

Kiwifruit: A game changer crop

for the farmers of Himalayan region

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The Chinese gooseberry, also known as kiwifruit, is referred to as "The horticultural wonder of New Zealand" and "China's miracle fruit." Kiwifruit is a dioecious plant that is being researched extensively because, in comparison to other fruits produced globally, its fruit has many nutritional benefits. It is considered as a crop of temperate region, therefore it can be suitably grown in north eastern parts of India in the range of 600–1500 m height above mean sea level where chilling of 0–7°C can be met for 500–800 h. Bruno, Allison, Monty, Hayward, Abbott and Tomuri are the cultivars suitable for the Himalayan region. So far, there are no reports of major pest and diseases of kiwifruit in this region. Adoption of scientific package of practice can improve the productivity and quality of kiwifruit and ultimately increasing the profitability of farmers of entire Himalayan region.

Keywords: *Actinidia deliciosa*, Himalayan, Kiwifruit, Northeast, Production

IN the world's mountain ecosystems, the Indian Himalayan region holds a unique position. These geo-dynamically young mountains support a diverse range of flora, fauna, human communities, and cultural diversity in addition to being significant from a climatic and life-giving perspective, providing water to a significant portion of the Indian subcontinent. The rich soil resources and agroclimatic conditions of the north eastern hills, which are a mega center for rich plant biodiversity, make them perfect for the horticultural industry. The wild relatives of apples, kiwi, and other temperate fruits and nuts can be found growing in their natural state in north eastern forests, illustrating the wide variety of adaptability of various temperate fruit crops. In the north eastern hilly states, especially in Arunachal Pradesh, Sikkim, Nagaland, and Meghalaya, fruits like apples, pears, plums, and peaches are grown on a semi-commercial basis. Strawberries, walnuts, and kiwi fruit are also introduced to new regions. In order to enhance the value of the produce, which has the potential to become a niche commodity for both domestic and international markets, farmers are increasingly integrating new technologies into organic farming systems, even though the majority of the crops are still grown traditionally. Kiwifruit [*Actinidia deliciosa* (A. Chev.) C. F. Liang and A. R. Ferguson] is dioecious plants and is widely being studied as its fruit has many nutritional values as compared to the other fruits

produced worldwide. Chinese gooseberry, China's miracle and New Zealand's wonder are some other names for kiwifruit. Nowadays, this fruit is frequently called kiwi in all export packages. The fruit is packed with vitamins, minerals, sugar, and carbohydrates, making it incredibly nutrient-dense. Despite having nearly all the minerals, kiwifruit is especially rich in calcium, magnesium, potassium, and phosphorus. The leaves are a good source of protein, starch, and vitamin C, and they can also be fed to pigs. The fragrant flowers are used to create fragrances. In the early 1900, kiwifruit was first exported to Asia as an ornamental vine. Americans tasted the fruit in the year 1904 and it reached New Zealand in 1906. Kiwifruit is a relatively new fruit crop in India as it was first planted in Lal Bag garden in Bangalore. Commercial varieties were introduced by Plant Introduction Division, IARI and planted its center at Phagli, Shimla, Himachal Pradesh in 1963.

Area, distribution and production

Despite having originated in China, kiwifruit was fully commercialized in New Zealand before spreading to other countries. China, Belgium, Chile, Spain, India, United States of America, the Soviet Union, Italy, Australia, France, England, and Japan are all currently seeing prosperous growth of this crop. In India, it thrives well in Himachal Pradesh Sikkim, Uttarakhand, and Arunachal Pradesh. Its cultivation has now begun

in Manipur, Nagaland, and Mizoram as a feasible alternative to other temperate fruit crops. Kiwifruit presents significant opportunities for growth in nearly all north eastern states, with the exception of Tripura and Assam, due to their warmer climate. Arunachal Pradesh stands as the leading producer of kiwifruit in India, encompassing an area of 3,558 hectares and yielding an annual output of 7,111 metric tonnes. Other states that cultivate kiwifruit include Manipur, with a production of 3,025 metric tonnes; Sikkim, contributing 2,159 metric tonnes; Nagaland, at 1,600 metric tonnes; Mizoram, with 1,030 metric tonnes; Himachal Pradesh, producing 116 metric tonnes; as well as certain regions in West Bengal and Jammu and Kashmir.

Botany and dioecism

Kiwifruit is a robust, woody vine or climbing shrub that can reach heights of up to 30 feet (9 m). Its deciduous leaves, which are arranged alternately and have long petioles, measure between 3 to 5 inches (7.5–12.5 cm) in length. These leaves are typically oval to nearly circular in shape, with a heart-like base. The mature foliage appears downy-white and features prominent light-coloured veins on the underside, while the young leaves and shoots are adorned with red hairs. In contrast, the upper surface of mature leaves is dark green and devoid of hair. The aromatic flowers, which can be bisexual or dioecious, appear either individually or in clusters within the leaf axils. Each flower features five to six petals, measuring between one to two inches (2.5–5 cm) in width, and contains a central tuft of numerous stamens in both male and female flowers; however, the male flowers lack viable pollen. Initially, the flowers are white but gradually change to a buff-yellow hue. The fruit, which can reach lengths of up to 2.5 inches (6.25 cm), is oval, ovoid, or oblong in shape, with a russet-brown skin densely covered in short, stiff brown hairs. In its early stages, the fruit is topped with a prominent, five-pointed calyx that eventually separates from the mature fruit, leaving behind five small sepals at the top. The flesh of the fruit is shiny, juicy, and delectable, typically bright green but may also appear yellow, brownish, or off-white, remaining firm until it is fully ripe. The interior is white and succulent, featuring numerous fine, pale lines. Scattered throughout these lines are tiny dark-purple or nearly black seeds, which are nearly indistinguishable when consumed.

Climate

Kiwifruit naturally thrives at altitudes ranging from 600–2000 m above sea level. In its dormant state, the plant can withstand temperatures as low as -12°C ; however, it requires time to acclimatize and is vulnerable to abrupt temperature drops. While the needs of various cultivars differ significantly, the Hayward cultivar specifically necessitates 800 h of winter dormancy at temperatures between 0 and 7°C . If winter temperatures are excessively mild, the plant may retain its leaves and fail to produce flowers. Kiwifruit flourishes in regions where citrus,

peaches, and almonds thrive, although its foliage and blossoms are more sensitive to cold compared to those of orange and peach trees. Fall frosts can impede new growth, damage developing flower buds, and, if they occur after flowering, prevent fruit set. It is noted that kiwifruit tends to have enhanced flavour following late winter frosts. Alternating warm and cold spells during winter can negatively impact flowering. For optimal dry matter accumulation and shoot development, conditions of long daylight hours and elevated temperatures are preferred, specifically around 16 h of light and 20°C . An annual rainfall of approximately 150 cm, distributed evenly throughout the growing season, is sufficient for the plant's needs.

Soil

Kiwifruit thrives best in deep, well-drained sandy loam soils that are abundant in organic matter and resistant to rapid drying during the summer months, as opposed to clay loam soils. The plants cannot tolerate heavy soils with poor drainage or saline conditions. Although kiwifruit can grow in soils with a pH range of 6.0–8.0, an optimal neutral pH of approximately 7.0 is preferred. Soils that are excessively alkaline may lead to nitrogen deficiencies in the foliage. Cultivation in waterlogged, heavy soils is entirely unsuitable. A substantial layer of humus contributes to improving soil texture and maintaining soil moisture.

Cultivars

Key pistillate cultivars cultivated for commercial use include Bruno, Hayward, Allison, Abbott, and Monty, while the staminate cultivars consist of Alpha, Matua, and Tomuri. The morphological traits of the stems, shoots, and leaves, along with the fruit's maturity and flowering, as well as the colour of the fruit and its flesh, do not permit the differentiation of one cultivar from another. Distinctions among cultivars have been made based on the fruit's shape, hairiness at the base of the style, and the petal shape.

Field preparation, layout and planting

A suitable location for establishing a kiwifruit orchard must be free from frost during spring and early autumn, possess well-drained soil, and have relatively high air humidity. To maximize sunlight exposure, the rows should be aligned in a north-south orientation. Successful establishment of a kiwifruit vineyard requires thorough soil preparation. It is essential to incorporate well-decomposed farmyard manure and to pulverize the soil to eliminate hard pans or stones during ploughing or digging. Pits approximately $0.6\text{ m} \times 0.6\text{ m} \times 0.6\text{ m}$ should be dug between September and October, with 20–30 kg of well-decomposed farmyard manure added to fill each pit completely. The choice of training system and cultivars will influence the spacing of the plants, which should generally be set 4–5 m apart. Kiwifruit is dioecious, meaning male and female flowers grow on separate vines. To ensure healthy orchards that produce fruit and receive sufficient pollination, it is important

Table 1. Distinguish traits of cultivars

Cultivars	Traits
Bruno	The fruit's slightly tapering shape towards the stem end allows it to be easily identified from other cultivars. Out of all the cultivars available in India, it is the longest. Ascorbic acid content is higher in fruit than in other cultivars. The plant has a lower chilling requirement and better bearing.
Allison	The fruits are a little bit wider than they are long. The fruits have a medium size and taper slightly on both ends. Compared to other cultivars, its average production and sweetness are likewise higher. It is appropriate for mid-hill regions and a heavy bearer. The edges of the flower's petals are crimped and overlap each other. Low levels of acidity and ascorbic acid.
Monty	Although the cultivar flowers late, it matures quickly. The fruits are medium-sized, oblong, equally thick, and flat on both ends, with a slight tapering. Prolific bearer that occasionally needs to be thinned to produce medium-sized fruits. It has a medium sugar blend and a higher acidity.
Hayward	This cultivar is most commonly grown due to its large, eye-catching oval fruit that has the best keeping quality. The fruit is flat and wide, with a much larger width than length. Its flavour is also regarded as superior, and its sugar and ascorbic acid content are relatively high. This cultivar matures slowly and is relatively shy. Therefore, for commercial production, close planting and late flowering pollinizer are needed. Due to the vine's longer chilling requirement, it is better suited for high hills.
Abbott	This cultivar matures and flowers early. Medium-sized, densely haired fruits have a sweet flavour, low ascorbic acid content, and medium titrable acidity. It grows well in mid-hill regions and requires little chilling time.
Tomuri	Late in the season, flowers typically appear in groups of five (1–7) and have long peduncle hairs. It is a best pollinator for the Hayward cultivar.
Bruno	Early in the season, flowers are typically borne in groups of three (1–5) and the peduncles have short hair. For early and mid-season pistillate cultivars, the cultivar is an effective pollinator.

to plant male and female plants in a ratio of 1:8. While hand pollination is labour-intensive, it leads to high-quality fruits and increased yields.

Propagation

Kiwifruit can be propagated through two primary methods: vegetative and seed propagation. Seedlings are cultivated to produce rootstocks suitable for grafting or budding. To enhance germination rates, seeds require a stratification period of 6–8 weeks at approximately 4.4°C. It is advisable to plant the seeds in late winter. The growing medium must be well-drained, adequately aerated, and consistently moist. Additionally, it should be sterilized to eliminate any pathogenic organisms. To shield the seeds from adverse weather conditions, it is prudent to sow them in a glasshouse or polyhouse. Effective techniques for propagating kiwifruit plants include grafting, budding, top working, and both softwood and hardwood cuttings. Among these, softwood cuttings represent a commercial propagation

method that produces high-quality plants in a short time frame. Essential practices include misting, providing bottom heat, and utilizing growth hormones. Cuttings should be taken from the current season's semi-mature growth, with the most suitable cuttings measuring 0.5–1.0 cm in thickness, having relatively short internodes, and a length of 15–20 cm. A concentration of 2000–5000 ppm IAA is effective for promoting rooting. For hardwood cuttings, mature, dormant shoots measuring 15–20 cm in length and possessing at least 2–3 nodes are harvested from the previous summer's growth. The bases of these cuttings are wounded and treated with 5000 ppm IAA before being placed in a moist, coarse-textured rooting medium, either in the field under polythene film mulch or on a propagating bench. To prevent desiccation, the shoots should be provided with adequate shade and fine-mesh watering following their emergence.

Training and pruning

During the initial year of a vine's life, a single apical bud is allowed to grow until it reaches the wire, while the vine is pruned back to a height of 30–40 cm from the ground, establishing the main trunk. No additional branching is permitted on this trunk. In the second year, two shoots are selected and secured to the center wire from both sides, forming the secondary arms. In the third year, the tertiary fruiting arms, which will yield fruit in subsequent years, are chosen based on these secondary arms. To ensure stability, these tertiary arms should be tied to the outer trigger wire. The first crop will develop on these laterals, or they may be replaced by fruiting arms. It is important to avoid training fruiting arms parallel to the permanent leaders along the outer trigger wires, as this can lead to competition between the shoots from the leaders and the fruiting arms, resulting in dense growth that adversely affects vine management and development. Pruning is a vital aspect of managing kiwifruit vines to ensure a consistent production of high-quality fruit. Especially the flowers and fruits on wood that has grown from the previous season. For female vines undergoing dormant pruning, the fruiting canes from the previous year should be trimmed back to 10–12 buds beyond the last fruit. To promote the growth of new, robust canes, it is essential to severely prune small, weak wood after a few years. Canes that are broken, twisted, or tangled must be removed, as well as any that cross from one side of the plant to the other. Any growth that droops to the ground should be tied to the trellis or pruned away. Additionally, excess fruiting spurs should be eliminated to maintain a spacing of 8–12 inches between each cane. Male vines can be pruned more aggressively to manage growth, while care should be taken not to overcrowd the female vines. For male plants, heavier summer pruning is often practiced. It is advisable to refrain from pruning in early spring once the plant has begun to grow, as this may lead to excessive bleeding and potential harm to the plant.

Organic nutrient management

When nutrients are effectively managed, kiwifruits can thrive and produce abundantly through vegetative growth. Given that plants are significant consumers of nitrogen, it is advisable to add organic fertilizers generously during the initial half of the growing season. To ensure consistent high yields and quality, well-decomposed, dried cattle manure or compost should be utilized at a rate of 10–40 t/ha hectare from the time of planting until the peak fruit production stage. Farmyard manure should be administered at a rate of 25–100 kg/plant, divided into two applications in February and March. Additionally, neem cake should be applied at a rate of 2 t/ha in early spring, once the vines have developed several inches of new growth. As the plants mature, it is important to gradually increase the annual application of manure. During the active fruit growth phase, vermicompost should be applied at a rate of 4–10 kg/plant to enhance fruit quality and growth. Mulching with straw and/or manures offers numerous benefits; however, care should be taken to avoid direct contact between the mulch and the vine to prevent crown rot.

Irrigation

The robust requirement for moisture is reflected in the vigorous growth of the foliage. Foliage orchards demand substantial water, particularly during the initial two to three years following their establishment. Consequently, the entire soil surface of the foliage orchard acts as a mulch, which reduces the necessity for irrigation. Symptoms of drought stress during the summer include wilting leaves, browning at the leaf edges, and complete leaf drop accompanied by new shoot growth when the stress persists. Water-related issues are more likely to lead to plant mortality than any other cause. Commercial kiwifruit vineyards typically employ overhead sprinklers for both irrigation and frost protection, with sprinkler heads positioned approximately three feet above the training wire. Conversely, drip irrigation is a more efficient use of water. During the hot summer months, plants require watering every 10–15 days. Newly planted vines should receive deep watering once a week throughout the summer. It is crucial to avoid exposing plants to drought stress.

Mulching

Natural weed cover contributes significantly to the preservation of organic matter and soil conservation. To maintain soil moisture, it is essential to regularly clean and mulch the vine basin. In Sikkim, *Schima wallichii*, commonly known as *Chilaune*, is the most effective mulch material, while *Artemisia vulgaris*, referred locally as *Titepati*, serves as a strong alternative. Both of these plants help mitigate disease occurrence. Weeding should be performed just prior to mulching and the application of manure. Depending on the growth rate of the weeds, it may be necessary to conduct weeding two or three times.

Insect and their organic management

So far, no significant pests have been identified on kiwifruit plants in north eastern hill regions. Pests of the polyphagous family may cause some crop damage. Two major pests that cause significant losses are the leaf roller and greedy scale.

Diseases and their organic management

In the context of India, there are no recorded instances of severe disease affecting kiwifruit. While there have been observations of specific leaf spots, these do not lead to significant losses. Conversely, waterlogged conditions, which are more prevalent in clay soils, can lead to root rot. Consequently, it is essential to implement suitable drainage systems.

Harvesting and yield

Kiwifruit stands out as it exhibits no noticeable alteration in the colour of its flesh or skin. The flavour and aroma do not develop since the fruit is picked while still firm. Research indicated that a maturity index of 6.2% or greater in total soluble solids is optimal for harvesting. In Sikkim, kiwifruit harvesting commences in the first week of November. The process involves snapping the stalks at the abscission layer where they attach to the peduncle while the fruit remains firm. After harvesting, fruits are either shaken in a gunny bag or rubbed with a coarse cloth to eliminate any residual stiff hairs from the skin. The firmness of the fruit facilitates its transportation to distant markets. After a storage period of 10–15 days, fruits are ready to be served at room temperature. The average yield is significantly influenced by hand-pollination practices and effective orchard management, with a well-cultivated plant capable of producing up to 90 kg.

Grading

In India, kiwifruit grading typically involves classifying fruits based on weight, with common grades including:

- **Grade A:** Fruits weighing 70g or more are typically classified as Grade A. It is of premium quality and price.
- **Grade B:** Fruits weighing between 50 and 70g are usually categorized as Grade B. Price and quality considered lesser than Grade A.
- **Grade C:** Fruits weighing less than 50g are often designated as Grade C. This is the least quality fruit and can be used for juice, wine and other post-harvest processed products.

Storage

When stored in polythene bags containing ethylene absorbent, kiwifruit can be preserved for an extended period at room temperature by meticulously regulating temperature, humidity, and gas concentration. After four to six weeks of storage, fruit that is not adequately protected may show noticeable shrivelling on its surface due to moisture loss. Shrivelling typically occurs after the fruit has lost approximately 3–4 percent of its weight. No significant physiological disorders have

Table 2. Details of the insects attacking kiwifruit in hilly regions

Insects	Symptoms	Treatment
<p>Leaf roller</p> <p>Numerous leaf roller species, including the green-headed leaf roller (<i>Planotortrix excessana</i>), the black-lyre leaf roller (<i>Cnephasia jactatana</i>), the brown-headed leaf roller (<i>Ctenopseustis obliquana</i>), and the light brown apple moth (<i>Epiphyas postvittana</i>), are significant and cause significant losses.</p>	<p>In the lower half of the canopy, on the smooth upper surface of mature leaves, are the eggs. The caterpillars eat folded, immature leaves early in the season and mature leaves later. Pupae are frequently observed near the base of the canopy.</p>	<p>It is found that two sprays of neem oil 0.15 EC (1500 ppm) @3 mL/L, spaced 15 days apart, are effective against leaf rollers.</p>
<p>Greedy scale (<i>Hemiber lesiarapax</i>)</p>	<p>It is primarily found on a variety of shrubs and trees in temperate to subtropical climates. It is primarily located on the leaf's upper surface, close to the petioles and the midrib. Early-season crawlers only cause damage to leaves or woody sections, and their populations colonize before the fruit ripens.</p>	<p>It is found that two sprays of either neem oil 0.15 EC (1500 ppm) @3 mL/L or petroleum-oil based spray @ 10 mL/L at intervals of 15 days are effective against the Greedy scale.</p>

been reported during the storage of kiwifruit, even in cases of premature harvesting or accidental freezing of the fruit tissue.

Constraints

The favourable climate and soil conditions are present; however, the primary obstacles to enhancing the productivity of temperate fruits, especially kiwifruit, include the scarcity of high-quality planting materials, high cost of establishment of plantation, absence of comprehensive organic farming practices, lack of polliniser varieties and hand pollination, lack of modern precision farming technologies, lack of use of plant biostimulants and insufficiently trained labourers.

Prospects and thrust areas of kiwifruit in Himalayan region

Kiwifruit presents a promising future in our nation, particularly in the northeast region. It has been identified as a significant commercial fruit for the future, offering substantial returns per unit area, with farmers potentially earning between ₹4 to 5 lakhs/ha each year. The kiwifruit consistently yields abundant harvests annually, with no instances of crop failure reported. Renowned for its nutritional and medicinal benefits, it is particularly recommended for individuals with diabetes and heart conditions due to its numerous health-promoting properties. Furthermore, there have been no significant pest or disease issues associated with

kiwifruit, enhancing its potential as an environmentally friendly commercial crop in the country. The fruit's tough, hairy skin protects it from damage by birds and monkeys. Additionally, kiwifruit boasts an extended shelf life, remaining viable for up to one month at room temperature and for 4–6 months when stored in cold conditions. The state wise potential areas are as follows:

- **Arunachal Pradesh:** Ziro Valley in lower Subansiri district is a key area for kiwifruit cultivation in Arunachal Pradesh. Kiwis are also grown in West Kameng, Lower Dibang Valley, Si-Yomi, Kamle, Papum Pare, and Pakke Kessang districts.
- **Sikkim:** The Lachung, Fakra Farey, and Lachen areas in north Sikkim are known for kiwifruit cultivation. Yuksom in west Sikkim is another area where kiwifruit cultivation is thriving.
- **Manipur:** The Purul sub-division in Senapati district is known as a prime area for kiwifruit cultivation in Manipur.
- **Nagaland:** Phek district has emerged as a significant kiwifruit-producing area, while Zunheboto, and other districts like Kohima, Wokha, and Peren are also contributing to the state's kiwi production.
- **Mizoram:** In Mizoram, Champhai district particularly and other higher elevated regions of districts like Aizawl, Lunglei, Serchhip, Saiha and Lawngtlai can be potential areas for kiwifruit cultivation.



A fully growing kiwifruit plantation in Sikkim



Kiwifruit in fruiting stage

Table 3. Details regarding some diseases that impact kiwifruit in the Himalayan region

Disease	Causal Organism	Symptoms	Disease Cycle	Management
Root rot, Collar rot and Crown rot	<i>Phytophthora coctorum</i> , <i>P. cinnamomi</i> , <i>P. citricola</i> , <i>P. lateralis</i> , <i>P. megasperma</i>	Delayed bud break, wilting and reduced leaf size, and dieback of twigs and shoots are the initial symptoms. When a plant is starved of water and nutrients, its leaves droop, and eventually the vine collapses. The infection begins at the outermost layer and progresses to the crown and main root.	Spring or early summer is when these fungus infections are most common. Sites with inadequate soil drainage are more prone to the disease. The fungus grows in the earth and disperses through contaminated plants, soils, tools, and irrigation water.	Spring or early summer is when these fungus infections are most common. Sites with inadequate soil drainage are more prone to the disease. The fungus grows in the earth and disperses through contaminated plants, soils, tools, and irrigation water.
Leaf spot	<i>Alternaria spp.</i> , <i>Botryosphaeria spp.</i> , <i>Fusarium spp.</i> , <i>Cladosporium spp.</i> , <i>Colletotrichum acutatum</i> , and <i>Phomopsis spp</i>	On the leaves, brown lesions are widespread and asymmetrical, while white lesions are confined. colonize only wounded	It is observed that pathogens leave tissues rather than directly attacking healthy tissues.	Cleaning up the field, gathering, and burning sick leaves. Removing diseased branches or shoots can help lessen the illness. Implementing the best training system possible to improve airflow and light penetration and stop the creation of a microclimate that encourages leaf diseases. Spraying copper oxychloride (0.25%) or Bordeaux mixture (1.0%) is advised if disease symptoms are observed, especially following wind or hailstorms that injure foliage.
Bacterial leaf blight and Blossom blight	<i>Pseudomonas viridiflava</i>	Only leaves and flowers are afflicted by this illness. The pathogen causes blossom blight, which significantly lowers the yield, but it has no effect on vine vigor. Dark, angular lesions with a yellow halo surrounding them are the primary symptoms on the leaves. Subsequently, the lesions could grow larger and the necrotic tissues might finally fall apart. The brown, sunken patches on the sepals of closed flower buds are the first signs of blossom blight. The filaments and sterile anthers of the severely infected female flowers are rotten. The hair is usually colored brown and stunted. Although partially infected flowers may produce tiny or distorted fruits, infected flowers typically shed.	Bacteria are thought to be present on the vines all year round. The infection is favored by wet conditions and rain during bud break and early flowering.	Keeping the field clean overall and trimming any afflicted areas aid in disease detection.

SUMMARY

It is highly advisable to pursue commercial-scale kiwi fruit production across all states in the northeast, excluding Assam and Tripura, provided that essential development prerequisites such as suitable self-sustaining technologies, infrastructure, and effective marketing facilities are systematically addressed. This initiative should be undertaken with a long-term vision and in a mission-oriented manner, involving the active collaboration of the local, regional and central agencies

involved in development of horticulture. The temperate fruits found in the north eastern hill states, especially kiwi fruit, have the potential to be cultivated into a significant industry. This development could provide a sustainable economic foundation for the rural population of the hilly areas and contribute to the overall economy of the northeast region, enhancing livelihoods and facilitating exports to neighbouring countries.

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