put in planter bags. This gives a saleable plant quickly with the least amount of growing area being used.

We are very concerned in avoiding plant roots going around in circles in containers and not getting out of this "merry-go-round" as the plants mature, hence our large use of peat pots and our practice of not leaving plants in plastic tubes when we receive them from another nursery.

"COSTING" A GROWING MEDIUM

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In general terms I am not keen on the process commonly called "costing", although I am happy to admit that cost-accounting, correctly applied, can make a valuable contribution to business management. Too often, however, the process commonly referred to as "costing" is not carried out in accordance with sound cost-accounting principles, and the results so obtained are frequently misused to produce conclusions which may be economically unsound. This approach to costs has recently been focused on growing media for container grown plants.

The true costs of a growing medium are made up of a number of factors, some of which are not easy to measure. The most important of these are:

(a) *The raw materials.* The material costs of a growing medium are fairly easily determined. Table 1 sets out the on-site-cost per M^3 of some commonly used materials, while Table 2 sets out the materials cost of three mixtures made from these, including the costs of a fertilizer programme. These costs will vary from nursery to nursery, and are included here merely as an illustration.

Table 1. Material costs, per cubic meter, delivered on site to the New Zealand Nursery Research Centre.

Soil, good quality loam	$ 8.75
Sand, river, washed	$ 7.50
Sawdust, pine	$ 5.75
Peat, baled Hauraki	$23.00

To the casual observer the difference in price is considerable, with the most expensive mix raising growing media costs by 77% above the cheapest.

(b) *Storage.* When materials are delivered to the site they must be stored, and storage represents a cost. Soil needs to be

Table 2. Materials cost, per cubic meter, of three mixtures, commonly used in nurseries.

Mixture	50% sand 50% sawdust	7 soil 3 peat 2 sand	50% sand 50% peat
Cost	$ 6.65	$11.35	$15.25
Fertilizer	$ 4.50	$ 2.50	$ 4.50
Total	$11.15	$13.85	$19.75

stored under cover to avoid delays during wet weather; other materials may need bin storage if they are not to be dispersed by wind. Storage represents a real cost, the cost of tying up capital, which could only be determined for a particular nursery.

(c) *Preparation of the mixture.* Before use, the materials must be bought together, treated if necessary, and combined. Ease of handling can reduce the costs involved; the more that the materials can be secured in easily handled packages, the less will be the handling cost involved. If sterilization is required for materials handled, the cost of sterilization becomes a cost of using that material. Soil, for example, will normally require sterilization for both disease and pest control; this could cost $2 to $3 per cubic meter.

(d) *Bulk density of the mixture.* Media vary considerably in weight per unit volume. Heavier media increase handling costs in the nursery, both in preparation of the mixture, and in all subsequent operations. When the plants are dispatched from the nursery extra weight means increased freight costs. In one nursery, a 50% reduction in weight of plants brought about a saving in freight greater than the cost of all the growing media used.

(e) *Adaptability to automated systems.* Todays production technology is increasingly based upon automation of the production processes, e.g. automated watering systems. Only media with the correct physical characteristics are adaptable to these systems, which may not only save labour, but may also produce better "yields". The extra labour costs arising from not being able to use automated systems, and the costs of not securing the possible extra growth, are costs of using media not adaptable to these systems.

(f) *Crop yields.* Despite claims to the contrary, our work continues to indicate that the best possible growing medium tends to increase "yield" in three ways:

1. larger plants,
2. saleable plants in shorter time,
3. a higher percentage of saleable plants.

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