Propagation Notes for Some New and Novel Crops Introduced Into New Zealand

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INTRODUCTION

New Zealand's economy is largely based on its primary industries with this likely to continue into the foreseeable future In order to strengthen that base, many plants and animals not normally associated with New Zealand have and are being evaluated to determine their economic viability. Within the horticultural industry crops, such as, persimmons, nashi, autumn raspberries, chicory, babacos and pepinos have, with varying degrees of success, been grown for export.

One of the problems with the evaluation of new crops is that there is often little information available on propagation and production techniques because of language barriers and unfamiliar, traditional cropping practices also tending to confuse the issue.

This paper outlines some of the new and novel crops that have been evaluated at Ruakura along with the propagation techniques that we have found successful. These crops include florence fennel, ginseng, mitsuba, myoga, shungiku, stevia and wasabi.

PROPAGATION METHODS

Myoga. Myoga *(Zingiber mioga)* is a member of the ginger family and native to Japan. It is grown commercially for the young shoots and flower inflorescences or 'blooms' it produces in spring and autumn, respectively. Both are used in culinary dishes. Propagation is generally carried out through division of the underground rhizome (Follett, 1986a). To propagate, the rhizome is cut at an internode. There should be at least one and preferably two nodes present on each section of root. The root sections should then be cool stored, followed by planting out into the field or lining out into propagation trays in a glasshouse. For propagation, rhizomes are lifted in the late autumn or at the end of winter and cool stored. At Ruakura we have found that rhizomes lifted in autumn, divided and repotted into planter bags were more likely to emerge if they had been subjected to six or more weeks of cool storage at 4°C (Figure 1). The assessment, carried out after the myoga rhizomes had been left to grow in a glasshouse environment showed that over 90% of myoga rhizomes were likely to emerge within three months of being divided if they were subjected to cool storage for six weeks or longer. This can be compared with a 45% emergence for rhizomes with no cool storage.

The length of time the roots were in cool storage also affected the rate at which the shoots emerged when planted out Myoga rhizomes that were lifted in autumn were divided and potted into planter bags These rhizomes were then cool stored for either three or six weeks. Cool storage for six weeks compared with three weeks resulted in more plants growing with shoots emerging more quickly (Figure 2).

Seed propagation is unknown with the plant generally being regarded as sterile (Palmer, 1984). Japanese studies indicate that this may be due in part to the highly specific conditions required for pollen germination and pollen tube growth (Adaniya

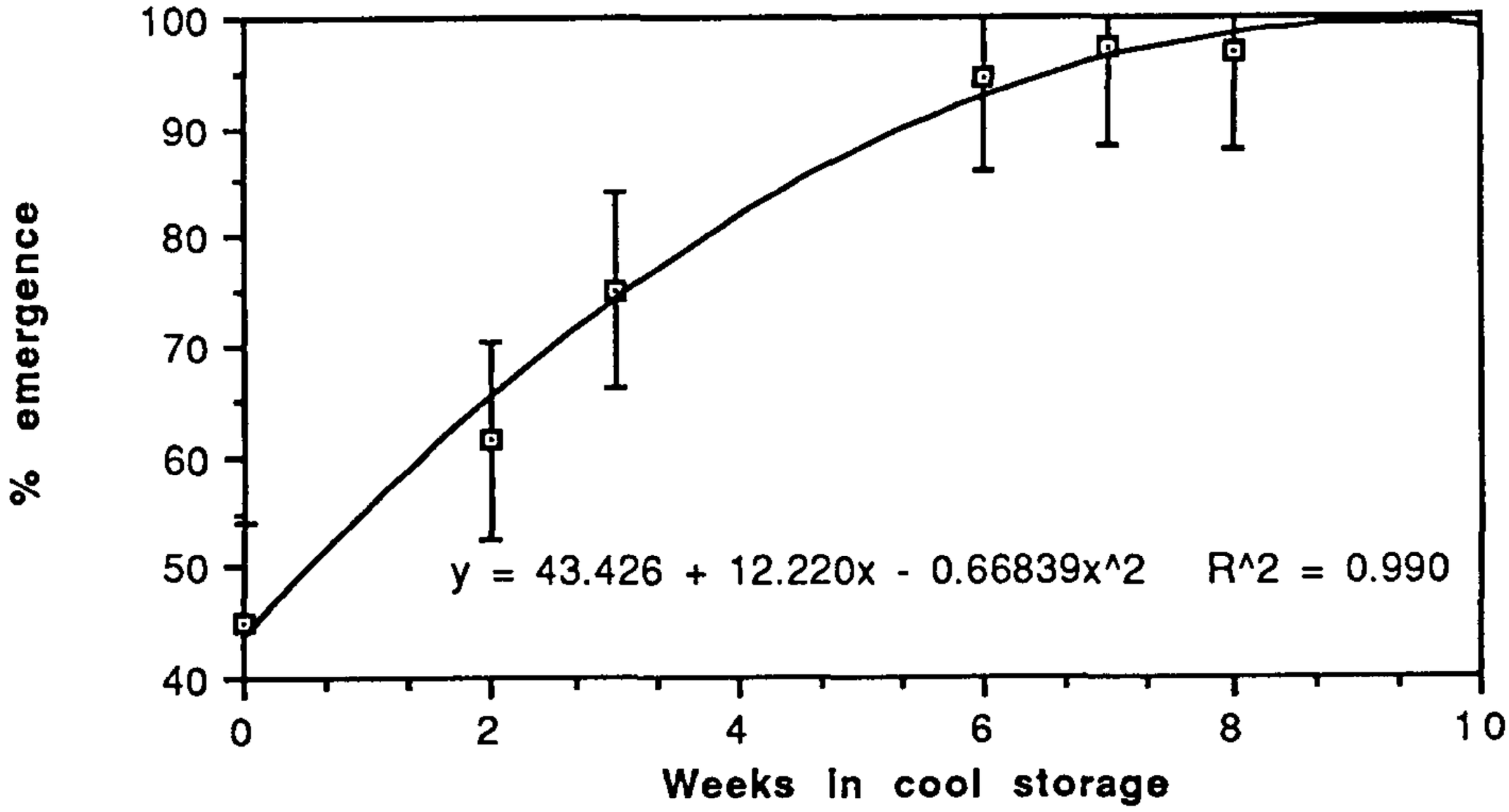

Figure 1. Effect of cool storage of rhizomes on myoga shoot emergence

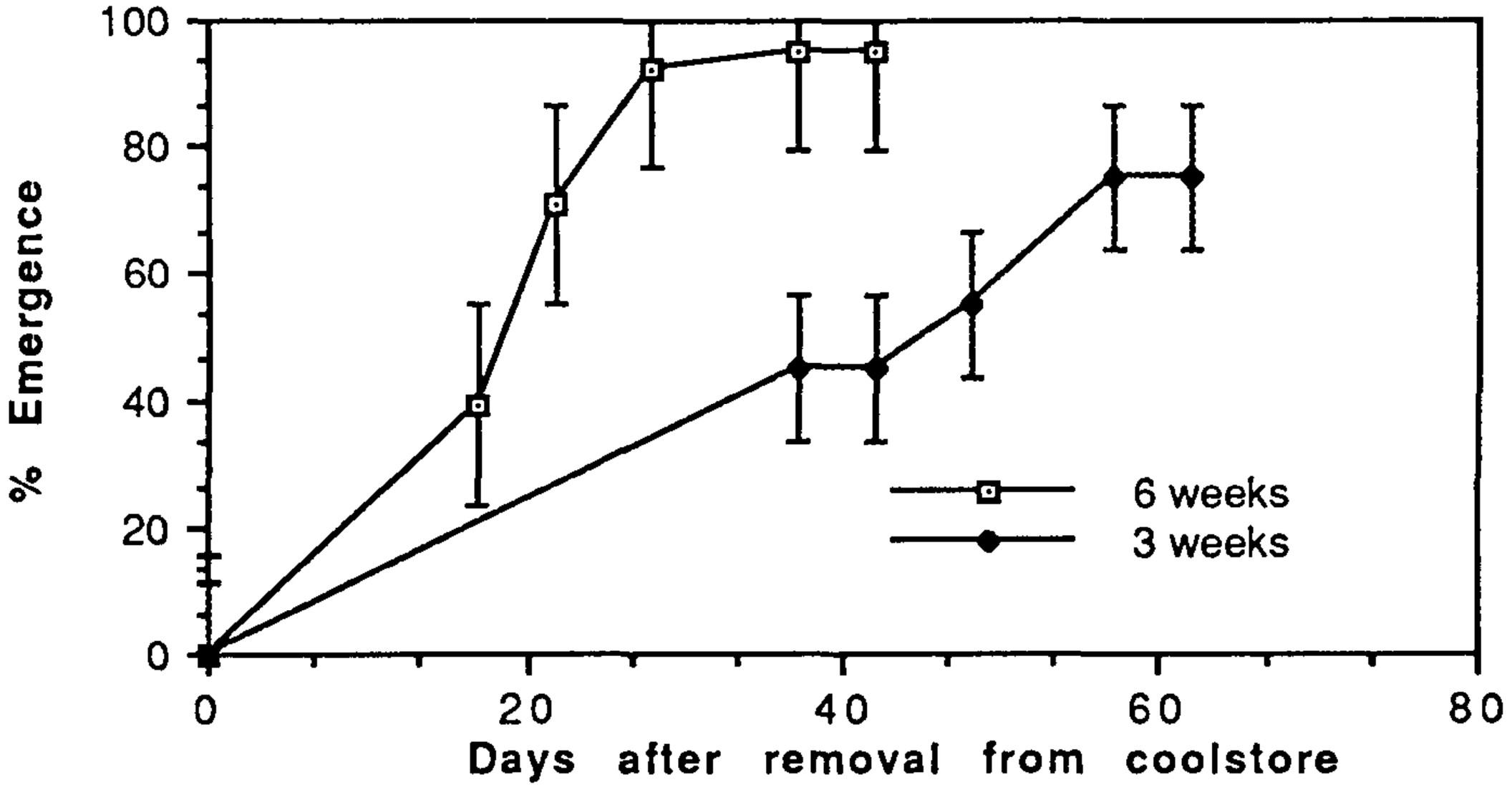

Figure 2. Effect of the length of time myoga rhizomes are in cool storage on the rate of stem emergence

and Higa, 1988). Myoga is also easily propagated by tissue culture .

Ginseng. Ginseng is an herbaceous perennial grown for its root which is highly prized in Asia for its medicinal qualities. The most important economic species are Korean ginseng (*Panax pseudoginseng*) and American ginseng (*P. quinquefolius*).

Propagation is generally by seed which is collected in late summer/autumn A

curing period over a 6 to 18 month period is required to allow the seed embryo to mature and to overcome seed dormancy. At all stages the seed must remain moist. In Korea it is suggested that 100 days is required to fully cure the seed. The seed is mixed in sand in a 1:3 ratio then placed in large cement or wooden troughs between layers of sand and pebbles to ensure adequate drainage. In these troughs the seed is subjected to a period of stratification during the winter followed by storage over summer at 20° C or less which ensures that the embryo grows most rapidly (Stoltz and Garland, 1980). The seeds are regularly watered in excess to ensure they do not dry out. Frequency of watering depends on the time of the year The seeds are then lifted and sown in the autumn so that they can undergo a second period of cool storage prior to germinating in the following spring (Stoltz and Snyder, 1985) Seed coat splitting is an indication that the seed has been cured correctly and is ready to germinate and grow. Present indications are that fresh seed treated with gibberellic acid will split slightly faster and start to germinate after only one period of stratification (Table 1). Further work is required to determine the optimum concentrations of gibberellic acid, as well as optimum soaking and stratification times.

Table 1: Effect of gibberellic acid on ginseng seed ripening.

Treatment	Percent of seed			
	Not split	Split	Split and germinated	Split and rotten
Gibberellic acid	85	10	1	4
Control	99.5	0.25	0	0 25

Green unripened seed was either treated with gibberellic acid or left untreated then stratified for 54 days at 4°C followed by storage at ambient for 36 days before being assessed; 400 seeds were used per treatment

Seed treatment with fungicides is not recommended for *P. pseudoginseng* as it reduces seed viability (Proctor et al., 1990) however American research on *P. quinquifolius* has shown no deleterious effects for most fungicide treatments (Stoltz, 1986). Work at Ruakura has however shown a reduction in the rate of seedling emergence after seed had been soaked in a 1% benlate solution for five minutes prior to sowing for the control of fusarium (found on the seed). Again further work is required on disease control.

Seed is usually sown in situ using either hand pushed or tractor mounted seeders at a rate of 78 to 157 kg/ha (Hartman, 1979). At Ruakura we are sowing seed onto raised beds in rows 15 cm apart.

It is also possible to propagate ginseng by using tissue culture techniques (Choi, 1988).

Wasabi. Wasabi (*Wasabia japonica*) is a semi-aquatic plant native to the montane regions of Japan The plant is used as a condiment with mainly fish and buckwheat noodle dishes.

Propagation is possible by seed, offshoot cuttings, or tissue culture. In New Zealand wasabi flowers from early spring through to autumn. Seed germinates best when sown fresh with seed viability decreasing rapidly when the seeds are allowed to dry.

Optimum germinating temperature for wasabi seed is 5° C (Palmer, 1990). Generally seed is precision sown by hand into specially prepared nursery beds The Japanese seedling production cycle usually sees the seed collected in spring with seed being sown over summer. This ensures the seedlings are ready for planting in autumn. Seed is usually collected for propagation purposes when there is a need to eliminate virus build up and where it is not necessary to maintain a selected cultivar.

Generally wasabi is propagated using offshoot cuttings which are broken from the main wasabi plant at harvesting (Follett, 1986b). Offshoots can be either planted directly into prepared beds or lined out in propagation trays to allow roots to develop before final planting out. At Ruakura we have found that offshoot cuttings readily form roots when lined out in cool shady conditions with the application of propagation aids, such as rooting hormones, having no effect on the production of roots.

Florence Fennel. Florence fennel or finnochio (*Foeniculum vulgare* var. *azoricum*) is grown for the pseudobulb formed by the swollen bases of the stalks. Until recently florence fennel has been a major vegetable crop only around the Mediterranean. Increasing interest both in Europe and the rest of the world encouraged some New Zealand growers to plant small quantities.

Propagation is by seed with 1 gram producing about 120 plants. The optimum germination temperature is 20-22° C, with germination failures likely to occur from seed being sown direct into cold wet soils (Follett and Douglas, 1984). For early spring planting, plants are usually produced under cover in containers or in seed trays, but they should not be planted out too early as cold conditions can induce the plant to bolt and seed.

Sowing directly into containers is not generally recommended because of the uneven germination rate. Seed should be broadcast into seed trays at approximately 20 g/m^2 and the seedlings later pricked out into containers or, if they are vigorous enough, planted direct into the field after grading into similar height classes. In containers the young plants should be grown on at a temperature of 15-20° C. When the young seedlings have grown three to four true leaves they are considered good planting material. For late spring and summer plantings seed can be direct sown at 3 kg/ha to a depth of 1.5-2.0 cm in rows 40 cm apart and a spacing within the rows of 20-25 cm to give a plant density of 10/m^2. Wider spacing encourages plants to develop side shoots, which detract from bulb quality, while closer spacings tend to spoil the shape of the bulb.

Mitsuba. Mitsuba (*Cryptotaenia canadensis*) has long slender stems topped with three small leaves and is used extensively in Japan as a vegetable.

In Japan there are four production systems, all of which involve seed propagation (Follett, 1990). Production of kirimitsuba or cut mitsuba involves spring sowing seed in the field. The crowns that develop are lifted in early winter and these are then forced in specially constructed troughs to produce a product with green leaves and a blanched stem. Ne mitsuba and ito mitsuba are both seed sown field crops. Ne mitsuba produces a white stem as a result of mounding up the soil around the

stem during the growing season while ito mitsuba is not mounded up resulting in a green stem. The fourth production method (ao mitsuba) involves growing the crop hydroponically in glasshouses. Seed is sown thickly onto foam pads placed in trays of water in growth cabinets. When the mitsuba germinates the foam is cut into $2cm^3$ blocks with each block containing several plants. The blocks are then fitted into holes in large polystyrene sheets that float in large troughs containing nutrient solution.

At Ruakura we have found no problems propagating mitsuba by seed.

Stevia. Stevia (*Stevia rebaudiana*) is a small herbaceous shrub grown for its leaves which contain sweet glucosides.

The plant can be propagated by cuttings, seed or tissue culture. Cuttings with a terminal bud collected from new growth produced after winter dieback produce strong healthy cuttings (Follett, 1985). Propagation by seed is more variable. Seed can be sown in situ. However, better results are obtained by germinating seed in a more controlled environment. Seeds can be collected in autumn, sown under cover during winter and be ready for transplanting in spring (Shock, 1982). Stevia can also be propagated from stem tips by tissue culture (Tamura et al., 1984).

Shungiku. Shungiku, garland or spring chrysanthemum (*Chrysanthemum coronarium*) is a popular green vegetable in Japan.

Propagation is by seed produced during the summer months. Seedlings are generally sown into seed beds with the seedlings being transplanted into formed beds when they are at the 4-5 leaf stage (Follett, 1990). The beds are usually 100-120 cm wide with 4 rows/bed and plants spaced 15-20 cm in the row.

At Ruakura we have found no problems propagating shungiku by seed.

CONCLUSIONS

One of the primary requirements of new crop investigations is to have sufficient plant material available for evaluation. Research on plant propagation at Ruakura has enabled sufficient plant material to be generated to allow agronomic research programmes to follow. We have found little difficulty in propagating and bulking up myoga, florence fennel, mitsuba, stevia and shungiku. Problems which require further research include virus buildup in vegetatively propagated wasabi, the loss of desirable characteristics in wasabi grown from seed, and the long curing time required before ginseng seed will germinate.

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