

Annex 2: Cultivation Guides for Upland Chin State

These cultivation guides are for cash crops prioritized by Chin State's Department of Agriculture. They are adapted for upland Chin State but may be relevant to other upland areas in Myanmar.



Grape



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The common grape vine (*Vitis vinifera* L. spp.) is a liana growing to 105 ft. in length with flaky bark. The leaves are palmately lobed and are 2.0–8 in. long and broad. The fruit is a berry, known as a grape. In cultivated plants it is usually up to 1.2 in. long, and can be green, red, or purple/black.

There are more than 5,000 known types of grapes, with only a few cultivated for the production of wine and table grapes. Approximately 71% of the world's grape production is used for wine, 27% for fresh fruit, and 2% for dried fruit. The wine type grape is the most commonly grown in Chin State. It has a sour taste with less sugar, a thick skin and a high juice content.

Climate Requirement

The general characteristics of wines from a cool climate vary distinctly from those from a hot climate. Grapes are resistant against high levels of rain but the vine should not be standing in flooding areas. The suitable pH value of the soil should be between 5-7.

Site Selection

Grape is a resistant plant which can adapt to a wide range of soil type. Select a field site with good air drainage and sufficient supply of surface water. Grapes can grow on a leveled surface and on slopes with 5-10% decline.

Digging Hole

If the field site is on a sloping area the site must be measured by using contour line and line pegging to ensure the best results. Dig a hole measuring 1.5 x 1.5 x 1.5ft. Refill the hole with top soil, manure and 1 spoonful of insecticide: such as Furadan 3G or carbofuran.

Grape Propagation

Grapes are typically propagated by pruning and grow well from the branches of the vine. In Chin state the optimal period for grape pruning is January- February.

Nursery Preparation

The optimal time to begin the nursery process in Chin State is February- March. Transplanting should take place in June or July due to the moisture level of the soil.

Establish a grape nursery shelter with a height of 6 ft. The main purpose of the nursery shelter is to protect the nursery from environmental impacts such as direct sunlight and excess rain.

A grape nursery can be made by potting or making a nursery bed - usually potting will achieve the best results (see picture 7 and 8). Pots must be topped with a mixture of 3 parts top soil, 2 parts sand and 1part cow manure or compost. The nursery bed should have at least 8 inches of top soil, sand and manure with the same mixture ratio as for potting.

Cut a healthy looking 6-8-inch branch with 3-4 nodes.

If potting, the branch must reach 3-4 inches into the soil in the pot. In a nursery bed the branches should be planted with a spacing of 4 inches.

Water the nursery bed or potting bags daily and shoots will begin to sprout within 2 weeks.

Remember to keep weeding the nursery throughout the process. The seedlings can be transplanted after 4-12 months. This should preferably be done in June or July.



Fig 1. Cut a branch (6-8) inches with 3-4 nodes



Fig 2. Put the selected branch with 4 inches between the rows



Fig 3; Put the selected branch to the potting bag



Fig 4. Day 60: Grape seedlings in the nursery bed



Fig 5. Day 60: Grape seedlings in the nursery bed



Fig 6. Day 115: Grape seedlings in nursery bed ready to be transplanted



Fig 7. Day 115: Grape saplings in potting bags ready to transplanted

Transplanting to the Field Site

When the seedlings are between 4-12 months and ready for transplanting in June or July, a few steps must be undertaken. The nursery stock must be planted in the middle of the hole with 6 x 8ft. or 8 x 8ft. spacing between the plants. Stakes and trellis should be used to a height of around 6ft. and with 6-8ft. between the poles. Stakes should be made of concrete or hard wood with a strong durability. The trellis between the poles can be made of wire. While the plant is still young and growing to full potential the grape shoots should be cut to ensure an optimal growth of the branches.

Care and Maintenance of the Grape Vines

Grapes must be pruned at least once every year.

A year after the transplanting from the nursery to the field site, all the branches should be cut except the 2 strongest.

Ensure the 2 branches are growing in opposite vertical directions on the stake or trellis.

In year 2, cut the 2 selected branches down to 4-8 ft. and remove the other branches.

In year 3, all the other branches must be cut down and one of the selected branches should be trimmed to 6-8 inches, while the 2 selected branch must be cut down to one node.

Going forward, the pruning process from year 3 should be repeated once per year.

A 4ft. area around the plant base should be kept free from weeds. From the third year the plant will begin to flower and produce grapes.

When maturing the grapes needs a lot of sun. Pruning the leaves ensures good ventilation and exposure to sunlight. This will create bigger grapes that mature faster.

Applying Fertilizer and Mulching

Mulching should be done 6 inches from the plant base using straw, hay or dry leaves. When applying the fertilizer, dig a hole or a channel 2 ft. away from the plant base and fill it with cow manure, dry leaves, hay, straw and some topsoil. The hole or channel must be filled with fertilizer once per year.

Pest and Diseases Management

In Chin State, diseases do not often affect grapevines but the following diseases are known to occur:

Powdery Mildew

This disease is caused by a fungus and infects the grapevine on its leaves, petioles, shoots and grapes. A whitish grey, dusty or powdery white color will appear on the infected area and the shoots will be distorted or stunted. The fruit will dry out before ripening.

These diseases are mostly caused when the climate conditions are characterized by low rainfall and high humidity. The disease can be controlled by using resistant varieties of the grapevine fungicide.

Downy Mildew

This disease is similar to Powdery Mildew disease. It also infects the leaves, petiole, tendrils and grapes. The infected leaves will turn pale yellow/green and eventually brown before falling to the ground. The infected grapes will turn dull gray-green before ripening. This fungus thrives best during the rainy season and the warm summer.

Black Rot

The symptoms of black rot disease are leaf lesions which appear as circular brown and dark spots. Black rot can infect both the leaves and fruit - and in severe cases the fruit will shrivel, rot and dry. The disease can be controlled by using resistant varieties and by applying fungicide.

Grape Stem Borer and Cane Borer

These pests are commonly observed in in Chin State. The adult borer penetrates the stem, entering from the grapevine's node. It can attack all branches, including the main stem. The pest will gradually destroy the plant tissue and the plant will gradually wilt, dropleaves, and appear unhealthy. In some cases, the branches or the stem break and the plant eventually dies. These pests are difficult to control and appropriate care is important for prevention. They can be avoided by keeping the plants healthy and well-fertilized. If borer is discovered, cut off the affected branches and burn far from the vineyard. Borer can also be prevented by creating smoke in the vineyard.

Grape Harvesting

The grapes are ready to be harvested when they are fully ripened. The clusters of grapes with a scissor or a grafting knife. In China, grapes begin to flower in March-April and can be harvested in June and July. Grapes cannot be stored for longer periods – especially during the rainy season – and the wine making process should be initiated immediately after or during the harvest, before the grapes begin to rot. A single grapevine produces around 3-7 viss of grapes depending on how efficient the pruning system is and the variety.



Fig 8. Grape harvesting with scissors

References

Erin Doman.2015., Most Common Grapevine Diseases
Phil Mulder, Oklahoma State University. 2014., Adult cane borer (*Amphicerus bicaudatus*)

Avocado



Avocado (*Persea. Americana* ssp.) is a tree with healthy fruit which was introduced in Myanmar more than 60 years ago. Avocados are commercially valuable and are cultivated in tropical climates throughout the world. Trees yield little fruit in the first year and take three to six years to mature. They have a green-skinned, round, fleshy body. Avocado trees are partially self-pollinating, and under normal conditions each plant bears 150 to 200 fruits each season. There are 8 different types of avocado in Chin state; Reed, Hass and Pinkerton are the most commonly grown. Chin avocados have a good export market in wider Myanmar and China.

Climate Requirements

Avocado is a subtropical crop, that grows in temperatures between 6-28°C with average temperature around 18°C in the flowering and maturing process. It is grown at altitudes around 1500-6000 ft. above sea level. The tree can handle mild frost conditions but not temperatures below 0°C.

Nursery Preparation

Avocado can propagate through reproductive propagation using seeds or through vegetative propagation by grafting and budding.

The seed selection is the most important factor in both types of propagations. Seed must be collected from a fully ripe fruit taken from a healthy, pest and disease-free tree. Average weight for an avocado seed is around 40-60 grams. After the seed has been picked, it should be dried for 1-2 days in the sun, soaked in water for 12 hours and then sundried for 1-2 hours. The seed coat should be peeled off – this will be easy after soaking. Cut off the apical part of the seed around 1 cm and cut the basal of the seed around 0.5 cm. Finally, it should be soaked in a hormone and fungicide mixture for 0.5 hours.



Fig 1. Peeling the seed's coat



Fig 2. Cut 2cm. of the apical and 1 cm. of the base of the seed



Fig 3. Soaking the avocado seed in Hormone and fungicide



Fig 4. Planting in the potting bags



Fig 5. Day 60: Avocado seedling



Fig 6. Day 115: Plants ready to be grafted

Nursery Shelter

Construct a 6 ft. high nursery shelter in a non-flooding area, with a fence to protect against animals. Prepare 6x7 inch potting bags with the mixture of 3 parts topsoil, 2 parts sand and 1 part cow manure or compost. After watering the potting bags, push the seed into the potting bag with 80% of the seed covered in the soil.

Water the seeds daily, using only a small amount to avoid rotting. Weeding should be done once every 2 weeks. After 45 days the avocado will begin to germinate.

Propagation with Higher Quality Varieties

If only one variety is selected, it is possible to transplant the avocado after 3-4 months directly in the field. At that time the mature plants should have 5-8 leaves.

To propagate unknown varieties, take 3-5 inches of the avocado shoot from a higher quality variety, remove all the leaves from the shoot and cover it with wrapping plastic to protect the shoots. Take the avocado stock from your nursery bed and cut the stock 3-5 inches above the soil by using a grafting knife.

Next split 1 inch of the stem from the initial cut of the avocado stock and then cut 1 inch in both sides of the scion base, as it forms a wedge shape. Let the ends of the newly cut scion and the rootstock meet and wrap plastic around the scion and the rootstock from bottom to top.

After around 10-days the scion will begin to sprout gradually and after 8-12 months can be transplanted to the permanent field.



Fig 7. Cut 1 inch in the middle of root stock



Fig 8. Cut 1 inch in both side of basal scion Avocado seedling



Fig 9. Splice the scion and root stock



Fig 10. Wrap with plastic from lower to upper

Permanent Field Preparation

Make a contour line by using an A-frame peg out a line with spacing of 20x20 ft., 25 x 25 ft. or 30 x 30 ft. If the avocado is grown as a shade tree, the spacing should be 30 x 30 ft.

Dig holes measuring 2x2x2 ft. on the line. Fill with top soil, 6-8 kg. of cow manure and 150 g. of lime.

Planting into the Permanent Field

The trees should be planted when the soil contains a good level of moisture, typically in the beginning of the rainy season (late May – early June).

Cut and remove the bottom of the potting bag. Then cut along the side of the potting bag from the bottom to the top, without damaging the potting soil and its roots. Remember to check for dead roots, dark colored roots and curled roots. Lastly, plant the tree in the center of the hole. If the tree does not get any rain after it is planted, it should be irrigated within 2 weeks.

Care and Maintenance

If the plant is too exposed to the sun and freezing degrees, it will be damaged. That is why it is important during both summer and winter to create a shelter, which can be made out of local materials such as waste sacks or mosquito nets.

If the soil is very dry during the summer season, irrigate by hand, piping or drip irrigation.

Young plants can easily break in the wind. Support young plants with a stake made from bamboo or local wood for 2-3 years until it is strong enough to withstand the weather.

Weeding can be done by hand. Remember to spread straw or hay mulch around the plants to secure the soil moisture and reduce weeds. 1 year after transplanting, trim the top of the plant to make more branches grow as the plant matures.

When weeding and applying fertilizer – keep in mind that lateral roots are running 6 inches beneath the soil. Old avocado trees required heavy pruning to stay healthy and to keep generating large amounts of fruit.

Disease Control

Avoiding rotten fruit

Diseases that rot fruit are caused by fungi which infects the plant parts (stems, leaves and fruits). In order to prevent fungi diseases from spreading; remove the dead fruit, branches and leaves and prune branches to minimize canopy.

Phytophthora root rot

This disease is very serious in avocado. When the disease infects the avocado it will begin to lose its leaves gradually, and in some cases the leaves will fall to the ground, leading to overflowering and eventual death of the plant. The only valid treatment is the application of chemical fungicide. Good site selection, soil preparation and disease-free nursery stock can all help with prevention.

Avocado bark canker rot

This disease mostly occurs in the stem of the plant base and around the lower branches of the tree. The color of the bark changes from red to dark brown and the damaged area leaks a sap which dries to a white crystalline powder.

Bark rot can be prevented by using disease free nursery root stocks and by applying phosphoric acid or fungicide. Cut away the damaged area with a sharp knife and spray phosphoric acid or fungicide on the bark.

Pest Control

Shot Hole Borer/ Ambrosia Beetle

These beetles infest the plant by tunneling into the stem of plant, where they feed of the steam and lay eggs. The beetles are carriers of fungus diseases and are difficult to prevent. If the plant is infected with the beetle, cut off and burn the infected branch to ensure it does not spread any further.

Asian Long Horned Beetle

These beetles are a common sight in Chin state. The beetle tunnels into the stem and destroys the xylem and phloem of the tree, disrupting the flow of nutrient and water throughout the tree.

You might see sawdust around exit holes or on the ground next to the plant; and sap oozing out of the wounded site. The infected area will gradually dry and weaken – and eventually kill - the plant. Treat with a pesticide trunk injection or cut off and burn the infected branch.

Harvesting

Avocados ripen after harvesting. Pick the fruit when the fruit has reached its full size and stopped growing. If it is not harvested in time, the fruit will turn brown and easily fall of the tree in the wind. The fruit should be be picked individually by hand and handled with care, as it is easily damaged.

Store the fruit in a cool place away from direct sunlight.

Avocado has a high sale value and can be sold in the local market or to a broker. In Chin State, the price of an avocado ranges from 200-700 MMK per fruit.

References

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Coffee



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Coffee (*coffea* spp.) is a plant widely consumed throughout the world because of the flavor of the fruit seeds (known as coffee beans) - mostly for drinks. It is becoming increasingly popular as a cash crop in Myanmar because of internal and export opportunities and the favorable climate conditions of the Myanmar upland regions such as Chin State and Shan State.

There are many varieties of coffee, with Arabica and Robusta accounting for almost all the coffee production in the world. Robusta can be cultivated in lowlands, is less exposed to pests and diseases and has a higher but less profitable yield than coffee Arabica. A rust resistant hybrid varietal – Catimor – is cultivated by some farmers in southern Chin State.

The tree begins to produce fruits from three to five years. The fruits are usually ripe and ready for harvest after 9 months after which the coffee fruits are picked, processed, and dried. Dried coffee seeds (known in English as beans) are roasted.

Coffee Nursery Bed

Coffee can propagate in two ways: reproductive propagation through seeding and vegetative propagation by cutting, grafting and budding the plant. The most common approach is reproductive propagation with seeds sown in a nursery. In upland Chin, the nursery stage should be from February to ensure the optimal conditions for the growing process.

Seed Selection

To ensure quality, seeds should be selected from coffee plants aged 8-15 years. The seeds should be picked from a healthy coffee tree of high quality, with no history or signs of pests and diseases.

The seeds must be picked when ripe and afterwards be washed with clean water in order to remove the layer of wax that coats the seeds within the fruit.

The seeds should be dried in the sun before sowing. Use two seeds per potting bag in the nursery.

Land selection for the Nursery Bed

It is important to choose the right land location for the coffee nursery to achieve the best results. The nursery should be placed close to a water source on a horizontal leveled plot which is not affected by flooding and is easy to access.

A minimum 6 ft. shade shelter - ideally made with a horticulture net -should be constructed to provide shade from the sun for around 60% of the day.

Sowing Seeds in the Nursery Bed

Two seeds should be planted into a potting bag filled with top soil, sand and cow dung. The mixture ratio should be 3 parts topsoil, 2 parts sand and 1 part cow dung.

If the seeds are sown directly in the nursery bed, ensure the bed consists of 4 inches of topsoil in the lowest layer of the bed and 2 inches of sand in the upper layer.

The optimal spacing between the seeds sown in the nursery bed is 4 inches and 1 inch of soil should separate the plants in the nursery bed.

The seeds must be watered every day throughout the growing process. Applying a thick layer of straw mulch around the plant can be a useful way of keeping it moist and avoiding undesirable weeds.

After 2 months the seeds begin to germinate - and after 3-4 months the plants reach the butterfly stage (with only two leaves). It is now ready to be transplanted into a potting bag.

The unhealthy plants should be discarded - look out for the curled root plants which should be thrown out. The potting bag should have a 2-inch hole to fit the straight roots of the coffee plant. Continue to water the plants daily.

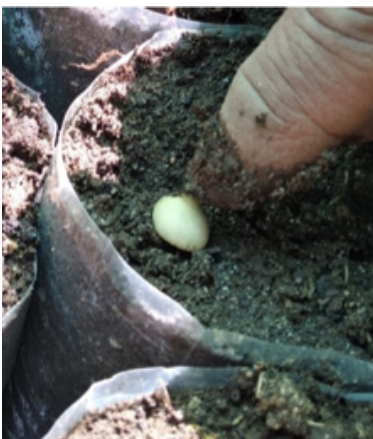


Fig 1. Seed sowing in prone position in the potting bag



Fig 2. Day 60: Radicle sprout



Fig 3. Day 115 coffee seedling



Fig 4. Day 115: Butterfly stage



Fig 5. Day 150: Plants ready to transplanted



Fig 6. Transplanting to potting bags

Last phase of the Nursery Bed and Final Transplanting

The coffee plant should be transplanted from the nursery bed and into the permanent land plot after 8-12 months when the plant has 6-8 full-grown leaves.

The shelter must be removed from the nursery bed 1 month before the coffee plant is transplanted to the permanent field in order to enhance the strength of the plant.

Site Selection for Permanent Field

A healthy permanent field needs well aerated and fertile soil with pH levels between 4.5-6.5.

A level or sloped surface can be used. The decline should not exceed more than 15%.

Arabica is preferable grown 2500 ft. above sea level in areas without any frost which will heavily damage the fruits.

Permanent Field Preparation

During the summer season, the permanent field should be cleared of weeds and wild plants. A shade level of around 70% should be available.

Measure a contour line with an A-frame, alongside a line pegging with spacing between 8x6 ft² to 8x8 ft². If the permanent field is on a slope, 8x4 ft² spacing is sufficient.

Dig a 1 x 1 x 1 ft. hole and refill it with topsoil, 2 kg. of cow manure, 2 spoons of T-super fertilizer and 150 grams of lime.

Planting Coffee in the Permanent Field

The coffee plant should be transplanted to the permanent field in the early rainy season (late May – early June) when the soil has the right level of moisture. Make sure the plants from the nursery bed are not more than 2 years old, as these will be too mature to transplant successfully.

Remove the potting bag without destroying the potting soil and plant the coffee plant in the

prepared hole. Make sure the roots are not curled and - if necessary - cut the curled part of the root.

To avoid frost damage -the plants should be protected and covered by straw or hortinet, which will provide the necessary shade during summer season.

Canopy Tree Planting for Shade Protection

Trees are necessary to provide shade protection to the coffee plants and can be an income opportunity. Canopy trees can be could be avocado, plum, lychee, stink bean or silver oak.

Cover crops/green manure crops can be grown between the coffee rows to avoid soil erosion, maintain soil moisture, fertilize the coffee plants and minimize weed upspring. legumes are often used as cover crops for nitrogen-fixing.

Cover crops are sometimes grown for a specific period, and then ploughed under the soil before reaching full maturity in order to improve soil fertility and quality. It is also possible to let the cover crop reach full maturity and harvest the crop to generate an extra income.

Maintenance

1. Weeding is essential at least 3 times a year, especially during the rainy season. The weeds can afterwards be used as mulch around the coffee plant.
2. Cover crops must be sown and maintained as they are supporting the coffee plants and can generate an extra income opportunity.
3. The coffee plants might need water during drought periods in the summer season, but water should be properly managed in cases of limited access.
4. Pruning of dry and disease-infected branches is required to maintain a healthy plant. The number of branches should be kept under control, especially before the flowering process begins. Heavy pruning is necessary for older plants in order to continually maximize the harvest.
5. Fertilizer – NPK/compound fertilizer should be applied 3 times over the course of a year; Once in the beginning of the rainy season (late may – early June); again in August and finally in November. The first and second times require smaller amounts of fertilizer than the third time in November.
6. Each plant requires 4 kg. of organic fertilizer over the course of the year. A minor-nutrient must be applied once a year before the flowering process begins.
7. The following pests can potentially infest coffee plants:
 - a. Green Scale
 - b. Aphids
 - c. Semi Loopers
 - d. Hairy Caterpillar
 - e. Tailed Caterpillar
 - f. Stinging Caterpillars
 - g. Leaf Miner
 - h. Antestia bug
 - i. White Stemborer
 - j. Red Stemborer
 - k. Coffee Berry Borer
 - l. White Grub.

Coffee is also frequently affected by rust. It is good to use rust-resistant varieties, cultural control and chemical control.

8. Weed, straw and dried leaves should be used as mulch after the rainy season, in thick layers around each coffee plant.

Harvesting

Arabica will start flowering after 2.5 years and can be harvested after 3-4 years depending on the variety.

It will take 8-10 months for the coffee to be ripe with the flowering process beginning in April and the ripening process from December to March.

It is strongly advised that the fruits are only harvested when they are completely ripe - as shown by the deep red color of the fruit. The coffee can be harvested up to 4-5 times during the process, which must end in mid-March at the latest in order to ensure the quality of the next cycle and leave enough time for thorough pruning . Typically one coffee plant can generate 3-6 viss per season which can be sold to a local processor or broker.

Drying and Selling the Coffee Beans

There are two ways of drying the harvest. The first way is to dry the whole fruit in the sun and the second is to separate the beans from the fruit through a hulling process and then dry them in the sun.

The coffee beans should be dried to a moisture level around 1-12% and should afterwards be stored in a good quality bag.

Often processors buy the coffee as fresh fruit and then sort/grade the fruit, dry it and sell it. The price of fresh coffee fruit is usually around 800-1200 MMK per viss.

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Elephant Foot Yam in the Uplands (with special reference to Chin State)¹



Elephant Foot Yam (EFY) (*Amorphophallus* spp.) is a popular crop in Chin State and also in Kayah, Kachin, Rakhine and Shan States. It produces a large underground tuber which is readily sold. EFY can also be grown for subsistence but most is sold to traders for Chinese and Japanese markets. As there is limited local market, it is good for farmers and extensionists to try to keep aware of changes in international markets.

EFY grows in infertile soils and requires limited inputs (other than initial planting material) and little attention during growing. It is relatively easy to keep free from pests and disease. Processing before sale is straightforward - and harvesting and selling periods are comparatively flexible. For these reasons, EFY is a popular crop with Chin farmers even when prices are relatively low. The average yield of the fresh tuber for low-input agriculture is 4,000-5,000 viss/acre. Farm-gate prices vary between years and distance from the market but may average about K 1500-1700 per viss fresh weight of tuber.

Site selection

EFY does not grow well in waterlogged soils. Soils should be free draining and not very clayey. EFY grows best in fertile soils but can also produce profitable yields in relatively infertile soils. In nature, EFY occurs in shady conditions in the forest. EFY may grow better in shade but is also grown successfully without shade. However, EFY can be grown in orchards and tree plantations where the trees are not too closely spaced. The planting of leguminous shade trees may assist the long-term growth of EFY. EFY can be grown during the early stages of the fallow phase in shifting cultivation fields or in the early stages of reforestation but is usually grown in backyards or in separate fields.

¹Ko Lwin (2016), 'Market Study and Value Chain Assessment', ADRA - Price II/Aust-Aid, Yangon, and Keesecher, J. et al. (2017), 'Value Chain Assessment: Elephant Foot Yam Production in Southern Chin State', MIID/RECOFTC, Yangon.

Planting material

EFY may be established from true seed (seed from flowers), leaf bulbils, small tubers, pieces of cut large tubers or from tuber offsets. However, most farmers establish EFY from leaf bulbils. This is because it only takes 2-3 years to produce large tubers for sale from bulbils compared to 5 years if true seed is sown.

There are many species of EFY but only a few species produce leaf bulbils. Species also differ in their internal colour - some are white inside, some yellow and some pink or red. Some traders have a preference for white tubers.

Leaf bulbils and tubers may be purchased from traders in towns, other farmers, or farmers may keep their own bulbils and planting tubers.

Leaf bulbils are pulled off the leaves or collected from the ground at the end of the growing season. Bulbils are relatively easy to store and will remain viable for more than one year. Tubers are more difficult to store and must be kept in the dark and undamaged.

Planting process

Planting time is at the start of the monsoon season in May. Planting pieces are placed singly in dug holes sufficient to well-cover the planting piece at a spacing about 1' x 1' within rows and about 2-3' between rows - but this is variable. The rows between EFY plants may be intercropped with vegetables or other short-term crops. True seed should be sown in a nursery and then transplanted to the field after one year. Bulbils are also often planted in nurseries and transplanted later. The surface of cut tubers should be coated with fungicide or fire ash (if no fungicide is available), to reduce rotting.

Growing management

Most farmers can obtain profitable yields without adding any external nutrients. However, yields will be larger if compost, animal manure or industrial fertilisers are applied at planting and at the start of each year. The standard 16:20:0 or 15:15:15 fertilisers are recommended unless local knowledge indicates otherwise.

The area around the growing EFY plants should be clean weeded 2-3 times of the year and weeds between rows never allowed to become tall.

There is usually no need to treat for pests or diseases but the EFY should be protected against grazing animals. Rats need to be controlled if they are present.

Harvesting

Since the leaves of EFY die in each dry season, the tubers may be harvested any time during the dry season. It is most important not to damage the tubers when they are dug out as they will rot easily if damaged. For many farmers, harvesting in February-March is best, when labour demand is least and the weather is best for drying cut chips.

Processing and sale

Tubers can be sold fresh but this has the disadvantages of higher transport costs (weight of fresh tubers) and potential damage to tubers during storage and transport.

Farmers can also cut the tubers into slices, dry them and sell as dried chips. Selling dried chips has the advantages of less transport costs, easy storage and some value-addition. On average, 6 kg of fresh tuber are required to produce 1 kg of dried chip.

The most important factor for farmers when making their own dried chips is to dry the chips quickly and sufficiently to prevent any blackening of the chips through fungal damage. The prices traders pay depend on the degree of blackening of chips.

Dirt is washed or brushed off the tubers. Tubers are cut into slices $\frac{1}{2}$ - 1' in thickness. Thick tubers are more prone to blackening. Tubers should be cut to the same thickness to allow for even drying – either with a knife or slicing machine. The cut tubers irritate the skin so plastic gloves should be worn while cutting.

Many farmers dry chips on sheets on the ground or on a roof in the sun. Farmers can also use porous trays, suspended nets or solar boxes. Drying over charcoal/sulphur is not recommended as this introduces impurities into the dried chips which may be rejected at sale.



