers ranked second, seeds/ seedlings, ranked third, farmyard manure ranked fourth, land preparation ranked fifth, harvesting ranked sixth, inter cultivation ranked seventh, packing and transportation ranked eighth, pinching & tipping ranked ninth, sowing / transplanting ranked tenth and weeding ranked eleventh. These may be because of the reason that since it is a new crop and fetchers more income to the farmers they spend more money on the yield increasing practices. Keshava (2005) [3] reported that there was average gross returns earned from an acre of gherkin production was Rs. 42,001.75 per acre and the net returns was Rs. 11,374.33 per acre, The net returns per rupee of investment was Rs. 1.37 in gherkin production, which is substantial compared to other vegetable crops in the study area. Senthil kumar *et al* (2018) [5] reported that Cultivation of high value crops is yielding more rather than in the conventional farming system. Vegetable like capsicum yield few fold under protected cultivation. The cost of investment on poly house significantly higher which was Rs. 40.67 lakhs/ 4000 m2, if the cost of investment could be subsidized for instance 50 per cent in the Capsicum grower it is economically feasible. The financial viability of Capsicum grown under poly house had PBP (2. 66 years) and B-C ratio (1.24).

The major constraints perceived by Capsicum growers in production of capsicum were price fluctuation, incidence of pest and diseases, no support price at the time of price fall, lack of credit facility on time, higher rate of farm inputs and low quality seed material. Further, the major suggestions of Capsicum growers to enhance the adoption of recommended Capsicum cultivation practices were minimum support price during price fall, crop loan at minimum interest rate, mechanism to control price fluctuation, more high yielding hybrids from public sector research institutions, farm inputs at subsidized price and cold storage facilities at local level. (2005) reported that labour problem was the major constraint faced by all the farmers, since gherkin is a labour intensive crop, which requires labour throughout its cultivation. Shilpa (2010) [6] reported that majority of respondents expressed government intervention was essential as some felt that the firms tried to manipulate the norms for their profits and caused losses to the farmers. There should be strict laws to safeguard farmers. Further, respondents expressed the need for technical guidance on problem of pests and diseases.

Table 1: Overall Adoption of Recommended Cultivation Practices by Capsicum growers (N=90)

Adoption categories	Number	Per cent
Low	12	13.33
Medium	42	46.67
High	36	40.00
Total	90	100.00

Table 2: Adoption of Specific Recommended Cultivation Practices by Capsicum growers (N=90)

Sl. No.	Recommended cultivation practices	Extent of adoption					
		Complete Adoption		Partial Adoption		Non-adoption	
		No.	%	No.	%	No.	%
I	**Seedling raising**						
1	Seed bed preparation	6	6.67	28	31.11	56	62.22
2	Application of FYM	4	4.45	30	33.33	56	62.22
3	Application of fertilizers	6	6.67	28	31.11	56	62.22
4	Recommended spacing	5	5.56	29	32.22	56	62.22
6	Covering seed bed with dry fodder	34	37.78	-	-	56	62.22
7	Irrigation	32	35.56	2	2.22	56	62.22
8	Stopping irrigation one week before transplanting for hardening	6	6.67	18	20.00	66	73.33
II	**Main field**						
1	Recommended varieties	61	67.78	-	-	29	32.22
2	Recommended quantity of FYM	27	30.00	63	70.00	-	-
3	Recommended spacing	78	86.67	12	13.33	-	-
4	Time of planting	66	73.33	21	23.34	3	3.33
5	Frequency of irrigation	39	43.33	48	53.33	3	3.34
6	Recommended quantity of fertilizers						
	1. Basal dose						
	A. Nitrogen	30	33.33	57	63.34	3	3.33
	B. Phosphorus	26	28.89	54	60.00	10	11.11
	C. Potassium	27	30.00	54	60.00	9	10
	2. Top dressing						
	A. Nitrogen	40	44.44	50	55.56	-	-
7	Inter cultivation	89	98.89	1	1.11	-	-
8	Hand weeding	69	76.67	21	23.33	-	-
9	Plant protection measures	28	31.11	62	68.89		
10	Pinching & Tipping of flower buds at initial flowering stage	29	32.22	61	67.78	-	-
11	Harvesting	88	97.78	2	2.22	-	-

Table 3: Relationship between Profile Characteristics of Capsicum growers and Adoption of recommended *Capsicum cultivation* practices (N=90)

Sl. No.	Profile Characteristics	Correlation Coefficient (r)
1	Age	-0.088^{NS}
2	Education	0.820**
3	Farming experience	0.258*
4	Family size	0.097 ^{NS}
5	Management orientation	0.326**
6	Extension participation	0.230*
7	Achievement motivation	0.265*
8	Extension contact	0.341**
9	Land Holding	0.243*
10	Annual Income	0.298**
11	Scientific orientation	0.219*
12	Material possession	0.166^{NS}

** Significant at 1 per cent level. * Significant at 5 per cent level, NS: Non-Significant.,

Table 4: Multiple Regression analysis of Independent Variables with Adoption of Recommended Capsicum cultivation practices by Capsicum growers (N=90)

Sl. No.	Profile Characteristics	Regression Coefficient	Standard Error of Regression Co-efficient	't' Values
1.	Age	0.30	0.28	0.933^{NS}
2.	Education	0.28	0.69	2.49*
3.	Land holding	0.33	0.78	2.36*
4.	Family size	0.45	0.41	0.92^{NS}
5.	Farming experience	0.36	0.25	0.71^{NS}
6.	Annual income	0.30	0.62	2.06*
7.	Extension contact	0.28	0.59	2.10*
8.	Scientific orientation	0.33	0.61	1.84*
9.	Achievement motivation	0.30	0.70	2.33*
10.	Extension participation	0.38	0.82	2.15*
11.	Management orientation	0.29	0.62	2.13*
12.	Material possession	0.08	0.11	1.26^{NS}

R^2 Value =0.699; *Significant at 5 per cent level; **Significant at 1per cent level; NS= Non-significant

Table 5: Economics of Capsicum Cultivation/ hectare (N=90)

Sl. No	Items	Rupees	Per cent	Rank
I. Cost of production				
1	Land preparation	10,050/-	8.88	V
2	Farmyard manure	11,250/-	9.95	IV
3	Sowing /Transplanting	6,407/-	5.66	X
4	Seeds/ seedlings	14,750/-	13.04	III
5	Fertilizers	16,500/-	14.58	II
6	Inter cultivation	7,250/-	6.40	VII
7	Weeding	4,750/-	4.20	XI
8	Pinching & Tipping	6,500/-	5.74	IX
9	Plant protection chemical	20,250/-	17.90	I
10	Harvesting	8,500/-	7.51	VI
11	Packing and transportation	6,950/-	6.14	VIII
Total		1,13,157/-		
II. Returns				
1	Yield	27.75 tones/ha		
2	Gross Returns	3,60,750@ 13/ Kg.		
3	Net Returns	2,47,593		
4	Benefit - Cost Ratio	2.19		

Table 6: Constraints in Capsicum production as expressed by Capsicum growers (N=90)

Sl. No	Constraints	Number	Per cent	Rank
1	Price fluctuation	84	93.33	I
2	Incidence of pest and diseases	79	87.77	II
3	No support price at the time of price fall	78	86.66	III
4	Lack of credit facility on time	69	76.67	IV
5	Non-availability of labour	61	67.77	V
6	Higher rate of farm inputs	60	66.67	VI
7	Low quality seed material	52	57.77	VII

Table 7: Suggestions of Capsicum growers to enhance the adoption of recommended Capsicum cultivation practices (N=90)

Sl. No	Suggestions	Number	Per cent	Rank
1	Minimum support price during price fall	82	91.11	I
2	Crop loan at minimum interest rate	78	86.66	II
3	Mechanism to control price fluctuation	71	78.88	III
4	More High yielding hybrids from public sector research institutions	60	66.66	IV
5	Farm inputs at subsidized price	58	64.44	V
6	Cold storage facilities at local level	52	57.77	VI

5. Conclusion

The introduction of new farm technology initiated the transformation of Indian agriculture and thereby created a large potential for increasing agricultural production. Agricultural production depends on the extent to which farmer adopt new agricultural innovations. It is felt that large parts of gains from new farm technology still remain to be realized. This is because of non-adoption of new innovations on the farm, since the adoption process is not simple and a number of social, economic, psychological factors influence it to a considerable extent. Based on findings it can be concluded that majority of the capsicum growers' were belonged medium adoption level it means that scientific adoption of improved capsicum cultivation practices was not up to the mark in certain extent. This implies that there is a vast scope for the horticulture department to intervene and educate the farmers through extension educational activities such as training programmes, demonstrations, regular field visits and extension literature. Further, the results of study will help the planners, policy makers, scientists and extension workers in understanding and devising appropriate measures to tackle the constraints more efficiently.

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