

Version 1

This manual is intended to be updated as we learn more about cultivating xate in Belize. Check back for updated versions at <u>http://www.belizebotanic.org/xate_manual</u>

XATE IN BELIZE A GROWER'S GUIDE

This booklet is intended for farmers and agroforestry technicians. It provides basic information on growing organic xate in Belize from obtaining seed to selling cut leaf.

Produced by:



Funded by:



Belize Botanic Gardens





XATE IN BELIZE, A GROWER'S GUIDE

Produced by:

Belíze Botaníc Gardens

Ya'ache Conservation Trust,

The Natural History Museum, Londan

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Darwin Initiative

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What is xate?

The term 'xate' is the common name used for several species of economicallyimportant understory palms from the genus *Chamaedorea*. This manual deals with three:

Botanic name	Common name	Other common names
Chamaedorea ernesti-augustii	Fishtail	Cola de pescado, pata de vaca, rabbit ears
Chamaedorea oblongata	Jade	Xate macho, oblongata
Chamaedorea elegans	Elegans	Xate hembra, parlour palm

The leaves of these palms are attractive and can last for up to 45 days after being cut. For this reason they are collected from their native forests of Mexico, Guatemala and Belize and sold (usually to the USA and Europe) for use in flower arrangements, Palm Sunday services and decorative displays. Whole palms are also sold as houseplants and for landscaping as they are small and shade tolerant.

The need for sustainably grown xate in Belize

Because they are small and attractive palms, many species of Chamaedorea from Mexico and Guatemala are harvested (of leaf, seed or entire plant) from the wild. Some species have been over-collected to the point of becoming threatened or extinct. Fishtail is one of the species affected by this activity. In the Petén region of Guatemala many people rely on income from harvesting fishtail to support their families. In 1998 failing leaf production in wild populations due to continued over-harvesting in Guatemala caused xateros (collectors of xate) to cross the border into Belize to illegally gather the rich xate supply found in the Chiquibul and north-western Columbia River forest reserves.

Currently all fishtail from Belize is wild-harvested from our forests and this activity is affecting both the health of their populations and our forests. An estimated 600-700 xateros gather leaf in this country, camping and hunting while they work. Like many hunters they damage the forest ecosystem by collecting wild plants for shelter, food and sale and by killing a wide variety of animals, including tapir, kinkajous, peccaries, deer, tinamous and guans.

These activities have been recently brought to public attention and sparked interest in the possibility of xate as a non-timber forest product for Belize. To guide the development of a sustainable xate industry in Belize the Government of Belize created a the Xate Technical Committee comprised of the Ministries of Agriculture, Natural Resources and Foreign Affairs. Independently, the Natural History Museum, London, was awarded a grant by the Darwin Initiative (a UK based funding agency) for a 4-year xate project. The goals of this project included an evaluation of the health and abundance of wild xate in Belize and determining the long-term effects of xatero activities. It also funded agricultural trials and education programs related to xate at Belize Botanic Gardens (BBG). Similarly, the Ya'axche Conservation Trust (YCT) conducted a yearlong trial cultivation project in the Toledo district. This was funded by the GEF SGP (Global Environment Facility, Small Grants Program).

This manual is the result of the combined efforts of BBG and YCT to guide Belizean xate growers through the important steps of sustainable xate cultivation. In order for Belize to have a healthy xate industry and healthy forests, wild harvest of xate must be replaced by sustainable farming of the leaf. This will ensure that Belizeans gain long-term benefits from xate and the conservation of our forests.

For more information on any of the projects mentioned above, please contact the relevant people listed in Appendix 2.

IS XATE RIGHT FOR YOU?

Despite the attention xate has received, there is nothing to prove that xate is a good cash crop for Belizeans. At the time of writing this manual there are no individuals or organizations in Belize selling cut leaf from xate they have raised from seed and there is not an established market for Belizean xate. For these reasons, it is recommended that xate be used only as a supplemental income crop for farmers growing other money-making plants such as cacao, allspice, black pepper, timber and/or fruit trees.

Before you begin growing xate consider the following:

The right land

Even if you are prepared to take the risk and make the effort, your land must be suitable for growing xate. One good indicator of this is the natural presence of the xate species that you want to grow.

Water/Drainage

Planting on gentle slopes is recommended. Xate does not like having its roots in standing water. Seedlings are planted at the start of the rainy season but may need to be watered if the dry season is severe. Once the palms are established they should not need water unless there is a severe drought.

Shade/Canopy

Shade is essential to growing xate. The land that is required for the transplanting of xate should have at least 60 percent shade provided by existing tree canopy. 70-80 percent shade is ideal, particularly if growing of xate for leaf. Naturally occurring shade trees can be supplemented by growing useful trees such as mahogany. Check the trees on your land and make sure the majority are not species that lose their leaves during the dry season. If they are you should grow another source of shade (such as the fast growing Spanish elder) under the larger trees.

Soils

Xate needs good drainage and alkaline soil. If you are not sure about the pH of your soil you can get the pH tested at the Citrus Research and Education Institute (CREI) for \$5.75 or obtain a complete soil analysis from Prosser for \$65.00. You are looking for an ideal pH of 6.0 as nutrient availability is most abundant at this level.

If your soil is mostly made up of clay it will hold too much moisture for xate to thrive. The ideal soil is sandy loam.

Investment

Growing xate requires time and money. Seeds can cost up to BZ\$110 per 1,000 (current price from Teakettle Enterprises, a Belize based supplier of palm seeds), and buying and transporting materials for nurseries and storage facilities can be expensive. You will need to invest time caring for xate seedbeds and forest farms and harvesting and selling your leaf.

Profit

It takes 4 years from the time you plant before you can harvest and earn a profit from growing xate. Currently 1 acre of fishtail in the village of Union Maya Itza, Petèn (Guatemala), earns the farmer an estimated BZ\$716 per year [based on 11,330 plants per acre, 2 harvested leaves per plant per year and a BZ\$3.16 sales price for 100 leaves].

Organisations such as BBG, BELTRAIDE (The Belize Trade and Investment Services), and YCT are working to establish reliable markets for Belizean xate. There is no guarantee that prices will not change. **The price of xate could drop.**

Selling

Before you begin growing xate you should give some thought to whom you will be selling your xate. There is not a central xate processing or sorting centre in Belize where you can take your leaf to sell. At this time no market has been established for Belizean xate by any organization in Belize.

If your land is right for xate and you understand the risks involved you may be ready to begin growing some palms. The chapters ahead will help you do this.

	Before you begin :
X	Contact the organizations listed in Appendix 3 for help and collaboration.
×	Try to sell directly to florists or floral wholesalers.
⊠ alle wo lea	Form or work with a xate co-operative. Working with others ows you to share costs and have better selling power than orking alone. Wholesalers will require a steady supply of aves that one small farmer cannot provide.

V GETTING STARTED: SEEDS

Acquiring seeds

In order to plant xate in Belize the first step is to acquire seeds from a reliable source. Our natural xate populations are already in trouble from over-harvesting. Do not contribute to the damage by purchasing or harvesting illegally-collected seed. Obtain the proper permits and licenses before you buy or harvest seeds.

If you buy seeds from a plantation in Guatemala first check with an organization such as ACICAFOC (Asociación Coordinadora Indígena y Campesina de Agroforestería Comunitaria Centroamericana) to make sure you are using recommended seed suppliers. See Appendix 2 for contact details. To import seeds from Guatemala you need to get an importation permit from BAHA (Belize Agricultural Health Authority) before you bring them across the border. Imported seeds must be clean, free of pests and disease and have a certificate of origin. Your supplier will need to get the certificate of origin and other documents from the Guatemalan authorities to export the seed. This can take a long time. Start planning well in advance.

In Belize the only known supplier of farmed xate seed is Teakettle Enterprises. Belize Botanic Gardens hopes to have seed available for farmers in 2007. The Ya'axche Conservation Trust should be able to supply Toledo farmers in 2009. (See Appendix 2 for contact details of the organizations mentioned above.) To collect seed in Belize you will need to apply for a license from the Belize Forest Department. Permits from the Forest Department are area specific. Before you apply make certain you can give details as to the exact location of the seed you wish to collect. Remember that our xate populations are already in trouble.

DO NOT REMOVE ALL SEEDS FROM AREAS WHERE YOU COLLECT. LEAVE SOME SEED ON EACH PLANT.

THIS WILL PROVIDE PLANTS AND SEED FOR THE FUTURE.

The number of seeds you need to buy or collect depends on how many acres of xate you plan to plant. One acre can hold approximately 8,661 fishtail or jade and between 34,729 to 78,266 elegans. Plan accordingly.

SEED PER POUND AVERAGES FOR XATE

Elegans	1 POUND = $2,135$ SEEDS
FISHTAIL	1 POUND = 747 SEEDS
JADE	1 POUND = 1,300 SEEDS

Checking seeds for quality

Whether you collect seeds or buy them from a supplier make sure you get only ripe, healthy seeds that have been collected from the tree and not from the ground. Make sure seeds have been collected from the right palms.

See Appendix 1 to assist you in identifying xate species.

Check for viability

Perform a float test to see if your seeds are viable (i.e. good to plant). To do this fill a bucket half-way with seeds, then fill it to the top with water. Mix the seeds and water with your hands. The seeds that float to the top should be discarded. They are not likely to germinate. Test a small sample seeds before you buy them. If too many do not pass this test do not buy the seeds.



Check for ripeness

Only ripe seed should be harvested. The outer skin of xate seed is black when ripe. Do not harvest green seeds. Some collectors harvest green seed and let it turn black before selling. To check for this cut open several seeds and make sure they are not discoloured. Xate seeds ripen between July and October.



Ripe fishtail seeds

Check for problems

Before buying seeds check them carefully with your supplier. Look for signs of pests, fungus and mixing of other types of seed. Cut open several seeds and see that the inside is not dried-out or discoloured. Good elegans will be greyish inside while good fishtail and jade will be white. Smell the inside of the seed. If it smells bad it is not good.

Seed boring insects are difficult to detect. The eggs are inside the seed and hatch only after the seed is sown. These seeds may pass the float test. To avoid buying infested seed look carefully for tiny holes on the outside of the seed.

Check for the right species

Some seed suppliers may mix in other kinds of *Chamaedorea* seed to meet your order. Check for different looking seeds and ask your supplier about them. Many *Chamaedorea* seeds look the same and you will not know you have been sold the wrong seed until the palms starts growing in your seedbed. Look for seedlings that show different growth rates or leaf development than expected.

If you are growing jade be very careful. Chamaedorea pinnatifrons (False jade) looks very similar but its leaves are worthless. See Appendix 1 for help identifying xate species.



Cleaning and storing seeds

Seed cleaning

You need to remove the soft skin from around the hard seed. To do this let the seeds dry in the shade for one or two days. When they are dry the outer skin is easily rubbed off. Rub the seeds together in front of a fan or in the breeze.

OR

Soak seeds in water for a few hours or overnight to soften the skin. After soaking them drain the water and add fresh water to the top of the bucket. Rub the seeds together. The skin will float up and can be poured off the top. The seeds will remain at the bottom of the bucket.



Rub seeds together in water. Seed skins will float to top.

Treat or store

Treat the seeds as described in the next section and sow immediately. If you must store the seeds dry them well in the shade. Store them in crocus bags in a dry, well-ventilated area. Do not leave sacks on the ground. The manual for cultivation of xate produced by Fernando Ramírez (see References) states that you can store seeds for a maximum of 4 months. Trials at BBG and San Antonio have successfully germinated older seeds but it is better to use fresh seeds if possible.



Do not store seeds on the ground.

Seed treatments

Xate seeds naturally take around 6-9 months to germinate. To speed up this process you can treat your seeds by using (1) the bucket treatment, (2) soaking treatment or (3) soaking and the peroxide treatment.

Bucket treatment

This method has been proven to germinate fishtail seeds in 20-25 days in trials carried out by ACICAFOC xate technician James Mesh. Soak seeds for 24 hours in a bucket filled with water. Drain the water off after 24 hours. Keep the wet seeds in the bucket. Cover the top of the bucket with a lid and store in the shade or in the house. Check the bucket daily. All the seeds should be wet but no water should rest in the bottom of the bucket. If necessary add water and drain off excess. Leave in bucket until germination begins.

Once you see signs of germination, sow as recommended on page 28. If any seeds have developed long roots you need to take care to bury these with the root down, otherwise just lay them loosely in the seedbed and cover with soil.

Soaking treatment

Always soak seeds for 24-48 hours before sowing. Fill a bucket half way with seeds and top up with water. Leave it to soak overnight. To soak for 48 hours drain out water the next day and add fresh water. Soak for one more night then drain and sow or treat with hydrogen peroxide method.

Hydrogen peroxide treatment

Soak seeds as explained above before treating seeds with hydrogen peroxide.

You will need:

Bottle(s) of hydrogen peroxide Syringe(s) for measuring hydrogen peroxide (at least 5 ml) 1-litre container (such as a litre water bottle) Good supply of water, preferably rain water Clean buckets



Method

<u>Step 1</u>

Using your litre bottle to measure, fill a clean bucket half way water. Count the number of litre bottles you use. (Usually about 9 or 10 litres for $\frac{1}{2}$ of a 5-gallon bucket)

<u>Step 2</u>

Read the label on your hydrogen peroxide and see whether it is 3%, 5% or 10%. For every litre of water added measure out one of the following and add to the water.

3% hydrogen peroxide solution use 16.5 ml per litre 5% hydrogen peroxide solution use 10ml per litre 10% hydrogen peroxide solution use 5 ml per litre

For example:

If you use 10 litres of water add: 165ml of 3% hydrogen peroxide OR 100ml of 5% hydrogen peroxide OR 50ml of 10% hydrogen peroxide.





Pour seeds into the water and peroxide solution.

(The seeds should be covered with water and able to move freely.)

• Stir the seeds constantly for 15 minutes.



- Drain the seeds and rinse them well in clean water for 10 minutes.
- Rinse 2 more times using clean water each time.



Plant as soon as possible.

XATE NURSERY

To sow your seeds build a raised seedbed and fill with soil (see page 27 for soil mix recipe). The bed should be 12 inches (30cm) deep and about 3.25 feet (1metre) wide. This size allows you to care for your bed easily without walking on the soil or seedlings. You should never walk on your bed as this will compact the soil and make it harder for the seeds to germinate and grow.

Steps to making a seedbed :

- 1. Make the bed in an area where you can check it everyday.
- Use stones, wooden boards or any other suitable material to build a 12 inch wall to hold soil in the seedbed.
- 3. Fill with soil mix (See page 27).
- 4. Level the soil with a flat board to make it smooth.
- 5. Leave the soil to settle for about 2-3 weeks before sowing.
- Build a fence around the bed to stop damage by pigs, dogs, birds and wild animals.

Seedbed construction

Size

A bed that is 33 feet long and 3.25 feet wide will hold 10,000 seeds. Plan accordingly.

Shape

If you have misters to irrigate your seedbed a rectangular bed is the easiest shape to build. If you do not have misters you should make 2 half-circle beds. This allows you to stand in the middle and water all seeds with minimum work. This shape also allows you to install a sprinkler that can reach all seeds. Make the seedbed a little smaller than the range of your sprinkler.



Round seedbed watered by hose



Rectangular seedbed with misters

Irrigation

You will need to keep your seedbed moist at all times. Rain water is the best kind of water to use on your plants, but river water, municipal water and well water can also be used. Many wells contain high amounts of lime and this will form a whitish layer on your seedling leaves. Below are some irrigation options.

Hose and spray nozzle

Hoses and spray nozzles are cheap and easy to use, but they waste water and require a lot of work. A person has to hand-water all parts of the seedbed. Make sure to buy a nozzle with a fine mist or shower attachment. You do not want to use a hose without an attachment or use the nozzle on a jet spray or heavy spray. This will compact the soil, expose seeds and possibly damage seedlings.

Misters

Misters are installed in black hose pipe above the bed. You need 1/2 inch black hose with mister heads inserted according to their range. This requires the most time and money but the advantages are: (1) easy operation, you just have to turn on the system (2) even water distribution as the misters are turned on together rather than relying on a person to control the amount of water on each section (3) the fine mist will not compact the soil and is less likely to cause waterlogged soil and (4) it wastes the least amount of water.

Hand water with watering can

This is the least expensive way to water but takes the most work. Choose a watering can with a spout that allows water to fall gently on the bed.

Sprinkler on the end of a hose

A sprinkler on the end of a hose is simple, inexpensive and easy to use. The problem with a sprinkler system is finding a sprinkler that will



not spray heavy water drops on the seedbed. Choose a sprinkler carefully. You want a fine spray on the bed. Heavy drops can compact the soil, expose seeds and possibly damage seedlings. Using sprinklers wastes a lot of water.

- Do not over water and make sure drainage in your seedbed is good. Palms are most likely to rot (damp-off) before germination. Standing water will contribute to fungal and disease problems.
- Do not allow the seedbed to dry up. Having moist (not wet) soil is the key to successful germination.
- Do not let heavy water drops (such as from a hose with no nozzle) fall on the seedbed. This can expose the seeds and damage small roots.

Soil

There are many recipes for the ideal soil mix. You can make up your own mix according to what you have available but always sow seeds in good, free-draining soil. Adding sand and organic matter helps to improve the drainage of soil. Organic matter can be compost, rice hulls, composted animal manures (horse, cattle, chicken or bat) mixed with composted sawdust. Sand should be coarse sand as from the river, not fine sand.

Soil Mix1

- 2 Parts sharp sand
- 2 Parts organic matter
- 1 Part dark topsoil

Soil Mix 2

- 1 Part compost
- 1 Part topsoil
- 1 Part rice hulls

Acid soils: If you have acidic soil you should add 8 pounds of dolomite for every cubic yard of soil mix.

Clay soils/Drainage: If possible avoid using clay soil. If it is all that you have available add more sand and 1 more part organic matter to improve drainage. Rice hulls are a good source of organic matter to improve drainage.

Planting your seedbed

- 1. Prepare rows less than 2 inches (5 cm) deep and 4 inches (10cm) apart.
- 2. Lay seeds loosely next to one another down the length of each row.
- 3. Cover the seeds with a thin layer of soil mix.
- 4. Water the seedbed well.
- 5. To help keep sunlight out and moisture in, cover the seedbed with shade cloth or large leaves such as cohune or coconut. If you use leaves make sure they allow water to reach the seedbed.



Seedbed care

- Keep the seedbed moist. Never let them dry out completely. Check seedbed daily for moisture. Stick your finger about 1 inch deep into the soil to test for moisture. Water the seedbeds when necessary.
- Do not over water. The soil should be moist but not waterlogged (heavy with water). If the soil is too wet it will cause damping off (fungal rot). Too much water may also cause roots to develop only near the surface of the soil.
- Inspect the seedbed regularly. Check for problems such as fungus, insects and seeds which are not covered with soil. Most fungal and pest problems can be treated organically with Neem-X (available at Prosser). Exposed seeds are caused by heavy rain, animals or birds. Just cover exposed seeds with a light layer of soil mix.
- As soon as you see signs of germination remove the leaves from the bed. Make a new shade cover 2-4 feet (70 cm) from the ground. It should extend past the sides of the bed to give full coverage. Put up the new shade early in the morning or evening when there is no strong sunlight. The seedlings are very sensitive and are easily killed at this stage, even by 5 minutes of direct strong sunlight.
- Continue to keep the seed bed moist and check it regularly for problems. Repair any places in the leaves that let in sunlight.
- Transplant after the rains begin. The seedlings should be at least 4 inches (10cm) high with 1-2 leaves. You can transplant larger seedlings but do not transplant smaller seedlings.

V TRANSPLANTING OF SEEDLINGS

Prepare the land

Before you transplant your xate seedlings, create space for them by clearing the small plants and underbrush from your forest farm area. Leave large trees to provide shade. Keep any trees, like fruit and timber trees that could be useful in the future. Remember: 1 acre holds 8,661 fishtail or jade and up to 78,266 elegans.

Cacao farmers see Appendix 3 for more information on growing xate with cacao.

Transplanting from seedbed to forest

Do not begin planting until the rainy season has begun and rain has soaked the ground.

Seedlings are most vulnerable (most likely to die) when you transplant them from the seedbed to the forest. Treat the seedlings gently, perform all steps with care and check frequently for signs of stress after transplanting.

Transplanting for xate seed farmers

Xate grown for seed instead of leaf can be planted closer together because you do not have to be as careful about damaging the leaves.

Xate palms are either male or female. Only female xate plants will produce seed. You cannot tell the male and female plants apart until they begin producing flowers. If you are planting for seed, plant more than the recommended number of xate and remove some of the male plants once you have identified them. For help identifying male and female flowers go to www.belizebotanic.org/xate id.

Male plants produce pollen to fertilize seeds. The insects that pollinate xate in the wild occur in Belize, so fertilization should happen naturally. Leave a large amount of male plants for good cross-pollination.

Removing seedlings from seedbed

When you are ready to plant, calculate how many seedlings you can plant that day and carefully remove only these seedlings from the bed. Do not damage their roots while removing them. Do not remove seedlings that are still attached to the plant. Let the seed sit on the top of the soil when you plant the seedling.

After removing seedlings from the bed keep their roots moist at all times. Plant as soon as possible. To keep the roots moist, wrap the seedlings in wet newspaper, moist leaves or a piece of damp cloth, then carry them in plastic bags or crocus sacks. Do not seal the tops of the bag. Allow air to pass in and out of the bag.

Planting the seedlings

If you are planting jade or fishtail, carefully place one seedling in each hole. For elegans your can place 1, 2 or 3 seedlings in each hole. Keep the green part of the stem above the soil level and cover only the roots with soil. Palms do not grow and develop properly if they are planted too deep. Gently but firmly pack the same soil that was removed from the hole around each seedling. Do not add a different soil mix to the holes. Make sure to keep on adding soil after packing it in until it reaches the green part of the stem.

You can form a small ridge around each stem with the backfill soil to keep water around young plants. Check on the plants every other day for the first 2 weeks and again a few weeks after planting. Check to see if the soil has compacted and exposed the roots of the plants. If so, cover the roots with soil.



Spacing

We recommend planting in a 'double row' system with plenty of space between plants. This gives adequate room for the plants to grow and helps reduce the spread of fungus and disease.

Plant 2 rows that are 2 feet (0.6 m) apart, then allow a 3 foot (0.90 metre) corridor between the next two rows. Each plant should be 2 feet apart along each row. If you are planting for seed you can reduce the space between each plant to 1-1.5 feet.

Measure each row and mark it with string or coloured tape to help guide you when digging holes. Holes should be large enough for the roots of the largest plant to just touch the bottom of the hole. A plant should not be planted in a hole shorter than its roots. If the roots of a palm are longer than the hole, make the hole bigger. Do not trim the roots to make it fit.

Plants should be planted in long rows 2 feet apart. Between each 2 rows should be a space of 3 feet.

GROWING XATE

The best defence you have against pests, disease, drought and other problems is to maintain healthy plants. Do this by keeping your plants free from weeds, mulching, feeding the soil with mature compost and observing them carefully and regularly for any sign of problems.

Organic Farming

The information provided in this manual is for organic cultivation. Organically grown crops are those raised without synthetic chemicals. Organic farming is the best practice for your health because you are not handling dangerous chemicals. It is best for the health of the environment because chemicals that leach into the soil and water table are not used. Because xate occurs naturally in Belize it is easy to care for organically.

Organic farmers use soil building, maintenance of the existing variety of insects and animals that feed on pests and naturally made controls to keep plants healthy. This kind of farming maintains environmental balance, prevents erosion and desertification, saves water and conserves the diversity of all living things associated with a farm and surrounding areas. We hope that you choose to grow your xate organically. It helps to sustain the balance of nature and keep our environment, and all of us who live in it, healthy. The alternative is conventional farming which involves the use of synthetic chemical fertilizers and controls. These can be absorbed by the body through inhalation, skin contact and ingestion. Improper handling of certain pesticides can cause mild to severe affects including skin disorders, cancer, liver damage, seizures, pulmonary fibrosis and even death. We encourage you to use safer organic alternatives such as citrus oil, neem extract or cornmeal to control pests and fungus rather than risk your health by exposure to toxic chemicals.

Organic farming is also safer for your family and community. Agricultural run-off, containing pesticides and fertilizers, gets into our water system. This contaminates our clean water supply, polluting it with toxins or causing algae blooms which depletes oxygen in the water. If you use organic practices you avoid these problems and help to keep our watersheds healthy and your community's water supply safe.

Xate grows wild in the forests of Belize. It is therefore suited to organic production. If you experience problems and need advice contact the Agriculture Department, CARDI (Caribbean Agricultural Research and Development Institute) or IICA (Inter-American Institute for Cooperation on Agriculture). They know what is locally available and can advise you on organic practices as well as conventional, if necessary. See Appendix 2 for contact information.

Weed control

Check your xate farm on a regular basis. Clean the vines and underbrush with a machete, being careful not to damage the stems of young plants. As the xate develops you will need to clean less.

Do not remove leaves that fall from the canopy onto the forest floor as these will break down and provide nutrients for the palms. If leaves fall onto a seedling or plant you should remove them from the plant to avoid blemishing the xate leaf.

Only remove leaves from your xate plant for harvest. Don't remove damaged or aging leaves from your palms. Palms are different from many other plants because their dying leaves return nutrients to the plant. Allow the leaves to drop naturally from the palm trees.

Mulching

If you have the time and the material available you should mulch around the base of each palm. Mulch is any material placed in bulk around a plant. It helps keep plants healthy by keeping in moisture, suppressing weeds, adding nutrients to the soil and improving soil fertility. Mulch can be peanut hulls, cacao shell meal or compost. Make sure the mulch does not touch the stem of the palm. For more information about mulching contact Belize Botanic Gardens.

Fertilization

Do not fertilize your palms with regular fertilizer. If you are going to use a commercial fertilizer you must use one called palm special. Palms need a fertilizer with a 3-1-3 NPK ratio. Xate palms grow naturally in Belize so you should not need to fertilize at all. If your palms look stressed it could be from drought, waterlogged soil, insect damage or fungal attack. Look closely to determine the problem and act accordingly.

If you need organic fertilizer you can buy bat guano for nitrogen (N), bone meal for phosphorus (P) and wood ash and seaweed for potassium (K). See Appendix 2 to find organic fertilizer suppliers.

When you fertilize your palms use only properly decomposed animal manures. Animal manures that are not properly composted and those applied in high quantity can 'burn' plants, cause severe yellowing of the leaves and sometimes death. Animal manures can also tie up manganese in the soil and make it unavailable to your palms. It is better to apply smaller amounts at intervals than large amounts at one time.

Symptoms	Possible Problem	Organic Solution
Overall yellow or light- green appearance , stunted growth.	Nitrogen deficiency	Dried bat guano or chicken manure.
Yellow streaks between veins of the leaflets begin- ning on new leaves.	Iron deficiency	Addition of organic material such as manure or bone meal.
Symptoms appear on old- est leaves. Chlorosis (yellowing) of lower leaves beginning at leaf tip.	Magnesium deficiency	Dolomite.
Leaf tip and margin burn.	Root damage from waterlogged soil	Reduce watering and figure out how to improve soil drainage.
Symptoms appear on old- est leaves. Speckling lead- ing to overall withered leaves. Obvious change in the trunk diameter.	Potassium deficiency	Wood ash, cocoa shell meal, dried sheep manure.
Emergence of smaller, yellowed leaves (Frizzle- top). Particularly on highly alkaline soils	Manganese	Usually occurs because Manganese cannot be absorbed at high pH. Lower the pH of your soil with wood ash or chicken manure, mulch with organic matter.

Organic pest controls

Whether cultivating xate organically or conventionally, your best tools are your eyes. Observe your plants for damage and find out what is causing it. Some pest problems will be controlled naturally as all pests have predators. However, some problems will need your attention. Below are some simple ways to deal with different pests in your garden and some pests to watch out for. See Appendix 2 for organizations you can contact for assistance.

Spray tips T

- Always read labels and follow the recommended safety precautions for application and protection of your skin, eyes, mouth and nose.
- Spray during the morning or evening when it is cooler and the humidity is higher. Spraying when it is too hot can burn plants.
- 24-48 hours before spraying all of your plants, when using a spray for the first time, test a small area of one plant to make sure it won't cause damage.
- ☑ Never leave pesticides in unmarked bottles. Always label bottles with the contents!
- Store all chemicals and poisons out of the reach of children.

Neem-X

This is an organic insecticide used in the control of 131 different insects including mealy bug, thrips and aphids. Neem controls bugs by interrupting their feeding, metamorphosis or reproductive cycle. Because of this, neem based insecticides may need to be reapplied several times before all insects are gone. Use as directed on the bottle.

Sticky Traps

Yellow sticky traps can be used to control white flies and blue or yellow sticky traps can be used to control other insects. To make a sticky trap take a piece of bright yellow or bright blue poster board (or paint thick paper yellow or blue). Coat these thickly with Vaseline and hang them from a stick on a string or on a piece of wire. The insects will become stuck on the traps and die. Sticky traps may need to be replaced after heavy rains.

Soap spray

Use about 3 tablespoons of liquid hand soap and 1 tablespoon of alcohol (you can use over-proof alcohol or rubbing alcohol) with 1 gallon of water. Mix and spray on plants with a spray bottle or backpack sprayer. Make sure to apply thoroughly as soap spray does not continue working. It works only when applied to pests by covering the air holes in the sides of their bodies and suffocating them. It is good for mites and mealy bugs. Different soaps affect plants in different ways so test a couple of leaves 24 hours before spraying.

Y2K degreaser

Y2K is made from citrus oil. You can buy Y2K at most grocery stores, hardware stores and gas stations. It can be used for most insect pest problems, including scale and fire ants. Keep a 50/50 mix ofY2K degreaser and water on hand. To use add 2 ounces of the 50/50 mixture to every gallon of water. Apply with a backpack sprayer by spraying directly on insects.

Garlic and hot pepper spray

You can make an effective spray of hot pepper and garlic by blending 1 garlic bulb and 1 habanero pepper with 4 cups of water. Leave overnight then strain the mixture and add 12 cups of water to make a concentrate. To use dilute 1/2 cup of the mixture in one gallon of water. Add 2tbsp of liquid hand soap. This spray works on aphids, thrips, spider mites and white fly.

Baking soda fungicide

At the first signs of fungal attack, spray with baking soda fungicide. Mix 4 tsp of baking soda, 1 tbsp citrus oil or molasses in 1 gallon of water and shake well. Apply with backpack sprayer. Repeat every 5-7 days as needed.

Cornmeal fungicide

Soak 1 cup of whole ground cornmeal in a gallon of water. Strain into a backpack sprayer and use directly on plants or as a soil drench for fungus and soil borne diseases.

Some Pests

Ants (Wee wee/leaf cutter)

Although they do not usually cut xate plants, they can damage them with their paths. Digging up the nests and destroying the queen is the only sure way to permanently eliminate a nest. Do this with a shovel and a backpack sprayer of the Y2K degreaser mix. Spray the degreaser on ants in the area you are working while you dig up any area containing eggs until you find the queen. For advice on this contact Belize Botanic Gardens. Depending on the size of the nest, this can take a couple of hours or 2 days of work. It will save you time in the long-term as it only needs to be done once. Spraying poison or blowing up the nests with gasoline must be repeated weekly and will only control the population of the ant colonies. It will not destroy the nests.

Armadillos/Birds

Armadillos may dig up the palms at night looking for grubs and birds may pick out the seedlings looking for food. As long as they don't damage the palms too much you can just replant any they dig up.

Mealy bug

Mealy bugs are small bugs that are coated with a white waxy layer and look cottony. Lady beetle larva look very similar but they do not have the two long antennae that mealy bugs have. Do not kill lady beetles. They eat pest insects. Plants with mealy bug will often have sooty mould on them. Treat mealy bugs with Neem-X, Y2K or soap spray.

Scale

Scale looks exactly as it sounds i.e. small flat discs (like the shape of fish scales) attached to the leaves or stems of plants. Scale is usually accompanied by the presence of sooty mould. If there is only a small amount of scale you can scrape it off your plant with your fingernail or with an old toothbrush dipped in soapy water. If you have a large infestation this might be too time consuming and you can treat with Y2K.



Scale x2.5

Always sterilize the equipment used in caring for diseased or pest infested plants. You can clean tools with rubbing alcohol or a solution of 1 tsp of bleach or 1 tbsp—1oz of hydrogen peroxide mixed with one gallon of water. After cleaning tools, dry and oil them.

Spider mites

These are very small pests and you may need a hand lens or magnifying glass to see them. Some signs that you have mites are tiny webs on the undersides of leaves, yellow or rust coloured spots on leaves, leaves that are yellowish or silvery looking. If you suspect mites but cannot see them take a piece of paper and knock a leaf above it. Some mites should fall on the paper. They are about the size of a salt grain.

Spider mites do not like moist conditions. Sometimes a hard spray with cold water will get rid of them. If your xate forest farm is not within reach of a hose and sprayer. You can try Neem-X, garlic-pepper spray or soap spray.

Thrips



Not all thrips are pests some are xate pollinators. Make sure they are causing problems before you destroy them. Thrips are very small insects with long bodies and feathery/bristlelike wings.

If you need help identifying pests or other problems take samples in sealed containers to the nearest Belize Agricultural Health Authority (BAHA) office.

XATE HARVEST

Growing for leaf or seed

You must decide whether you are growing your xate to harvest for leaf or for seed. You should not harvest leaf and seed from the same plant.

If you are growing for seed do not harvest the leaves of your plant. The leaf is where a plant makes the food which gives a plant energy to grow. Harvesting the leaves will limit the amount of energy made by the plant. If you cut the leaves the plant will put energy into making new leaves and so it will have less energy to make seeds.

You can grow seeds to sell for export or to sell in Belize to provide our local xate farmers with seed. If you wish to grow xate for seed we recommend that you contact Teakettle Enterprises (see Appendix 2 for contact details). Teakettle Enterprises already exports palm seed and may be able to buy seed from you.

If you are growing xate for leaf, cut the seeds off the plants. That way the plant will have more energy to make leaves.

Harvesting xate leaf

Trials at BBG and YCT have not yet reached the harvest stage. As the trials develop this manual will be updated for you to print from:

http://www.belizebotanic.org/xate manual

If you are growing xate, check regularly for updated versions.

The following section (beginning and ending with the paragraphs titled Harvesting cycle and Caring for leaves during harvest respectively) of the xate manual has been translated and reproduced, with permission, from Manual for the Cultivation of Xate which was written by Fernando Ramírez Ramírez and produced by Ford Foundation, ACICAFOC and Proyecto Sierra de Santa Maria, A.C.

Harvesting cycle

The xate farm will be ready for harvest at the end of 3 years, when the leaves reach the size required for sale. In the case of elegans 2 leaves can be harvested from each plant every 3 to 4 months. In the case of jade and fishtail one leaf can be harvested from each plant every 4 months.

The plants should never be left without leaves, in other words do not remove all leaves from a palm. This will cause the palm to immediately slow down its production of new leaves and could kill it. It is not recommended to cut the 2 or 3 youngest leaves on each plant. Following this method, depending on the vigour of each plant, 1 or 2 leaves can be cut every harvest cycle.

Harvesting method

To harvest xate leaves it is recommended that you use pruning shears (secateurs) rather than a knife or machete. Begin harvesting the oldest leaves on the palm. These will be lower down on the palm. The sizes of leaf for the commercial market are:

Leaves that are damaged, stained or perforated (have holes) are thrown away. This decreases the quality of the leaf and is less acceptable to buyers. Good leaves of the same size are wrapped flat together and tied in bundles of equal thickness (120-144 leaves). The stems of the leaves should be trimmed to the same length.

Big	Medium	Small
23 – 24 inches	16 – 17 inches	12 – 14 inches
61cm	43cm	35cm

Caring for the leaves during harvest

Do not allow the harvested leaves to become overheated. The bundles of moist leaves should be kept out of the sunlight. Store the harvested leaves under the shade of a roof with ventilation or, if possible, in a refrigerated storeroom.

Storing xate leaf

After harvesting sort your xate according to size and wrap in bundles of 100 leaves. Store the bundles in a cooler with the stems in water. Ship the leaves as soon as possible.

The coolers needed for storage and refrigerated trucks for transport can be very expensive. Collaborating on such purchases with other farmers that need to re-frigerate their goods will help to lessen these costs.

SELLING YOUR XATE

Work with a co-op to share transportation and shipping costs of xate and to be able to provide buyers with steady amounts of xate. This will help you get the best price. Your co-op should contact a fair trade organization like ACICAFOC or Rainforest Alliance who might help you to certify your xate and put you in touch with buyers.

For assistance in creating a co-op contact the Cooperatives Department in your district or area.

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Many thanks are due to Dr Sam Bridgewater of the British Natural History Museum, who is responsible for co-ordinating the Darwin Initiative xate project in Belize. It was through his suggestion that BBG and YCT have collaborated to produce this manual.

Lou Thomas of Teakettle Enterprises, Wilmot Garnett of IICA and James Mesh of Itzamna Society have also all contributed to the information in this manual.

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APPENDICES

Appendix 1: How to identify xate

For additional assistance go to www.belizebotanic.org/xate_id

While trying to use the simplest language here, we have put the botanical terms in brackets for those that would prefer them.

Xate come from a big group (genus) of palms called *Chamaedorea*, with more 80 different types (species). We are interested in the 3 types that called xate: fishtail, jade and elegans. Although these 3 palms look very different, they do all have some similar features:

Xate **DO**:

- ☑ grow wild in Guatemala, Mexico and Belize.
- ☑ have woody stems.
- ☑ have rings (nodes) around their stems, like sugar cane.
- ☑ have only one stem.
- ☑ have leaves that are either fishtail shaped (bifid) or feather shaped (pinnate).
- \blacksquare grow long, but normally fall over when they get to the height of a man.
- ☑ have smooth leaves.

Xate DO NOT:

- have spines on their stems or leaves.
- 🗵 normally grow higher than a tall man.
- Ave hairs or scales on their leaves (not tomentose or scaly).
- A have stems thicker than a mans thumb.
- have leaves that are fan shaped (palmate).

If the plant obeys all of the rules above, then it may be one of the 3 types of xate. To find out if it is one, ask yourself the following questions.

1) Do the leaves look like a cow's foot or a fish's tail (bifid)?

If so, it might be fishtail. Check the description for fishtail. If not, ask yourself:

2) Do the leaves have many little leaves (leaflets) on each leaf (pinnate)?

If so, it could be jade or elegans, ask yourself:

3) How many 'little leaves' (leaflets) are there on each leaf?

20 to 40 – Check the description for elegans

6 to18 - Check the description for jade.

Elegans (C. elegans):

They are single (solitary). They grow up to 7 feet (2m) tall. **Leaves:** They have 11-21 leaflets on each side of their leaves. **Flowers:** The middle part of the flowering structure is straight and it has 5-35 straight branches. The fruits are round and are black when ripe. The fruits are about as wide as a pencil (0.2 inches, 4-7 mm).



Fishtail (C. ernesti-augustii):

They are solitary. They grow up to 7 feet (2m) before falling over. Leaves: They normally have 5 - 8 leaves. The leaves are fishtail shaped: a wedge shape with an indent at the end that is about half the total length of their leaves. The leaves can be length of a mans forearm up to the length of his arm. They have 12-18 ribs or veins on each side of their leaves. Flowers: The central part of male flower is straight, but it has 13-25 branches that hang down. The female flowers normally just have one 'spike' that points straight up.

Watch out for the 'Little fishtail' !! (C. geonomiformis). Within Belize, the little fishtail only grows wild in the Toledo district. It has much thinner and longer leaves. The veins do not stick out very much. Flowers: The male flowers have 1-6 branches that hang down. The female flowers have 1-3 branches that stand up.

Jade (C. oblongata):

They are solitary. They normally only grow up to 7 feet (2m) before falling over. Leaves: It has 3-8 leaves. Each leaf has 3-9 leaflets. The leaflets are normally slightly longer than the length of a mans hand and 4 fingers wide. The flowers are straight with 6-25 branches.

Watch out for the 'False jade' !! (C. neurochlamys or C. pinnatifrons) The leaves of false jade do not have any commercial value. The stem of false jade has a white patch where the leaf attaches to the stem. The leaves are thinner in false jade than they are in jade.

Appendix 2: Contacts and Resources

Below is a list of companies and organizations and suppliers that may be of assistance to those interested in growing xate.

ACICAFOC (Asociación Coordinadora Indígena y campesina de Agroforestería Comunitaria Centroamericana)

This organization is involved in xate projects around Central America. Contact for seed supplies, to check the references of seed suppliers and for marketing and growing assistance.

Address: APDO Postal 2089-1000, San Josè, Costa Rica

Tel/Fax: (506) 240-6274, (506) 236-6217, (506) 241-1996

Email: info@acicafoc.net, oficinaregional@acicafoc.net; Web: www.acicafoc.net

Agriculture Department

Contact for xate cultivation advice and services

Belize City—Tel: 227-4979; Fax: 227-5867 Central Farm—Tel: 824-2129, 824-2131 Corozal—Tel: 422-2297 Dangriga—522-2514 Orange Walk—322-2149 Yo Creek—323-2019 Punta Gorda—722-2689

BAHA (Belize Agricultural Health Authority)

Contact for Import/Export permits, Phytosanitary certificates and to identify plant pests and diseases.

Address: 2 Mango Street, Belmopan, Cayo, Belize General Office, Belize City—224-5230; Fax: 224-4794 Administration, Belmopan—Tel: 822-0197, Fax: 822-0271 Central Farm—Tel: 824-4872; Fax: 824-4829

Email: baha@btl.net, foodsafety@btl.net

BBG (Belize Botanic Gardens)

Contact this xate project in Belize for xate cultivation advice.

Address: PO Box 180, San Ignacio, Cayo, Belize

Tel: 824-3101, Fax: 824-3301

Email: info@belizebotanic.org; web: www.belizebotanic.org

Belize Minerals Ltd.

Contact to obtain dolomite and application advice.

Address: 10 Front Street, Punta Gorda, Toledo, Belize

Tel: 722-2477; Fax: 722-2483

Email: dolomite@btl.net

BELTRAIDE (Belize Trade and Investment Services)

Contact for assistance on marketing and exporting your xate.

Address: 14 Orchid Garden Street, Belmopan, Cayo, Belize

Tel: 822-2832; Fax: 822-2837

Email:beltraide@belizeinvest.org.bz; Web: www.belizeinvest.org.bz/

CARDI (Caribbean Agricultural Research and Development Institute)

Contact for cultivation advice and assistance.

Address: PO Box 2, Belmopan, Cayo, Belize

Belmopan—Tel: 822-2602

Central Farm—Tel: 824-2934

Email: cardi@btl.net; Web: www.cardi.org

Cooperatives Department

Contact for assistance in developing a xate cooperative.

Belize City—Tel: 227-5826; Fax: 227-5867 Corozal—Tel: 422-2320 Orange Walk—Tel: 322-2179 Dangriga—Tel: 522-2104 Punta Gorda—Tel: 722-2689 San Ignacio—Tel: 824-2191

CREI (Citrus Research and Education Institute)

Contact for soil testing and to supply citrus oil.

Address: 9 Mls Stann Creek Valley Road, Stann Creek, Belize

Tel: 522-3585; Fax: 522-2686

Email: crei@belizecitrus.org

Forest Department

Contact for plant collection permits.

Address: 23/25 Unity Blvd., Belmopan, Cayo, Belize

Tel: 822-2079, 822-1524; Fax: 822-1523

Email: wildlifebelize@yahoo.com, conservation@mnrei.gov.bz

IICA (Inter-American Institute for Cooperation on Agriculture)

Contact for advice on organic cultivation.

Address: 31/33 Toucan Ave., PO Box 448, Belmopan, Belize

Tel: 822-0222, 822-1087; Fax: 822-0286

Email: iica@btl.net

Mike Benetti

Contact to supply organic fertilizers (bat guano, wood ash, seaweed, bonemeal, bloodmeal etc)

Tel: 601-5197

Ministry of Foreign Affairs

Contact for information about the Guatemalan xatero situation in Belize.

PO Box 174, Belmopan, Cayo, Belize

Tel: 822-2167; Fax: 822-2854

Email: belizemfa@btl.net ; Web: http://www.mfa.gov.bz/

Itzamna Society

Contact for advice on xate cultivation and forming a cooperative.

Address: c/o Maria Garcia, PO Box 75, San Ignacio

Tel: 820-4023

Email: jamesmesh2003@yahoo.com; Web: http://www.epnp.org/

Prosser Fertilizer and Agrotec Co. Ltd.

Contact to supply Neem-X and for soil testing.

Belize City—223-5384 Orange Walk—322-2915 Belmopan—822-2460 Corozal—422-3584 Big Creek—523-2375 San Ignacio—824-3046

Proyecto Sierra de Santa Marta, A.C.

Contact this Mexican xate project for seed supplies and advice on xate cultivation.

Address: Callejón Cuauhtémoc (antes Jesús Te ampare) # 10 A, Colonia Centro, Xalapa, Veracruz, México. C.P. 91000

Tel/fax: (228) 812 - 4449

Email: santamarta@prodigy.net.mx, Web: mx.geocities.com/pssm_ac/index.htm

Rainforest Alliance

Contact to see if they can assist you with sustainable seed suppliers or marketing help.

Guatemala

Address 1: 3a. calle 21-81 Zona 15 VH I, Guatemala, Guatemala Tel 1: (502) 2369-3121 , Fax: (502) 2369-5026

Email 1: Adolpho Lemus, alemus@smartwood.org, Regional Manager

Edgar Bamaca, ebamaca@smartwood.org, Technical Coordinator

Francisco Castillo, fcastillo@smartwood.org, Regional Office Coordinator

Mexico

Address 2: Av. Hidalgo 502, Centro, 68000, Oaxaca, Oaxaca, Mexico Tel 2: (52-951) 516-3244 or 516-5630 or 514-0711 Email2: Eva Fernandez, efernandez@smartwood.org, Regional Manager Julia Delafield, jdelafield@smartwood.org, Regional Office Coordinator Cesar Castaneda: ccastaneda@smartwood.org, Forestry Specialist

Web: http://www.rainforest-alliance.org/

Teakettle Enterprises

Contact for advice on farming xate for seed and to supply xate seeds.

Address: PO Box 177, Belmopan, Cayo, Belize

Tel: 822-0520; Fax: (305) 847-7612

Email: teaket@direcway.com; Web:http://www.teaket.com/

Toledo Cacao Growers Association

Contact for advice on organic farming or growing cacao with xate.

Address: PO Box 160, Main Street, Punta Gorda, Toledo, Belize Tel: 722-29921 Email: tcga@btl.net

Union Maya Itza

Contact this Guatemalan xate cooperative to supply seeds or for advice on xate cultivation.

Tel:(502) 861-2627; Fax: (502) 926-3272

Email: Secre_general@acofop.org;

Web:http://www.acicafoc.net/pymescomunitarias/mayaitza.php

YCT (Ya'axche Conservation Trust)

Contact this Belizean xate project for advice or assistance on xate or cacao cultivation.

Address: PO Box 177, Punta Gorda, Toledo, Belize

Tel/Fax: 722-0108

Email:yct_ffi@btl.net ; Web: http://www.yct.bz/

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Appendix 3: Growing xate under cacao

This appendix is a supplement to the xate manual for cacao farmers interested in growing xate under their mature cacao fields.

For those interested in growing cacao, contact the Toledo Cacao Growers Association (TCGA) or Ya'axche Conservation Trust. (See Appendix 2)

Why grow xate under cacao?

Growing more than one crop makes farming less risky. If one crop fails or the price drops you still have another source of income. If you are planting xate a good second crop to choose is organic cacao. Organic cacao already has a good market value in Belize, with a yearly average of about Bz\$560 per acre.

You can get more money out of the same piece of land if you grow xate and cacao together. You will also only have one area to weed, water and fertilise, making it easier to look after.

Is your land suitable?

Shade

To grow xate, your cacao should be mature and no less than 4 years old. You need between 60 and 80 % shade. If you have too much shade, prune your cacao so that there are no overlapping branches.

Alkaline soil

Xate grows best where there are limestone rocks near to the surface. If you do not see these, then test the acidity of your soil. (See Appendix 2 for who contact). If it is too acidic then you should add dolomite. (See Appendix 2 for who to contact).

Good drainage

If water stays on the ground's surface for more than a few hours at any time, your land does not drain well and is not suitable for xate.

Tips on growing xate under cacao

Spacing

Cacao trees are normally 12 feet apart in a plantation. It is recommended to plant three rows of xate between the rows of cacao. The xate rows should be 3 feet away from the cacao and two feet away from each row of xate. In this manner you can plant 7,128 xate plants per acre. If your rows of cacao are less than 12 feet apart you will not be able to plant as much xate.

Keeping the soil pH high

Before you plant xate under cacao, rake fallen cacao leaves away from the rows of xate. The leaves are too acidic for xate. Keep the leaves at the base of the cacao plants. After planting you will need to continue to rake the leaves away from the xate.

Organic concerns

If you already grow organic cacao, you know that you cannot use any chemicals that are not approved by the Soil Association. Doing so would cause you to lose your organic certificate and you will not be able to sell your cacao as organic. For more information on what you can and cannot use, contact the Soil Association. Approved fertilizers are animal manure, rice hulls, wood ash or any non-acidic or non-toxic rotting plant material.

For all other information on growing xate, see elsewhere in the manual.



Xate seedlings under cacao.