Bhutan Chamber of Commerce & Industry

Kiwifruit Cultivation

Information Booklet

Bhutan Chamber of Commerce and Industry

2016

Research & Policy Department

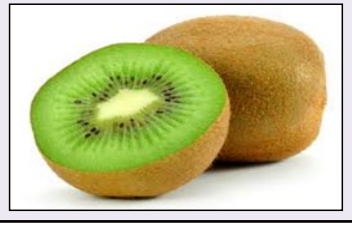
Why Information Booklet?

This information booklet is intended towards providing basic guidance to the growers on cultivation of kiwifruit and its nursery development.

The Bhutan Chamber of Commerce & Industry (BCCI) has been instrumental in promoting trial cultivation of kiwifruit with the establishment of Kiwifruit Demonstration Farm (KDF) at Wangkha, Chukha. Today the moment has gone commercial with more and more farmers demonstrating their interests to cultivate kiwifruit. Licensed suppliers of fruit saplings have also come in to fray. Informal sources reveal that a large number of farmers have been sourcing plants from different suppliers for commercial cultivation of kiwifruit in their private lands.

There is a growing concern within the BCCI with regard to these farmers not being provided with right guidance on orchard development, management and care by the so-called suppliers of saplings. This concern is further corroborated by the fact that the BCCI has infact triggered the movement with kiwifruit as one of its products under the ongoing "**One-Dzongkhag-Three-Products**" (ODTP) program.

This is therefore produced as a guide to inform the growers about the technicalities of kiwi-fruit plantation, care and overall orchard management.



1. What is Kiwi-Fruit?

The kiwifruit or 'Chinese Gooseberry' (Actinidia Deliciosa) is a large woody deciduous vine native to the Yangtze Valley of China. The most common cultivar group of kiwifruit is the 'Heyward', which is oval, about the size of a large hen's egg.

Kiwifruit has a fibrous, dull greenish-brown skin and bright green or golden flesh with rows of tiny black seeds. The fruit has a soft texture and a sweet but unique flavor.

2. Initial Propagation

Literatures confirm that seeds from China were taken to New Zealand in 1906 and the commercial cultivation began in New Zealand in about 1940 and in the United States of America in the late 1960s. Now it is a commercial crop in several countries such as Italy, New Zealand, Chile, Greece and France.

In Nepal, the International Centre for Integrated Mountain Development (ICIMOD) has set up a research cultivation facility at its Knowledge Park in Godavari, which is an hour drive from Katmandu Valley. In terms of commercial cultivation, the Ilam district of Nepal prominently features as a progressive center.

The grafted saplings for the Kiwifruit Demonstration Farm at Wangkha, Chukha in Bhutan have all been sourced from the ICIMOD Knowledge Park at Godavari under the institutional partnership program between the BCCI and the ICIMOD.

Kiwifruit Cultivation

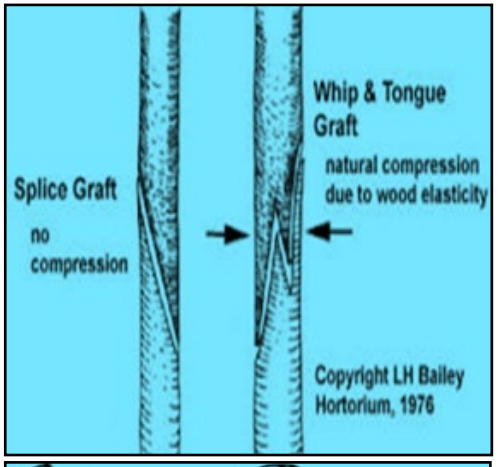
3. Nursery & Propagation Techniques

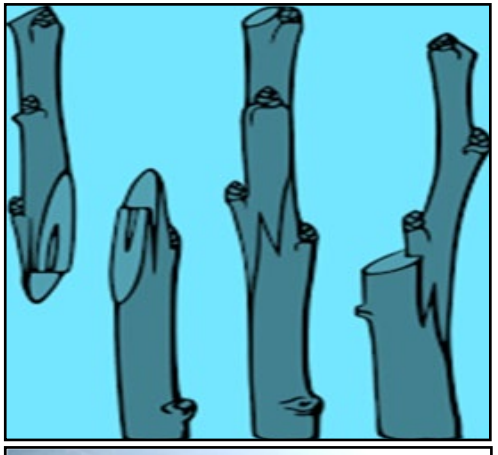
The International Centre for Integrated Mountain Development (ICIMOD) recommends the following as essential techniques for nursery development and plant propagation & progression:

- The nursery should have access to water. For larger nurseries, trained nursery workers are essential;
- The area should be relatively flat and easily accessible;
- The seed bed should be prepared during January – February of the year;
- For preparing right seed bed, sand and forest top soil should be used at the ratio of 1 : 2 in composition;
- Seeds should be sown during the month of February either in poly-pit hotbed or in plastic trays;
- Seeds need to be mixed with sand for line-sowing. As the seeds are so small, mixing is recommended so that it is not clustered too much in one space or line;
- Thin layer of fine sand should be applied for top dressing/covering of the seeds sown;
- Regular sprinkling of water is essential to keep the bed moist for germination (hand spray or through spray pump)

4. Pricking & Transplantation

- As the seeds germinate and the plants are of 3 or 4 leaves, prick out the plants. This happens in the month of March;
- The pricked-out seedlings should be transplanted in the nursery bed;
- The newly planted seedlings should be protected from wind, strong sun & hail-stone by providing shade(agro-net)
- Regular watering of the nursery to keep it moist is critical for healthy growth of the seedlings.





5. Grafting

- By the age of one plus year, the transplanted seedlings are used for root stock;
- The scion stick (male or female depending on the propagation desired) is taken from the father or the mother plant. The scion stick should be from branches older than 6 months;
- The scion stick used for grafting should have two nodes;
- Side grafting is easier and more successful in kiwi propagation;
- Regular watering of the grated plant is essential to keep the nursery bed moist and for healthy growth of the grafted saplings.

6. Preferred Site for Plantation

For healthier orchard, good growth and fruiting, the following are recommended while selecting plantation site:

- Climatic zone preferred should be between 1000 – 2500 meters from the mean sea-level. Kiwifruit has a huge climatic range;
- Land gradient (slope) preferred is 10 – 14 degree
- The site should not be a water-logged area;
- Adequate irrigation facility is essential
- Site facing South or North-East is recommended
- The soil PH – level recommended is 6 to 6.5

Kiwifruit Cultivation

7. Pit Preparation & Plantation

- The ICIMOD suggests the following for field-plantation of the grafted plants:
- The pit size should be 3 feet by 3 feet (width by depth)
- Upon completing the pit digging, put an identification stick in the middle and fill up the pit with desired soil and compost as discussed under Spacing, Mulching & Manuring;
- Plant the grafted seedling at the raised center of the pit where the stick has been positioned (remove the stick)
- The grafted part should always be above the soil / ground
- Provide support using a 5 – 6 feet long stick to the plant.
- Loosely bind the plant with the stick using thin jute rope (degradable)
- Trim the tip of the planted sapling, and water the plant

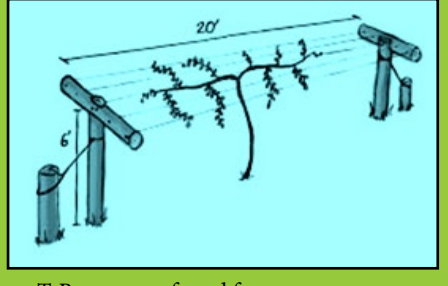
8. Spacing & Mulching / Manuring

- For proper spacing and manuring, the following basics may be noted:
- A plant-to-plant distance of 6 meters needs to be maintained for desired space and healthy growth;
- The row distance should be 5 meters atleast to provide adequate aisle for care and management of the plants.
- With this spacing, a hectare of land can take in around 300 to 330 plants;
- Each plant needs to be provided with around 25 kg of farmyard manure or compost mixed with the filled-in pit soil to provide required nutrients to the plant.
- Provide mulching to the plant on top of the planted surface in order to retain moisture
- Fencing of the plantation site is essential to save the plants from animals

9. Trellises & Plant Training

The ICIMOD advises that:

- Kiwifruit is a deciduous plant and climber in nature. The ratio between male and female plants is normally maintained at 1 : 8;
- Kiwifruit plants are trained to a permanent framework, either using T-Bar or Y-Bar like clotheslines with 4 to 5 parallel wires on the bar top. However, T-Bar is preferred to Y-Bar (refer to the sketch provided).
- For easy harvest, the wires of the trellises should be atleast 6 feet above the ground;
- Cross-arms on the T-Bar and double wire systems should be 5 – 6 feet long.
- Intercropping (grass for fodder, MAPs, tea, etc) is possible, which however should not directly compete with the nutrients applied for the main plant (kiwifruit)
- Keep single stem right up to the trellis and when two branched appear, train them to opposite direction along the wire (refer the sketch provided below)



- T-Bars are preferred for:

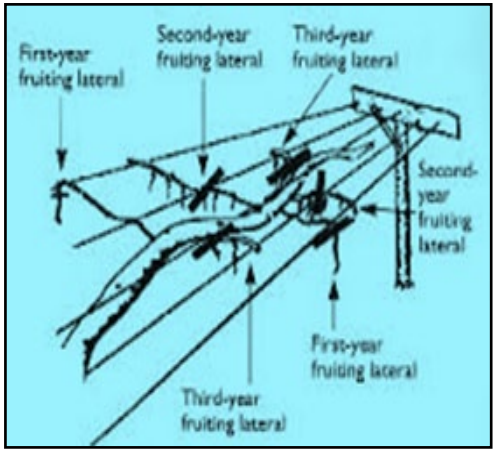
1. It is relatively, a simple fabrication, cheap and provides space underneath to work;
2. Provides easy access to pollinating agents such as bees, butterflies, etc.
3. It is labor saving device also
4. Relatively better protective to the kiwifruit from birds and animals.

Kiwifruit Cultivation

10. Pruning

Kiwi pruning is done during the winter (December to February) every year:

- First Year: Develop one straight trunk by tying it loosely to the stake as it grows;
- Second Year: Encourage two warm (or Cordon) on opposite sides of the vine and drape one in each direction on top of the wire and tie them loosely;
- Third Year: Train the lateral shoots perpendicular to the Cordon;
- Later thereafter, cut off new leaders forming around the base of each vine plant above the soil surface;
- Branches or tendrils wrapped around other branches or the wiring system should be pruned;
- During winter pruning, shoots that are less than a pencil width in diameter should be cut back, as well as the wood that fruited the previous year;
- Deadwood and overlapped branches should be removed;
- While the harvest is usually done during the month of November, regular maintenance of the vine / plant should be year round



11. Kiwifruit Harvesting

- Harvesting is done manually. Kiwifruit reaches almost of full size in August. However, it is not matured enough for harvest until late October or early November (Sugar level 6 to 6.5 percent)
- When the fruit is ready for consumption, it should contain 12 – 15 percent sugar.
- Fruits are harvested by snapping the stem at the abscission layer at the base of the fruit
- Commercially, kiwifruits are harvested all at a time. However, in the home garden, the largest fruit can be removed first and the smaller fruits allowed to grow and mature in to bigger sizes
- While the grated plants actually start fruiting at the nursery bed only, kiwi vines reach the full / optimal production level (commercial production) within 8 to 12 years.

Kiwifruit Cultivation

12. Kiwi Farming & Nursery: Seasonal Calendar

Month	Major Activities for Kiwi Orchard	Nursery Activities
April	• Flowering time • Dry season – irrigation required • Weeding • New leaves flushing • Removal of branches below grafted part	• New leaves sprouting from grafted plant in nursery bed • Removal of branches below the grafted part • Shade from grafted plant to protect from hot sun (agro-net)
May	• Training of kiwi branches • Irrigation (watering) • Removal of branches below the grafted part • Weeding	• Watering of transplanted in nursery bed • Weeding • Provide support to grafted plants in the nursery bed • Cover the nursery bed with agro-net to protect plant from hot sun & hail stone
June & July	• Summer pruning (leader branches) • Fruit thinning • Weeding grasses / weeds around vine plants • Keeping plant straight with the support of stick • Drainage preparation for reducing water logging	• Weeding • Maintaining of only one branch on the grafted plant • Removal of unnecessary branches
August	• Regular weeding and cleaning • Keeping the plant moist (around the vine plant) • Removal of branches below the grafted part	• No major activity as such
September	• Fruit maturing period • A bit early to harvest the fruits (Sugar level around 6 percent)	• Watering
October	• Time to harvest fruit. However, it differs with sites) • Fruit grading	• Watering
November	• Harvesting period	• Uprooting of successfully grafted plant for field plantation / sale • Seed collection from fruits • Seed bed preparation • Collection of forest top soil
December & January	• Time for winter pruning • Time for pit preparation • Time for kiwi plantation • Manuring and watering	• Time for seed bed preparation • Time for seed sowing
February	• Last month for kiwi plantation • Irrigation (watering of newly planted plants)	• Replanting of under-sized plant in the nursery bed for the next year • Time for in-situ grafting & cutting
March	• Time for flowering • Timely watering of the plants	• Pricking out seedlings from the germination bed and transplantation of the same in the nursery bed • Watering

Source - ICIMOD

13. Common Pests and Diseases

Disease	Symptoms	Cause	Comments	Management
Armillaria root rot (Armillaria Mellea)	Vines may completely collapse; whit mycelia mats may be present under bark close to the soil line; cortical tissue has a dark discoloration and white mycelia strands are present; root-like rhizomorphs extend from roots into soil	Fungus	Disease emergence favored by continually damp soil	Ensure that land to be used for new kiwi planting is completely cleared of roots which are greater than one inch in diameter; ensure kiwi vines are adequately irrigated but not over watered
Phytophthora root and crown rot (Phytophthora spp)	Reduced shoot growth; small, chlorotic leaves; vines may collapse suddenly or show a gradual decline in productivity over several seasons; red-brown discoloration of roots and root crowns which is visible when root is cut in two	Oomycete	Disease emergence favored by poorly drained soils and flood irrigation	Control of the disease is reliant on good water management and application of appropriate fungicides; kiwi should be planted in well-draining soils where water does not pool after rain or irrigation; plants should be allowed to dry out between irrigations
Bacterial blight (Pseudomonas spp.)	Brown, sunken lesions on petals covering flower buds; yellow-orange discoloration of petals; small yellow spots may appear on leaves after periods of rain	Bacteria	Bacteria enter plants through wounds	Control of the disease relies on the avoidance of injuries to the plant which allow bacteria to enter; there are currently no recommended chemical control strategies for the disease
Crown gall (Agrobacterium tumefaciens)	Reduced plant vigor; small leaves; poor growth; open canopy; reduced yield; galls may be too small to see	Bacterium	Bacteria enter the plant through wounds	Control of the disease relies on the avoidance of injury to kiwi vines; existing galls can be surgically removed
Bleeding canker (Pseudomonas syringae)	Wilting plants; blighting of canes; red, rust colored cankers on branches which may exude red colored discharge	Bacterium	Disease has a wide host range; bacteria overwinter on vines	Infected areas should be pruned by cutting 1 foot below the edge of the canker; disease severity can be reduced by protecting plants from freeze injuries over winter

Sources: Gardening Know How (www.gardeningknowhow.com) & Plant Village (www.plantvillage.org)

Kiwifruit Cultivation

14. Kiwi Nutritional Value &Health Benefits

Nutritional Breakdown:

- Calories: 42
- Protein: 0.8 grams
- Total fat: 0.4 grams
- Vitamin C: 64 Milligrams
- Vitamin A: 3 Micrograms
- Iron: 0.2 milligrams
- Potassium: 252 milligrams
- Folate: 17 micrograms

Source: Medical News Today (www.medicalnewstoday.com)

- Vitamin C: 85%
- Vitamin K: 31%
- Copper: 10%
- Fiber: 8%
- Vitamin E: 7%
- Potassium: 6%
- Manganese: 4%
- Folate: 4%

Source: The World's Healthiest Foods (www.whfoods.com)

Health Benefits

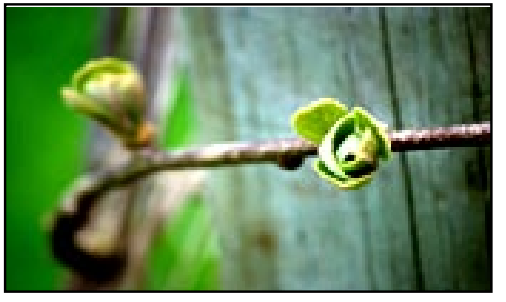
- Protection against asthma
- Maintaining healthy skin tone & texture
- Reducing blood pressure
- Preventing heart disease and stroke
- Constipation prevention
- Improves iron absorption
- Contributes towards eye health(Macular degeneration)
- Pregnancy - Kiwifruit is a perfect fruit for pregnant women attributing to the abundance of natural folate
- Diabetes - Kiwifruit has low glycemic index which makes it suitable for the individuals with diabetes
- Strong immune defence - Kiwi contributes favourably in regulation of innate & adaptive immune system.

Sources:
1) Medical News Today http://www.medicalnewstoday.com/
2) The World's Healthiest Foods, www.whfoods.com
3) Organic Facts, www.organicfacts.net

Top kiwifruit-producing countries in 2012 (in metric tons)

Rank	Country	Production (Tonnes)
1	Italy	3,84,844
2	New Zealand	376,400
3	Chile	240,000
4	Greece	161,400
5	France	65,253
6	Turkey	36,781
7	Iran	32,000
8	Japan	28,000
9	United States	26,853
10	Portugal	25,000
	World	1,412,351

Source: **UN Food & Agriculture Organization**



Contact Us

Research & Policy Department
Bhutan Chamber of Commerce & Industry
P.O.Box # 147
Thimphu, Bhutan
Telephone: +975 2 322742/324254
Fax: +975 2 323936
E-mail: info@bcci.org.bt
Website: www.bcci.org.bt