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A PRELIMINARY GUIDE TO PRODUCE VANILLA IN PAPUA NEW GUINEA

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ABSTRACT

Preliminary information on vanilla production intended for vanilla growers in Papua New Guinea is outlined below. It reports on trails done at Kerevat Lowland Agriculture Experimental Station, Pacific Islands countries where vanilla is grown, and experiences of farmers on the Gazelle Peninsular.

Vanilla is a tropical climbing plant belonging to the Orchidaeceae *family. Two species are of economic importance,* Vanilla planifolia and V. tahitensis. *Vanilla is native to Central America and was introduced to Papua New Guinea and other Pacific Islands during the 19th century. It grows well under moist, humid and shady conditions from sea level to about 600 m altitude. It requires light fariable and well watered soil but not water logged and drained areas. When farming Vanilla, it is advisable to grow on support trees which will also provide shade. Propagation is by cuttings of 80 - 100 cm. Cuttings should be planted at 2.5 m between and within rows depending on spacing of shade trees. Pollination is by hand and to produce commercially viable beans it must be done carefully.*

KEWORDS: *vanilla, vanillin, alternate cash crop, propagation, pollination, curing*

INTRODUCTION

This article is prepared due to a popular demand for information by vanilla growers and people involved with vanilla in Papua New Guinea (PNG). It is important to note here that research is being carried out at the Lowland Agriculture Experimental Station (LAES at Kerevat in the East New Britain Province (ENBP). The information made available here is only preliminary. Some suggestions in this report may change as more information become available. However we believe that information provided here will be useful to farmers and those involved with the crop now, rather than waiting for a full information package which may take a few more years to be released.

Information used here is based on work done by vanilla growing countries of the South Pacific, farmers' experiences on the Gazelle Peninsula in ENBP, past experiences in PNG, and preliminary results of current research by LAES. Relevant literature and experiences have also been consulted.

Vanilla belongs to the *Orchidaceae* family, and grows by climbing on trees. Over 100 species of this genus are reported (Pureglove 1968) but only two are known to be of commerical importance.

They are:

1. *Vanilla planifolia* (syn. *fragrans*)
2. *Vanilla tahitensis*

Vanilla planifolia and *V. tahitensis* are the most commonly grown of the tree species. A third species, *V. popona* is said to be of commercial importance but it is seldom used.

Vanilla is native to Central America (Mexico and Guatemala). It was traditionaly used for flavouring a beverage drink derived from cocoa beans by the Aztecs of Central America. Today vanilla is used mainly in the food industry. The chemical of importance is vanillin. Cured vanilla beans contain 1-3% vanillin. The extract is then used in flavouring ice cream, chocolate beverages, cakes, custard, puddings and other confectionery.

The two species of vanilla grown in PNG are *V. planifolia* and *V. tahitensis*, where the principal

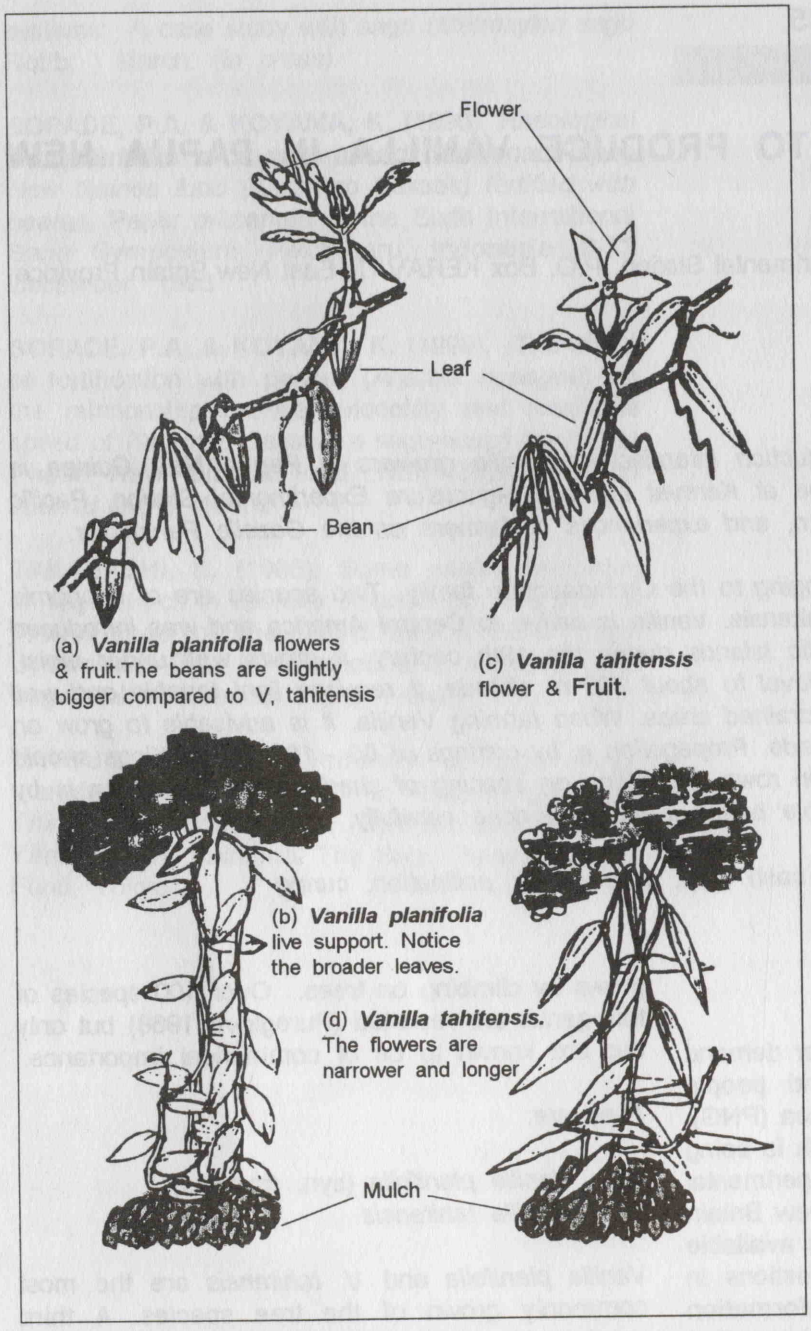

Figure 1: **Illustration showing differences between the two vanilla species, *V. planifolia* and *V. Tahitiensis.***

vanilla of commerce is *V. planifolia.* Material of both of these is maintained at LAES. It is easy to tell the difference between the two types when grown together. *Vanilla planifolia* is the more vigorous type, with thicker stem and larger leaves compared to the thiner stem, longer and narrower leaf of *V. tahitensis* (Figure 1).

Vanilla was introduced to PNG some time during the European colonization of the pacific in the 19th century. Other introduced crop species (cocoa, coffee, etc.) have been in the past cultivated on large scale and subsequently gained increasing importance. Vanilla remained only a curiosity and insignificant crop. Except on one plantation on Bougainville (Bym 1984) vanilla was not cultivated commercially until recently.

Compared to other cash crops in the agriculture sector, the vanilla industry is small and insignificant, but is likely to expand. Unfavourable and frequent price fluctuations of major commodity crops and the long fall in the prices of major commodity crops in the recent past has forced us to look at other cash crop possibilities. Vanilla is one of several crops being investigated by LAES to determine its potential as an alternative cash crop. So far, it has shown to have good potential and is quickly becoming a significant minor alternative cash crop. Increasing demand for information on vanilla production and planting material is showing that a small vanilla industry could emerge.

ENVIRONMENT

Vanilla grows best in hot and moist conditions with temperatures ranging from 21°C - 32°C. It grows well from sea level to about 600 meters. A distinction is made later in the paper on the suitablity of different species at different altitudes. An evenly distributed annual rainfall of 2000 mm - 3000 mm is desirable. However a drier period of 3 - 4 months with less rain is essential. This condition checks vegetative growth and induces flowering. Vanilla does not like excessively drained soils nor does it tolerate water logged conditions. It does best on light friable and humid soils. Additional information regarding environment can be obtained from a booklet on how to assess land suitability for vanilla (Venema, 1992) from Department of Agriculture and Livestock (DAL), Land Utilization Section.

Research work at LAES and farmer experience in

PNG is showing that *V. planiforlia* flowers and produces well at elevations above 300 meters and *V. tahitensis* thrives in the coastal areas. It is therefore wise to grow *V. tahitensis* at elevations below 300 meters and *V. planifolia* at elevation between 300 and 600 meters. Because of this it is important to know the altitude of the area you wish to grow vanilla.

PROPAGATION

Vanilla is grown from stem cuttings or vines. Any part of the vine can be used but must be taken from a healthy and vigorous plant. Cuttings ranging from 50 cm to 3 meters have been reported to be used but cuttings measuring 80 cm to 100 cm are preferred. Cuttings less than this will take longer to come into first flowering. Material longer than 100 cm would be seen as wasting material. LAES recommends apical stem cuttings measuring between 80 cm - 100 cm.

SOURCE OF PLANTING MATERIAL

There are several places where planting material can be obtained. Growers have mainly been obtaining their vanilla cuttings from Vunakanau Plantation near Rabaul in the past. There are also several other suppliers on the Gazell Peninsula selling cuttings at the present. Requests are either put directly to suppliers or Alternative Crops Extension and Development Program (ACEDP) Co-ordinator in Kokopo who then co-ordinates the buying and selling. People on the PNG north coast can now obtain their planting material from DAL's ACEDP Co-ordinator in Madang. Material is also now available from Bubia Agriculture Research Station near Lae in the Morobe Province.

LAES has been supplying cuttings and will continue to do so. Prices vary between suppliers and range from K0.50t to K2.00. Material at LAES is selling for K0.50 per cutting.

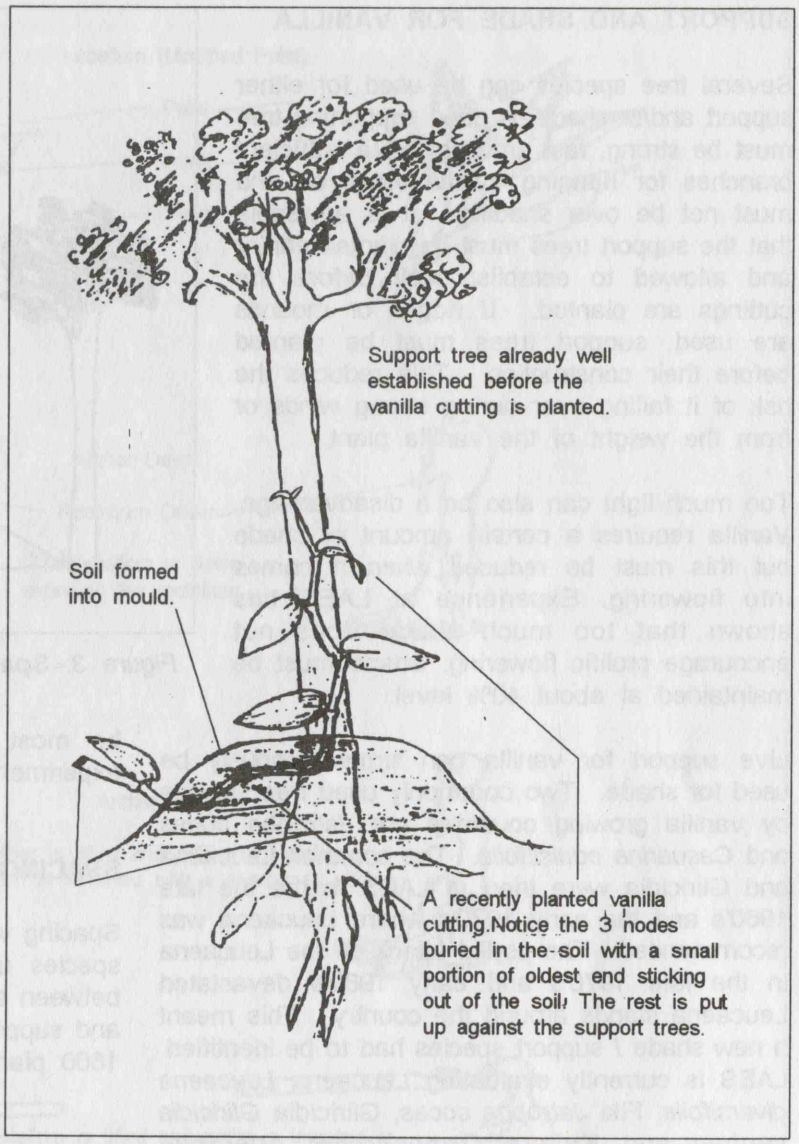

Figure 2: **Planting of a vanilla cutting**

PLANTING

Vanilla cuttings are planted next to the support tree that should have been already planted and well established. A small long hole of up to 10 cm deep and 30 cm long and wide enough to fit the cutting easily must be made. The cutting is then planted as shown in Figure 2.

It is important to plant the cutting with at least two nodes buried in the ground. The end of the older portion of the cutting must be left sticking out of the ground. This will allow for healing of the wound where the material was originally cut. The other half to two thirds of the cutting can be left standing upwards or lying on the ground close to the support tree *(Figure 2).*

SUPPORT AND SHADE FOR VANILLA

Several tree species can be used for either support and/or shade. A good supporting tree must be strong, fast growing, have sufficient branches for hanging vanilla vines on and must not be over shading. It is advisable that the support trees must be planted earlier and allowed to establish well before the cuttings are planted. If ridges or mounds are used, support trees must be planted before their construction. This reduces the risk of it falling over during strong winds or from the weight of the vanilla plant.

Too much light can also be a disadvantage. Vanilla requires a certain amount of shade but this must be reduced when it comes into flowering. Experience at LAES has shown that too much shade does not encourage prolific flowering. Shade must be maintained at about 40% level.

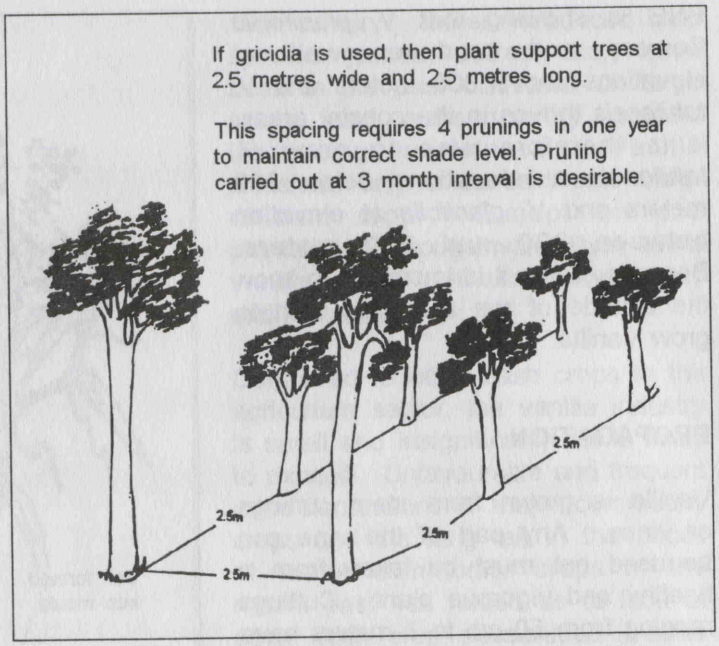

Figure 3. **Spacing of support and shade trees**

Live support for vanilla can simulataneously be used for shade. Two commonly used tree species by vanilla growing countries are *Jatropha cocas* and *Casuarina equisitfolia*. The common Leucaena and Gliricidia were tried at LAES in the the late 1960's and the early 1970's where Leucaena was recommended. The psyllid attack on the Leucaena in the late 1970's and early 1980's devastated Leucaena stands around the country. This meant a new shade / support species had to be identified. LAES is currently evaluating Leucaena *Leucaena diversifolia,* Fiki *Jatropha cocas*, Gliricidia *Gliricidia sepium* and Kalava *Ormocarpum orientale*. Gliricidia has not been sufficiently trialed to be recommended as shade for vanilla. However, many farmers are reported to be using it more than any other species at present, therefore it should be used until a suitable species is identified and recommended.

Farmer experience on the Gazelle Peninsula has shown that Gliricidia planted at 3m x 2m grows well. If spacing of 2.5m x 2.5m is given, the widest spacing experimented with Gliricidia at present, then it must be pruned 4 times a year at 3 months interval. This pruning arrangement should maintain vanilla shade at about 40 - 50% at all time. Other shade tree species being trialed will probably have slightly differenct shade management practices. Farmers are also trailing their own choice of shade and support trees. We do not discourage this as they may find other species suitable for their environment. We would be most interested to know this so we can experiment with the species here at LAES.

SPACING

Spacing varies with the type of shade/support tree species used. Vanilla is being trialed at 2.5 m between and within rows using Gliricidia as shade and support tree. This spacing arrangement gives 1600 plants per hectare (*Figure 3.)*.

FLOWERING

Management and environment affect flowering. Under LAES conditions vanilla flowers throughout the year with large monthly fluctuations. Rainfall has a big effect on flowering with peak flowering during the lowest rainfall month of the year. It takes *V. tahitensis* and *V. planifolia* up to 2 and more than 2 years respectively to first flower. This has also been commonly reported by other vanilla growing countries. The earliest first flowering recorded at LAES is 18 and 29 months for *V. tahitensis* and *V. planifolia* respectively.

To induce flowering, up to 10 cm of the vine apex must be plucked or pinched off 6 to 8 months before the flowering season starts in June and continuous through to October.

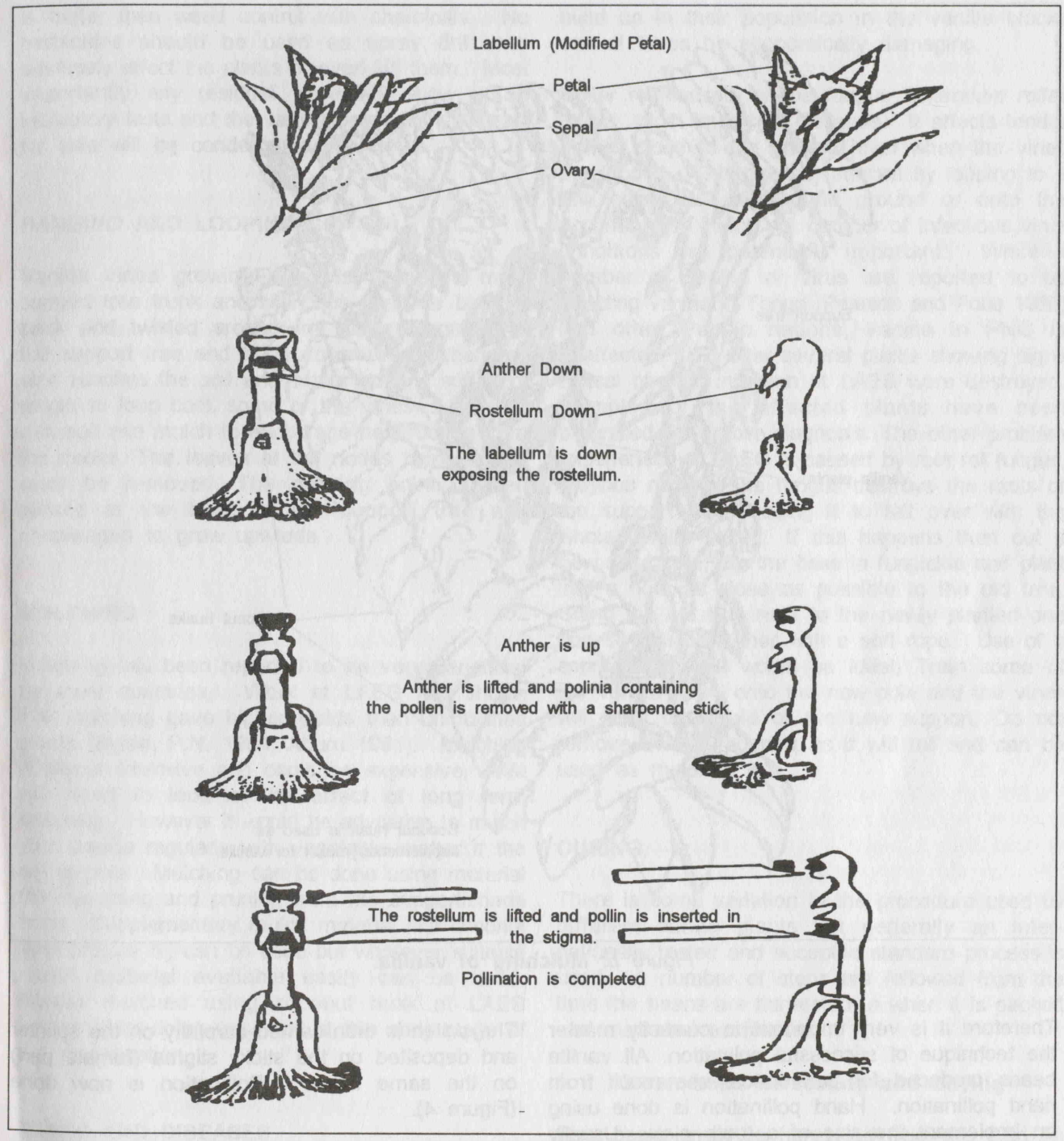

Figure 4: **Vanilla flower and steps leading to complete pollination**

POLINATION

Pollination is a process where a female part of a plant is fertilized by the male part or the pollen in order for it to produce fruits. A single plant may bear many flowers that individually remain open for about 24 hours during which they must be pollinated. Natural pollination of vanilla is very rare. In Mexico the Milipona bee and humming birds are reported to be reponsible for natural pollination (Stace 1961). These bees are not known to be present in PNG.

Pollination in vanilla is very important. The number of beans produced is directly related to how successfully fertilization is carried out. If successful pollination is carried out on 6 of the 10 flowers pollinated then the farmer will only get 6 beans.

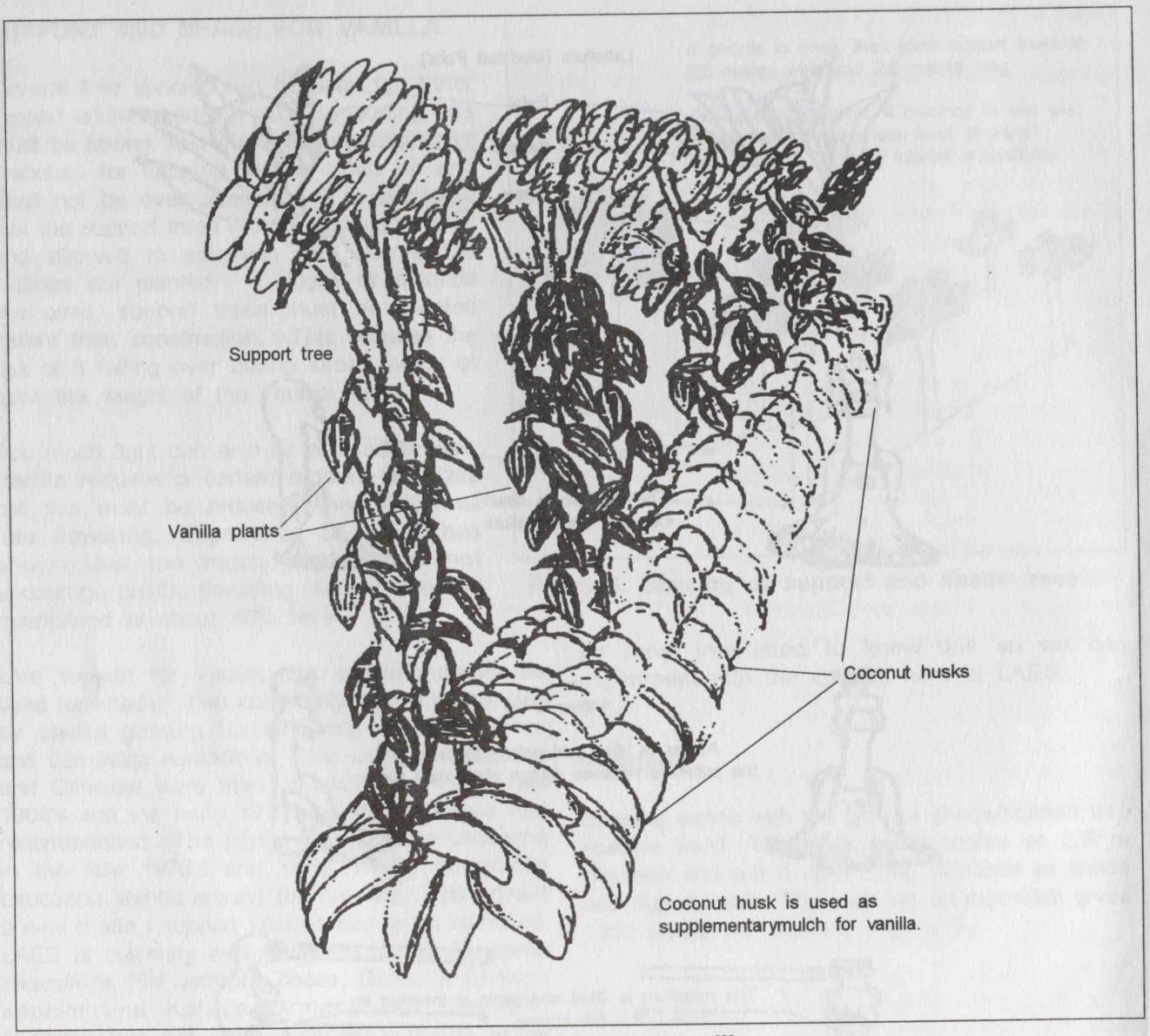

Figure 5: **Mulching of vanilla.**

Therefore it is very important to correctly master the technique of successful polination. All vanilla beans produced for commerical use result from hand pollination. Hand pollination is done using an implement the size of a tooth pick. Usually bamboo splits are used. Reports of natural pollination in PNG is being investigated. An ant seems to be the pollinator (Annon, per. com.). LAES would be most interested in any further reportings of natural pollination of vanilla in PNG.

To pollinate, the flower is held with a thumb and the pointer on one hand and the part holding the male and female parts is pushed down with the fingers on the other hand exposing the cavity containing the pollen (male part). This is pushed upwards with a splinter and the pollen collected. The pollen is then carried carefully on the splinter and deposited on the sticky stigma (female part) on the same flower. Pollination is now done (Figure 4).

If pollination is sucessfully done, the flower will remain intact and slowly dry up with the development of the vanilla bean. If the flowers drop off within a week then successful fertilization has not occured.

WEEDING

While clean weeding of vanilla may not be necessary it is important to control other climbers and weeds. Hand weeding with knives and spades

is better then weed control with chemicals. No herbicides should be used as spray drift can adversely affect the plants or even kill them. Most importantly any residual trace will show up in laboratory tests and the vanilla batch being offered for sale will be condemmed by buyers.

HANGING AND LOOPING

Vanilla vines growing upwards from the main support tree trunk and branches must be brought back and twisted around the lower branches of the support tree and hung downwards. When the vine reaches the soil and when there is sufficient length to loop back some of the vines is covered with soil and mulch to encourage new rooting from the nodes. The leaves at the nodes being buried must be removed. The growing point is then placed at the base of the support tree and encouraged to grow upwards.

MULCHING

Mulching has been reported to be very beneficial by most countries. Work at LAES has shown that mulching gave higher yields than unmulched plants (Byren, P.N. 1984; Aburu 1981). Mulching is labour intensive and could be expensive. We will need to look at the effect of long term mulching. However it would be advisable to mulch your vanilla regularly with vegetable matter if the soil is poor. Mulching can be done using material from weeding and pruning from the support/shade trees. Supplementary mulch material like coconut husk *(Figure 5.)* can be used but whatever suitable mulch material available easily can be used. Vanilla mulched using coconut husk at LAES seems to be doing very well at this early stage of our investigation.

PESTS AND DISEASES

Two minor pests could be of economic importance. They are *Hypochlorosis danis milo* GrSm. Syn. *Pseudonotis danisoides* Nicer and *Adoxophyes* spp. These small caterpillers are in the same large group of insects as the butterflies. During their larval stage they damage the young flowers and capsules by chewing on them. Avoid use of insecticide. The numbers are usually too small to warrant any spraying therefore it should be kept in check by their natural predators. Gray weevil has also been seen chewing on the vines. The build up in their population in the vanilla blocks can at times be economically damaging.

Collar rot caused by the fungus *Sclerotium roflsii* is the most important diesease. It affects tender leaves close to the ground level when the vines are looped. This can be reduced by looping to a few centimetre above the ground or onto the coconut husk mulch. A number of infectious virus conditions are potentially important. While a number of strains of virus are reported to be affecting vanilla in Tonga (Pearson and Pone 1988) and other Pacific nations, vanilla in PNG is unaffected. However several plants showing signs typical of viral infection at LAES were destroyed. Samples of the affected plants have been organized for proper diagnosis. The other problem experienced at LAES is caused by root rot fungus, *Phlynus noxius*. The fungus destroys the roots of the support tree causing it to fall over with the whole vanilla plant. If this happens then cut a new stout pole, dip the base in fungicide and plant into a hole as close as possible to the old tree. Stand the old tree next to the newly planted one and tie them together with a soft rope. Use of a copra bag twine would be ideal. Train some of the vanilla vines onto the new pole and the vines will soon take hold of the new support. Do not remove the old support as it will rot and can be used as mulch.

CURING

There is some variation in the procedure used by different curing plants but generally an internationally tested and accepted standard process is used. A number of steps are followed from the time the beans are harvested to when it is packed and marketed as follows:

1. Green bean harvesting and buying

Ripe beans must be harvested from the field on a certain day during the week and brought to the buying points, usually not far from the vanilla blocks. The beans must be bought the same day and brought to a central curing plant.

2. Boiling and sweating

Boil water to 63°C in a 44 gallon drum. Progressively dip all the beans in the warm/hot water for 3 minutes only. Water temperature must be maintained at 60°C - 63°C. After 3 minutes take out the beans and wrap in blankets and put

away in sweating boxes for 72 hours.

3. Drying

Sweated vanilla is then subjected to a series of drying processes to reduce moisture content. The beans would normally be sun dried but can also be dried indoors during wet days. Beans are brought out daily, between about 8.00 am and 3.00 pm and spread out on black palatine sheets and allowed to dry. Drying must be done daily for a period of 4 weeks. Turn the beans every two hours to ensure that all beans are equally exposed to the sun. At the same time select the beans which are ready for further in-house drying.

Sun dried beans should be further dried in a spacious and well ventilated house for two weeks

4. Grading and conditioning

It is of prime importance that grading is done by only one person. This person must possess absolute knowledge of what is required.

During drying, identify and select properly dried and good beans for grading. Separate split from unsplit beans. The remaining beans can be moved for further grading.

Vanilla is graded either as marketable or rejected material. A further grading of marketable material is done with A grade material. They are divided into unsplit and split. All low grade and unmarketable material should be disposed.

Each grade is then packed into 200 gram bundles. The bundles are placed into air-tight containers for conditioning. The beans remain in the containers for a period of 5-6 months but exposing them to air for several hours each month. Vanilla aroma develops during conditioning.

5. Packaging and marketing

After conditioning, the beans are prepared for marketing. The cured vanilla is packed in waxed plastic bags to a predetermined weight and put into maturing boxes. It is common to pack one plastic bag to 10kg. Several bags of these are further packed into strong cardboard boxes or into sealed tin boxes for export. The packed material can be stored for up to 1 year while awaiting marketing.

Considerable amount of skill and experience is required to cure the beans to the required marketable standard. Processing for overseas market should be restricted to people who posses correct knowledge in carrying out the curing process properly.

A new curing process is being planned for trial by the authors at LAES. Information will be made available after completing the trail.

TRADE AND MARKETING

Madagasca, Indonesia, the Comoros and the Reunion are at present the biggest producers and exporters of vanilla (Vinning 1992). In the early 1900's Tahiti was the biggest producer and exporter of vanilla. At present Tonga is the biggest producer and exporter from the South Pacific region but the volume produced is only very small compared to the four main producers. PNG has only started growing vanilla in the last couple of years.

Germany, France and USA import about 90% of the world's vanilla. About 50% of this is consumed in the ice cream industry. Export markets for PNG are not yet well established. The few established producers aim for niche markets. Meanwhile samples are being sent to posssible buyers abroad for their acceptability assessment.

The price of natural vanilla fluctuates from year to year like other commodity crops. However it is the most stable of all spice crops with respect to price fluctuations. For example, between 1983 and 1988, price fluctuation on average was 19%; the lowest of all spice crops (Vinning 1992). Over the last year the price of cured vanilla averaged at US$70.00 per kg. Specialist niche market prices are believed to be higher.

Papua New Guinea has very little hard data on marketing so far. At the end of 1992 and the beginning of 1993, cured vanilla was sold at K40.00 per kg for *V. tahitensis* and K68.00 per kg for *V. planifolia* (DAL, ACN 1992).

CAUTION

There is growing interest at present in vanilla but farmers should be cautious. First the supply and demand analysis has shown that the rate of increase in supply is greater than the demand. There is a possibility of over supply leading to a

price fall in the near future. The second reason may be associated with social organization and habits of the PNG people. The PNG society based on non-monetary activities may not be favourable for a viable long term vanilla industry.

Vanilla should be encouraged only as an alternative to already existing cash crops. Following points must be taken into account by people involved with vanilla production.

1. **Grow an area you know you can comfortably and economically manage**

Farmers should restrict themselves to growing blocks of 1 hectare and less because it could be quite labour intensive. It is better to have a small very productive block of vanilla than to have a large poorly managed unproductive block.

2. **Obtain correct information**

Obtain correct information from the right people and places on agronomic practices for vanilla. For example, there are two types of vanilla being grown in PNG. One of them grow and flowers well on the coast (up to 300 meters). The other does well at elevations greater than 300 meters. It is important that you grow the right type for your environment.

3. **Curing and marketing**

The quality of vanilla is affected during harvesting and curing. Vanila quality is easily reduced if correct procedures are not followed. It is advisable at this stage to only let people who have the right skills and expertise to be involved in this stage of the process. The survival of a possible PNG vanilla industry rests upon producing only the very best quality.

4. **Market access**

Do not grow vanilla where there are no green bean buyers. Make sure there is an easily accessible local market before you go into vanilla production. If there is none around it is advisable not to grow the crop.

5. **Maintain top quality**

It is vital that the highest standards are maintained at all levels of production. Obtaining information from the proper places will definitely help.

SOURCE OF INFORMATION

People seeking information should contact:

The Team leader
National Agriculture Research Institute
Wet Lowland Islands Program
Post Office Box 204
KOKOPO
East New Britain Province

Telephone: 675 9839145 675 9839200
Fax: 675 9839129

The Program Leader
National Agriculture Research Institute
Wet Lowland Mainland Program
Post Office Box 1639
LAE
Morobe Province

Telephone: 675 4751033
Fax: 675 4751034

The Officer-in-Charge
Stewart Research Station
PNG CCRI
P. O. Box 642
MADANG
Madang Province

Telephone: 675 8521651, 675 8521653
Fax: 675 8521657
Email: srs.ccri@global.net.pg

Also farmers should not hesitate to seek assistance from their local Agriculture Extension Officers'. They should be consulted before seeking help from outside of the farmer's local area.

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Note:

We have a pidgin version available for interested farmers not conversant in english.

Mipela igat dispela toksave bilong groim vanilla long tok pisin tu. Sapos yu laik kisim wanpela copi, yu mas raitim pas ikam long:

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