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**STUDIES WITH THE ASPARAGUS 'MOTHER FERN' CULTURE IN A  
TEMPERATE CLIMATE**

**A thesis presented in partial fulfilment of the requirements  
for the degree of Master of Applied Science  
in Plant Science at Massey University  
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## ABSTRACT

In temperate regions, asparagus is normally harvested in spring. An extended harvest season could prolong the supply of fresh asparagus and perhaps lead to an economic gain through high off-season prices. High production costs and low yield of some alternative strategies compared to the normal spring harvest seem to discourage their commercial use. However, field investigations on the mother fern system in a temperate climate have not been done.

From 1995 through to 1996, field and controlled climate growth cabinets studies were conducted to evaluate the asparagus mother fern system in New Zealand. Separate field experiments, for UC 157 and Rutgers Beacon were carried out. Harvesting treatments were, normal spring harvest (September-early December) and two mother fern treatments, run from October-March and December-March. The carry-over effects of the experiment was determined in the spring of 1996, when the crop was harvested for one month (September-October) using the normal spring harvest system only.

In the field study, peak spear production occurred in early December and mid-January, for normal spring harvest and mother fern treatments, respectively. Production of spears declined steadily from January to the end of March. The mother fern treatments resulted in a harvest season, which was 15 weeks longer than the normal harvest. However, the total-, marketable- and cumulative yields, and mean spear weight were significantly lower than for a 'normally' harvested crop. The normal spring harvest produced thicker and heavier spears than mother fern treatments. Spears from the latter were also more seedy than those from normal harvest. Environmental factors (insufficient moisture level, decreasing temperature) and possibly correlative inhibition may have been the causes of the reduced production of the mother fern system.

UC 157 produced higher yields than Rutgers Beacon. The latter produced a large number of thin spears, which resulted in a high rejection rate. The follow up experiment did not show any marked treatment differences in total yield and number of spears.

The experiment conducted in controlled climate growth cabinets studied the effects of temperature and harvesting systems (normal harvest and mother fern system) on spear and fern growth. Potted, one-year old plants, cvs. UC 157 and Jersey Giant, were grown at constant temperatures ranging from 15°C to 35°C at increments of 5°C. Spears (>8mm basal diameter, with closed tips) were harvested from these plants and used to visually assess postharvest shelf life at 20°C.

The relative spear growth rate, spear production rate per plant increased with rising temperature from 15°C through to 30°C, beyond which they declined. Relative spear growth rate, spear production rate per plant and average basal spear diameter of mother fern plants were lower than for those under the normal harvest. Average spears diameter did not show any trend with respect to growing temperature. Correlative inhibition and respiratory activity of the fern, including the production of new roots and buds may have led to a reduction in reduced performance of the mother fern plants. The relative spear growth rate of Jersey Giant was higher than UC 157.

The postharvest storage life of spears stored at 20°C in unperforated polythene bags averaged seven days. Growing temperature, harvesting system, cultivar did not influence the storage life of spears.

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## GENERAL INTRODUCTION

Vegetable asparagus (*Asparagus officinalis* L.) is a dioecious, herbaceous perennial plant belonging to the Liliaceae family. It is a member of about 300 genera of *Asparagus* and appears to be the only species grown predominantly for food, whereas *A. plumosus* and *A. meyerii* are cultivated as ornamental house plants. It is a native of many places including South-Central Europe, Western and Central Asia and North Africa where it may still be found growing in sandy places (Douglas 1990; Feher 1992; Falavigna and Nichols 1995).

*Asparagus* was originally grown and thought to be a temperate crop. However, its production has recently been distributed throughout many climatic zones world-wide (Burrows *et al* 1989; Feher 1992), though it still remains predominantly a temperate crop. The world production area was estimated to have been 120 724 ha and 122 610 ha in 1974 and 1986, respectively (Feher 1992). In 1995 it was estimated that there were 160 000 ha in the world, worth approximately US\$1000m at the farm gate (Falavigna and Nichols 1995).

*Asparagus* is valued for numerous uses: previous reports indicated that it was recognised as a herbal medicine in Europe, especially the rhizome which was used as a diuretic and herbal laxative. The greatest component of trade in asparagus is the spear, a gourmet food (Carpenter 1996). Spears are the vegetative shoots or stems, consumed either fresh or processed (e.g. frozen, canned or in soup powders). Nutritionally asparagus spears are rich in essential elements and have a low calorie content.

Economically, asparagus is a high value export cash crop, and constitutes a good source of foreign exchange earnings in several countries. For instance, in 1994 in the USA asparagus exports to Japan grew from 35% in 1990-93, and along with broccoli contributed to about 90% of \$102.6m of fresh vegetable exports realised within the first six months of 1994 (McNeil 1994a, b). In Lesotho asparagus is a foreign exchange earner and an income generating enterprise. It creates self-employment for approximately 3000 small-scale growers, more than 85% being women and provides seasonal employment to locals as factory workers.

A minor occasional benefit is the use of off-cuts and rejected spears as livestock feed, particularly for cattle.

Several researchers, (Brasher 1956; Nichols 1983; Poll *et al* 1990; Feher 1992) have noted that there is an all-year round demand, particularly for fresh green asparagus. A harvesting strategy that would prolong the harvesting period more than the current three months (depending on the age of the crop and region) in the temperate regions would thus appear advantageous. Harvesting longer would also compensate for the loss of product output due to a general decline in the total area under asparagus production caused by:

- (1) Older plantings gradually reaching the end of their economically productive period
- (2) The replant problem
- (3) Unavailability of suitable new land to establish new plantings

Longer harvest would also provide product for processing over a longer period and thus extend the use of the expensive capital investment (cannery).

The success of the mother fern in increasing asparagus yield and marketable spears, prolonging the harvest period, reducing plant loss, stimulating formation of new roots and buds during harvest has been proven in the tropics. Previous experimental evidence in the temperate climate showed that the mother fern could extend the harvest season. Therefore, expectations and questions arise as to whether this system could be used over the full growing season to produce similar results.

In this research work, it was sought to:

- i) Determine whether the harvest season could be extended using the mother fern in the temperate conditions.
- ii) Determine whether spear quality and yield (weight) would be influenced by use of the mother fern.
- iii) Evaluate the shelf-life of spears from mother fern in comparison to those from normal harvest system.