

RP-247

NEW KNOWLEDGE FOR CARDAMOM GROWERS

by

P. Abraham

RECENT investigations in the Singampatti Hills have given some very useful information on how best cardamom seedlings are raised.

The investigations were conducted under a scheme for providing scientific aid to the cardamom industry and sponsored by the Indian Council of Agricultural Research.

Raising seedlings in nurseries is the most difficult part of cardamom cultivation. Cardamom planters find getting satisfactory germination of cardamom seeds very difficult due perhaps to the defective methods they adopt.

Not more than 11 to 15 per cent of the seeds sown in the nursery-beds germinate. Consequently, the seed-rate used in raising seedlings and the cost of seed are usually very high. Nursery diseases in addition

cause extensive failures of seedlings. Cardamom nursery practices, therefore, need to be well improved so as to obtain maximum seedlings.

Cardamoms can be propagated vegetatively through rhizome cuttings. But the mosaic disease of cardamom is carried through these cuttings. Unless, therefore, rhizome cuttings are obtained from a region entirely free of the disease, new plantings with rhizomes should be avoided till the disease is completely under control.

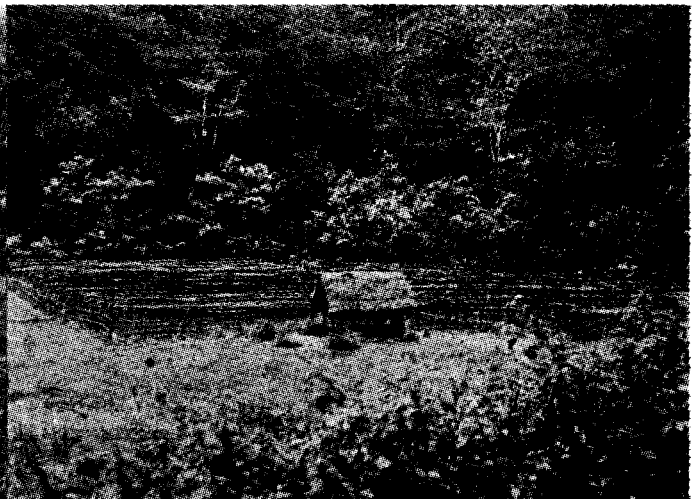
Fortunately, the mosaic disease is, as far as is known, not transmitted through seed. Propagation through seed is, therefore, the safest method of raising new plantations.

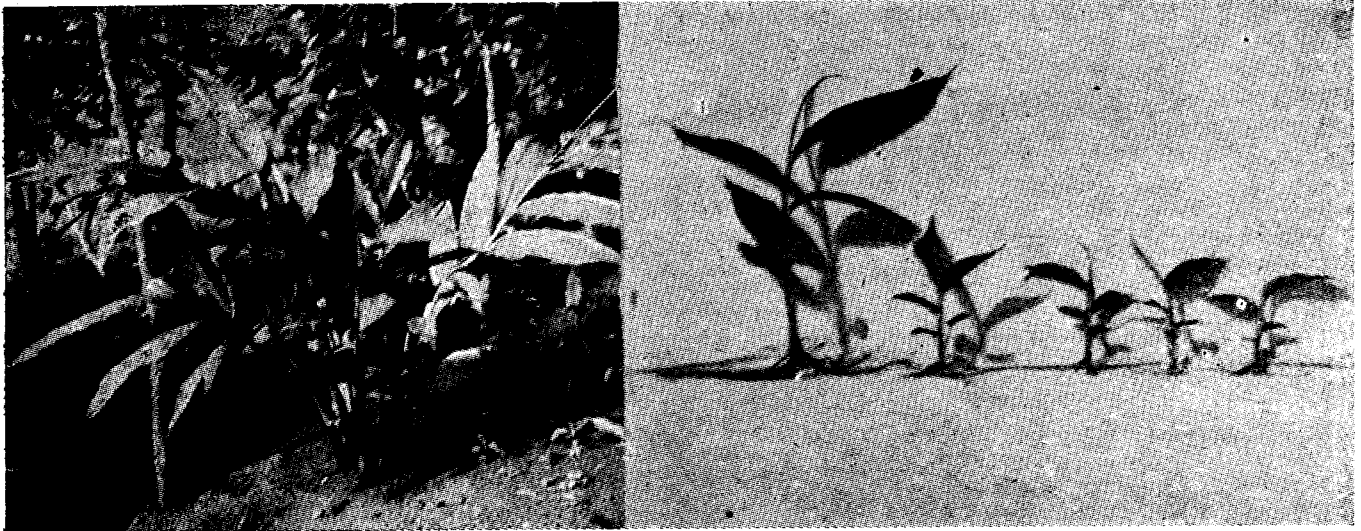
In the primitive stages of growing cardamom on a plantation scale, cardamom seedlings which

Cardamom first nurseries protected by...

...slanting, thatched roofs

...pandals





...two years

Cardamom seedlings aged...

—8 months, 6 months and, the remaining three, 4 months

came up spontaneously on thinning the shade of forest trees, could be collected and redistributed to form a plantation of a more even stand. This method is still employed in a number of places. Self-sown seedlings occurring in older cardamom plantations are also used in this manner.

In the *male* system of cardamom cultivation practised in Coorg, a plot of jungle is cleared in the same way as for ordinary cardamom planting on this system and seed is sown broadcast about February or March. The seeds germinate in the hot weather months and the seedlings are left to develop until the following year when they are transplanted to their permanent positions.

As these old methods were very unsatisfactory, a system of germinating seeds in prepared beds was developed by growers in most cardamom-growing regions. Clearly, this is the only sound way of obtaining a satisfactory outturn of seedlings from given quantities of seed. Even this method was vastly improved upon under the I.C.A.R. Scheme.

SEED VIABILITY

The fact that cardamom seedlings come up spontaneously when trees are felled and the overhead canopy thinned in jungles where cardamom is indigenous, indicates that seeds can remain dormant in the soil for long periods of time. This happens under the very special light, temperature and other conditions obtainable in the soils of the thick jungles of the higher elevations in the hills.

Experiments were laid out to find out how long freshly-collected cardamom seeds retained their viability under storage in the laboratory. Seeds were sown in nursery-beds immediately after harvest and at fortnightly intervals up to 6½ months. The highest percentage of germination (about 75 per cent of the seeds sown) was obtained from seeds sown immediately after harvest. There was a very steep fall of 54 per cent in the viability of seed during the first 15 days after harvest, while in 3½ months, it fell by 94 per cent.

Cardamom seeds have, therefore, to be sown in nursery-beds immediately after harvest to obtain maximum germination.

SEED-BEDS

The most developed system of cardamom nursery management among cardamom growers at present is germinating seeds in a prepared bed from which they are transplanted into a second nursery-bed and finally into the field.

Results from such germinating beds and nurseries are very variable and the outturn of seedlings generally very unsatisfactory.

Although the methods of preparing the seed-beds vary in detail from place to place, the usual general lines for seed-bed preparation are followed everywhere. The beds are laid raised above the general ground level. The size of a bed varies, but it is usually not more than four feet wide and 30 to 40 feet long. The topsoil layer of the bed may be well-pulverized with ordinary soil, from which all stones and pebbles have been removed, or jungle soil or mixtures of jungle soil and sand, compost, well-rotted cattle manure or mulch debris.

In Mysore, including Coorg, seed-beds and nursery-beds are almost invariably laid in wetlands or in the valleys between hills. The beds are separated by deep channels into which water may be run, or the nurseries may be entirely rain-fed. In the Cardamom Hills of Travancore and Anamallais, the seed-beds are usually laid on the lower reaches of hill-slopes near a water source to facilitate pot-watering, but wetlands are also used as cardamom nurseries.

Widespread observations revealed that although the beds should be kept reasonably moist and well-drained, undue wetness of the beds leads to nursery diseases and poor development of seedlings. Seed-beds laid out on the lower reaches of hill-slopes on terraces near a water source and pot-watered were almost always observed to yield a higher outturn of seedlings than those laid in wetlands and other low-lying areas.

The beds may be about three feet broad and six to ten feet in length and separated by footpaths to facilitate movements between the beds for watering, inspection and other operations.*

SOIL TEXTURE OF SEED-BEDS

Experiments were conducted to find out the most suitable soil texture of the seed-beds to ensure maximum germination of seeds. Mixtures of rich surface-soil taken from the jungle with either sand, leaf-mould, wood ash or well-rotted cattle manure spread on raised beds to an inch in depth, were compared with jungle soil alone spread on the beds in a similar manner.

The results revealed that the germinations in beds which received wood ash and cattle manure were significantly higher than those in jungle soil alone. The seedlings which received these two treatments were taller and healthier than those in the other treatments. A mixture of equal quantities of well-rotted cattle manure and wood ash would, therefore, be best for this purpose.

Some unwanted seeds of weeds and other plants may be present in the original and imported soils of the bed. To get rid of these, water the beds frequently for a period of about a fortnight. All such unwanted seeds would germinate, and can then be removed.

SHADING OF SEED-BEDS

In Mysore, including Coorg, cardamom seed-beds are not shaded at all until the seedlings have appeared.

When seedlings appear above ground they are shaded by raising *pandals* four to five feet above the beds. The *pandals* are thatched with branches of jungle trees whose leaves do not fall on drying. These *pandals* are very similar to those used in coffee and tea nurseries, though heavier.

Occasionally, the seedlings are shaded by a low *pandal* of not more than three feet above the bed, which is covered with a thin grass thatch to give an almost complete cover. In dry weather, this grass thatch is kept moist by frequent waterings to maintain humidity.

It was also observed that in certain places shading of seedlings was done by suspending dry leafy branches from a framework some five or six feet above the bed, instead of spreading them on the top of the framework.

In all these kinds of shading as well as non-shading before germination, there is considerable disturbance of the beds by drip from the leafy *pandals* and from the direct falling of raindrops. Even though mulched, the seeds and the seedlings are very much affected by its drip, resulting in a poor outturn of seedlings.

Widespread observations and experimentation have clearly shown that first nursery-beds even from the time of sowing should be provided each with a rain-proof thatched slanting roof. These slanting roofs are best faced eastwards to allow the morning sun to fall on the beds. The direct morning sunshine falling on seed-beds would give the warmth essential for the germination of the seeds.

Thatching of the roofs may be done with grass or other material obtainable from the jungle.

SOWING TIME

In Mysore, including Coorg and North Kanara, cardamom seeds are sown usually in September when good seeds are available and they germinate in about a month. Germinations of cardamom seeds in these regions were seen to be generally satisfactory.

In the southern areas of Nelliampathies, Anamallais, the Cardamom Hills of Travancore, Rajapalayam and Singampatti, there is rarely any likelihood of getting good seed early enough for sowing in September. In these southern regions, sowing of seed is usually done in November and germination is irregular and takes a considerably longer time, of even up to two months.

The differential behaviour of the seeds sown at these two different times may be attributed to the temperature prevailing at the different times. During November and December, a sudden drop in both air and soil temperatures occurs in the cardamom-growing regions, and this may account for some of the difficulties experienced with cardamom seeds sown late in the year in the southern areas.

Experiments were conducted to find out the best time for sowing seeds to obtain the maximum outturn of seedlings at the Research Station, Singampatti, in the extreme south of the cardamom-growing area in India. Seeds were sown in every month of the year. Fixing the results of February sowing as control (100) for comparison, December, January, March, April, May, June, July, August, September, October and November gave the results of 106, 115, 120, 92, 71, 92, 24, 58, 83 and 80, respectively.

At Singampatti, the temperature gradually rises from January onwards until May, and falls with the onset of the South-west Monsoon in June. Thus, the direct relationship between temperature and germination is evident. December to March is seen to be the best time for sowing cardamom seeds in the nursery. From September onwards till December, the North-east Monsoon continues to be very heavy at Singampatti, attended by a cloudy and misty weather. These conditions do not seem to be conducive to good germinations of cardamom seed.

In the northern regions of Mysore where the smaller cardamom with prostrate panicles is grown, good seed will be available only in September-October and nurseries can be laid out only at this time. In these regions, the North-east Monsoon lasts only for ten to 15 days in October-November, and this does not seem to be a serious obstacle to the progress of cardamom nurseries laid out in September.

MULCHING OF SEED-BEDS

Just as the texture of seed-bed soil, mulching of the seed-bed is a very important factor affecting germination of seed.

It is a general practice in cardamom-growing areas to mulch the seed-beds with dry leaves, dry grass or straw. In North Kanara, parts of old Mysore and occasionally in the Cardamom Hills of Travancore, the mulching material is the fine leaves of *nelli* or *amlā* (*Phyllanthus emblica*, L.) which is reported to be of special virtue for this purpose.

In an experiment on mulching, the comparative value of dry leaves cut up into small bits, jungle debris (well decayed in powdery form) and dry grass, evenly spread to a depth of $\frac{1}{4}$ inch on the seed-beds after seed is sown, were compared with no mulch. It was seen that the grass mulch was the best and jungle debris next best in securing good germinations. In areas where *nelli* leaf is easily secured, it may be equally effective.

The mulch serves as a blanket, maintaining moisture and temperature at a desirable level. This mulch may, however, be removed after the majority of the seeds have germinated.

PRE-TREATMENT OF SEED

Seed for sowing is generally collected from fully ripe fruits and is then either washed in water and sown immediately or mixed with wood ash and dried for two to nine days in the shade and then sown. If washed, rinse repeatedly until the sweetness of the aril is completely removed.

In experiments to find out suitable pre-treatments of the seed to induce quicker and better germinations, seeds were soaked (1) in cowdung slurry, (2) tepid water and (3) Hortomone 'A' (0.3 per cent), each for 12 hours and then sown. There was no significant difference in germination among the above treatments. The vigour of the seedlings was also not affected by the treatments.

In another trial, seeds were treated with the fungicides, copper sulphate, 'Ceresan', 'Agrosan', sulphur and mercuric oxide. None of these fungicides could improve germinations.

One of the factors which enable cardamom seed to lie dormant for considerable periods in the jungle soil may be its hard, stony seed-coat. Any method of thinning this seed-coat was supposed to assist seed germination.

Seeds were, therefore, mixed with coarse sand in a bottle and shaken vigorously for some time. This treatment gave very good results vastly improving germination. This was due to scarification (making scratches) of the seed-coat, making it more permeable to water.

SOWING

Scatter the seeds evenly on the surface of the bed. For a three feet \times three feet bed, 720 seeds would do; this means 80 seeds go to a square foot. Just cover the seeds with a $\frac{1}{8}$ inch thick layer of fine sand just to cover the seeds.

WATERING

Immediately after sowing, mulch the beds and start watering the beds with rose cans. Frequent (at least twice daily) and copious watering will be necessary in the early stages. The beds should be maintained moist but not too wet. The use of warm water for this



Cardamom second nurseries under *pandals* (background), under the shade of jungle trees (foreground)

purpose in the early stages adds to the warmth provided by the morning sun. Germinations start usually a month after sowing and go on for about three months.

CONTROL OF NURSERY DISEASES

Considerable losses of seedlings are experienced in the nursery from 'damping off' and other nursery diseases. For controlling these diseases, spraying the seedlings with Bordeaux mixture and colloidal copper of different concentrations were tried at weekly and fortnightly intervals. Losses of seedlings from diseases were very much reduced by these fungicides, fortnightly sprayings being found to be more efficient. One per cent Bordeaux mixture is easily made and can be generally used for this purpose.

SECOND NURSERY

When the seedlings are about a year old or have a couple of leaves, they have to be transplanted into a second nursery for further care until they are ready for transplanting into the field.

A second nursery is needed to avoid overcrowding of seedlings in the first nursery and the resultant poor growth and damage to seedlings by nursery leaf-rot and other diseases.

In Mysore including Coorg, and North Kanara and the Cardamom Hills of Travancore, beds are prepared for the second nursery also in the same way as for the seed-beds (first nursery), but there is very often the addition of more pulverized cattle manure or compost to the beds. Seedlings are planted in these second nursery-beds about six inches apart. They may be spaced wider at nine inches or even a foot or two apart, depending on the vigour and rapidity of growth of seedlings in the locality and the period for which seedlings are left in the nursery.

In the second nursery, the seedlings are lightly shaded with *pandals*, three to four feet above ground level and spread over with leafy twigs. Watering is done if necessary in the dry season. After a period of at least one year in this nursery, the seedlings are planted out in the field.

Instead of laying out the second nursery in regular beds, the seedlings when ready for transplanting may be taken out of the germinating bed and transferred to an area which is well shaded by trees and in particular

sheltered from the afternoon sun, and planted in pits two feet apart, two seedlings in a pit. If planted in June at the beginning of rains, no watering but only weeding will be needed. This kind of nursery may also be located in newly-planted areas between the cardamom clumps, and would be vastly cheaper than those laid in nursery-beds. If a mixture of cattle manure and ash is applied to the planting pits, the seedlings will grow very rapidly and vigorously.

GERMINATION TRIALS IN ASSAM

Using the methods evolved in the above investigations, trials of germinating cardamom seeds were conducted in the Khasi and Jaintia Hills in Assam, with seed supplied by the author from South India. Very good germinations up to 85 per cent were obtained in

these trials with seeds sown in the warmer part of the year. The nurseries were raised at an elevation of 1,700 feet. However, a major part of these seedlings died during the succeeding winter season perhaps due to the severe cold, and probably frost, in these northern latitudes. The minimum temperature in the cardamom-growing regions of South India never goes down to this level, but remains at a much higher level.

It may, therefore, be suggested that in regions like Assam, cardamom nurseries may be raised at lower elevations at the foot of the hills. Even the elevations at which cardamom can be grown successfully to fruiting stage in regions like Assam have yet to be determined. The situation may be the same in the North-East Frontier Agency to which place also cardamom seeds have been supplied for trials.