

Vegetable cultivation

by small and marginal farmers in rainfed and degraded lands under
Farmer FIRST Programme in Doon valley

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Uttarakhand state is characterized by diverse geographical features ranging from snow covered mountain peaks in the North to tropical forests in the South. Uttarakhand has 0.53 lakh sq. km geographical area with population of around 1.01 crore. Uttarakhand has been one of the fastest growing economies in India during the past decade. The share of agriculture in overall Gross State Domestic Product (GSDP) has declined from 22.27% in 2004-05 to just 9.59% in 2013-14. Still, agriculture sector holds important place as about 45% of work force depends on it for their livelihood. About 13% of total reported area of the State is cultivable and dominated by marginal and small land holdings (92%). Thus, there is no scale of economies in agricultural production. Agriculture in hills is primarily (78%) rain dependent and at subsistence level. Fragmentation of land holdings, poor diversification of farming activities, niche based collective or group farming with consolidation of land holdings, soils consist of boulders/pebbles, changing tenancy, improper management of rainwater, higher soil erosion rates, excessive damage by wild animals etc. are some of the important contributors for continuous decline in agricultural land and its productivity in the state.

Keywords: Doon valley, Farmer FIRST Programme, Small and marginal-farmers

Production system

Around 92% of the North Western Himalayan Region farmers are small and marginal and have 63% of the total cultivated area of the region. The production systems are mainly rice-wheat and maize-wheat based. Major *kharif* crops grown are paddy, maize, mandua and pigeon pea whereas, wheat, barley, mustard, toria and lentil are mostly raised as *rabi* crops across the hills. Apart from the cereals and pulses, vegetables like potato, tomato, cauliflower, bottle gourd, cucumber and chilli are also grown. Many of the cropping systems are far from their productive potential while accelerated economic growth now offers demand-side opportunities for agriculture. Non availability of appropriate and quality planting material and seeds at the right time is a major problem with

most of the farmers. Dominance of rainfed situations, poor access to modern technologies, poor productivity level leading to abysmally low marketable surplus and related environmental crises are the major limiting factors in the area. Due to its location and diverse agro-climatic situations, Uttarakhand has certain exclusive advantages for development of horticulture including off season vegetable cultivation, cultivation of medicinal and aromatic plants, agro processing industries and organic farming which can be profitably exploited. Considering all the major problems including agricultural problems which persist in the hilly region, vegetable cultivation is one of the major interventions to enhance the income of small farmers and will raise the standard of living of the people.

Vegetable Cultivation

Vegetable is considered as high value crops, providing higher income to growers compare to conventional food crops. Besides, vegetables are prominent source of vitamins and minerals (Table 1) along with numerous nutraceutical properties (antioxidants, flavonoids, phenols, fibers etc.) and form the important component of diet.

Vegetable farming is one of the most prominent economic activity in rural hilly areas of Uttarakhand. It generates income and employment generation activity among small farmers and weaker sections of the society for their livelihood security. Climate in Uttarakhand is suitable to grow diverse kind of vegetables in different agroclimatic zones. Range of vegetables including tomato, pea, potato, colocasia, cabbage, French



Fig. 1. Poorly managed terrace with boulders



Fig. 2. Farmers showing his Nutritional Kitchen garden

Table 1. List of vegetables rich in vitamins and minerals

Nutrients/vitamins	Vegetable crops
Calories	Tapioca, sweet potato, potato, colocasia, onion, peas, etc.
Proteins	Peas, cowpea, drumstick
Vitamin A	Carrots, spinach, drumstick, pumpkin, tomato, etc.
Vitamin B complex	Chillies, peas, broad beans, tomato, capsicum
Vitamin C	Aonla, leafy vegetables, tomato, etc.
Calcium	Curry leaves, drumstick, spinach and all the other leafy vegetables, etc.

bean, radish, onion, okra, cauliflower, capsicum, brinjal, leafy vegetables and others are commonly cultivated in the state. Traditionally, majority of households are engaged in cultivation of seasonal vegetables in the land around homestead. Produce of which are used for own consumption and surplus vegetables are sold in nearby market. In due course of time, the traditional cropping system was modified with the advent of market forces. The villagers began to cultivate vegetables, especially pea and tomato in their farmlands on commercial scale. Out of total cultivable area of the State, 0.898 lakhs ha is under vegetable cultivation. This area accounts for 9.545 lakhs MT of production of vegetables in the State. But productivity of vegetables in the state is much lower (10.52 MT per ha) than the National productivity level (17.30 MT per ha). Hence, there is an ample scope for increase in productivity level of the vegetables in the state by introducing hybrid varieties suitable for the area with scientific cultivation methods.

Unique micro-climate of many lower and mid hill pockets of

Uttarakhand provides unique advantage of producing off-season vegetables which fetches good price in the market. Risk and uncertainty in agriculture has also been minimized by vegetable cultivation with available resources and weather aberrations of the region. In recent past, emergence of neo-middle class with higher income in India boosted the purchasing power, therefore, demand of diverse quality vegetables has been increased. Promotion of scientific cultivation of diverse vegetable crops in Uttarakhand hills can lead to achieving food, nutritional and livelihood securities along with sustainability and profitability to the farmers.

The efforts for vegetable cultivation by small and marginal farmers were made by IISWC, Dehradun under Farmer FIRST Programme of Indian Council of Agricultural Research. For implementation of this project, three group of village hamlets namely Kotigaon group of hamlets, Sindhwalgaon group of hamlets and Badasi Grant group of hamlets were selected in Raipur block of Dehradun district. Initially, constraints faced by farm families for vegetable cultivation

were assessed through survey, field group discussions, interaction with farmers etc. Afterwards, four pronged strategies were devised for promotion of scientific cultivation of diverse vegetables. The four steps were as follows:

1. Awareness and capacity building of farmers
2. Distribution of quality seeds/seedlings, pesticides etc.
3. Technology demonstration
4. Impact assessment

Prominent constraints identified

In contrast to high input, capital intensive, hi-tech cultivation of vegetables in plains, the farmers in hilly areas of Uttarakhand relied upon traditional and conventional agricultural techniques and are lagging behind in respect of technological and socio-psychological factors. Unlike plains, the vegetable growers in the hilly areas of Uttarakhand face multiple challenges on different fronts such as less access to inputs like seed and planting material, fertilizers and pesticides, abrupt weather changes like hail storms, inadequate irrigation facility, and most importantly difficulties in transportation of produce and marketing. On the other hand, micro-climate in mid-and-low hills favours off-season vegetable cultivation. For instance, farmers of Jaunsar area of Dehradun district are engaged in off-season tomato production and fetching premium prices for their produce in Delhi's Azadpur Mandi.



Fig. 3. Capacity building of women farmers

Restraints in vegetable cultivation in hilly areas

- Lack of knowledge and poor adoption of improved technologies such as high yielding hybrid vegetable varieties, scientific package of practices (seed rate, seed treatment, crop spacing, nutrient management), integrated diseases and pest management technologies etc.
- Non-availability of quality seeds and planting material of improved vegetable cultivars and hybrids.
- Insufficient irrigation facility for off-season vegetable production.
- High cost of vegetable seeds and pesticides and inadequate subsidies/incentives from state agriculture department.
- Hilly terrain, poor road infrastructure, inadequate storage facility, poor supply chain mechanism and dependence on middleman make the cultivation of high value, perishable vegetable crops risky affair.

Addressing these challenges is critical to diversify the State's traditional agriculture and boost its vegetable productivity which in turn can raise the farmers' income, bring nutritional security and can reverse the process of migration in hills.

Capacity building of farmers

Capacity building is the one of the important component of Farmer FIRST Programme. Several extension activities and different training programmes were organized at village level, KVK and ICAR-IISWC

Dehradun for capacity building and empowerment of farmers of project area. Considering most of the farm families were traditionally engaged in mono-cropping of selected few vegetables i.e. potato, green peas, tomato, colocasia etc. focus was given for augmenting agro-biodiversity through cultivation of diverse vegetables. Awareness was created in farm families for diversification of vegetables and training was imparted for scientific cultivation of diverse vegetables. Different vegetables i.e. leafy vegetables, leguminous and cucurbitaceous vegetables were promoted. Besides, awareness was created to grow and conserve diverse kind of traditional vegetables. The scientific techniques like selection of suitable site, layout, sowing time, rotation of vegetable crops, integrated disease and pest management, nutrient management, soil and water conservation and marketing of vegetable produce were promoted through different training programmes, *kisan gosthis*, field days, frontline demonstration, exposure visits etc. (Table 2). Considering the key role played by farm women in day-to-day agricultural operations in hilly states like Uttarakhand, special

focus was given for capacity building of farm women (Fig. 3). Training of farm women for bridging the knowledge gap through learning of scientific cultivation of vegetable crops was accomplished.

Vegetable included

Kharif Season: Tomato, brinjal, chilli, okra, cucumber, bottle gourd, bitter gourd, pumpkin, ridge gourd, sponge gourd, cowpea, cluster bean and round melon.

Rabi Season: Turnip, spinach, fenugreek, bakla, radish, garlic, pea, French bean, onion and knol-khol.

Technology demonstration

One thousand five demonstrations were conducted at farmer's field during 2016-17 to 2018-19. In these demonstrations vegetables namely; pumpkin, bottle gourd, sponge gourd, ridge gourd, bitter gourd, apple gourd, cucumber, okra, cowpea, brinjal, tomato, capsicum, French bean, moringa, green pea, radish, turnip, beatroot, spinach, fenugreek, cauliflower, cabbage, coriander and green chili were promoted among farmers of project area. These demonstrations played significant role in dissemination of scientific vegetable techniques and enhanced the area under vegetable cultivation in the region (Figs. 4 & 5).

Salient achievements

Annual demand and availability of vegetables in the villages before project implementation: Annual demand of vegetables of the villages adopted under the FFP was 5,026.78 quintal and in contrast availability of vegetables was only 1,998.16 quintals. Hence, the deficit was of 3,028.62 quintals. The deficit of the vegetables was being fulfilled by purchasing from local market by the villagers. Average vegetable deficit in

Table 2. Capacity building activities organized in the project area

Extension Activities	Number	Farmer's benefitted
Training programmes	5	218
Kisan Gosthis	10	536
Field Days	2	342
Frontline Demonstrations	1,005	1,005
Exposure visits	6	272
Mahila Diwas	1	82



Fig. 4. Vegetables grown under protected conditions



Fig. 5. Women farmer showing harvested tomato crop

adopted villages was about 60.25%.

Share of different vegetables in the annual availability before project implementation: Before the project implementation, annual availability of vegetables was 323.83 kg per family. Annual production of vegetables at home in the project area was only 186.20 kg per family while to fulfill the requirement annual purchase of vegetables was reported to be 137.63 kg per family. Total purchase of vegetables in all adopted villages under project was 849.18 quintals. Maximum availability was of potato (20.27 %) followed by colocasia (17.18 %).

Impacts: A drastic change was found in the availability and purchase pattern of vegetables by the farmers from local market. There was 233.48% increase in annual production of vegetables in all the adopted villages under the project.

Result of Table 3 reflects that there was 45.77% decrease in total purchase of vegetables while 48.26% decrease in cost incurred for purchasing vegetables. Annual purchase of vegetables (kg per family) was also reduced by 45.77% which shows that requirement was fulfilled from their own kitchen garden. There was 237.84% increase in annual production of vegetables at home. Vegetable deficit in adopted villages was reduced by 75.76% while the share of major vegetables like potato, colocasia and onion consumption was reduced by 13.30%.

In contrast, share of green leafy vegetables consumption was increased by 13.30%. This reflects that green leafy vegetables which are rich source of vitamins and minerals is substituting carbohydrate rich major vegetables *i.e.* potato, colocasia

and in turn providing the holistic nutritional diet. Furthermore, number of vegetables consumed was increased by 17.86% indicating diversification in diet. Demonstrations conducted helped the villagers in adoption of scientific vegetable cultivation technology.

Conclusion

Transfer of better and appropriate vegetable technologies with scientific package should be encouraged in the hilly areas. Special efforts are required to be made for technology application, processing and marketing of the variety of vegetables, fruits and other farm produce. Hon'ble Prime Minister Sh. Narendra Modi has set up target of doubling the farmers income by 2022 and to achieve this target, vegetable cultivation by the small and marginal farmers is one of the most important intervention. There is urgent need of promoting organic farming among vegetable cultivators and organizing farmer interest group's at village level, federations (farmer producer organization) at block/district level. Farmer producer organization (FPOs) will ensure procurement of inputs like planting material, seeds, fertilizers, pesticides, machines and tools, packaging material etc. They also make arrangement for marketing, setting up of small and medium processing units etc. for income enhancement of the farmers.

Table 3. Change in availability, consumption, production, purchase and cost involved in purchase of vegetables.

Indicators	Before Project	After Project	Increase/ Decrease (%)
Annual availability of vegetables (Kg/family)	323.83	695.59	114.80
Annual Availability of Vegetables in all adopted villages (q)	1998.03	4291.79	114.80
Annual production of vegetables in all villages (q)	1148.85	3831.26	233.48
Total purchase of vegetables (q)	849.18	460.53	- 45.77
Cost of vegetables purchased (₹)	11,09,070	5,73,850	- 48.26
Annual purchase of vegetables (Kg/family)	137.63	74.64	- 45.77
Annual production of vegetables at home (Kg/family)	186.20	620.95	233.48
Vegetable deficit in adopted villages (q)	3028.62	734.21	- 75.76
Share of Potato, Colocasia and Onion vegetable consumption (%)	52.30	39.00	-13.30
Share of green leaves vegetables in vegetable consumption (%)	47.70	61.00	13.30
No. of vegetables consumed	28	33	17.86

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