

Integrated crop management for off-season capsicum production

Field demonstrations were carried out in selected villages of Almora district in Uttarakhand during 2020 and 2021 in off-season capsicum. Three components namely, varietal introduction, nutrient management and pest and disease management have been demonstrated with farmers participatory approach. A total of 120 demonstrations were conducted in 5 ha area during both the years. The demonstration of Indra hybrid under proper nutrient, pest and disease management gave 13.5 metric tonnes/ha productivity as compared to 7.75 metric tonnes/ha productivity recorded on farmers field. The net income received in the demonstrations was also higher. The article discusses the ICM strategies adopted to enhance the off-season capsicum production.

CAPSICUM is considered as high value low volume vegetable crop. It is widely grown as an off-season crop (March–October) in hills of Uttarakhand including district of Almora. Capsicum is rated as highly remunerative crop for hilly region of Uttarakhand and other mountain regions of India. In hilly region of Uttarakhand, capsicum is very profitable crop as it is cultivated for long duration with great scope of sustainability. Cultivation of capsicum gives higher profit during the lean period when supply of capsicum is limited and prices are high in plain areas. In plains of Northern India, capsicum is cultivated from September to April under polyhouses and in open field conditions as well. The availability of capsicum is almost nil in plains of Northern India during May to October which is considered as lean period as far as production of capsicum is concerned.

Although capsicum is commercially important vegetable crop in mountain regions of Uttarakhand but its productivity is low, i.e. 5.07 metric tonnes/ha. However, we have obtained average productivity of 13.50 metric tonnes/ha in the field demonstrations in various parts of Almora district of Uttarakhand during 2020 and 2021. It was observed that major constraints for low productivity of capsicum in the regions is poor adoption of high yielding varieties/ hybrids, poor management of pests and diseases along with improper nutrient management. It has been realised that if farmers adopt integrated crop management practices in their capsicum crop throughout the season, the productivity can be increased by 2 to 2.5 folds as reflected in the field demonstrations. Considering the significance of capsicum and its enormous potential as an off-season crop, it is highly imperative for the farmers of hills of Uttarakhand and other mountain regions of India to understand the impact of demonstrated technological interventions and adopt them in order to enhance the productivity and income.

Varietal demonstration

The Indra hybrid of capsicum was demonstrated on farmer's field during 2020 and 2021. The fruits of Indra are dark green, thick-walled and glossy with average weight 170 g, length 10-12 cm, girth 10 cm, having 3-4 lobes. However, plants are medium tall, bushy having vigorous growth, dark green leaves and dense foliage providing fruit shelter. Fruit setting starts in 50-55 days after transplanting. Shelf life is longer due to which it is ideal for long distance transportation. This hybrid has high export potential. It showed high yielding capacity, medium to big sized uniform fruits and strong plant with short internodes. It has been observed during demonstrations and picking of fruits that the average sale price was comparatively higher because of uniform size, attractive green colour, thick wall, etc. Number of pickings in the demonstrations was up to five while it was three on the farmers field. The feedback of the farmers revealed that they appreciated the performance of Indra hybrid and shared during interaction that they are cultivating capsicum from the last 15 years but they did not find such an outstanding hybrid. They have also assured that they will grow Indra hybrid of capsicum from the coming season. As a result, this hybrid also spread in the neighbouring villages and farmers of these villages have seen the demonstrations and they are also convinced for its cultivation. Thus, Indra hybrid of capsicum made tremendous impact on the mindset of the farmers due to very high productivity and quality in the same existing practices adopted by the farmers for their own capsicum cultivation.

Demonstration of nutrients management

Three applications of NPK 19:19:19 @ 5 g/L of water + sagarika @ 2 ml/litre of water started 30 days after transplanting (DAT) at weekly interval. After three

applications, alternate use of NPK 0:0:50 @ 5 g/litre of water + sagarika @ 2 ml/litre of water and NPK 19:19:19 @ 5 g/litre of water + sagarika @ 2 ml/litre of water at weekly interval on rotational basis were done till the end of crop. The application of NPK and sagarika accelerate the vegetative and reproductive growth, enhance flowering and fruit setting. The average weight in the demonstrations was also higher compared to farmer's field. The uniformity in fruits was maintained till the last picking because of NPK and sagarika application throughout the crop season. It has been noticed during interaction with the farmers that they apply only FYM as basal dose in their capsicum. They do not apply any nutrients in the standing crop due to which they do not get optimum productivity and quality from their capsicum crop. In the demonstration, the importance of NPK and sagarika in improving the productivity and quality of capsicum became evident. These nutrients are available on very reasonable prices in IFFCO Cooperatives spread at village level. Thus, their application is not a problem for the farmers. The impact of nutrients in enhancing productivity and quality attracted the attention of farmers towards demonstrated nutrient management in capsicum. The demonstrations of nutrient management and its result forced the farmers for thinking towards implementation of NPK and sagarika for better production and income in the same ecosystem.

Demonstration of pest and disease management practices

The major pest and disease that attack capsicum are

anthracnose, fusarium wilt, dieback disease, fruit borer and blossom end rot which are recorded under protected and open field conditions. The incidence of dieback disease is a serious problem in both protected and open field condition. However, incidence of fruit borer, fusarium wilt and blossom end rot is a major problem in lower hills of Uttarakhand. The severity of these pest and disease was very low in mid hills and high hills of Uttarakhand. The incidence was serious in lower hills of Uttarakhand because of optimum temperature during cultivation of capsicum while these pests did not cause any considerable loss in mid hills and high hills of Uttarakhand due to low temperature. The various pests and diseases recorded during demonstrations have been effectively managed by timely application of recommended and judicious use of chemical pesticides which are tabulated here.

Effect of demonstration on production and profitability

The field demonstrations conducted during 2020 and 2021 in capsicum indicated their tremendous impact on production and profitability as compared to farmer's field. The enhancement on production and profitability was observed only due to timely adoption of improved integrated crop management practices like high yielding hybrid, proper nutrient management at different stages of the crops and judicious use of chemical pesticides for effective management of various pests and diseases. The result of the demonstrations revealed that average productivity recorded in the demonstrations was 13.50

Table 1. Major pest and disease of capsicum and their management

Name of pest and disease	Symptoms	Management
Anthracnose	First sign of the disease are small, slightly sunken, dark yellow spots on the fruit surface. The spots darken, enlarge and merge during wet weather or when humidity is high, often, there are multiple infections on one fruit.	Spraying of Tebuconazole @ 1 ml or Thiophenate Methyl fungicides @ 1 g/litre of water has been found very effective. The spray should be initiated when symptoms are visible during crop monitoring.
Fusarium wilt	Plants appear healthy until fruit set and then wilt suddenly. Above-ground symptoms only occur after fruit set. Initially, plants wilt during the warmest part of the day under suitable conditions, all leaves drop off and only small fruit are retained on the stem and branches. Affected plants die or produce small, shrivelled, unmarketable fruit.	Cultivate capsicum in well drained soils and avoid waterlogging. Drench the root zone with <i>Trichoderma</i> + <i>Pseudomonas</i> @ 10 g/litre of water. Thiophenate Methyl fungicides @ 1 g/litre of water can be drenched in the root zone.
Dieback	Disease can be identified by the presence of characteristic concentric rings on leaves. It reaches peak intensity during June and July with prevailing high temperature. Twigs get blighted; purplish black streaks start appearing on stem associated with yellowing of leaves.	Spraying of Tebuconazole @ 1 ml or Difenconazole @ 0.5 ml or Azoxystrobin+ Difenconazole @ 1 ml/litre of water has been observed very promising.
Blossom end rot	High sun intensity and hot weather in mid of July month causes sunscald on fruits. White papery area appears on fruit, which gets eventually colonized by secondary fungi which turn to black with powdery masses. Incidence is more in plants defoliated by foliar diseases. The most diagnostic symptom is the presence of dark, water soaked, greasy-like angular lesions on leaves. Blossom end rot disorder is noticed in first two fruit setting period, in July month. Dry sunken decay from blossom end of the fruit makes the fruits unmarketable.	Apply calcium nitrate as spray @ 3 g/litre of water and repeat the same after 15 days to prevent blossom end rot. Avoid excess nitrogen application and moisture stress as it predisposes capsicum to Blossom end rot. Never mix micronutrients with pesticides in a single spray.
Fruit borer	These caterpillars enter into the fruits and feed inside. Due to the damage, fruits are unfit for selling or consumption. This pest is severe in capsicum. Young larvae feed on flower buds and young fruits by making a circular hole. Later, the larvae feed on seeds usually with its head inside the fruits and rest of the body outside. A circular hole is noticed at the base of the pedicel. Premature dropping of flower and fruits occurs.	Spraying of Lambda Cyhalothrin @ 0.5 ml or Flubendiamide @ 1 ml or Emamectin Benzoate @ 0.5 g insecticides proved to be most promising in effective management of fruit borer in capsicum.



Incidence of anthracnose in fruit



Infestation of fruit borer



Incidence of wilt disease



Fruits affected with blossom end rot



Fruit bearing in capsicum



Farmers Scientists interaction

Table 2. Impact of demonstrations on production and profitability in off-season capsicum (Average data of 2020 and 2021)

Vegetable	Capsicum
Variety/Hybrid used in the demonstration	Indra
Variety used in the farmer's field	California Wonder
Number of demonstrations conducted/ area in ha	120/ 5.0
Cost of cultivation in the demonstrations (₹/ha)	1,72,262
Cost of cultivation in the farmer's field (₹/ha)	1,38,654
Average productivity recorded in the demonstration (q/ha)	135.00
Average productivity recorded on farmer's field (q/ha)	77.56 (7.75 metric tonnes/ha)
% increase in yield over farmer's field (%)	74.05
Gross income in the demonstrations (₹/ha)	5,40,000
Gross income in the farmer's field (₹/ha)	310240
Net income in the demonstrations (₹/ha)	3,67,735
Net income in the farmer's field (₹/ha)	171586
B:C ratio in the demonstrations	3.13
B:C ratio in the farmer's field	2.23
Average sale price (₹/q)	4000

metric tonnes/ha while the average productivity of capsicum on the farmers' field was 7.75 metric tonnes/ ha.

Table 2. (Continued)

Vegetable	Capsicum
Variety/Hybrid used in the demonstration	Indra
Present average productivity in hills of Uttarakhand (metric tonnes/ha)	5.07 (50.70 q/ha)
Average productivity recorded in the demonstration (metric tonnes/ha)	13.50 (135.00 q/ha)
Additional average productivity recorded in the demonstration (metric tonnes/ha)	8.43 (84.30 q/ha)
Average sale price (₹/q)	4000
% increase in average productivity (%)	166.27
Additional income received due to increase in average productivity (₹/ha)	337200.00
Total area under 11 districts of Uttarakhand hills (ha)	2456.19
Additional income to be received from 11 hilly districts of Uttarakhand (₹ in crore)	82.82

Similarly, the net income in the demonstrations was ₹ 3,67,735.00/ha whereas it was only ₹1,71,586.00/ha on the farmers' field. Almost same pattern was observed in B:C ratio which was 3.13 in the demonstrations and 2.23 on farmers' field.

The impact of demonstrations indicated that performance of Indra hybrid of capsicum has been outstanding in respect of production and quality as compared to California wonder grown by the farmers. The present average productivity in hills of Uttarakhand

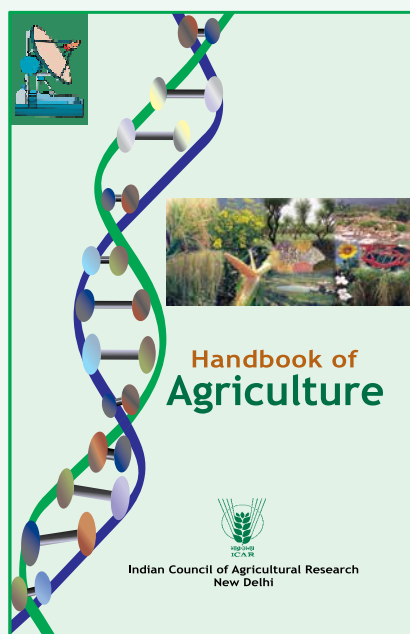
is 5.07 metric tonnes/ha while in the field demonstrations it was 13.50 metric tonnes/ha. Thus, 8.43 metric tonnes/ha of additional average productivity recorded in the demonstrations which was 166.27% higher as compared to average productivity in mountain region of Uttarakhand. The additional income received due to increase in average productivity was ₹ 3,37,200.00/ha. At present, capsicum is cultivated in an area of 2456.19 ha in 11 hilly districts of Uttarakhand. Thus, total additional income of about ₹ 82.82 crores may be obtained, if farmers adopt the demonstrated integrated crop management technology on their fields. It

is clear from the demonstrations that integrated adoption of crop management technology gave tremendous impact on production and profitability of capsicum as an off-season crop.

For further interaction, please write to:

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TECHNICAL SPECIFICATIONS

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