PLANT FACT SHEET

Metroxylon sagu Rottb.

GENUS *Metroxylon* **FAMILY** Arecaceae

COMMON NAMES Sago

EDIBLE PARTS AND USES

Edible parts: Starch, Cabbage, Palm heart, Grubs

The bud can be eaten cooked.
Sago starch can be processed from the pith.
The sap can be collected for a drink called “tuba” in the Philippines
Sago grubs are often cultivated and eaten.

DESCRIPTION

A clumping palm. It can grow up to 10 to 70 m high with a fat trunk (50-75 cm across). A palm can have 18-24 leaves which are 5-7 m long. The leaflets can be up to 100 per leaf and 50-160 cm long by 3-6 cm wide. After about 15 years the palm produces a large flower on top, then the palm dies. The flowering stalk can be 5-7 m long. The palm has suckers near the base. Some kinds have fertile seeds about 2-3 cm across on the flower. There is a complete range from very long thorns to short or no thorns on the leaf bases.

HABITAT

A tropical plant. A high water-table is tolerated or required by the plant. Temporary flooding does not appear to affect the crop but permanently flooded sites do not appear to be suitable. Because of the site requirements sago is almost always on locally level ground. The level ground can be a broad flat basin or flood plain or a local depression or stream edge in more dissected terrain. Sago seedlings are hardly harmed, by one rather saline flooding, per fortnight. Sago seedlings can probably withstand a salinity of EC = 10mmho/cm. The maximum altitude is about 1200 m but the optimum is between sea level and 800 m. Sago palms grow well in wet conditions. It can tolerate salty or brackish water. It grows better in well drained than in poorly drained conditions. It grows best with a temperature of about 25°C. It cannot tolerate temperatures below 17°C. It suits hardiness zones 11-12.
They are widely distributed in the central and southern Philippines. They are especially abundant in the fresh water swamps of the Agusan Valley in Mindanao. They also occur in Papua New Guinea and Indonesia.

PRODUCTION

Cultivation

Suckers or seedlings are planted in fresh water swamps or along creeks. Once stands are established in swamps, they continue to re-grow from suckers. Plants are thinned by removing some suckers. Some “seeds” will not grow but those that are fertile need to be planted as soon as they form because they loose their viability. Seeds

germinate within 3 weeks.
To plant sago, the planting site near a creek or in a damp place, is first cleared of trees and rubbish. Then a sucker of a suitable variety is chosen from an old sago clump. Often the fronds of the sucker are up to 3 m high. It is first checked to see if the sucker is old enough. Suckers ready for planting have a tough woody connection to the base of the old palm. It is also checked to see that fresh roots are being produced from the base of the sucker. A suitable sucker probably has fronds 3-4 m long and is about 1.5 years old. This is chopped through with an axe. The sucker is then simply taken to a new site and planted in a shallow hole 30 cm x 30 cm x 30 cm. If several palms are being planted, they should be about 7 m apart. The only other attention the new palm needs is an occasional weeding to cut back rubbish when it gets too thick. If a suitable seedling is available it can be replanted where it is wanted.

Several informants estimated that approximately 50% of transplanted suckers died. The suggested reasons were either choice of an immature sucker or climatic variability, especially drought. (Because of a general lack of awareness of disease organisms by Papua New Guinea farmers, these should not be ruled out.) If a seedling palm, as opposed to a sucker, was available for transplanting, it was considered to be equally suitable. Apart from walking time and site clearing, if needed, the work involved in planting a sago took about 10 minutes. Once planted the sago groves renew themselves through suckers and an almost permanent stand is produced.

The optimum spacing is considered to be 275 clumps per hectare. In most naturally established stands this would be thinner than that which occurs. It is also considered that for one clump thinning out suckers so that 3 suckers only of different ages were maintained to give optimum harvestable yield. Higher yields per trunk reduce the amount of labour involved in processing the pith.

The type of site chosen was just marginally too damp for gardening of annual vegetables, but not permanently inundated

It takes 12 to 15 years for a sago palm to grow big enough to cut down. Palms in poor soil grow more slowly.

Normally, one main trunk grows up, but several small suckers may shoot up around the base. Sometimes these suckers spread out and the space between the palms becomes crowded. Too much competition between clumps slows down the growth of the main palm, so the grove needs to be thinned out. This is very easily done. A small hole (10 cm x 10 cm) is cut with an axe into the top of the trunk of a sucker that is not wanted. This hole lets the sago beetle in and the sago grubs which develop quickly kill out the sucker. They don't get into the main palm or other suckers unless a hole is made. After a few months when the sucker is seen to be dead it can be split open to provide a feed of sago grubs.

There is no simple way of telling when a palm is ready to harvest. By experience people learn to recognise how big each variety should be before it is ready to harvest. If the palm were left too long it would produce a very large flower at the top and then die. This flower would use up all the starch in the trunk so that there would be nothing to harvest. As long as the flower has only started to grow and the seeds haven't yet formed on it, the palm is still suitable for harvesting. Sometimes when people are in a hurry to use a palm which isn't quite ready, they cut a hole to check how much starch is stored inside. But sago grubs must not be allowed to get in. It is considered that improvement in predicting the time for harvesting could be made by choosing trunks with at least 50 leaf scars on the trunk, with short internodes between the leaf scars and with a higher circumference.

After the palm has been cut and harvested another sucker grows more quickly than the others and becomes the new main trunk. It still takes about the same time to get mature. On some soil types such as where there is a clay pan and the soil is regularly flooded the palm can take up to 10 years longer to reach maturity.

Harvesting and Seed Production

Palms are ready to harvest after about 15 years. In swamps, about 10 to 60 trunks are ready per hectare each year. An average processing rate is 2.2 kg/hr of starch. A single trunk can yield up to 400 kg of sago.
First the sago palm is cut down. Mostly this is men's work. Then the bark is split off the trunk for about one metre along its length. Normally this bark is carefully laid out at the sides propped up by logs so that it both makes a seat for the person to sit on and a mat for the shredded pith of the trunk to fall onto. Sago in the trunk of the palm is all mixed up with the fibres of the plant. So this pith has to be shredded up into small pieces and the starch is then washed out. Special tools are made for pounding up the trunk. They need to be light, strong and with a hard stone (or metal) head. In areas where sago is the main food, sago is women's work. The woman sing special songs while they work. In areas where sago is not the main food, both men and women pound sago.

When a pile of shredded up trunk has been made, it is carried away to be washed. If a lump of the pith breaks off it is often chopped up with a bush knife or axe. A framework is set up for washing sago. It needs to be near water. If no convenient creek is nearby, a hole can be dug in the ground as this quickly fills with water in most sago places. The water needs to be clean or the starch gets a bad colour and taste.

The shredded pith of the palm is put into the bowl made by the fronds and the starch is washed out by banging it with a stick and pouring water over it. The filtered starch is allowed to settle out in a bowl. It is then dried and taken home

It takes about one hour to pound enough sago, then wash out the starch, sieve it and allow the starch to settle to give between 2 and 3 kilograms of starch.

Some people store sago for long periods. The sago to be stored is wrapped up in a tight bundle using leaves and bark. It is then buried in the mud. It will keep for one or two years. Sago which has been stored has a slightly different taste, but it is still quite good to eat. In some areas people store sago for up to 6 months by drying it above the fire or in the sun. When they want to use it they simply add water and cook it. The taste is little changed by this drying process. Some people store sago in the trunk of the palm by removing the flower just as it starts to develop and the sago in the trunk can be left for a year or more before harvesting. As well other people put the fallen sago log under water and store the unprocessed sago this way for several weeks.

The starch can be used to produce alcohol for motor fuel. One ton of starch produces about 73 gallons of alcohol.

Planting instructions

Sago

Tok Pisin: Saksak Scientific name: Metroxylon sagu Rottb.

The sago palm plant.

The sago palm grows up to 10 or 25 m tall and is nearly a metre across the trunk. It produces suckers around the base. After about 15 years the main trunk produces a very large flower at the top and then the trunk dies.

The centre of the trunk is filled with starch. The plant also produces useful building materials. The fronds are very good house roofing material.

The sago palm common in Papua New Guinea also grows in Indonesia and Malaysia.

Sago palms come in many varieties and these vary as to how many spines they have on the leaf bases. They also vary in may other ways such as the time to maturity and the colour of the starch.

Where does it grow?

Sago palms grow in the lower areas, up to about 1200 m.

It is very important in the Sepik and Fly river areas. In some of these areas it makes up most of the diet and in other coastal areas it may make up 50% of the diet. It varies around the country how much of the sago is planted and how much grows naturally. Sometimes where sago is of decreasing importance people just continue to harvest from sago groves that have been planted previously. Sago is also very important along the Gulf region.

Sago can also be important in some of the mid altitude zones. In the Southern Highlands in the Kutubu area (Foi and Fasu) sago is the staple food. In other lowland areas of the Kaluli, Onobasolo, Etoro, Hawalisi, Pole, Podopa and Samberigi peoples it forms an important supplementary staple but not the main food. In the Western Province at Kiunga it is the main food. It is eaten daily and palms are grown in the forest as well as along river banks.

Sago isn't planted just anywhere in these places, but is planted in special sago sites. Often these are along the banks of creeks, or in the bottoms of valleys such as the. At Kutubu, the sago groves fill up large swamps and in many areas sago is grown just behind the Nipa palm swamps.

Sago doesn't like to be in a very wet swamp and doesn't like to be in a dry place. Often sago sites are just slightly too wet for gardening.

Varieties of sago.

People in Hegiso village near Kutubu recognise and have names for at least 34 varieties of sago. These vary from having no thorns, up to ones with very long thorns on the bases of the fronds. The height, shape, toughness of the bark, and length of the fronds varies. Some palms mature quickly, some have many suckers and the taste and colour of the starch varies.

In other areas the people only recognise a few kinds of sago.

Planting sago.

In the Southern Highlands practically all sago is planted. One or two varieties will grow fairly easily from seed, but most kinds are planted from suckers. Even where large natural groves of sago occur people often still plant better varieties which give a higher yield of starch.

To plant sago, the planting site near a creek or in a damp place, is first cleared of trees and rubbish. Then a sucker of a suitable variety is chosen from an old sago clump. Often the fronds of the sucker are up to 3 m high. It is first checked to see if the sucker is old enough. Suckers ready for planting have a tough woody connection to the base of the old palm. This is chopped through with an axe. The sucker is then simply taken to a new site and planted in a shallow hole. If several palms are being planted, they should be about 7 m apart. The only other attention the new palm needs is an occasional weeding to cut back rubbish when it gets too thick. If a suitable seedling is available it can be replanted where it is wanted.

Growth of sago palms.

It takes 12 to 15 years for a sago palm to grow big enough to cut down. Palms in poor soil grow more slowly.

Normally, one main trunk grows up, but several small suckers may shoot up around the base. Sometimes these suckers spread out and the space between the palms becomes crowded. Too much competition between clumps slows down the growth of the main palm, so the grove needs to be thinned out. This is very easily done. A small hole (10 cm x 10 cm) is cut with an axe into the top of the trunk of a sucker that is not wanted. This hole lets the sago beetle in and the sago grubs which develop quickly kill out the sucker. They don't get into the main palm or other suckers unless a hole is made. After a few months when the sucker is seen to be dead it can be split open to provide a feed of sago grubs.

There is no simple way of telling when a palm is ready to harvest. By experience people learn to recognise how big each variety should be before it is ready to harvest. If the palm were left too long it would produce a very large flower at the top and then die. This flower would use up all the starch in the trunk so that there would be nothing to harvest. As long as the flower has only started to grow and the seeds haven't yet formed on it, the palm is still suitable for harvesting. Sometimes when people are in a hurry to use a palm which isn't quite ready, they cut a hole to check how much starch is stored inside. But sago grubs must not be allowed to get in.

After the palm has been cut and harvested another sucker grows more quickly than the others and becomes the new main trunk. It still takes about the same time to get mature.

On some soil types such as where there is a clay pan and the soil is regularly flooded the palm can take up to 10 years longer to reach maturity.

Sago does not like droughts and in some areas poor sago can be seen growing. In areas south of the fly river sago often looks yellow and to be growing poorly. Where there is drought, flowering is often delayed and plants sucker more than normal.

Harvesting sago starch.

First the sago palm is cut down. Mostly this is men's work. Then the bark is split off the trunk for about one metre along its length. Normally this bark is carefully laid out at the sides propped up by logs so that it both makes a seat for the person to sit on and a mat for the shredded pith of the trunk to fall onto.

Sago in the trunk of the palm is all mixed up with the fibres of the plant. So this pith has to be shredded up into small pieces and the starch is then washed out. Special tools are made for pounding up the trunk. They need to be light, strong and with a hard stone (or metal) head.

In areas where sago is the main food, sago is women's work. The woman sing special songs while they work. In areas where sago is not the main food, both men and women pound sago.

The normal method of pounding sago is to sit at the side of the trunk, hold the sago pounder in both hands and lift it above your head, then chop it down so that it just scrapes a thin layer off the edge of the trunk. When a pile of shredded up trunk has been made, it is carried away to be washed. If a lump of the pith breaks off it is often chopped up with a bush knife or axe.

Sago washing.

A framework is set up for washing sago. It needs to be near water. If no convenient creek is nearby, a hole can be dug in the ground as this quickly fills with water in most sago places. The water needs to be clean or the starch gets a bad colour and taste.

The washing framework is mostly built using the bottom section of the midrib of the sago fronds.

The shredded pith of the palm is put into the bowl made by the fronds and the starch is washed out by banging it with a stick and pouring water over it. The filtered starch is allowed to settle out in a bowl. It is then dried and taken home. Different things are used as the filter in the pounding framework. Some people use the fibrous coconut leaf sheath, others make a matting from the sago palm, pieces of coarse woven cloth are used and the fibrous pupae case of some insects is used in some places.

It takes about one hour to pound enough sago, then wash out the starch, seive it and allow the starch to settle to give between 2 and 3 kilograms of starch.

Sago storage.

Some people store sago for long periods. Near Mt Bosavi, most Kaluli people always have some sago in storage. People near Erave and Woposali occasionally store sago. People at Kutubu don't seem to store sago often. The sago to be stored is wrapped up in a tight bundle using leaves and bark. It is then buried in the mud. It will keep

for one or two years. Sago which has been stored has a slightly different taste, but it is still quite good to eat.

In some areas people store sago for up to 6 months by drying it above the fire or in the sun. When they want to use it they simply add water and cook it. The taste is little changed by this drying process.

Some people store sago in the trunk of the palm by removing the flower just as it starts to develop and the sago in the trunk can be left for a year or more before harvesting. As well other people put the fallen sago log under water and store the unprocessed sago this way for several weeks.

Sago cooking.

In some areas people simply fill up a bamboo tube with sago starch and bake it near the fire. Sometimes sago is cooked wrapped in leaves. The bamboo tube is then split open and the sago eaten, along with greens and other foods. Occasionally people add leaves such as "tu-lip" leaves, or okari nuts. There are lots of other interesting ways sago can be cooked and used, but people in some areas don't seem to use these. People in some areas make a sago porrage by putting sago into boiling water.

Extra food from sago.

At the top of the trunk of a sago palm there is a bundle of young tender undeveloped leaves. This is often called the palm "cabbage". It can be cut out and cooked and eaten. It is good food.

Sago grubs, and sago starch go together. Sago grubs are grown in several different ways in sago areas. Normally the top and bottom sections of the trunk are left for sago grubs to grow in as these sections have less starch and more fibre and are therefore harder to work. As already described, sago grubs are grown in suckers that are being killed. If too many palms are ready at one time, the extra ones are cut down for grubs to grow in. Sometimes a poor tasting or very fibrous palm is left for grubs to grow in. Particularly near Bosavi, sago grubs are also cultivated in another palm called the fishtail palm (waiyo). It takes about 2 months for a harvest of grubs from the time the beetles are first let in.

Sago grubs are the larvae of a beetle. They are good food.

Sago as food.

Sago is a very good energy food. But it has very little of the growth food (protein) or health food (vitamins and minerals). Therefore in sago areas it is particularly important to pay special attention to the other foods that make up the diet.

The food value of 100 g of the food eaten is:-

	moisture	energy	protein	calcium	iron	proVitA	provitC
	%	cals	g	mg	mg	µg	mg
starch	20-45	285	0.2	30	0.7		
grubs	70.5	181	6.1	461	4.3		
cabbage							

Yield and work required.

One sago palm may last an average family (6 people) for 4 weeks. It is worked in sections of 60 cm to 100 cm of the trunk and 6 to 8 of these sections can be got from one palm. A typical routine would be for a woman to spend 3-4 hours pounding and washing one section and this would produce about 20-25 kg of starch which would last the family for about 3 days.

NOTES

There are 8 Metroxylon species.
Sago
Sago is the staple food in the Kutubu area and is an important subsidiary staple in a number of the lowland areas. The sago palms are planted from suckers into land just slightly too wet for gardening. The palm matures after about 15 years and is cut down. The starch inside the pith of the trunk is removed by shredding the fibrous pith then extracting the starch by washing and pounding the fibre. A palm is processed in sections about 1m long and this provides the sago for a family for 2 or 3 days. A palm lasts for about 4 weeks. An important supplement is the sago grubs that are cultivated in the end sections of the palm and in unwanted palms. The palm shoot is edible.

Sago growing

The best conditions for growing sago are an average temperature of at least 26°C, a relative humidity of at least 90% and an irradiance of about 9MJ/m2 per day.

Daily flooding is harmful to seedling growth.

Sago palms grow best on mineral soils with a high organic matter content (up to 30%). As water becomes more brackish, sago palm often border on stands of more salt tolerant nipa palm. The water table should not be lower than 50 cm.

Root suckers about 1 year old with a basal diameter of 10-15 cm are severed from the parent palm. About 15 cm of runner are left on the sucker to serve as food reserve. The cut wound is rubbed with wood ash to prevent rots. Roots need to be kept from drying out. A spacing of 7m x 7m is suitable in a 30 cm deep hole. Suckers should be staked and shade provided. One sucker per 1.5 years should be allowed to develop.

For maximum starch production trunks are cut between flower initiation and the ripening of the fruit. An ongoing yield of about 85 trunks per hectare of 180 kg each per year can be achieved but a more normal yield from minimally managed stands is 50 trunks per hectare producing 10 t/ha.

Processing involves three stages.
1. Separation of bark and pith.
2. Pulverisation of the pith.
3. Separation of starch from pith.

Sepik estimate as 500,000 ha.

Sago plants become permanently stunted as the swamps become deeper. Also stunted sago occurs on sites where the water table sinks low enough to cause drought stress. These kinds of sago sucker strongly.

PICTURES



Credit: Food Plants International (Bruce French)



Credit: Food Plants International (Bruce French)



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