ESTABLISHING A NEW ZEALAND GREEN TEA INDUSTRY

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INTRODUCTION

Several attempts have been made at establishing a tea industry in New Zealand, the most definite of these having been in the north of the South Island. As far back as the 1920s Motueka farmers, in a bid to find new crops for the area, investigated tobacco and tea production. The last remaining tea bushes I believe were at Marahau on the coastal strip in the 1950s, while during that period tobacco production was approaching its peak of around 2000 hectares.

During the 1960s another attempt was made to establish tea production, this time on the west coast of the South Island, and trials were carried out on several sites. This attempt was based on seedling production and the remnants of that indicate the excessive variability of types that resulted. Failure was, I believe, as much due to apathy of the local farmers as anything else. There was support and encouragement from the local Public Relations Officer and help from some existing farmers who were mainly involved in dairying, but when dollars and committment were needed to plant commercial areas, enthusiasm was wanting. Failure was blamed on a number of things, including devastation by opossums, but the people of the area were not ready to diversify into horticulture. It might be different now. In 1979 the first winds of change blew through the tobacco industry with the Government announcement to begin restructuring and removing protective legislation. At the same time a tobacco farmer returned from visiting the Nerada plantation in Queensland and discussed with DSIR the possibility of tea production in the Motueka region. Seed was imported from several sources and plots established with the variability one would expect from open pollinated seed. A feasibility study established that production would not be economic with the New Zealand cost structure and the nearest world market so far away and the project would have died at that point had it not been for an approach from the Japanese to consider green tea production for export to a Japanese company. With an assured market the situation changed somewhat.

ESTABLISHMENT OF A NEW ZEALAND GREEN TEA INDUSTRY

In its most simplistic terms the initial growers met, formed a group, and decided to levy themselves to get the project underway.

In 1981 two members visited Japan and purchased the first cutting material of *Camellia sinensis* cv. Yabukita and returned with this and it was propagated and placed in quarantine.

In May 1983, 800 rooted plants were released onto the Riwaka Research Station to begin trials on propagation and culture of green tea. The project was born from 800 rooted plants and a desire from Sagara Bussan of Japan to purchase the production from 100 hectares.

Two further lots of cuttings were purchased but one did not establish well and the other was destroyed after the identification of a mite not found in New Zealand on the foliage.

THE PROPAGATION RESEARCH

In the early part of 1980 it was clear that a seedling population was going to produce variable rather than quality teas and so some work began to investigate clonal propagation. At Riwaka we had been successful developing a low cost system for hop plant production and the same system was adopted for the *Camellia*.

Success was not immediate as timing of cutting production appeared to be most successful from mid-February to mid-March. Earlier than this, cuttings decayed—later they sat all winter and finally rooted in the spring. The system involved a low wooden frame of 100 × 25mm timber with wire hoops to hold the polythene covering off the cuttings. The frame was set on a shingle base covered with a sheet of black polythene and then filled with 75mm deep propagating compost—a mixture of 50/50, peat/coarse sand.

After setting and watering, the cuttings were sealed into the frame. All of this took place under a shade house to cut out the extreme heat buildup of such a structure in direct sunlight.

In the February–March period, 90 to 95% rooting was achieved within 2 months and the unrooted cuttings were generally of some selections that were obviously difficult to root.

Cuttings were generally tip growth, semi-hardwood, 8 to 10cm long with bottom leaves removed along with a 2cm long sliver of bark, then dipped into Seradix #2 rooting hormone powder (0.3% B-indolylbutyric acid). Though extremely successful, it soon became clear that to produce the required 2,000,000 cuttings by this technique it was going to require a major investment in peat and timber framing.

Early in 1982, Dr. Cohen of Plant Physiology Division, DSIR, and Mr Bruce McKay of the Nursery Research Centre, obtained material and began looking at tissue culture and mist propagation techniques. Both of these were ultimately dropped because of cost factors, though mist and bottom heat were used at Riwaka to bulk up the initial number of plants available for stock. This allowed use of much softer wood.

It was time to modify the closed box system and try some form of field propagation. In late 1983, cutings of hardened spring growth of the plants released from quarantine were set directly into a field situation. The peat and framing were eliminated and cuttings were set directly into a sandy loam, with wire hoops over the top, covered with plastic dug into the soil on each side to maintain humidity, and covered with a double layer of windbreak cloth. A trial to try soil fumigation prior to setting, and setting through black polythene mulch also under the tunnels, showed us all we wanted to know to begin on a much larger scale. We gained very little from fumigation except a clover problem; the weeds were uncontrollable without the black polythene; the polythene, though successful, created problems for feeding once rooting was underway.

THE COMMERCIAL PROPAGATION

Galvanised hoops with a wire spring clip to tension and hold polythene in place are available commercially in New Zealand and so form field cloches for outdoor vegetable and strawberry production. These formed the basis for the commercial propagation of tea. Using wide polythene for the cover enabled sufficient sealing along the soil to adequately stop excessive moisture loss. Along the centre of each tunnel an alkathene tube with micro-sprinklers attached formed an irrigation system. This was manually operated but could easily have been automated. Irrigating during the summer was done 3 or 4 times per week initially but as rooting began this was reduced to 1 or 2 times per week.

A layer of windbreak cloth, to provide shading, was laid on top of the polythene initially, but later light wooden frames were added with a double layer to give protection from sunburn.

Because of the requirement for very large amounts of propagating wood and so as to conserve material a decision was made to change to leaf-bud cuttings. This was adopted for all propagation from 1985 onwards. A sliver of bark was removed from each cutting prior to dipping in Seradix #2 and sticking. Holes were not made in the polythene mulch but the cut end of the cutting was simply stuck through the polythene.

Cuttings were set approximately 2.5cm apart each way and wet down frequently as sticking progressed. Wood was firm enough to begin cuttings in midsummer (mid-December) and continued each season until May. Early cuttings rooted before winter while later cuttings rooted the following spring.

Losses were mainly from *Glomerella cingulata* attack. Aeration to reduce humidity and frequent spraying with captafol (difolatan) or prochloraz (octave) were practised to control *Clomerella*. During 1987/88 narrower polythene was used allowing a 5 to 10cm gap along the bottom of each side of each tunnel and, although spraying continued, the decreased humidity resulted in no *Glomerella* attack. In late October the polythene covers were removed and, after 4 weeks, the shade cloth also.

In spring of 1987 a serious nutrition deficiency developed as cuttings began to put on new growth. Because of the polythene mulch no solid fertiliser could be applied and weekly applications of liquid feed (7:2:4:2+TE) were begun. It took until January, 1988, before cuttings began to respond, but this was totally overcome by late autumn and plant growth was 20 to 30cm high.

Liquid feed was applied with all fungicide sprays during 1988 to try and overcome the nutrition problem. A trial was laid down using 8–9 month Osmocote 18:2.6:10 at 25 gms/m^2 worked into the soil prior to setting. By October, 1988, growth of shoots with this treatment appeared superior to untreated shoots but no measurements have been made. Cuttings have been allowed to grow *in situ* during the summer following setting and in autumn they have been trimmed down to a standard height of 20cm in preparation for planting in spring. Wrenching has also been done twice, once in late February and again in May, by passing an hydraulically-mounted steel wrenching bar beneath the cuttings.

COMMERCIAL PLANTING

In spring, 1987, and early spring, 1988, planting began in the field using Powell tobacco planting equipment or, for the large plants available in 1987, a modified orchard tree planter. This has worked extremely well with in excess of 99% field take.

Planting has been on clay, sandy loam, and stony sites, on ridges and on the flat. Nutrition is either by fertigation or solid fertiliser, inline dripper irrigation, or sprayline overhead and, so far, all variations have been successful.

Weed control is a major consideration with any new large scale field crop. The desiccant herbicides, paraquat, Diquat, and Preglone have been used up to the plant using shields while oryzalin (Surflan) (4–6 kg a.i./ha.) has given excellent weed control sprayed over the rows 3 to 4 weeks afer planting and followed by irrigation or rain. On second year plantings oryzalin has been used over the immediate row with simazine between the rows. Trials on 4 year old plants have shown that simazine can be safely used right up to the stems of plants so, in the future, this will become the main herbicide.

As stock plants became big enough to begin taking larger amounts of cuttings the Grower Cooperative took over the propagation and, since 1985, two million cuttings have been set and approximately 60 hectares planted.

This whole project was initiated by the private sector, carried through by public and private sector cooperation and then, by a group of dedicated farmers banding together, levying themselves and totally funding the costs involved in establishing a new industry.

It has involved probably the largest propagation of a single cultivar of a plant by cutting propagation at one time in New Zealand and the total plants required to set up the industry have all been grown in the space of just 5 years from the original plants leaving quarantine. Over all, costs have been 12 cents per plant.

SLOW-RELEASE HERBICIDES: AN UPDATE

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The need for effective chemical weed control in container-grown nursery stock is obvious. Equally, or perhaps more important, is the need for pesticides that are as safe as possible to society with minimum chance to contaminate the air, soil, or ground water.

Weed competition has been estimated to cause an annual loss of over 3.5 billion dollars in yield and quantity of crops in the U.S. alone (1). In nursery research studies it has been reported that 624 man-hours are required to remove weeds from an acre of one gal. (3.78 liter) containers (approximately 30,000/A) (4). At a labor rate of 5.00/hr the cost to weed an acre could exceed $3,000.

Hebicides, indeed, can reduce these costs significantly. The herbicides, however, must be effective, non-phytotoxic, and environmentally safe.

To assist in this effort slow-release herbicides have been the focus of research at Ohio State University. Original research by Varma and Smith in Georgia (9) and subsequently Ohio (1,3,5,6,7,8) have indicated the feasibility of utilizing particular pre-emergence herbicides in a slow-release form.

In 1980, Koncal (3) incorporated separately, metolachlor (Dual), alachlor (Lasso), oxadiazon (Ronstar) and oryzalin (Surflan) into tablets made of plaster-of-paris in a template. Only highly soluble herbicides leach out of the tablets and result in acceptable weed control. Solubility of metolachlor is 330 ppm, alachlor 242 ppm, ozyzalin 2.5 ppm and oxadiazon 0.7 ppm. Metolachlor and alachlor were most effective in controlling weeds, but neither oryzalin or oxadiazon were effective at all. Very good weed control was achieved for 120 days with metolachlor impregnated tablets.

In 1982, Ruizzo (5) used dicalcium phosphate with magnesium stearate to prepare tablets by dry compression in a Stokes single punch tablet machine. Metolachlor, alachlor, propachlor,