

Diversification in Temperate Fruits- Potential and Prospects in India

****Aascharya Pandey¹, *Saket Mishra², *Gaurav Singh vishen³ and *Sudhir Kumar Mishra⁴**

¹Ph.D scholar, Department of Horticulture, Naini Agriculture Institute SHUATS Naini Prayagraj

²Associate professor, Department of Horticulture, Naini Agriculture Institute SHUATS Naini Prayagraj, U.P

³Ph.D scholar, Department of Horticulture, Naini Agriculture Institute SHUATS Naini Prayagraj, U.P

⁴Assistant professor, Department of Horticulture, N.P.G. College Barhalganj Gorakhpur, U.P

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Introduction

Indian Himalayan region offers vast opportunities for cultivation of temperate fruits predominant amongst these are apple, pear, peach, plum apricot, cherry, almond and walnut. The average productivity of temperate fruits is quite low due to lack of superior genetic material, irrigation facilities, non availability of critical inputs, inadequate adoption of plant protection measures, scattered small and marginal land holdings and above all non adoption of advanced modern production technology. Hence, the developmental strategies should be focus on diversification, production of quality genetic material, integrated farming approach, strengthening post harvest infrastructure and organized export oriented marketing. In the diversification of horticulture, high value cash crops like nut fruits, soft fruits and other less important indigenous and exotic minor fruit species need to be incorporated. The Indian Himalayas spread over in an area about 5 lakh km² and lies between latitudes 26°20' and 35°40' N and between longitudes 74°50' and 95°40' E starting from foot-hills in the south (Siwaliks) towards the region extends to Tibetan plateau in the north (trans-Himalaya) comprising about 95 districts of the country. The fragile mountains contribute about 16.2% of India's total geographical area, and most of the area is covered by snow-clad peaks, glaciers of higher Himalaya, dense forest cover of mid-Himalaya. Temperate fruits growing in India are spread over in major Himalayan region (Table. 1) in 18 states of India (Chadha, 1992). Amongst these, Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal

Pradesh occupy the major share in production of temperate fruit. With relative advantage in the region due to climate, a large number of temperate fruits are grown. The commercially grown temperate fruits are apple, peach, plum, apricot, cherry, almond and walnut. Amongst these, maximum area has been occupied by apple and pear followed by stone fruits (peach, plum apricot, cherry & almond). The low productivity of temperate fruit industry in Himalayas are attributed to low pollination, fruit drop, poor fruit set, high biotic pressure and the use of old degenerated varieties as well as lack of elite planting material and proper orchard management technology. Keeping in view of the current scenario of temperate fruit production, crop diversification is one of most popular strategy suggested to ensure food security and to make judicious use of land, water and other available resources in the region.

Table. 1. Major temperate fruit growing areas in India

North Western Himalayan region (NWHHR)	Jammu and Kashmir, Himachal Pradesh, and Uttarakhand
North Eastern Himalayan region (NEHR)	Arunachal Pradesh, Sikkim and Hilly areas of Assam, Meghalaya, Nagaland, Mizorum and West Bengal.
Other hilly areas	Hilly areas like Tamil Nadu, Rajasthan, Karnataka, Madhya Pradesh, Chattisgarh, Punjab and Jharkhand.

Major constraints

The total fruit production of India is 63503 million tones and temperate fruit production accounts very less share in area and production. Amongst the various temperate fruits apple is most important which accounts for 5.0% of total area and 3.2% of total fruit production of country. The major temperate fruit producing states are Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh. The time series data exhibits very erratic pattern of annual production of temperate fruits in the country (Table 1). The average productivity and quality of temperate fruit is far below compared to tropical and subtropical fruits. The main problems of low productivity and poor quality is owing to small and scattered holdings as well as marginal and sloppy land, rain fed situations, poor mechanization in sloppy terrain, poor transport and communication at higher attitudes, adverse weather conditions like spring frost, hails, drought and heavy monsoon. Apart from these, lack of superior planting material having good yield & fruit quality and better consumer preference. Moreover, high biotic pressure especially apple scab, premature leaf

fall, canker and red spider mite, phytoplasma, gummosis disease in peach and almond are some of serious diseases and pest causes serious losses to temperate fruit industry. Moreover, current plant protection strategy is based on use of chemical, which is not cost effective and damaging to the fragile natural ecology as well.

Besides these, majority of temperate fruit plantation under North Western Himalayan region have gone senile and re-plantation is a major issue that needs to address immediately. Hence, rejuvenation programme of old existing orchard should be promoted in good spirit and executed effectively. Simultaneously, the major thrust for temperate fruit production need to be initiated in a phased manner and accordingly planned for short term, midterm and long term periods as suggested below.

Short term planning (For 3- 5 years)

Under short term planning the following action need to be initiated at least for three to five years period. In the present situation, important production problems related to pre and post practices currently followed should be looked upon to improve the productivity and quality of fruits. Hence, the scientific recommendation emerged from researchers from various institutions in the region need to be disseminated for proper adoption. Here some important pre and post harvest factors suggested to improve the current situation in the region

Pre harvest factors

- The heavy pruning needs to be employed to provide good canopy and light penetration to obtained uniform fruit set and improved fruit quality.
- Spraying of fungicides and pesticides in order to control the disease/pests.
- Application of Bordeaux paste during December-January to avoid collar rot as well as other diseases.
- Timely application of recommended dose of manures and fertilizer in different crops need to be monitored regularly.

Post harvest factors

- Harvesting of various fruits and their varieties based on maturity in the scientific manner.
- Grading of fruits based on colour, size and variety.
- Packaging in corrugated boxes with proper lining and transportation of produced to local and distant market.



- Development of processing industries so that culled/ ungraded fruit can be utilized.
- Policy planning for assured fixation of standard price of different commodities/ fruits in the region so that farmers may get optimum price for their produce.

Midterm planning (5 – 10 years)

Under midterm planning, the major thrust should be given on rejuvenation of old and senile orchards of temperate fruits between the age of 40-50 years, area expansion programme through cluster area approach planting as well as promotion of organic farming systems.

Rejuvenation of old senile orchards

Presently, majority of temperate fruit plantations especially in North-Western Himalayan region have gone senile and re-plantation is a major issue that needs immediate attention. For this, rejuvenation techniques need to be promoted and executed in full spirit to control the replant problems. During rejuvenation process a great precision need to be ensured with timely application of recommended dose of manures and fertilizer, use of mulch to conserve soil moisture and recommended schedule of spraying of insecticide and pesticides. Moreover, appropriate number of pollinizers in the temperate fruit need to be ensured to maintain in appropriate ratio and can be done very efficiently through top working.

Clusters area approach

Almost entire temperate fruit plantations are rain fed on small, scattered sloppy marginal land. Hence, the temperate fruit industry has to be oriented to follow the cluster area approach where in suitable for production of identified fruits/varieties need to be promoted. Moreover, this approach is going to provide major advantage of organizing the production and post harvest management right from nursery production to marketing at single door. Therefore, area expansion programme of new plantation need to be advised on above theme.

Organic farming

By default the Himalayan region of India are organic since the per unit utilization of chemical fertilizer and insecticides are too less compared to other region. Hence, there is a need to promote organic production of temperate fruits to promote export and enhance proper return to the producers as demand of organic production is increasing 20 per cent annually. The minimum use or no use of chemical fertilizers and pesticides in the Himalayan regions



are considered as weakness in hi-tech production technology. But these weaknesses could be converting into opportunity by adoption of organic farming. Hence, to take the benefit of organic farming in terms of high value of produce, there is immediate need to standardized and promote the technologies for producing vermicompost, bio-fertilizers, mycorrhizae and bio pesticides in different temperate fruits.

Long term planning (10-15 years)

Under long term planning there is need to assess the strength and weakness of present day problems of temperate fruit industry in Himalayan region. The important problems of temperate fruit in the Himalayan region are identified on following issues and their remedial measures are suggested as under.

Hi tech nursery development

There is need to initiate the establishment of a bud wood bank for temperate fruit planting material which shall be conserved in mother plant block so that multiplication of true to type vegetative plants for sale/distribution from the registered nurseries should be ensured. Crop specific nurseries need to be developed to cater the need of identified cluster zone/ fruit varieties of cluster area approach suggested earlier. Hence, the major thrust should be given on mass multiplication of temperate fruits on suitable root stocks. Simultaneously, suitable infrastructure has to be also strengthened by adoption of modern nursery production tools and technologies in the respective region.

High density plantation and use of clonal root stocks

Presently grown standard plantations need to be converted to high density plantation to reduce the juvenile period and increased productivity per unit area. High density plantation provides higher yield, precocity, higher return per unit area and facilitates efficient use of inputs. This system is much possible due to availability of dwarfing rooting rootstocks as well as spur types scion cultivars since they are very responsive to various training & pruning system compared to seedlings rootstocks and old age cultivars. Hence, it is advisable to adopt the modern orchard management technologies such as micro irrigation, fertigation along with intervention of improved canopy architectures although the full potential of clonal rootstocks will be obtained only under irrigated conditions.

Globally a large number of rootstocks in temperate fruits are available but in India only seedling rootstocks are commercialized although, clonal rootstocks proved to be

advantageous in improvement of productivity and quality over seedling rootstocks in various temperate fruits. A series of experiments on standardization of rootstocks on various temperate fruits were worked. Merton and Malling Merton series viz; M-9, M-26, MM-106 and MM-111 were identified as dwarfing, semi dwarfing and semi vigorous respectively in apple. Similarly, polish series namely P-2 & P-22 from Poland shows promise as dwarfing, inducing earliness and heavy bearing. Ottawa seedlings develop from Canada as OH-1, OH-6 and MAC-9 are found to be resistant to latent viruses along with crown rot, root rot. From India, *Malus baccata* var. *himalaica* collected from Gyabung, Rohru, Khrot and Shillong are found as dwarf as well as resistance to various diseases like collar rot, root rot, mildew and apple scab but have low production potential. Hence, this particular species can be used as parent in the resistant breeding programme of apple.

Post-harvest management

In India, approximately 10 to 30 percent of the total horticultural produce is lost during transit, storage, transportation and marketing. These losses are attributed as perishability of produce, improper harvesting and handling practices, in appropriate packing and transport, unavailability of organized marketing and market glut for fresh market, uniformity in grading and packing needs to be ensured by enforcing the standardized grades for which establishment of community grading packing infrastructure in the cluster areas in a prerequisite. Simultaneously, establishment of cool chain from producing site to the consuming markets also needs to be developed. Similarly for processing there is an immediate need to standardize and adopt farm based minimal processing combined with commercial value addition of the minimal processed fruit products.

Diversification of temperate fruits

Presently, it has been clear that a blend of old and new approaches is needed to achieve the sustainable promotion of less known crops in order to contribute towards economic development and well being of people along with maintenance of genetic diversity and its associated local knowledge. Although a better understanding of socio-economic mechanism that hinders the greater deployment of these crops of local significance is fundamental to strengthen their role in poverty alleviation programme of hill region. Hence, under the overarching goals of food security, poverty elimination and environmental

sustainability, less known temperate fruits species should be selected based on their best potential to address following challenges.

Food Security

Major attention should be given to both quantity and quality of foods. The less known temperate fruit species offers untapped potential to contribute to fight mal nutrition. Hence, their enhance use can bring about better nutrition (vitamin, A, C and Carotenoids in *Rubus* and *Ribes* is more than ten times higher than commercial fruits). Moreover, the major emphasis should be thus given to these species having comparative advantages in providing better food being affordable by the poor and available both in terms of time & space.

Nut fruit

In India, nut fruits has not been given due importance compared to pome and stone fruits although ample scope exist in the region. Amongst the nut fruits, walnut has occupied major area being maximum in Jammu & Kashmir followed by Uttarakhand & Himachal Pradesh. No systematic commercial orchards have been developed so far. Presently grown walnut produce come from seedling which varied greatly in terms of nut weight, shell thickness, kernel colour, kernel recovery as well as quality (Pandey *et al.*, 2004, 2006; Pandey and Shukla, 2006 and Pandey and Tripathi, 2007).

The foremost important limiting factor in the commercialization of walnut is lack of vegetatively propagated planting material and suitable variety in the hill region although, few selections has been made in recent years as Sulaiman. Hamdan, Pratap, Govind, Kothkhai Selection-1, Chakarata Seedling 13 (Gautam, 2000, Bhat and Ahmad, 2002, Lal and Singh, 1978) from North Western Himalayan region of India (Table 3). Hence the immediate needs to multiply these promising varieties through vegetative means and make it available to farmers in the region. Apart from this, other important nut fruits like Pecan, Chestnut, Filbert or hazelnut, Pistachio and Macadamia nut can be grown on high attitude and cold arid temperate areas in the interior to diversify the temperate base. The important nut fruits and their promising indigenous and exotic cultivars suitable for diversification in hill region of India are given in (Table-3).

Table -3: Indigenous and exotic nut fruit varieties suitable for diversification

Important nut fruits	Varieties	
	Indigenous	Exotic
Walnut (<i>Juglans regia</i>)	Sulaiman, Hamdan, Pratap, Govind, Kotkhai Selection-1, Chakrata Seedling-13	Cisco, Tulare, Vira, Lara, Placentia, Idaho Trinita, Black More, Lake English, Izvor
Pecan (<i>Carya illinoensis</i>)	-	Mahan, Major, Jenkins, Barton, Greek, Tubilec, Hopi, Goosepond
Chestnut (<i>Castanea sativa</i>)	Local seedling types	Abundance, Nanking, Crane, Merriling, Orin, Wiloka
Hazel nut (<i>Corylus avellana</i>)	Wild seedlings	Butler, Annis, Northampton Erma
Pistacio (<i>Pistachio vera</i>)	Wild type	Jole, Lasone, Sirrorra, Kerman Peters, Pontikis, Chico, Sirrorreal, Sarman

Exotic soft fruit crops

Among the soft fruit kiwi fruit is one of the most important introduction to India. Presently it has been adapted to Indian hills and its cultivation is increasing during recent past. Present day available cultivars of kiwi fruit in India are Allison, Bruno, Monty, Abbott, Hayward female and Allison, Tomuri male. These varieties are only suitable for foot and mid hill region of Indian Himalaya except to some extent Hayward. However, there is a need to have some more varieties suitable for higher attitude locations so that it can be extended towards higher hills. Apart from this, the pineapple guava (*Feizoa sellowiana*), quince (*Cydonia oblonga*) and chinese ber (*Zizyphus jujube*) also need to be incorporated in the area expansion programme of hills. The important cultivars of soft fruit available at global level are given in Table 4.

Table 4. Globally available exotic fruit crops and their promising varieties suitable for diversification.

Common Name	Botanical Name	Commercial cultivars
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Kiwifruit	<i>Actinidia deliciosa</i>	Allison, Bruno, Monty, Hayward, Abbott (female) and Tomuri, Allison (male)
Pineapple guava	<i>Feizoa sellowiana</i>	Tropical, Marian, Triumph, Coolies, Grace
Chinese ber	<i>Zizyphus jujube</i>	Important cultivars from China and Korea
Quince	<i>Cydonia oblonga</i>	Champion, Apple Shaped, Pineapple, Fulers, Orange, Smirna

Indigenous soft and minor fruit crops

Indian Himalayan region are rich in diversity in *Rubus*, *Ribes*, *Docynia*, *Cydonia*, *Myrica* and *Elaeagnus* minor temperate fruits (Table. 5). These fruit crops are brought to Himalayan region for thousands of years not only survived but got established in the hills, leading to evaluation of new varieties. These species have been naturalized and some important selection can be evolved from few of them for exploitation. The most important minor fruit genera which can be exploited for commercialization are *Rubus*, *Ribes*, *Elaeagnus*, *Cydonia*, *Docynia* and *Myrica*. These fruit crops have already been in use by hill peoples and significantly contributed to the economy of tribal farmers. Moreover, these fruit crops are rich source of various nutrients, vitamins and antioxidants. The *Rubus* and *Ribes* are already been exploited in the developed countries and rated on top ten fruits available at global level based on maximum antioxidants. Hence, there is need to initiate some preliminary research work on few of them as they are growing naturally in the Himalayan region under rain fed condition without any care. Generally, local inhabitants collect the fruit at maturity and sale in the market for their livelihood.

Table 5. Indigenous minor temperate fruit species occurring wild in Indian Himalayas and suitable exotic cultivars available in world.

Genus	Name of species	No. of species	Important exotic cultivars
<i>Rubus</i>	<i>R. ellipticus</i> , <i>R. fruiticosus</i> , <i>R. niveus</i> , <i>R. paniculatus</i> , <i>R. biflorus</i> , <i>R. macilentus</i> , <i>R. calcinus</i> , <i>R. acumminatus</i> , <i>R. hexagynus</i> , <i>R.</i>	28	Autmn Bliss, Chiloctin, Comax, Heritage, Malling Lio, Malling Admiral, Titan, Williamette, Rosu Tim Piru

	<i>hamiltoni</i> , <i>R. assamensis</i> , <i>R. insignis</i> , <i>R. ferox</i> , <i>R. moluccans</i> , <i>R.</i> <i>birmanicus</i> , <i>R. lucens</i> , <i>R.</i> <i>oppulifolius</i> , <i>R. lasiocarpus</i> , <i>R.</i> <i>rosaefolis</i> , <i>R. gracilis</i> , <i>R. irritanus</i> , <i>R.</i> <i>pendunculatus</i> , <i>R. purpureus</i> , <i>R.</i> <i>saxatilis</i> , <i>R. pungens</i> , <i>R. discolour</i> , <i>R. antennifer</i> , <i>R. ulmifolias</i> .		
<i>Ribes</i>	<i>R. glaciale</i> , <i>R. nigrum</i> , <i>R. rubrum</i> , <i>R.</i> <i>alpestre</i> , <i>R. orientalis</i> , <i>R. himalayens</i> , <i>R. grossularia</i> .	07	Titania, Laxton's Giant, Fortum, Boldwin, Black Smith, Climax, Red lake, Random, Margoretor, Nortum
<i>Docynia</i>	<i>D. indica</i> , <i>D. hookeriana</i>	02	Local Selection
<i>Elaeagnus</i>	<i>E. angustifolia</i> , <i>E. latifolia</i> , <i>E.</i> <i>umbellata</i> , <i>E. conferta</i>	04	Local Selection
<i>Hippophae</i>	<i>H. rhamnoides</i> , <i>H. salcifolia</i> , <i>H. turkestanica</i>	03	Local Selection
<i>Actinidia</i>	<i>A. callosa</i> , <i>A. strigosa</i> , <i>A. kolomikta</i>	03	Zespri Gold, Matua,
<i>Myrica</i>	<i>M. nagi</i> , <i>M. hooheriana</i> , <i>M. Sapida</i> , <i>M. farquhariana</i> , <i>M. esculenta</i>	05	Local selection

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