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VIRUS-FREE STRAWBERRY PROPAGATION IN NEW SOUTH WALES

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First let me qualify the term virus-free strawberry plants. This has become an accepted term for strawberry plants (i.e. by commercial strawberry growers) for strawberry plants that have been grown in certified strawberry plant schemes similar to that which exists in New South Wales. In actual fact the plants we propagate should be more correctly described as plants grown from virus-tested mother stocks The scheme that presently exists in New South Wales is similar to many operating around the world The principles of virus eradication in the initial instance remain basically the same, however, varying climatic conditions and differences in pest and disease controls necessary for the many environments in which these

plants are grown make it necessary for the certifying authorities to vary such rules as isolation, spray programs, and acceptable weed control measures.

The New South Wales scheme has been in existence for ten years and was started as a result of pressure from a group of commercial strawberry growers of which I was one, on the New South Wales Department of Agriculture to start such a scheme to ensure a regular supply of top quality virus-tested plants of the cultivars required here in N.S.W. This need was quite obvious to our Department as they also realised that it was necessary for the commercial fruit growers to use only virus-tested material if they were to remain viable in the future. Crop yields drop dramatically unless plants are kept free of the known strawberry viruses. Yields prior to the introduction of such schemes had dropped as low as one tonne per hectare; however, today yields have increased almost ten-fold with the help of virus-tested plants.

The initial work for the New South Wales scheme commences at Narara Horticultural Research Station — Gosford, where the nuclear stocks of plant material are kept. Most virus testing is also carried out there. Plants then move to the next stage where the process of multiplication begins for the supply of sufficient mother stocks to runner growers such as myself

For the next year plants are grown in screenhouse conditions, i.e. a glasshouse of the highest standard with stainless steel screening to prevent any possible movement of the main virus vector, aphids They are grown in tubs in a medium that has been fumigated to further assist in the control or spread of any soil borne diseases.

For the next stage of multiplication plants are planted the following year in isolation at the Somesby Horticultural Research Station, Somesby. Soil fumigation is normally undertaken at this stage also to further limit any possible spread of any soil borne diseases such as fusarium or verticillum wilt Plants from this last stage form the mother stock for release to certified plant growers. Growers must undergo a one year probation period when they are supplied with a maximum of 1,000 mother plants. As the mother plant supply is limited and subsequent inspection by departmental officers expensive, growers must be able to show their competence before they are able to obtain large quantities of plants.

It is necessary to make application to the New South Wales Department of Agriculture for mother plants and, in so doing, certain information must be supplied such as location of proposed block in respect to any other strawberry plantings (apart from those plants grown in the mountain lagoon quaran-

tine area). Soil tests are then carried out by the Department for the detection of nematodes. If all details of application are approved and tests prove negative then plants are released to growers in approximately mid-winter (July) each year.

Planting on established growers properties is not permitted until total removal of all previous season's plants and crop residue has been affected. In our own instance planting usually takes place in the spring (October) as removal of our cool-stored plants does not finish until late August. For the past five years total soil fumigation of our block is undertaken with 66% methyl bromide + 33% chloropicrin. This serves a two-fold purpose for us by offering excellent weed control as well as continuing the control and possible spread of soil borne diseases.

Excellent soil preparation is necessary to ensure the best possible root development. This fact is most important for successful establishment when planted in fruiting beds. Our normal fertilizer application takes place prior to fumigation and consists of 1½ tonne superphosphate, 625 Kg. sulphate of ammonia, and 250 Kg. sulphate of potash per hectare. Dolomite lime at the rate of 5 tonne per hectare is also applied. This assists in the supply of magnesium as well as lifting our pH which normally runs at 4.7 to 4.9. For a number of years we grew our crop without the use of dolomite lime as we were led to believe strawberries grew well under acid conditions. We believe, however, that they may exist in relatively acid conditions but they certainly do not thrive. I believe much of the fertilizer used in early days remained tied up in the soil and was never available to the plant.

Side dressings of nitram, which supply nitrogen in the form of nitrate 17%, and ammonium 17%, are occasionally applied depending on seasonal conditions (i.e. rainfall etc.). However, the overuse of nitrogenous fertilizer usually leads to excessive vegetative growth, not necessarily increasing plant numbers, crown or root development. It has been found under certain situations that excessive applications of nitrogeneous fertilizers can have an adverse effect on subsequent fruit crops. Work in this area is currently being undertaken by the New South Wales Department of Agriculture. Plants are set at varying distances apart depending upon cultivar and time of anticipated digging.

Digging commences in late autumn (early April) and continues to late winter (late August). As many plants are not fully mature in early April, plants to be dug at this time are usually set more closely in an attempt to achieve an economic yield per hectare. We have found that whilst vegetative growth appears to finish during late April, root growth contin-

ues until well in May, with total maturing of roots not being complete until mid to late July.

An attempt is made to keep surface soil in a moist condition; however, in the main growing months of late summer (January, February, March), this is very difficult especially in years such as we have just experienced with summer rainfall dropping to an alltime low.

The effect of rain as against sprinkler irrigation has been most noticable both in plant health and overall crop yield. Lack of health and drop in yield have been very evident due to poor rainfall.

Approximately three to four weeks after planting, trusses of flowers will appear on most plants; removal of these is carried out by hand. Our experience has shown that runners will appear more quickly if this operation is done as soon as possible. Chemical pruning has been attempted with Ethrel, however, timing is difficult as flowers appeared over an extended period and need to be sprayed before they have developed too far As hand removal is not a large task for our size of operation it would appear to be the most practical solution.

We have found that pinning of runners in the early stages of the crop development has had a beneficial effect on crop yield. The sooner runners take root the sooner further runners are produced. Once a canopy of foliage exists, runners appear to take root more easily and I suspect this is partially because the soil moisture remains closer to the surface, thus encouraging the appearance of roots more quickly Root development from newly formed runners is adversely affected by excessive movement across the soil surface by such things as wind. It appears to have the effect of causing callusing on the base of the crown where the new roots appear and at times this seems to totally inhibit root development.

Pest and disease control must be carried out at all times as the crop must be maintained in top condition to ensure certification by inspecting officers. Excessive foliage damage by pests or hail, etc. can make it impossible for a proper inspection to be done. Inspections of the crop take place at approximately one monthly intervals, so every care must be taken.

Excessive weed growth can also make inspection impossible so it is important to keep very good control of weeds. We have found the best weed control is with pre-planting soil fumigation followed by spot hand weeding. Mechanical weeding is not practical as it disturbs too many young runners in the early stages and weeding later on is not possible because the total ground surface is covered by plants

Many strawberry cultivars have been bred throughout the

world for various reasons, i.e. processing, fresh fruit production, home garden, and pick-your-own farms. In most cases it is the climate that has the greatest effect on the cultivar that will grow best in a given area. Market demands such as fruit size, colour, and keeping quality also play a big part in the selection of an acceptable commercial cultivar.

Winter chilling, i.e. number of hours below 7°C is most important to almost all strawberry cultivars, the requirements ranging for different cultivars from just a few hundred hours to many thousands of hours for those which do best in very cold climates. Plants that do not get at least their minimum number of chilling hours will not be vigorous enough to produce a marketable crop. They often flower prolifically, but the fruit produced from such flowers rarely reaches maturity. At times flowering is so minimal that the crop produced is totally uneconomic.

As far as the strawberry runner plant producer is concerned, all this means is that cultivars that are grown by us are governed, firstly, by market demands and, secondly, whether there is a supply of virus-tested mother stock available from our department of agriculture.

We have watched with great interest, as well as having involved ourselves, in the propagation of strawberry plants from tissue culture. We feel, at this time however, the economics of such a method do not compare with the method I have discussed here today. As subsequent crop yield is greatly affected by weather conditions prevailing in runner growing areas (which are usually situated in cold climates), one wonders what might be the effect on yield of plants grown in such artificial conditions, unless seasonal conditions can also be artificially reproduced to ensure sufficient chilling, etc.

I believe many questions must be answered before commercial propagation by tissue culture methods will be undertaken on a large scale for sale of plants to commercial strawberry fruit producers.

Propagation by seed is another method of reproducing strawberry plants, however, this is usually confined to breeders in developing new cultivars.

As you can see that whilst the skills required in the actual propagation may not be at all difficult to acquire, expertise in crop management is most important to achieve certification of a strawberry crop. Economic fruit yields will only be achieved on a long term basis with the use of "virus-free" plants.