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National Agricultural Research Institute

Pepper Cultivation

NARI TOKTOK
KER010E

Revised
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THE INSTITUTE

The National Agricultural Research Institute (NARI) was established by an Act of the National Parliament of Papua New Guinea in July 1996 as a publicly funded, statutory research organisation, to conduct applied and development oriented research on food crops, alternative food and cash crops, livestock and resource management issues. Besides applied and adaptive research, NARI is responsible for providing authoritative technical, analytical and diagnostic services and up-to-date information to the entire agriculture sector in PNG. The major targets are the smallholder semi-commercial farmers in the country.

The mission of NARI is to contribute, through applied research and technical services, to the development of the agriculture sector and realisation of the national goals by identifying, adapting and transferring agricultural technologies and information, so as to:

- Enhance the productivity, efficiency and sustainability of the smallholder agriculture, and
- Improve farmer income, food security and welfare of Papua New Guineans and the nation.

This toktok was written by Tio Nevenimo, NARI Wet Lowlands Islands Programme in July 2003 (revised in January 2004). The material presented is based on the best information available at the time of printing (January 2004).

Medium management of pepper in US$

1 ha pepper. Spacing 3 x 3 m; paid labour (US$ 2.50/ day); fertiliser use and other inputs; processing equipment based on > 5 ha. Price US$ 2/ kg

Year	1	2	3	4	5	6	7	8	9	10	Total
Prod. kg (dry)	0	0	300	1000	2000	2500	2500	2500	2500	2500	15,800
Income	0	0	600	2000	4000	5000	5000	5000	5000	5000	31,600
Expenditure	1300	290	490	720	1110	1330	1330	1330	1330	1330	10,560
Profit/loss	-1300	-290	110	1280	2890	3670	3670	3670	3670	3670	21,040

Note 1: After the 10th year, production continues at the same level for another 10 years.
Note 2: Paid labour for upkeep, harvesting and leaf pruning (from year 5)
Note 3: Increasing fertiliser use from 2nd - 6th year according to production increase.
Note 4: Equipment and tools for upkeep, harvesting and processing US$ 10 per year/ ha (average).

Low level management of pepper in US$

1 ha pepper. Spacing 3 x 3 m; unpaid labour; no fertiliser; no other input; price US$ 2/ kg

Year	1	2	3	4	5	6	7	8	9	10	Total
Prod. kg (dry)	0	0	100	200	300	500	500	500	500	500	3,100
Income	0	0	200	400	600	1,000	1,000	1,000	1,000	1,000	6,200
Expenditure	998	10	10	10	10	10	10	10	10	10	1,088
Profit/loss	-998	-10	190	390	590	990	990	990	990	990	5,112
Labour (day)	18	46	39	42	45	51	51	51	51	51	445

Note 1: After the 10th year, the production continues at the same level for another 15 years.

Note 2: Expenditure for year 1 includes paid labour for field preparation and planting. Other years for small tools and equipment.

Note 3: Labour includes upkeep and harvest.

Note 4: At 'full' production: profit/labour (day) = US$ 19.41

Cultivation of Pepper

Pepper is one of the oldest and most important spices in the world. It is produced from the fruit of a vine.

Common name: Black or White Pepper
Scientific name: *Piper nigrum*

Varieties

Several varieties are cultivated internationally: India - Paniyoor, Malaysia – Kuching, Indonesia - Belantung and Jambi (Sumatra), PNG - source probably from Indonesia or Malaysia.

Material used for propagation

Cuttings from upright shoots.

Sources of planting material

NARI Wet Lowlands Islands Programme at LAES Keravat, ENBP.

Altitude

Between 0 - 500 m above sea level.

Soil

Well-drained sandy loam, loam, or loamy clay. Groundwater table below 1 m. Topsoil should be rich in organic matter.

Temperature
Wet tropical lowland temperature 23 - 31 °C.

Rainfall
2,000 - 2,500 mm annually with a maximum of three months period (with less than 100 mm rainfall/month).

Nursery
Use three-nodes cuttings from upright shoots only. A node is the swollen part of the stem where the leaf base attaches. Plant one node in soil in raised bed with mixture of compost and sand (sandy soil). Heavy shade at start, gradually decreasing until five months old. For the last month, transplant in poly bags under light shade. Water twice a day (morning and afternoon).

Field preparation
Clean the field from tree stumps and weeds. No tillage. Plant support trees. Use Rosewood (*Pterocarpus indicus*), *Leucaena* or *Gliricidia*, straight 2 m above ground, 20 cm in ground. Planting of support should be done six months ahead of pepper planting.

Sustainability
Good, according to management level, provided no diseases or pests destroy the plants. Pepper plantings are expected to have the following life spans:

- ***most intensive -*** life span approx. 12 - 15 years
- ***medium -*** life span approx. 20 years
- ***most extensive -*** life span approx. 30 years

Environment
On sloped land there is the possibility of erosion problems. Severe slopes need terracing.

Economics
Two different levels of management will be considered: low level and medium, both on live supports. The medium level requires high investment for dead supports that last at least 15 years and was not considered.

The following tables give a rough indication of the economic potential of pepper. Pepper is sensitive to good care; climate may influence yearly production; good drainage is important.

Price for processed Pepper

Price fluctuations can be more than 100% in a three to five year cycle.

Price trend

Ten year average (very variable) US$/ 1kg

Period	1970	1980	1990	2000
US $	1.50	1.70	1.90	2.05

Farmer Suitability

Pepper is suitable for smallholder farmers, based on family labour (up to 1 ha) or for large scale (up to 50 ha) based on hired labour. The crop can be grown with different levels of management (labour). Yields vary accordingly to management inputs:

- ***most intensive:*** 3–5 t processed pepper/ha
- ***medium:*** 1–3 t processed pepper/ha
- ***most extensive:*** 0.1–1 t processed pepper/ha

Pepper should always be grown in addition to other cash crops. It should not be the only cash crop to rely on.

Spacing

3 x 3 m or 3 x 2 m (north-south row arrangement).

Shade

Pruning of support trees (two to four rounds a year, depending on type of support tree) is essential to reduce shade in a bearing pepper crop. Shade reduces production.

Planting Pepper

Support trees must be well established and provide shade for young plants. Plant six month old cuttings with one or two shoots at a distance of 20 - 25 cm from the support trees and in line with the row. Planting holes should be about three times larger than the pepper poly bag and a little deeper, half filled with well mixed compost and topsoil. Place the plant (with poly bag removed) in the half filled hole and fill with soil. Press the ground gently and make small mounds. Put mulch around the plant, but keep stem free.

Pruning Pepper

After planting, pepper should be pruned every three months for about two years. Three stems are allowed to climb the support tree (tie with plastic or raffia). After a vine stem has formed about ten nodes, cut it back to three nodes to

force the development of more laterals. Remove upright shoots if more than three. Repeat pruning until laterals have formed on every node and the vines have reached a height of two metres. Pinch off any new shoots at the top. All flower spikes during the first two years must be removed.

Up-keep of Pepper

Ring weed every three months, apply fertiliser as recommended below and cover weeded area with mulch from cuts between rows (weeds/ legumes). While ring weeding, remove runners from the pepper vine and upright shoots that develop on stems. Prune supports to the minimum number of branches needed to keep the tree alive.

Fertiliser

In the first year after planting apply 100 g NPK to each plant. This is increased by 150 g per plant in the second year and 200 g per plant in the third year. After the third year the amount of fertiliser applied will depend on the size of the crop produced.

Apply 100 g NPK for every 1 kg of fresh fruit produced per year, with a minimum application of 300 g per plant. It is best to apply the fertiliser in four split applications. First application after

Storage

Long storage periods require low air humidity. Pepper moisture content should be kept below 13%.

Uses

Pepper is used by households to flavour food. It is mainly exported to North America and Europe. It is increasingly used in ready-made food products.

Export

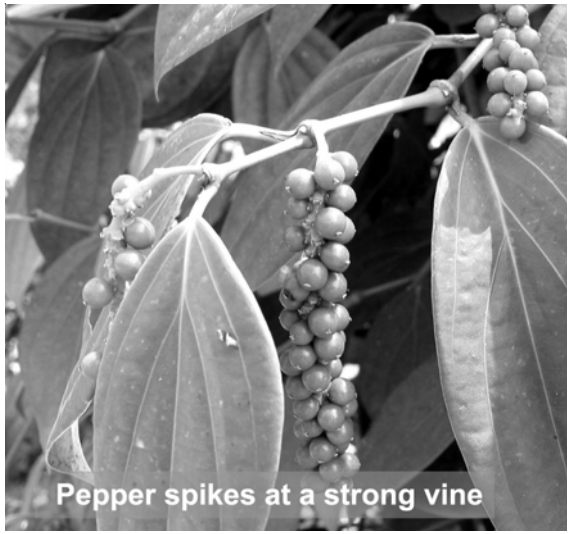
World market on average has an annual demand of about 180,000 tons. Leading producers are Indonesia, India, Brazil and Malaysia. Supply is flexible as is the price. Demand increases by about 3% annually.

Buyers and Exporters

Alma Trading
PO Box 545, Rabaul, ENBP
Phone, Fax: 983 7198

Follywell No. 6 Limited - Pacific Spices
PO Box 1539, Rabaul, ENBP
Phone: 983 7703, Fax: 983 7557
Email: isexton@datec.com.pg

Young pepper plant in poly bag before planting



Pepper spikes at a strong vine

the dry period should also include 100 g kieserite (*Mg* - magnesium) and 100 g lime (not needed if sufficient *Ca* - calcium - in soil) per plant.

Always cover fertiliser with mulch. If no fertiliser is applied, add at least 4 kg of compost or manure per plant per year.

Intercropping

Pepper does not produce well if intercropped with other crops. A leguminous crop that is not high, not climbing and which can stand regular cutting to supply mulch (such as *Stylosanstis*, *Crotalaria*, *Flemingia* or Pigeon pea) can be planted between the 3 m rows.

Pests

Many different insects can be found on pepper. Chemical control of pests is not normally recommended except in cases of heavy attack where the damage threshold is exceeded. Seek advice at your local DPI or NARI office.

Diseases

The most serious disease to occur on pepper is foot rot caused by the fungus *Phytophtora palmivora*. Prevention is possible by only growing pepper in well drained soil with low water table

and having good air circulation in the plantation. Several other diseases caused by different pathogens may occur. Seek for advice at your local DPI or NARI office.

Leaf Pruning

Pepper is highly variable in production. Normally pepper will produce ripe spikes at any time during the year. The ‘first’ and biggest flush will appear after a dry period. This flush can be increased by leaf pruning. Leaf pruning is done by removing all leaves except one or two end leaves at each side branch. Leaf-pruned plants require less shade and more fertiliser to obtain the higher production. Avoid over production as it may cause production fluctuation over the successive years or even kill the plants.

Harvest

The harvest time is about eight months after the flush. Harvesting is concentrated over a period of about three to four months. Spikes are ripe for making black pepper when two to three berries turn yellow or red. Only these spikes should be picked in the harvesting round.

Yield

Depending on the level of management (shade, weeding, fertiliser, mulching, leaf pruning) yield may vary between 1 – 15 t fresh spikes/ha. By processing (drying to 12% moisture content), this is reduced by one third of the original weight for black pepper, giving a yield of 0.3 – 5 t/ha of black pepper.

Processing

Fresh spikes are dipped in boiling water for six seconds, air-dried and then threshed to separate the pepper corns from the spikes. The corns are sun or mechanically dried to 12% moisture content. Then winnowed to remove dirt and spike remains.

Quality and Grades

International standards for quality refer to the presence of dirt and fungus appearance at the skin. Grade A has highest quality with 100% full kernel. Grade B is good quality but corns are somewhat smaller. Grade C is lowest quality, good for grinding.