

Rubber Planting Techniques—Part II—Nursery Practices.

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In a previous article, Papua and New Guinea agric. J. 17 (1), the author discussed the handling of rubber seed. This series is now continued with nursery practices.

NURSERY BEDS.

NURSERY beds must naturally be situated on good soil, in proximity to a water source, as regular watering of the young plants will be required. Flat land, in a central position to the area which is to be planted, is preferred.

A soil with a high water table must obviously be avoided. The plants on such soil may grow quite well in the early stages but when the taproot reaches the waterlogged level growth comes practically to a standstill and the plant will eventually die.

Nursery beds may vary in width from 4-8 feet with a spacing of 2-4 feet between beds. Length of the beds depends on the shape of the area and the number of plants required; in other words the beds could be of any desired length. However, for practical reasons a rectangular lay-out of beds would be preferable to an elongated one. At the Bisianumu Rubber Centre a standard nursery bed is eight feet wide with four feet between beds and 40-60 feet in length. It was found that this shape of nursery bed was more practicable for digging and shading work and was of a convenient size for the propagation of seedling-stock as well as for seedling stumps.

In establishing the nurseries it is a normal practice in this Territory to dig the beds to a depth of at least two feet, preferably three feet. The usual method is to dig out the soil placing the top soil on one side and the subsoil on the other side. Upon reaching the depth required, the soil is returned into the hole, subsoil first. Another method is to dig out the soil to a depth of 1-1½ feet and then fork a further depth of one foot. This method can only be used on the lighter soils and where there are no stumps and big roots to be removed. The deep digging of rubber nursery beds is done to ensure a loose soil for straight root development which will assist vigorous, healthy growth of the young plants and which facilitates pulling of the stumps for

transplanting. A good nursery bed is built up to some 4-6 inches above ground level in order to drain surplus water; the sides may be supported by bamboo or other suitable material. The top of the bed is worked into a fine tilth and levelled off with a rake. Overhead shade is erected at a convenient height. Palm leaves, kunai grass or any other suitable bush plant may be used as overhead shading material. Shade should be light and is only temporary. It must be of sufficient density to protect the young emerging plants from direct sunlight during the first month of growth. The erection of overhead shade completes the nursery bed.

In areas where bandicoots, pigs or other bush animals are troublesome it is advisable to surround the nurseries with a fence. Rats can also do considerable damage to seed and young seedlings.

PLANTING GERMINATED SEED.

The seeds are considered to have germinated as soon as the micropyle bursts and the tiny white rootlet, or radicle, appears. Germination beds should be inspected daily for germinated seeds which are immediately transplanted to the nursery beds. Transplanting is most successful if done before the young root is one inch in length, preferably before the young stem develops, as explained in Part I of this series under the heading *Germinated Seed*. Before placing the germinated seeds in the soil the bed is lightly watered for ease of working. Planting is done slightly deeper than at the germination beds; the seeds must be just covered with soil. After planting, the nursery bed is thoroughly watered. Spacing of the germinated seed at the nursery bed depends on the length of time required before transplanting into the field. The longer the plants are to be kept in the nursery, the wider the spacing has to be. For the propagation of pencil stumps of about $\frac{3}{8}$ in. to $\frac{3}{4}$ in. in diameter, for which normally a growing period

of 6-9 months is required, a spacing of 9 in. x 6 in. is recommended. Normal seedling stumps of about $\frac{3}{4}$ in.-1 $\frac{1}{4}$ in. in diameter, requiring some 10-12 months of growth, a spacing of 12 in. x 9 in. will be needed.

When propagating seedling stock for future bud-grafting a most convenient spacing are double rows of one foot apart with two feet between the double rows and the plants spaced nine inches in the row. Clonal seedlings at Bisianumu are propagated at a spacing of 9 in. x 6 in. on an eight feet wide bed; the first row at 6 in.-8 in. from the edge giving a total of ten rows. Spacing between rows is nine inches. These seedlings are kept in the nursery beds for approximately 8-9 months.

The above are recommended spacings for the planting of the germinated seed. This initial spacing of the seedlings becomes naturally wider after the thinning out of weak and diseased plants, as will be discussed in the following.

NURSERY MAINTENANCE.

There is no need to stress the importance of both weeding and watering during the early growing period. The growth of weeds is considerable in the first months after planting; weeds compete with the rubber seedlings for water and plant food. Efficient weeding during the first 3-4 months is essential for healthy and rapid development of the seedlings. As the seedlings grow, the shade of their leaves helps to prevent heavy weed growth and the need for weeding will become less frequent. Inefficient weeding reduces growth of the rubber seedlings, lengthening the nursery period and thus increasing expenditure. The newly planted seed may require daily watering in its initial two weeks in the nursery. Frequency of watering depends on weather conditions. The topsoil should be kept in a moist condition and must not be allowed to dry out. Watering is gradually reduced as the plants develop. Mulching will greatly help in moisture preservation as well as reducing weed growth and improving soil structure. Mulching is best carried out after completion of the first growth cycle, when the first pair of leaves have matured and the second growth cycle commences. This occurs normally in about 6-8 weeks after planting of the germinated seed.

Kunai grass (*Imperata cylindrica*) is most widely used for mulching in the Sogeri District, but other cut grasses and vegetable matter may also be used to advantage. Mulching could well coincide with the first reduction in overhead shade, which should be removed gradually in the period of 6-10 weeks from planting in the nursery.

Heavy shading over a long period results in weak, spindly seedling growth. Shade should always be reduced gradually, as removal of all shade at once will result in severe sunburn of the leaves. Weather conditions will more or less dictate the shade removal programme. In areas where cloudy and rainy conditions prevail, the removal of shade can be done earlier than in the sunnier and drier districts. In this connection it may be mentioned here, that at the Bisianumu Rubber Centre where cloudy and rainy conditions usually prevail during nursery establishment in April-May, overhead shade is not used at all on nursery beds for local seedlings*, and mulching is commenced within a month from planting. The normal practice, however, is to provide a light shade, up to approximately three months from planting in the nursery. The fact that no overhead shade is used at Bisianumu is mentioned merely to illustrate the point that there are no rigid rules on nursery shade management. The planter should judge local conditions and adapt his nursery shade establishment to the prevailing climatic conditions. Generally speaking, planters in this Territory establish a too heavy overhead shade on their rubber nurseries and leave this shade longer than is desirable.

Other nursery maintenance work includes the early removal of double stems. In cases where a double stem develops, the strongest of the two is maintained and the other one cut away with a sharp pruning knife or secateurs. Side shoots are regularly removed.

Weak plants and seedlings with deformed leaves are removed and discarded. Only strong, healthy plants, which will develop into vigorous rubber trees, are kept. Thinning out of the weak and undesirable plants is best done in two operations, at three and six months old respectively. This will reduce the number of seedlings by some 20-30 per cent.

* Seedlings derived from locally collected seed, clonal as well as common seed; seedlings derived from imported seed are propagated under temporary shade at Bisianumu.

MANURING.

Although manuring of rubber nursery beds is not a common practice in this Territory, it may be advisable to give some directions on the subject. Manuring depends entirely on the natural fertility of the soil, and the need for it should be judged by the growth of the plants. Territory rubber soils are generally of better natural fertility than are most of the soils for rubber cultivation in the Malayan Peninsula, where heavy manuring is the normal practice.

If compost or dung is available the initial manuring of a nursery could be done at the rate of 3-4 tons per acre. On Malayan inland soils it is a common practice to apply rock phosphate and magnesium lime at the rate of 5 cwt. and 2 cwt. per acre. This is worked into the soil to a depth of some 6-9 inches.

At the Bisianumu Rubber Centre nursery beds are not manured when established on virgin land. However, when the same land has to be used for a second time a dressing of a compound fertilizer, containing N.P.K. with the accent on the nitrogen component (N.P.K. 21 : 14 : 14), is usually given at the rate of approximately 3 ozs. of fertilizer per square yard of nursery bed. This is lightly worked into the top soil before the planting of the germinated seeds. Subsequent nursery manuring at the rate of 1 oz. per yard of plant row could be done at three-monthly intervals but only when the growth of the plants indicate that fertilizing is desirable.

PESTS AND DISEASES.

Pests and diseases of rubber nurseries in this Territory are fortunately limited to a few which need regular control measurements.

The most common nursery pest in the Sogeri District is the Papuan tip-wilt bug, *Amblypelta lutescens papuensis*, Brown. This insect sucks the soft tissues of the terminal growth and may cause severe wilting and dieback of the stem. The result is the growth of numerous unwanted side branches, making it difficult to develop the desired straight and single stem. Cassava is one of the favourite host plants of *Amblypelta* and should not be allowed to grow in the vicinity of rubber nurseries.

Insecticidal spraying is to be carried out as soon as this pest is noticed and regular spraying rounds at three-weekly intervals will effectively

control this bug. A widely used insecticide in the control of *Amblypelta* at rubber nurseries is Dieldrin concentrate 15 per cent. It is usually applied by means of a knapsack spray as a 0.3 per cent. solution, i.e., one part of Dieldrin to 50 parts of water.

D.D.T. emulsion 25 per cent. may also be used as a 0.25 per cent. solution, i.e., one part of D.D.T. to 100 parts of water.

Another troublesome insect in nurseries as well as in the field are the *Idiopsis* weevils, *Idiopsis grisea* and *Idiopsis caerulea*, these are leaf eating weevils which have been recorded on a great number of host plants including sweet potato, cacao and coffee. They can be a serious pest in young rubber. Damage consists of numerous small holes, "shotholes", in the leaves and they have also been known to completely defoliate a field of young rubber in the Sogeri District.

Control by D.D.T. emulsion as mentioned above for *Amblypelta*.

Army worm (*Tiracola plagiata*), when appearing in plague proportions is a serious threat to rubber of all ages. This pest has been recorded several times in the Sogeri District since 1958; the last time in April-May, 1964. It has also been reported in other rubber growing districts of Papua. These caterpillars completely defoliate the trees and practically all other growth in their path. They are a particularly serious pest in young budgrafted trees as they eat away the emerging shoot from the budpatch, resulting in a complete loss of the budgraft. They can destroy a rubber seedling or budgraft nursery in a matter of a few hours. D.D.T. spraying with a knapsack spray at 0.25 per cent. solution is the recommended control.

The above pests are the more important ones during the nursery stage. Further details of rubber pests are described by Smee: "Insect Pests of *Hevea Brasiliensis* in the Territory of Papua and New Guinea: their Habits and Control", *Papua and New Guinea agric. J.* 17 : 1.

With regard to diseases in the nursery, only the *Gloeosporium* fungus is of importance at this stage. Pink disease, caused by the fungus *Corticium salmonicolor*, is seldom found in the nurseries.

The *Gloeosporium* fungus causes the young leaves to shrivel and fall, and often results in deformations of the older leaves. In severe

cases it will cause dieback of stem and branches. The disease retards the growth of the plants, but usually does not result in death. The fungus is effectively controlled by copper spraying; Copper Oxychloride, 3-4 lbs. in 100 gallons of water, or approximately 1 oz. for every two gallons of water, applied by means of knapsack spray at 2-3 weekly intervals. The use of a sticker to the fungicide is advisable, particularly during the wet season when the disease is more prevalent. Leaves should be sprayed on upper and lower surface to be effective.

PROPAGATION OF BUDDDED MATERIAL.

When it is intended to propagate seedling-stock for subsequent budgrafting at the nurseries, the initial spacing of the germinated seed is usually wider than for the propagation of seedling stumps as described above under "Planting Germinated Seed". Otherwise, establishment, maintenance, etc., is the same as for seedling stumps.

Budgrafting of common seedling-stock is done either at 4-7 months of age (the so-called green budding method), or at 8-14 months of age for

the conventional shield budding method, as described in the *Papua and New Guinea agric. J.* 10 : 3. The budgrafted trees are transplanted from the nursery to the field either as budded stumps within 1-6 months after budding, or as stumped buddings at 9-15 months after budgrafting.

A budded stump is a budgrafted seedling tree in which the grafted bud is still dormant. The tree is stumped shortly before transplanting and the bud is then allowed to develop into a tree.

A stumped budding is a grafted tree which has been stumped before transplanting, i.e., the seedling stock has been grafted with the selected bud and this bud has over a period of approximately one year at the nursery grown into the desired grafted tree.

Propagation of budded stumps is the more common nursery practice when budded material is required. Stumped buddings are more costly in propagation and transplanting and are not generally recommended.

Transplanting and the care of all types of planting material will be discussed in Part III of this series.

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