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# Scope for cultivation of temperate fruits in the upper Pulney hills

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## Introduction

Kodaikanal, the treasure for temperate fruits in South India is located in the South Eastern scoot of Eastern Ghats (Fig.1). Geographically, Kodaikanal is situated at 10º 13' Northern latitude and 77º 29' Eastern Longitude. The altitude of Kodaikanal hills ranges from 900 to 2330 m above mean sea level and thus the climate varies from sub-tropical to temperate.

The hill ecosystem sits on the plateau above the Southern escarpment of the upper Pulney hills at 2,133 m between the Parappar and Guntar valleys. These valleys form the Eastward spur of the Western Ghats on the Western side of South India. On the Northern part, the high hills slope down into the villages of Pallangi, Vilpatti, Poomparai and Mannavanur forming the upper Pulney hills, which are the potential belts for temperate horticultural crops. On the East, the hill slopes low abruptly into the lower Pulney hills with a vast potential for fruit crops. A perceptious escarpment facing the Cumbum valley is on the South. On the West of Kodaikanal, is a plateau

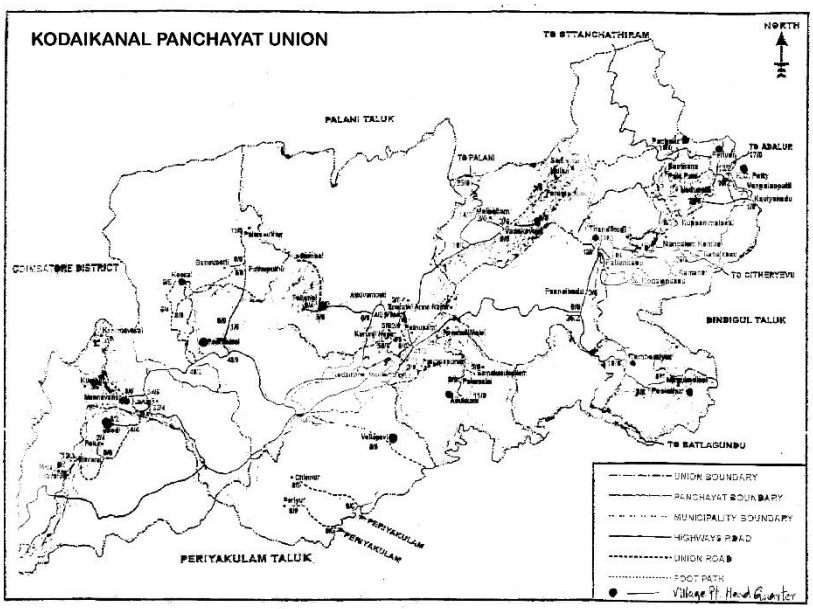


**Fig.1 Kodaikanal**



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leading to Manjampatty, the Anaimalai hills and the main Western ghats. (Fig.2)

With a total area of 1, 11,086 hectares, the Kodaikanal hills is divided into two distinct geographical zones viz., upper Pulney and lower Pulney hills (Table 1).

**Table.1 Geographical zones of Kodaikanal and the crops grown**

| S. No. | Climate | Zone | Crops grown |
|---|---|---|---|
| 1. | Temperate | Upper Pulney region comprising of Kodaikanl, Mannavanur, Vilpatti, Pallangi and Poomparai | Pear, plum, apple, peach avocado, strawberry, peas, garlic, cabbage, cauliflower, carrot, cut flowers like carnation, gerbera, alstroemeria and rose. |
| 2. | Sub-tropical | Lower Pulney region comprising Perumalmalai, Adalur, Pannaikadu, Thandikudi, Pachalur, Thadiyankudisai, and Sirumalai hills | Coffee, hill banana, mandarin orange, cardamom, avocado, chow-chow, beans, cut flowers like carnation, anthurium, cut rose and gerbera |

**Table. 2 General information on the development of temperate fruits in Kodaikanal**

| S. No. | Regions | Area (Ha.) | Altitude (m) | Temp °C | | RH (%) | Light intensity (k .Lux) | Rainfall / year (mm) |
|---|---|---|---|---|---|---|---|---|
| | | | | Max | Min | | | |
| 1. | Upper Pulney hills | 1864 | 1600 - 2330 | 15.3 - 25.6 | 9.0 - 18.4 | 32 - 87 | 4 - 110 | 1050 - 1650 |
| 2. | Lower Pulney hills | 3874 | 900 - 1600 | 20.0 - 30.0 | 15.0 - 20.0 | 37 - 85 | 10 - 120 | 1100 - 1350 |

**Present status of temperate fruit production in Upper Pulney hills**

The unambiguous adoption of the horticulture development programmes by the farmers of this region has transformed the horticulture sector during the last ten years. The total area under fruits which was only 920 ha in 1980s has increased to 2340 ha in 2010-2011.

At present, five temperate fruits *viz.*, pear, plum, apple, peach and strawberry are commercially grown in the upper Pulney hills by small and big farm holdings.



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**Table. 3 Area of commercial varieties grown in upper Pulney hills**

| S. No. | Crop | Varieties | Area (Ha.) |
|---|---|---|---|
| 1. | Apple | Parlin's beauty, Tropical beauty and KKL 1 | 20 (750 homestead) |
| 2. | Pear | Jarganelle, Williams, Bur Kieffer, Kieffer, New pear and Country pear | 1500 |
| 3. | Plums | Hale, Florida Hybrid I and Rubio | 750 |
| 4. | Peach | Floridasun, Shan-e-Punjab and Sha- pasand | 40 |
| 5. | Strawberry | Camerosa, Sweet Charlie, Winter Dawn | 3 |

**Table. 4 Mean monthly temperature of Upper Pulney hills the temperate fruit growing region**

| | | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| Temp. ºC | Max. | 18 | 19 | 20 | 21 | 21 | 19 | 18 | 18 | 18 | 17 | 17 | 17 |
| | Min. | 6 | 7 | 9 | 12 | 13 | 12 | 12 | 11 | 11 | 11 | 10 | 7 |

**Table. 5 Number of days with temperature below 7°C in the Upper Pulney hills**

| Year | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 2010 | 12 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 9 |
| 2011 | 15 | 9 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 15 |

With an average of 600 - 750 hrs of chilling experienced in Kodaikanal offers a wide scope for cultivation of temperate fruit crops.

**Table. 6 Germplasm maintained in the field genebank of HRS, Kodaikanal**

| S. No. | Crop | No. of collections | Varieties/Types |
|---|---|---|---|
| 1. | Pear | 13 | Red Bartlett, Punjab Nakh, Pathar Nakh, Punjab Beauty, Punjab Gold, Punjab Soft, Punjab Nectar, Jarganelle, Williams, Bur Kieffer, Kieffer, New pear and Country pear |
| 2. | Plums | 6 | Hale, Florida Hybrid-I, Rubio, Sutlej Purple, Kala Amritsari and Red Beam |
| 3. | Apple | 16 | Red Delicious, Mollies Delicious, Vance Delicious, Star Krimson, Top Red, Tydemann, Oregan Spur, Golden Delicious, Gold Spur, Vesta Bella, Mayan, Lal Ambri, Tropical Beauty, Parlin's Beauty, KKL-1, |
| 4. | Peach | 9 | Glow Heaven, Shan-i- Punjab, Florida Price, Early Grande, Parbhat, Partap, Sharbati, Shah Pasand, Country Peach |
| | Nectarine | 2 | Snow Queen, Silver King |



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| | | | |
|---|---|---|---|
| 5. | Apricot | 5 | CITH Apricot No.1, CITH Apricot No.2, CITH Apricot No.3, Harcot, New Castle |
| 6. | Kiwifruit | 4 | Monty, Bruno, Hayward and allison |
| 7. | Persimmon | 3 | Hyakume, Fuyu and Hachiya |
| 8. | Strawberry | 4 | Winter Dawn, Camerosa, Sweet Charlie, |
| 9. | Walnut | 7 | CITH Walnut 1, CITH Walnut 2, CITH Walnut 3, CITH Walnut 4, CITH Walnut 5, Hamdan and Suleiman |
| 10. | Almond | 7 | Merced, Primorskij, Pranyaj, IxL, Makhdhoom, Waris, Non Pariel |

**Temperate fruits for exploitation in Upper Pulney hills**

**I. Pome fruits**

**Apple**

Apple being the most important temperate fruit of the North Western Himalayan region in India its cultivation has also been extended to Nilgiris hills and Kodaikanal hills in Tamil Nadu. The apple-growing areas in upper Pulney hills do not fall in the temperate zone of the world but the prevailing temperate climate of the region and high altitude helps to meet the chilling requirement during winter season extending from mid-December to mid-March.

Most of the apple varieties require 1,000-1,500 hours of chilling below 7º C during winter to break the rest period. These conditions are available at an elevation of 1,500-2,700 m above mean sea-level. The average summer temperature should be around 21 -24 º C during active growth period. The areas with frost-free spring and adequate sunshine during summer without wide fluctuations in temperature are most suitable for apple cultivation. Low temperature, rains and cloudy weather, during flowering period hamper the bee activity, affecting cross pollination adversely. Areas exposed to high winds particularly the hill tops are also not suitable for its cultivation. Dry winds during summer desiccate flowers and hamper bee activity, resulting in poor fruit set. Well distributed rainfall of 100-125 cm throughout the growing season is most favourable for its optimal growth and fruitfulness. The long drought spells during fruit development and excessive rains and foggy conditions at fruit maturity hamper fruit size and fruit quality.

With the advantage of temperate climate and chilling period during the winter period, new varieties that have adaptation to mid hills and low hills of Himachal Pradesh can be exploited. Introduction of low chilling varieties will expand the scope for increasing the area under apple cultivation in Kodaikanal hills. However, all low-chilling varieties are poor in dessert quality, sub acid in taste and have poor shelf-life and as such have a scope for commercialization. Important table-purpose, low-chilling varieties are Michael, Schlomit, Anna, Tamma, Vered and Neomi. Tropical Beauty and Parlin's Beauty are suitable for processing purposes.



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Other than the delicious group of apples and the existing varieties in Kodaikanal, new varieties can be introduced

| Spur type | Standard colour mutants | Hybrids |
|---|---|---|
| Starkrimson | Vance Delicious | Lal Ambri ( Red Delicious x Ambri) |
| Well Spur | Top Red | Sunehari **(** Ambri x Golden Delicious)) |
| Red Spur | Skyline Supreme | |
| Oregon Spur-II | Hardiman | |
| Red Chief | Bright-n-Early | |
| Miller's Sturdy Spur | | |
| Hardi Spur | | |
| Silver Super | | |

**Pear**

Pear is the only temperate fruit that can be grown to any extent on the hills of South India and the pear orchards are dominant in upper Pulney hills surpassing apple and plum. Beyond its lacuna of being perishable in nature, pear can be extensively grown in this region, as the produce is of great demand in processing industries.

Pear is similar to apple in its cultivation requirements; therefore, it is mainly cultivated in the temperate regions all over the world. However, there are certain varieties which require very low temperature to break their dormancy and, as such, they can easily be cultivated in sub-tropical climate.



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With the overwhelming performance of old varieties viz., bur kieffer, kieffer, jargonelle and Williams new varieties can be introduced in this region. Pear variety, Patharnakh needs only 150 hr of chilling and can also withstand high temperature and hot winds during summer. The medium chilling requiring pear LeConte, Keiffer, Pineapple, Hood and Gola perform well in areas experiencing mild winter.

**II. Stone fruits**

**Plum**

Among the deciduous fruits, the cultivation of plum is more widely distributed in the world, due to the wider adaptability among different species and cultivars of plums to different climate and soil conditions. Plums can be grown in subtropical plains as well as temperate high hills of India. In general, European plums require 800-1000 hours below 7.2°C of winter chilling for satisfactory bud break in the spring. The cultivars of Japanese plum require 700-1000 hrs of the same winter chilling. European types are either very sweet fresh plums or prunes used for drying. Both types of plums require about 140- 170 days to mature the crop. Most Japanese plums bloom earlier and mature earlier. They typically require less chilling than European plums. In Kodaikanal region, Hale, Florida Hybrid I and Rubio comes up well and are commercially exploited.

**Peach**

Peach is basically a temperate zone plant and its commercial production area is confined between the latitudes of 30° N and 40° S although it is now grown almost all over the world extending from 10 – 49 N°. Today peach is being grown in the mid hill zone of Himalayas at an altitude of 1000 – 2000 m above mean sea level.

Low chilling varieties of peaches are highly preferred in the country as it comes to the market early in the season and growers get remunerative prices at this juncture due to non-availability of other fresh fruits in the market. Thus, introduction of low chilling varieties has



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encouraged peach cultivation on a small scale in the hills of south India comprising of Ooty, Coonoor and Upper Pulney hills of Kodaikanal. Based on the adaptability to the climatic condition of Upper Pulney hills the following varieties of peaches can be exploited in this region.

| Crop | Early varieties | Mid varieties |
|---|---|---|
| Peach | Flordasun, Shan-e-Punjab, Parbhat, Partap, Early Grande | Sharbati |
| Nectarine | Red beam | |

Nectarine, a botanical variety of peach (*Prunus persica*) is classified as *P. persica* var. *nucipersica*. Nectarine is a smooth skin mutant closely allied to peach and is a non pubescent peach with smaller sized fruits, which can adapt to the temperate climate of the Upper Pulney hills of Kodaikanal.

**Performance of nectarine variety at HRS, Kodaikanal**

**Apricot**

Apricot (*Prunus americana* L.) is one of the most important fruit crops of mid hills and dry temperate regions of India although not introduced for cultivation until the year 2010. The fruits are rich in vitamin A and contain more carbohydrates, proteins, phosphorus and niacin as compared to other common fruits. Fruits are generally canned and dried because of their perishable nature and are also processed into a number of products like jam, nectar and squash. Depending on the variety, the kernels may be sweet or bitter in taste. Sweet kernels are used in pastes and confectionery industry, while bitter kernels are used for oil extraction.

Apricots can be successfully grown at an altitude between 900 – 2000 m above mean sea level. The white fleshed sweet kernelled apricots require cooler climate and are grown in dry temperate regions upto 3000 m sea level whereas he coloured flesh and bitter kernelled



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apricots thrive better under the warmer climate of mid hills ranging from 900 to 1500 m above mean sea level. The long winter (300-900 chilling hours below 7°C) free from frost and warm spring are favourable for fruiting. As an average summer temperature in between 16.6 to 32.2 °C is suited for better growth and quality of the fruit, introduction of apricot in upper Pulney is a better choice of the as this region at an altitude of (1600m -2330m above msl) experiences 450 hours of chilling period and a summer temperature of 15.3 to 25.6°C with an annual rainfall of 105 - 165 cm well distributed throughout the year.

There are more than 100 varieties of apricot cultivated in India, which are mostly of exotic in origin. Apricot in India is grown in mid hills to high hills with a variable climate condition. Varieties which are suitable for cultivation in mid hills are not suitable for cultivation in high hills or dry temperate region. Early varieties *viz.,* New Castle and Mid-season variety, Shakarpra are recommended for mid hills, which can be introduced for cultivation in Kodaikanal hills.

**III. Other high value fruits**

**Kiwifruit**

Kiwifruit (*Actinidia deliciosa*) known as 'China's miracle fruit' and the horticulture wonder of New Zealand is a recent exotic introduction to India. With extensive research and development support, having realized the potential and importance of this fruit, kiwifruit has gained popularity for the past two decades extending its area under cultivation to the mid hills of Himachal Pradesh, Jammu and Kashmir, Arunachal Pradesh, Sikkim, Meghalaya and Manipur hills of North East Himalayas.

Kiwifruit prefers a log growing season (at least 240 frost free days), which will not be hampered by late winter, or early autumn freezes. For high yield and quality fruits it requires 700-800 chilling hours below 7°C to break its dormancy period. High temperature (> 35°C) accompanied by high insulation, low humidity, sunscald and heat stress are the main problem in its cultivation. Having introduced, seven varieties ( Allison, Monty, Hayward, Abbott, Bruno, Tomuri and Matua) of kiwifruit in India, four of the above varieties ( Allison, Monty, Hayward and Bruno) have been introduced for cultivation at Horticultural Research Station, Kodaikanal. Hayward and Allison have performed well under this condition with an average fruit production of 65 fruit per plant. Though morpho-agronomically, there were little variation in the four cultivars, Allison and Bruno are Hayward is the late and Monty is the mid season cultivar. Before, recommending it for commercial cultivation to the farmers, the techniques of propagation, training and pruning, irrigation, nutritional requirement and maturity standards of the fruit will be confirmed through evaluation trials at Horticultural Research Station, Kodaikanal.



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Performance of kiwifruit at Horticultural Research Station, Kodaikanal

**Persimmon**

Persimmon (*Diospyros kaki* Thunb.), often regarded as strictly a temperate species, it is adapted to a wide range of climatic conditions preferring moderate winters and relatively mild summers. Though introduced in 1921 in India, with few cultivars, its cultivation could not get impetus. This choice fruit having been introduced in Coonoor and Kodaikanal, have not been cultivated on a commercial scale. Persimmon cultivation in India suffers from lack of organized planting, inadequate planting materials from vegetative propagation, lack of suitable cultivars, standardization of training and pruning. Besides, problems of poor fruit set, heavy drop of young fruits, astringent nature and lack of sufficient knowledge regarding fruit maturity and its consumption also mired its cultivation.

With efforts being made in recent years to overcome the problems, its cultivation is gaining importance in India. The attempts taken up to overcome the problem of planting materials of persimmon will open a wide scope for commercial cultivation in the upper and lower Pulney hills of Kodaikanal.



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**Performance of different persimmon species under Kodaikanal conditions**

***Diospyros kaki* var. Hyakume**

***Diospyros lotus***

***Diospyros lotus***

***Diospyros kaki* var. Dai dai amru**

**Strawberry**

Cultivation of strawberries has gained momentum in recent days in Kodaikanal hills. Concentrating on the commercial demand, its importance and the variety, farmers can earn more from its cultivation, and also the strawberry growing farmers can benefit from exporting the produce. Strawberry performs best in a temperate climate. It is a short-day plant which requires exposure to about 10 days of less than 8 hours sunshine for initiation of flowering. The optimum temperature for most varieties ranges from 15º C to 35º C. The ideal temperature for flower bud initiation is 14ºC to 18º C. In general, temperature above 28ºC inhibits flower bud initiation and soil temperature below 25º C increases reproductive development and reduces vegetative growth. Exploiting these requirements in Kodaikanal, strawberry cultivation has been taken up in commercial scale in open and polyhouse condition. More possibilities for commercial exploitation of Strawberry under low cost protected structures. Strawberry growers can enjoy a profit of Rs.1.50 lakhs from one acre. Popular cultivars grown are Camerosa, Sweet Charlie, Festival and Winter Dawn.



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**IV. Nut crops**

The important nuts are almond, walnut, pecanut, chestnut, hazelnut and pistachio. In India, almond is the lost favoured nut and provides nourishment of great medicinal value. The major almond producing areas are Kashmir and dry temperate regions of Himachal Pradesh. From there on almond has been extended to mid hills condition. However, nuts produced in the mid hills are low quality because of the monsoon rains coinciding with the time of ripening of fruits and hence green almonds are sent to the market before monsoon rains.

**Fruits set in walnut at State Horticultural Farm, Kodaikanal**

Cultivation of pecanut, hazelnut, pistachios and chestnut is in initial stages in India. Though, these nuts have potential only in dry temperate climates, efforts can be made to introduce these nuts in Upper Pulney hills where the climate is slightly congenial for cultivation

**Thrust areas for improving temperate fruits in upper Pulney hills**

**Area of expansion**

The warm European climate in the upper Pulney hills with an annual rainfall of 105 cm



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is again suitable for pear, plum, peach, apple and nut crops. There are vast tracks of land still available for further expansion of these crops, as the cultivable wasteland in Kodaikanal accounts to 26,057 ha. Other high value crops like kiwifruit, persimmon, apricot, walnut, almond have good scope for cultivation in this region.

**Nursery improvement**

There is an urgent need to establish conventional bud wood banks or mother blocks for horticultural planting materials which shall conserve and propagate true to type propagules. Nursery infrastructure has to be strengthened by adoption of modern nursery production techniques.

**Varietal up gradation**

The present varieties of apple and other old varieties of pome and stone fruits are sensitive to adverse climatic conditions and are also susceptible to insect pests and diseases. Introduction of new improved low chilling varieties suitable to this pocket may be strengthened. In addition, varietal upgradation should be done as a continuous process wherein varietal diversity combined with prolonged availability of fruits can be created.

**Introduction and multiplication of clonal rootstocks**

To raise orchards of high and uniform performance, introduction of clonal rootstocks on a large scale is required for mother rootstock plantation for multiplication, which would meet the requirement of temperate fruit growers.

| S. No. | Crop | Rootstocks | Characteristics |
|---|---|---|---|
| 1. | Apple | M 9 and M 26 | Dwarfing rootstock, highly resistant to collar rot, mildews and apple scab |
| | | M 4, M 7& M 106 | Se4mi dwarfing and resistant to woolly aphids. |
| | | P 2 & P 22 | Dwarfing rootstocks besides including earliness and heavy fruiting |
| 2. | Pear | Quince A | Vigorous and dwarfing |
| 3 | Plum | Myrobalan (GF-31) | Vigorous, productive, tolerant to moisture and calcium |
| 4. | Peach | GF series | Promising for High Density Planting |
| | | Nemaguard | Resistance to nematodes and diseases like canker, gummosis and crown gall |
| | | St. Julian Hybrid No. 2 | More tolerant to water logging |



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**Mother tree orchards**

At present the concept of mother tree orchards as a source of bud wood is not prevalent in India and bud wood is taken from available sources. In this process, chances of mixing are common. Therefore, for the production of healthy bud wood, establishment of mother tree orchards is essential.

**High density planting**

Low - density standard population of present orchards in upper Pulney hills has to be converted to high density plantations to reduce the juvenile period and increase productivity per unit area. It is also necessary that advanced orchard management technologies be adopted to get desired outputs from the High-Density Planting.

**Micro irrigation and integrated nutrient management**

Water is the most critical input in successful cultivation of apples and for getting higher yields. In rainfed orchards, continuous drought adversely affects quality of fruit production. This can be overcome by rainwater harvesting and creation of structures based upon the water requirement of the orchards. Further, water use efficiency through drip irrigation should be improved. Irrigation technique should be refined and chemical fertilizers should be substituted by bio fertilizers and slow-release fertilizers

**Canopy management**

Most of the orchards in the upper Pulneys are under low density on seedling rootstock. The advanced training systems developed from time to time are for improving the photosynthetic efficiency of High-Density Plantations


**Two tier espalier system of training for High Density planting**
**Rejuvenation of old orchards**



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Majority of the temperate fruit orchards of upper Pulney region are more than 40 years of age that have gone senile. For this, the standardized rejuvenation technology of pear can be promoted among fruit growers of Kodaikanal. Rejuvenation techniques for other fruit crops can be standardized and a strategy can be formulated and executed to control the replant problem.

**Integrated pest and disease management**

Plant protection problems like scab, premature leaf fall, red spider mite and other diseases and suitable integrated pest and disease management may be given.

**Organized marketing and export orientation**

There is ample scope for marketing these fruits for local consumption and processing purpose in South India. The channelized marketing of taking up contract, once the fruits have set in temperate fruits and harvesting by themselves can be adopted at upper Pulney hills.

With ample opportunities to utilize the available cultivable wastelands at Kodaikanal (26,057 ha) for fruit production and with a diverse agro climatic conditions as its strength, the upper Pulney hills offers a great scope for cultivation high value crops *viz.*, kiwifruit, persimmon and strawberry. Also favouring the cultivation of variety of temperate fruits, upper Pulney hills offers wider scope for post-harvest management and value addition to generate avenues for employment at Kodaikanal hills.

**Future strategies for improvement of temperate fruits in Kodaikanal**

1. Introduction of new improved varieties of low chilling temperate fruit and nuts
2. Improvement of productivity of existing plantations
3. Post harvest and quality improvement of the produce
4. Modernization of nursery programme for mass production of quality planting materials
5. Promotion of high-density planting and arrive a high-density model suitable for the topography of Upper Pulney hills.
6. Promotion of integrated pests and disease management and biological control
7. Standardization of value-added products
8. Channelizing the marketing of temperate fruits of Kodaikanal hills



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