Applied Ecology and Environmental Sciences, 2014, Vol. 2, No. 4, 90-93
Available online at http://pubs.sciepub.com/aees/2/4/1

DOI:10.12691/aees-2-4-1

Changes in Traditional Agriculture Ecosystem in Rawain Valley of Uttarakhand State in India

Chandra Prakash Kala*

Ecosystem & Environment Management, Indian Institute of Forest Management, Nehru Nagar, Bhopal, Madhya Pradesh, INDIA
*Corresponding author: cpkala@yahoo.co.uk

Received June 27, 2014; Revised July 07, 2014; Accepted July 17, 2014

Abstract Food, nutritional and livelihood securities for human beings remain the centre point of agricultural development. Being the cash crops, at present, vegetables attract grower's attention more than the traditional food crops. This study aims to examine the changes in traditional cropping systems of the hilly villages in Uttarakhand state of India along with commercialization of vegetables and supply chain management. Two important vegetables, pea and tomato, were studied through questionnaire survey and focus group discussions. The findings reflect that though the recent innovations in traditional farming give monetary benefits, it has ecological and environmental ramifications. The high crop diversity as maintained by farmers in the past is now replaced by a few high yielding varieties and cash crops, which is prone to various pest attacks. The continuous use of pesticides does not only affect the crop productivity but impose negative impacts on the health of entire ecosystem and soil fertility. The heavy use of pesticides needs to be avoided in view of maintaining the health of ecosystem and environment.

Keywords: *Vegetables cultivation, Innovations, Uttarakhand, Purola, Pesticides, Ecosystem management*

Cite This Article: Chandra Prakash Kala, "Changes in Traditional Agriculture Ecosystem in Rawain Valley of Uttarakhand State in India." *Applied Ecology and Environmental Sciences*, vol. 2, no. 4 (2014): 90-93. doi: 10.12691/aees-2-4-1.

1. Introduction

The vegetables and fruits being rich source of vitamins, proteins, minerals and carbohydrates form the important component of a healthy diet [1]. Low intake of vegetables and fruits causes about 31% of ischaemic heart disease and 11% of stroke across the world, and if these two important food items are consumed properly about 2.7 million lives can be saved each year [2]. In low and middle income countries, the situation is more alarming as about 77% of men and 78% of women consume less than the minimum recommended daily servings of fruits and vegetables [3]. With growing demand, the productivity of vegetables has increased in India from 14.1 MT/ha to 17.6 MT/ha during 2001-02 to 2012-13 [4]. However, promoting production and consumption of vegetables involve its safety and quality concerns along with improvement in its supply and distribution systems.

Food, nutritional and livelihood securities along with sustainability and profitability remain the centre point of agricultural development. Vegetables being the cash crops attract grower's attention more than traditional food crops. In India, the share of cereals and pulses in the per capita food expenditure has reduced between 2000 and 2010 whereas it has increased for fruits and vegetables during the same period [5]. It is expected that this trend will encourage farmers to diversify their crops, especially the cash crops including vegetables. In the high hill areas of India, mainly Himachal Pradesh and Uttarakhand where the landholding is scattered and scanty, traditionally the farmers are known to adopt crop diversification, as visible in Uttarakhand in the form of 'barahnaja' (literally stands for growing 12 types of crops) [6].

Uttarakhand being a hilly region, there are many constraints in marketing agriculture produce, including poor road network and poor supply chain mechanism. This leads high risk in growing cash crops, especially vegetables. The farmers depend on middlemen who use to control the market. In most districts of Uttarakhand, generally growing commercial crops is insignificant, as the proportion of land for such crops is less than 5% however agriculture remains crucial for about 80% of this state's working population, as it forms their prime source of livelihood [7]. This study, therefore, aims to examine the changing patterns in traditional cropping systems of Uttarakhand along with commercialization of vegetables, being a prominent cash crop, and its supply chain management. This information is vital in order to investigate the causes and background of structural changes in cropping pattern, which can subsequently draw specific conclusions for the future and to make appropriate policy at local to national level.

2. Methods

2.1. Study Area

The present study was conducted in Uttarkashi district of Uttarakhand state in India, which lies between 30°27' -

31°27' N and 77°48' – 79°24' E. Uttarkashi is bordered by district Tehri in south, district Dehradun in west, district Chamoli in east and district Kinnaur of Himachal Pradesh in the north. The intensive study was focussed in the 4 villages namely Khaladi, Pujeli, Netri and Arakot of Rawain valley in district Uttarkashi. The study villages are located 140 km from state capital Dehradun, at elevation ranges from 1525 m to 1600 m. Kamal river flows in the middle of the valley. Rawain valley is also known for its beautiful landscape (Figure 1). Agriculture and animal husbandry are the major livelihood activities of villagers. Chir pine (*Pinus roxburghaii*) forest dominates around the villages in the study area. The study area soil is sandy loam, and here the mean monthly temperature varies from 8°C in January to 26°C in May.

Figure 1. The agriculture land and the landscape of the Rawain valley in Uttarakhand state of India

2.2. Survey Methods

Figure 2. Observing agricultural practices and interviewing a farmer in the farms of one of the study villages – Khaladi

Semi-structured and unstructured questionnaire surveys were conducted among the farmers of the study villages. Efforts were made to gather information from both sexes on the traditional cropping system, changes in the traditional agricultural practices, use of manure, fertilizers, pesticides and other agrochemicals. Nurseries and agricultural fields were also visited to take first hand information on the present status of vegetables farming, especially vegetable composition and cultivation methods (Figure 2). Besides, focus group discussions were carried out among the agents and private dealers involved in vegetable's supply chain management along with co-operative societies. Attempts were also made to record problems in supply chain and cultivation of vegetables through interviews among farmers, middlemen and members of co-operative societies.

3. Results

3.1. Cropping Pattern

The study villages in Rawain valley of Uttarkashi district traditionally administered four cropping systems depending on the land and water. The irrigated land was used to grow mainly paddy and wheat. The unirrigated land, which was mainly on slopes in the form of terraced farms, was used for cultivation of mixed crops, including millets, pulses, wheat, and paddy. The land around homestead, which was called kitchen garden, was used for production of seasonal vegetables and fruits for own consumption. 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. Earlier, a few plants of pea and tomato were grown by some villagers in their home gardens only. Since the water was important requirement for cultivation of these vegetables, the villagers began to concentrate more on their irrigated land, which was in the river valley.

At present, in order to diversify the cropping pattern within small land holdings, farmers have developed an orderly mechanism for growing different crop-combinations. In irrigated land alone, there are four major patterns in raising crops. i) In a field where pea is harvested in February tomatoes plantlets are transplanted in April. ii) In the piece of land where wheat is harvested in May paddy is transplanted in June-July. iii) In the land where tomato begins to produce fruits in the beginning of June immediately after fruit collection for about a month paddy is transplanted in July. iv) A small piece of land is also used for cultivation of miscellaneous crops, including fodder for livestock.

3.2. Farming of Pea

Pea seeds are purchased either from the market or from the local agent for farming. Rate of seeds is Rupees 90-120 per kg, which varies with agents. Generally, the period for sowing of pea spans for a month from mid November to mid December, which gets ready for harvesting in March-April. One month for sowing of peas is made purposefully so that the harvesting period of its pods remains for larger period of time. If the entire crop gets ripened together then it may create problem for its transportation. Meanwhile, the prices of same may go down in case of oversupply. The gradual ripening of peas gives better return and also does not hamper the transportation and storage management problems.

Pea is sown directly along with ploughing the field by broadcasting of its seeds. Since birds prefer to steal pea seeds, farmers cover the seeds with soil during ploughing and also keep close eye to fly them away. Seed predation problem persists till they germinate. While growing pea

bears mild stems and therefore it produces tendrils to move up. Farmers erect twiggy sticks into the ground to support the pea plant to climb up through its tendrils. With the onset of flowering water is being poured in the farm once in a week for development of good quality pods. The pods begin to mature from bottom to top of the plant. Farmers harvest peas regularly, which encourage more pods to be produced. In 2013-14, one sack of pea was sold at Rupees 500. One sack contains 30-35 kg of pea.

3.3. Farming of Tomato

Figure 3. Farms of tomato in the Rawain valley of Uttarakhand

Likewise pea seeds, the tomato seeds are purchased either from the market or from the local agents at the cost of Rupees 500 per 100 gram. Tomato seeds are first sown in the nursery and then planted in the field. Nursery is raised in December and by March tomato plantlets become ready for transplantation. Planting is done in the evening, generally after 6 pm. Plant-to-plant distance is maintained at one feet and row-to-row distance of plant is kept 3 to 3.5 feet. If the weather is dry, watering is done almost everyday. When the rainfall is less, irrigation is done 2-3 times in a month. Since some plants do not grow well and others die while growing up, the farmers replant on such spots as gap filling process. Likewise pea, tomato's stems become mild hence farmers erect twiggy sticks into the ground to support them to be straight (Figure 3). As the plants grow up, the farmers tie them loosely to the stick with soft strips of cloth or rope. After 25 June the fruits of tomato begin ripening and this will continue till 15 August. One nali (1 ha = 50 nali) of land produces 400 kg tomato. In normal circumstances, about 600 plants of tomato produce 100 carat of tomato. One carat contains 25 kg tomato.

3.4. Use of Pesticides

Less quantity of pesticides are used in peas as the crop grows in winter when the pests are low and remain less active. The pesticides are mainly used in tomato farming, which include neon and indofil. One full lid of neon is mixed in one canister of water. In the beginning less quantity of neon solution is sprayed in the tomato crops but when crops begin to flower it is sprayed after every 10-12 days regular interval. Indofil is sprayed during flowering only. Earlier, Demicron was also used which is, at present, not used.

3.5. Supply Chain Management

Earlier, only limited number of families used to grow pea and tomato. The immediate return from these crops in terms of cash attracted farmers to grow cash crops including pea and tomato. When large number of farmers began to grow these vegetables, a need was felt to organise the farming system for maximization of benefits. The local market was not enough to consume the increased production. With the help of local Non Government Organizations and World Bank sponsored projects, the farmers were encouraged to form Fruits and Vegetables Growers Association (FVGA). Mother Dairy was also approached for streamlining the supply chain. Through purchasing agreement with growers, FVGA and Mother Dairy began to regulate the supply chain of fruits and vegetable production in the Rawai valley. FVGA functions as a mediator between Mother Dairy and farmers.

As per the regulatory mechanism, after collection of fruit and vegetables at local collection centre, the collected stock undergoes for grading. The neglected and low quality fruits and vegetables are left. Before sending to the local office of Mother Dairy, the grading is done. Tomatoes are packed in plastic crates provided either by FVGA or Mother Diary for transportation in trucks to New Delhi office of Mother Dairy after grading. Mother Dairy also does grading at New Delhi for quality checks. FVGA receives payments from Mother Dairy and disburses it among the farmers. However, the rates at Ajaadpur Mandi, Delhi vary everyday depending on the demand.

Some wholesalers at Dehradun have deputed their agents in the village. Some farmers also sell their produce to these agents directly rather then FVPA. For packaging of tomato, three types of carats are used: 10 kg, 15 kg and 25 kg. Mostly 10 and 25 kg carats are used. For 40 days per day 3-4 trucks of tomato are loaded at the village collection centre, which are transported to Delhi. The connectivity of villages to cities by road network has also helped and catalyzed the production of cash crops.

4. Discussion

The present innovation in the traditional farming systems as explained has enhanced the livelihoods of hill farmers who mainly occupy small landholdings. The successful implementation of this innovation in the Himalayan villages has happened due to many reasons, including growing vegetables in the period of year when such vegetables are not produced in large parts of the plains, generally [7]. Though, the pea is produced in 24 States and Union Territories of India, the peak season of growing pea in Uttarakhand is April and May except Karnataka in south India and Sikkim in northeast India [4]. This differentiates Uttarakhand from rest of the pea producing States and Union Territories. Mother Dairy looks for off season vegetables, especially tomato during summer, which was earlier provided by farmers of Himachal Pradesh, the adjacent state of Uttarakhand. The rising demand of Himachal Pradesh's farmers compelled Mother Dairy to explore new areas and the Rawain valley was the best area for meeting the need of Mother Dairy [7].

Though, the present innovation gives monetary benefits, it has number of ecological and environmental ramifications. The change in traditional cropping pattern has affected the diversity of crops as grown by farmers in the past. The high crop diversity as maintained by farmers in the past is now replaced by a few high yielding varieties and cash crops, which is prone to various pest attacks. In order to control the severe crop damages, the reliance of farmers has switched over to the use of chemicals and pesticides. There are reports on the increase of pest population, which has compelled farmers to increase the number of pesticides sprays [8]. The continuous use of pesticides does not only affect the crop productivity but impose negative impacts on the health of entire ecosystem and soil fertility.

The village ecosystem in the hills is interwoven with the forests, animal husbandry and agriculture [9]. The forest biomass is transferred as organic manure through livestock to the agriculture land. The study villages being surrounded by pine forests, the farms receive organic manure through leaching of litter from the forest. The farmers perceive that though pine forest biomass is less fertile than the oaks, it is better than deodar forest, which grows further higher up in the hills. The crop residue is also transferred as manure through livestock. However, less straw is produced by the high yielding varieties, which declines the supply of fodder to the animal. This compels people to keep less number of livestock which subsequently reduces the quantity of organic manure. Less availability of manure enhances the use of chemical fertilizers. Organically grown vegetables are considered better for health as they are known to have more anti-oxidants [10].

The present model of innovation can be replicated in other areas for the upliftment and enhancement of living standards of poor hill farmers. However, as the scope of improvement remains with innovation, in the present model, the use of pesticides needs to be avoided in view of maintaining the health of ecosystem and environment.

Acknowledgements

The author thanks the villagers of Rawain Valley who actively participated and provided information during the fieldwork. Asharam Bangwal is thanked for providing logistic support. Members of the Fruits and Vegetables Growers Association, especially Brij Mohan Rawat and Dharamveer Singh are acknowledged for their cooperation and support.

References

[1] Byers, T., Nestle, M., McTiernan, A., Doyle, C., Currie-Williams, A., Gansler, T., and Thun, M. 2002. American Cancer Society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. CA: A Cancer Journal for Clinicians, 52 (2): 92-119.

[2] WHO and FAO, 2005. Fruit and vegetables for health. Report of a Joint FAO/WHO Workshop, 1-3 September, 2004, Kobe, Japan. World Health Organization and Food and Agriculture Organization of the United Nations.

[3] Hall, J.N, Moore, S. Harper, S.B. and Lynch, J.W. 2009. Global Variability in Fruit and Vegetable Consumption. American Journal of Preventive Medicine, 36 (5): 402-409. 2009.

[4] Indian Horticulture Database, 2014. Indian Horticulture Database - 2013. National Horticulture Board, Ministry of Agriculture, Government of India. 289 pp.

[5] Tuteja, U. 2013. Baseline Data on Horticultural Crops in Uttarakhand. Agricultural Economics Research Centre, University of Delhi, Delhi.

[6] Kala, C.P. 2010. Status of an indigenous agro-forestry system in changing climate: A case study of the middle Himalayan region of Tehri Garhwal, India. Journal of Forest Science, 56 (8): 373-380.

[7] Alam, G. and Verma, D. 2007. Connecting small-scale farmers with dynamic markets: A case study of a successful supply chain in Uttarakhand, India. Centre for Development, Dehradun, India.

[8] Singh, D.D. and Singh, N.P. 2004. To Assess the Usage of Fertilizers in the Hill Districts of Uttaranchal. Center for Organic Farming (COF) - Himothan Pariyojna, UOCB, Dehradun, Uttarakhand.

[9] Kala, C.P. 2004. The Valley of Flowers: Myth and Reality. International Book Distributors, Dehradun, India.

[10] Barański, M., Średnicka-Tober, D., Volakakis, N., Seal, C., Sanderson, R., Stewart, G.B., Benbrook, C., Biavati, B., Markellou, E., Giotis, C., Gromadzka-Ostrowska, J., Rembiałkowska, E., Skwarło-Sońta, K., Tahvonen, R., Janovská, D., Niggli, U., Nicot, P. and Leifert, C. 2014. Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses. British Journal of Nutrition.