CARIBBEAN FOOD CROPS SOCIETY

PROCEEDINGS

ELEVENTH ANNUAL MEETING

SOME ASPECTS OF AVOCADO PROPAGATION AND DISEASES ASSOCIATED WITH NURSERY SEEDLINGS IN BARBADOS

by

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SUMMARY

Propagation of avocado seedlings was started on a large scale at Soil Conservation, Haggatts in 1971. Propagation is done either by budding or grafting on to seedling rootstocks. Grafting and budding is normally done between December and April. Shield budding is done when the rootstock is red-brown in colour and still undergoing active growth from the seed. Once the seedlings have become green in colour and have 'hardened off' grafting is the method adopted. No grafting is done during the hot summer months: the rootstocks at this time have developed a white, corky and brittle pith and the percentage take is quite low.

Seeds are sown directly into polythene bags: thus reducing transplanting to a minimum. All seeds are hot water treated and the soil fumigated with methyl bromide, before being sown. Nursery seedlings are affected by root rot caused by *Phytopothora cinnamomi*, and by collar and fruit rot fungii. Further work is being done on collar rot -- *Botoyodiplodia theobromae* – and fruit rot Phomopsis sp.

INTRODUCTION

Propagation of Avocado is normally done by budding or grafting of selected varieties onto seedling rootstocks. "Plant derived from seed

take a long time to come into production and in some cases never do so." "The Avocado in Puerto Rico". R. J. Griffith. (1923). In any case, seedling trees vary extremely in yield and fruit type and this is not acceptable from a marketing point of view.

Disease of Avocado seedlings can result in an appreciable loss of plants. Seedlings are expensive to produce and therefore it is essential to have a spray programme implemented. Diseases which so far have affected avocado seedlings are root rot caused by *Phytopthora cinnamomi* and collar rot caused by *Botoyodiplodia theobromae.*

SEED SELECTION

At Haggatts, seed for rootstock production is obtained from many sources. Little work has been done on the influence of rootstock on scion, and therefore rootstocks are selected on the basis of vigorous growth rates.

Rootstocks are germinated from seeds: large seeds being used in preference to small ones. Where there is a shortage of seed material, seeds are cut into halves. All seeds are hot water treated before planting; seeds being held in water at 50°C for thirty minutes. This kills the seed borne spores of the fungus *Phytophthora cinnamomi.* In addition, the seed bed or germinating medium is fumigated with methyl bromide at the rate of 1.36 kg/2.83 m^3 (3 lbs per 100 cubic feet) of soil, before seeds are sown.

SEEDLING PRODUCTION

Two methods of producing rootstock seedlings are used. They are as follows:—

(1) Direct sowing of seeds into prepared seed beds. Seeds are sown 5cms (two inches) apart.

(2) Sowing of seeds direct into black polythene bags.

In both cases, seeds are sown with flat ends down, leaving the top flush with the Soil surface. Germination can be hastened by cutting a thin slice off the tip of the seed. Once seed has been sown, a thin layer of soil is spread over the seed bed. This prevents the drying out of seeds. Shade for the young seedlings is provided by using 50% saralon netting. "This prevents the young sprouts from being sunburnt". 'Propagation of Avocado'. Platt and Frolich (1965). It is necessary to keep the rooting medium moist at all times. This is done by watering seed bed or polythene bags once daily. Germination normally takes 30 days.

Direct sowing of seeds into polythene bags is preferred at Haggatts. It reduces labour costs considerably and also the area used for seed bed preparation can be put to some other use. This is particularly important where availability of land is a limiting factor.

TRANSPLANTING SEEDLING:

When the seed bed method of producing rootstock seedlings is used, all germinated seedlings are transplanted into polythene bags one week after germination. Care is taken to ensure that seeds remain attached to seedlings, otherwise growth rate is reduced. The seed bed is thoroughly wetted before transplanting takes place, thus ensuring that seedlings do not undergo physiological wilting.

Holes for planting seedlings into polythene bags are usually made with a wooden peg, which has one end tapered into a point. The peg is about 22.5cms. (9 inches) long. The holes are made deep enough to accommodate the entire root system.

BUDDING AND GRAFTING BACKGROUND PROBLEMS:

Budding and grafting of selected varieties onto seedlings is done between the five day old stage and the six month old stage. Availability of bud wood from varieties such as Lula, Pollock and Simmonds is the main limiting factor in the production of improved varieties. There are only a few trees of the above varieties locally.

The bulk of budding and grafting is done between the months of December and April, with a main peak in late January and early February. This is necessitated by a number of factors which are as follows:–

(1) Availability of Seeds. These generally become available in late September and October.

(2) Some workers visit the U.S.A. and Canada in the late months of the year – November – as migrant workers. This is followed in December by Christmas vacation for workers.

(3) In the hot summer months, the rootstocks have 'hardened off' and have developed white, brittle pith. The percentage take from budding or grafting onto such plants is quite low, "Plant grafting Techniques for Tropical Horticulture". W. Pennock (1970).

(4) During the hot summer months, the inserted bud tends to 'shed its eye'. Platt et al (1965).

SELECTION OF BUD MATERIAL

This is the most difficult part of the entire operation. Poor choice of bud material can result in 100% failure of buds. Buds are selected from mature terminal growth which is not producing new growth. Buds near the terminal end are preferred. Plump dormant buds are selected in preference to the thinner ones which have a tendency to dry out before union of rootstock with scion is effected. "Buds which have broken into growth should be avoided so should those from which the outer bud scales have dropped. This is indicative of old wood and such buds when inserted, frequently "shed their eyes". "Budding and Grafting of Avocadoes" T. W. Beddoe (1971).

SHIELD BUDDING

This is most successful when the stocks are small and full of vigour. 'Annual Report Soil Conservation'. (1971). Once the plants develop a green coloured stem, the sap is less abundant and great difficulty is experienced in getting bud to grow.

The incision is made 5–7.5cms (2–3") into the stem of rootstock above ground level. The incision is either an upright T or an inverted T. The rootstock should be about pencil size in diameter and it is at this stage that all off-type plants are discarded. The back of the knife blade is used to prise away bark from the stock. The cut bud is then gently inserted. Thin strips of transparent plastic are then used to hold the bud in place.

Wrapping is either done from a point below or above the point of insertion of the bud. If wrapped from below, upward overlaps of tape are used to seal the bud in place, care being taken to ensure that the bud eye is left exposed. If wrapped from above, downward overlaps of the tape are used. This method of wrapping the tape prevents water from seeping through the tape and entering the junction of the union of the scion with the rootstock.

TECHNIQUE OF CUTTING BUD

The thick end of budstick is held between thumb and fore finger of the left hand and the other end extends over the centre of the wrist and is supported from below by the fleshy base of the thumb. The bud is cut with a sliding motion of the knife. If the sliding motion is prolonged, the cut extends for some distance. To avoid this, and to terminate the shield, a second cut is made in a transverse direction to the first cut; about 1.9cms away from the point of initial incision. It is essential to use a thin, sharp, clean knife. A piece of cotton wool dipped in alcohol is used to keep the knife clean. Badly cut buds do not fit securely in the incision on the rootstock and bud failure is high. The bud is normally cut about 1.9cm (¾") in length.

POST BUDDING CARE OF PLANT

Three weeks after inserting bud, the plastic tape is loosened. By this time, the bud has united with the rootstock. Constriction of rootstock takes place especially in rapidly growing plants if tape is not loosened.

In order to force bud into growth, the tip of rootstock is pinched off. This forces lateral buds to develop and sets up an active flow of sap in the bud direction. Once bud has initiated growth, cutting back is done in stages. Rapid cutting back results in dieback of rootstock and scion. Where bud grows in a horizontal direction, tying to rootstock is done to promote a good growth habit. When bud has grown to about a foot; rootstock stump is completely removed.

GRAFTING TECHNIQUES

The majority of avocado rootstocks are grafted at Haggatts. The Cleft Graft to the top and to the side are the methods used. These techniques are used on seedlings which have 'hardened off'; but which do not have white, brittle pith formation. "It is essential that the pith remains succulent and has a translucent, slightly greenish appearance. Pith regeneration is of the utmost importance in avocado grafting." Pennock. (1970).

CLEFT GRAFTING TO THE TOP

Seedlings are decapitated 7.5–10cm (3–4inches) above the level of the soil. A vertical incision is made into the decapitated rootstock. The upper end of the scion is held – between the thumb and fore finger whilst the lower end of the scion is pivoted on the base of the thumb. The incision is made into the scion, with the knife held at an oblique angle to the body. As the knife slides into the scion, the latter is gently pulled against the direction of the knife cut. The scion is cut into a long slender wedge by tapering cuts on each side. Care is taken to ensure that the cut portion of the scion is not touched by the hand. The scion is then quickly inserted into the rootstock and tied in place.

CLEFT TO THE SIDE

The top of the rootstock is retained. Instead a sloping downward cut is made, diagonally half way or less into the rootstock. The cut is made 7.5–10cms (3–4 inches) above ground level. The wedge shaped scion is then inserted.

SELECTION, PLANTING AND CARE OF AVOCADO SEEDLINGS

In selecting plants for establishment of orchards, one should choose only healthy, vigorous plants. Plants with weak bud unions are discarded as these tend to break easily under gusty conditions.

Seedlings are planted in June with the start of the rains. This allows the plant to firmly establish itself by the start of the next dry season. Planting holes should be dug in advance with the size of hole being 45cms x 45cms x 45cms (18"x18"x18"). Holes are filled in with well rotted down pen manure. Before planting the contents of the hole are thoroughly mixed and made into a mound with a hollow in the centre. The spacing distance used is generally 6ms x 7.2ms (20ft x 24ft).

PLANTING OF SEEDLING

The potted plant is lifted by the bag; it is never lifted by the stem. Lifting the plant by the stem can damage it. The polythene bag is removed and the seedling planted in such a manner; so that the level of the surface of the earth around the plant roots, lie flush with the top of the surrounding mound. The earth is then tamped in around the tree after it has been placed in the hole. This is done to ensure firm contact between plant roots and the soil. The plant is then immediately watered.

At Haggatts, newly planted trees are irrigated once daily for the first two weeks; after which regularity of irrigation is reduced, until by the eighth week irrigation is done twice weekly.

Immediately after planting, all plants should be staked. This serves a two fold purpose.

1. Helps to train the growth habit of the plant.

2. Reduces the damage done by wind.

At six weeks, an application of 29gms (1 oz.) of 8:5:5 fertilizer is applied to the trees. At this stage, the plant roots should have become firmly established and capable of fully utilizing the applied fertilizer.

DISEASES OF AVOCADO SEEDLINGS

So far, avocado seedlings have been affected by P. *cinnamomi* which causes root rot; and by the collar and fruit rot fungi B. *theobromae* and *Phomopsis* sp.

AVOCADO ROOT ROT

This disease is commonly found in avocado producing areas. It affects trees of all sizes. It is generally found present under the following conditions:

(1) Where spores of the fungus are present in the soil.

(2) Where soils are poor draining or have excess moisture.

Only when these two conditions are present, will the disease occur. 'Avocado Root Rot' Zentmyer, Paulus and Burns. (1967).

GENERAL SYMPTOMS

The leaves of infected plants are smaller than usual; being normally pale or green yellow in colour. There is a general reduction in new growth by the plant. Many of the small feeder roots become black and eventually die.

CONTROL MEASURES

At Haggatts preventive measures are mainly used to control the disease and these are as follows:–

(1) Hot water treatment of all seeds.

(2) Fumigation of soil with methyl bromide.

(3) Addition of sand to rooting medium. This improves soil aeration.

(4) Use of soil fungicides. The fungicide normally used is Dexon. This is applied as a soil drench to seedlings in polythene bags. 2 teaspoons/4.5 litres (2 teaspoons/1 gallon) is the normal application rate. Repeated applications are necessary as the fungicide is rapidly inactivated by sunlight.

(5) Destruction of all plants with root rot symptoms.

COLLAR ROT AND FRUIT ROT FUNGI

Botoyodiplodia theobromae the agent of collar rot, and *Phomopsis* sp. the agent of fruit rot, have been consistently isolated from seedlings which developed necrotic lesions, following the cutting back of rootstock when the seedlings were kept under damp conditions.

SYMPTOMS

A progressive drying back of rootstock from below the point at which the stock has been cut back. Symptoms are similar to those obtained when the rootstock is rapidly cut back. The rootstock first shows black discolouration from the point of cut back, instead of the formation of a normal healthy callus layer. The colour spreads rapidly down the stem of the rootstock; merging from dark brown in the senescent areas to a dirty green brown above the uninfected part of the rootstock. This

progressive drying results in the death of the rootstock, and it is not uncommon to see a dead rootstock with a still green and healthy scion attached to it.

CONTROL MEASURES

These are as follows:

(1) Destruction of all severely infected plants. This has to be done as spores are spread by wind.

(2) Use of wound healer – such as Thionex – at the cutting back stage. This allows the development of callus layer before fungal spores can penetrate through the exposed surface of the plant.

(3) Tree surgery: Where the disease is not far advanced the rootstock is cut 5–7.5cms (2–3 inches) below the lesions. Thionex or wax is then applied to the exposed area. Where symptoms appear near the union of the scion, but where the scion is still unaffected; infected parts are removed by cutting and scraping away all affected tissue. This is done by removing all discoloured tissue. The exposed part of the plant is then sprayed with thionex.

(4) 2 teaspoons of Benlate /4.5 litres (2 teaspoons/gallon) applied to the soil and foliage of plants.

The number of avocado propagated has increased considerably since 1971. As with all new ventures, problems have been encountered. Most of these have been overcome. The improvement in propagation methods as well as in disease control, augurs well for the future of avocado production.

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