Items 1 and 2 may merely be manifestations of the same property. In some circumstances speed of growth may not be important in itself, but the larger plants produced in a season may command higher prices. In other cases, e.g. house-plants and bedding plants, quicker growth may mean quicker turn-around of crops, and increased output from a given installation.

A higher percentage of saleable plants from a given number potted may also make considerable differences in crop returns. Nurserymen often fail to appreciate what these differences may mean in terms of money.

Plants growing in P.B. 8s will pot at about 200 per M^3. If increased growth brings an additional 10 cents per plant, not difficult to achieve, the extra return could be about $17.50 per M^3, far more than the increased cost of the growing medium. If a better medium gives 5% more saleable plants, at $1.00 per plant, this represents $20.00 extra per M^3, again, far more than the increase in media cost. Quicker turn around may be even more effective. On one nursery, improved turn around gave increased profit in excess of the total media cost on that nursery for one year.

It is possible to overcome some of the effects of low yielding potential of a growing medium by using larger containers. This, however, increases cost in other ways, such as more media used per 100 plants, higher packing costs, and increased transportation costs.

I have endeavoured to point out areas where the less obvious costs can occur in using a particular growing medium. It is not possible to itemize these, because the individual items will vary from nursery to nursery. Growers would be wise, however, to compare any particular medium with the best medium which can be devised for their particular operation. They will then be in a position to evaluate many of the cost areas which I have discussed.

PLANT QUARANTINE PHILOSOPHY IN NEW ZEALAND

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Is Quarantine Justified? Two of the most important potato pests (cyst nematode and wart) have been found in New Zealand within the last few years; so have bacterial wilt of lucerne, *Sitona* weevils (pests of pasture legumes), and the blue-green lucerne-aphid, amongst others. However, New Zealand is still

fortunate in being free from many plant pests that occur overseas, as can be seen from Table 1.

Table 1. Approximate Number of Crop Disease Pests.

Crop	Known In	
	New Zealand	World
Barley	15	50
Maize	15	70
Dwarf beans	20	90
Potatoes	40	100
Onions	20	35
Strawberries	20	70
Peaches	45	80

The figures in the table are an over-simplification but show that many crops in New Zealand are still at risk from the introduction of new pests from overseas and that quarantine is necessary.

Many factors must be taken into account, such as our country's natural isolation, the need to import plant material either for planting or consumption, the pest status of our own economic and/or aesthetic plants, and the effect that a serious new pest could have on our plant exports.

Plant Quarantine. Animal quarantine in New Zealand is successful as animal disease cannot spread naturally; only two animal species are of prime economic importance, smuggling of cattle or sheep is difficult, and New Zealand is not dependent on imports of animals other than for the introduction of new breeds. By comparison, the plant quarantine situation is almost exactly opposite:

1) Because their hosts are stationary, plant pests are adapted for natural spread, although relatively few spread hundreds of kilometres on the wind. Like animal pests, however, they are easily spread by man when he moves infested propagating material or produce.

2) Many hundreds of plant species are of economic or aesthetic significance in New Zealand but, with the possible exception of rye grass and white clover, the economic importance of any one species is comparatively small.

3) The introduction of a new pest, although possibly of serious consequence for the crop concerned, will generally be of limited economic significance to the country as a whole.

4) Almost all the economic and most aesthetic plant species in New Zealand are introduced and we still depend on imported supplies of some plant produce and seeds.

5) Many of the seed-transmitted pests of New Zealand's traditional annual crops were already introduced long before serious thought was given to quarantine.

It is, therefore, neither necessary nor desirable to apply similar quarantine measures to the introduction of both plants and animals.

Potential Benefits of Plant Quarantine. It is difficult to place a monetary value on the benefit of quarantine but the establishment of a new important pest will cause loss in crop production and/or quality and is likely to result in increased production costs through additional control measures. There may also be an effect on exports. Although not a major item, New Zealand does export significant quantities of plant products, seed and nursery stock, with considerable potential for more, but this potential would be reduced if serious new pests become established. Already we are in a somewhat privileged position in respect to the export of some crop seeds to Australia. Seed certified as being grown in New Zealand has assured entry into Australia, *provided the pest status in New Zealand does not deteriorate*. Similarly, we have very few of the serious pests listed by the countries of the European Economic Community and so there are few plant health restrictions on trade with those countries — *provided the pest status in New Zealand does not deteriorate.*

Quarantine Philosophy. New Zealand's philosophy seems to be:

1) Being at considerable risk from the introduction of new pests from overseas and having good natural isolation, it is worthwhile taking sensible plant quarantine precautions.

2) Economic crops should be protected against known serious exotic pests, by strict measures if necessary.

3) A prohibitive procedure in respect of all propagating material is not justified.

4) Planting material cannot be considered pest-free on the basis of visual inspection alone and detention for a period in post-entry quarantine is necessary.

5) The greatest risk is with imported nursery stock and seed, where a pest is already in contact with its host.

6) The risk of introducing a new pest increases with the quantity of plant material imported.

7) Fruit and vegetables for consumption should not be imported from regions that present a serious pest risk unless the produce can be effectively treated.

8) Exotic pests will continue to arrive in New Zealand either naturally, or by accident as "passengers" on imported goods; some of these may become established. Introductions of

this nature are largely unavoidable and contingency plans are necessary to eradicate or contain a new outbreak if practicable.

Quarantine Practice. New Zealand has put its philosophy into practice through the Introduction and Quarantine of Plants Regulations, 1973, issued in pursuance to the Plants Act, 1970. These regulations govern the importation of plant material into New Zealand and their main provisions are summarized in respect of the following classes of material:

Nursery Stock (whole plants, cuttings, budwood, etc. for growing) frequently carries pests which, being already in contact with their host, can easily establish when the host is moved to another area. Importation of nursery stock of economic plants such as berry fruits, citrus, many conifers, grapes, pip and stone fruits is therefore restricted to very small quantities of new cultivars which must pass through a period of strict post-entry quarantine (close quarantine). Most other classes of nursery stock (covering several thousand species of plants) present less of an economic risk and importation is subject to a less restrictive procedure (open quarantine). Nevertheless there is a limit on the number of plants that an importer may introduce in any one year and the plants are still required to be grown for a period in post-entry quarantine, usually on the importer's property. In theory this is not a very good precaution because conditions may not be suitable for a pest to manifest itself and it could escape detection or, alternatively, conditions may be so good that the pest builds up between inspections and has already spread by the time it has been detected. Nevertheless this system has been operating in New Zealand for about 25 years and very few new pests are known to have been introduced in this way.

Seeds of all annual economic crops can carry pests that are transmitted to the following crop but, because traditional crop seeds have been in international trade for so long, New Zealand already has many of the important seed-transmitted pests of these crops. Quarantine precautions therefore vary with the species of plant. There are almost no health restrictions on seeds of most common vegetables because all the important seed-transmitted pests are already in New Zealand. On the other hand we have few pests of newer crops such as maize and soya beans and seed import requirements are very strict, but vary with the pest situation in the country where the seed was produced.

Commercial crop seed often contains seeds of noxious plants as impurities and importations must also be officially sampled, usually in the country of export, and certified free from specified noxious plant impurities before entry will be permitted.

Fruit and Vegetables for consumption do not present such a risk as planting material; nevertheless they are usually infested to some extent with insect pests in particular and they are imported in relatively large quantities. New Zealand will not import these commodities from countries where a serious pest risk exists. For example, we are completely free from fruit flies (family *Tephritidae*) and will not import fruit from areas where the more serious species of this family occur unless an effective treatment such as fumigation is available.

SOIL-BORNE DISEASES AND THEIR ROLE IN PLANT PROPAGATION

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Abstract. The effects of four genera of fungal plant pathogens on seedlings and cuttings are reviewed. Current control measures for these diseases are discussed.

Poor seed germination, seedling diseases, and failure of cuttings to grow are common problems. Many fungal disease organisms have been found to be associated with these disorders. All are soil-borne, while some are also carried on seed and may cause disease when seed is sown in moist soil.

Symptoms caused through invasion of plant tissue by these organisms may include seed rot, pre-emergence or post emergence seedling rot and collapse ("damping off"), and a root rot and/or stem dieback of cuttings.

Unfortunately, conditions required for propagation (i.e. misting, high humidity, etc.) often favour growth of disease organisms which are present. The cut base of cuttings and wounding may provide an entry point for disease organisms. In some cases, poor growing conditions may precede fungal invasion (e.g. with *Pythium* spp.).

The following fungal organisms can be important in preventing establishment of seedlings and/or cuttings:

Fusarium spp. A large number of *Fusarium* spp. are present in soil, often occupying a saprophytic role from where susceptible host tissue may be attacked.

Fusarium avenaceum, *F. culmorum*, *F. oxysporum* and *F. solani* are the more important species involved in diseases of seedlings and cuttings. These species are generally not host specific at the seedling stage and have a wide host range. *Fusarium* attack can result in seedling death, (34, and J.W. Ray,

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