The New Cultivars of New Zealand Flax

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INTRODUCTION

My interest in flax had its roots in a childhood of viewing large green or bronze New Zealand flax, paired with tree ferns and *Philodendron*, planted in "modern" 1960s landscapes. In structure and form this plant had no equal yet its use had become so prevalent that the plant was on the verge of becoming overly common and boring. Fortunately, new cultivars making there way into the horticultural trade in the mid 1980s rescued New Zealand flax from this mediocrity. San Marcos Growers has had a major role in the introduction of this plant into the U.S. and I would like to share some of what we have learned about this group of plants.

The common name "flax" is applied to several different plants with a fibrous nature that are used for items such as rope and clothing. Thus, such unrelated plants as the "true" or Asian flax (*Linum usitatissimum*) are often confused with New Zealand flax (*Phormium* sp.). As the common name implies *Phormium* come from New Zealand. The name *Phormium* comes from the Greek word for basket after its usage by the Maori, the Polynesians who have inhabited New Zealand since the 13th century. The two species in the genus are variable in growth form and each can be found growing throughout the other's range. The primary differences between the two are in their form, flower color, and position of the fruit. *Phormium tenax* grows vertical in habit, has erect stems of dull red flowers, and upright three-angled fruit. *Phormium cookianum* is typically smaller, has arching foliage, radiating stems of greenish-yellow flowers, and drooping fruit that are cylindrical and often spiraled.

Phormium tenax, first introduced into the U.S.A. in San Francisco, CA in 1871, was followed in 1947 by *P. cookianum,* also first introduced in San Francisco. Eventually both plants migrated from the collector's garden into the mainstream gardening world and unfortunately took on the aforementioned banality of the overused plant. With the introduction of new cultivars in the early 1980s, with a range in color, size, and form that is nearly overwhelming, *Phormium* popularity received an immense boost. The collective name Rainbow Hybrids has been aptly applied to this group which includes such now well known cultivars as 'Maori Maiden', 'Maori Queen', 'Dazzler', 'Sunset', and 'Sundowner'. Many of these cultivars reflect their relationship to one species or the other and some exhibit characteristics that show that they are hybrids between the two.

PROPAGATION OF NEW ZEALAND FLAX

Seed propagation, while relatively easy, limits the grower to one of the species unless a certain amount of variability is tolerable. Much of what is in the nursery trade as *P. tenax* Purpureum Group (syn. 'Atropurpureum') is from seed and the resulting plants are variable in stature and color. Seed collected in late summer and fall should be sown fresh and germinates in 3 to 4 weeks. Seed propagation is one of the few ways that new cultivars are found and in fact much of the "hybridization" that occurs in New Zealand nurseries is really selection from open-pollinated seed. We are

currently evaluating plants grown from *P.* 'Dark Delight' seed that appear very uniform and have deep rich-colored foliage.

Division is by far the most common and reliable method used in propagation of the cultivars of New Zealand flax. Our divisions are taken fall through spring and placed on bottom-heated benches either in a cool greenhouse or under saran. The soil medium should be well drained and the crown of the plant exposed. The size of the division differs greatly with the different cultivars and some cultivars will have very large to small divisions. The smallest divisions are rooted into 2¼-inch rose pots and the largest into 1-gal containers. Rooting-out the liner container can take 4 weeks to 3 months depending on the cultivar, division size, and weather conditions. From the liner it will take 2 to 4 months to root out the 1-gal container and it may take another growing season to fill out the fans in the container. *Phormium* is not a fast crop and considerable nursery stock must be held back to assure an adequate supply for divisions.

Tissue-culture propagation has dramatically increased the availability of many plants, often making rare and difficult-to-reproduce plants common. This has yet to happen to the new cultivars of New Zealand flax, although several attempts have been made. Monrovia Nursery tissue cultured *P.* 'Dazzler' but lost the bold red stripes in the foliage in the process. The resulting plant, dubbed *P. tenax* 'Nanum Purpureum' (syn. 'Atropurpureum Compacta') is an outstanding small red New Zealand flax, but is not *P.* 'Dazzler'. Tissue culture may remain a viable method of propagation of nonvariegated forms of *Phormium*.

GARDENING WITH NEW ZEALAND FLAX

In an article in Fall 1994 of *Pacific Horticulture*, the author, Bob Hornback, noted that "many gardeners were disappointed by these colorful plants, discovering the hard way that the new flaxes are not as hardy or as easy to grow as the old types ... the new flax need to be better understood". The following general guidelines should aid in understanding the needs and limitations of these new hybrids.

New Zealand flax are commonly thought of as plants for full sun and in cool coastal communities, such as San Francisco; full sun does bring out their best foliage color. In inland sites the upright forms grow well in full sun but placement of the softer arching foliage cultivars should be in light shade or morning sun. Evidence of heat stress and sunburn on these cultivars is often seen as gray-brown patches on the leaf surface. The yellow variegations such as *P. cookianum* subsp. *hookeri* 'Cream Delight' seem to tolerate the greatest amount of shade but the red forms tend to loose their luster in deep shade. In Southern California, with the common occurrence of dry Santa Ana winds, some of the hybrids will need summer protection from full sun even when planted near the coast.

The hybrids are generally less cold tolerant than the species, but all seem to be root hardy to at least 15F. In the dry, cold spell that engulfed California in December, 1990, we measured the low temperature at 18F. Most of the flax in our collection went undamaged at this temperature while others had disfiguring damage to all leaves.

Irrigation practices for New Zealand flax are dependent on soil conditions and climate. Coastal plantings can be considered drought resistant, but even here the plants remain most attractive with periodic to frequent irrigation. With short fleshy roots, *Phormium* is an ideal plant for drip irrigation that focuses the water at the

crown. Overhead irrigation works equally well with the plant channeling the water to its base. Some cultivars are even tolerant of waterlogged conditions and used in ponds so long as the crown is kept above the water level.

Planting into well draining soils is a key factor to having New Zealand flax thrive. At the very least the plant should be positioned so that water does not collect around the crown. Many of the cultivars, especially the smaller ones, will languish in heavy soils and often collapse when waterlogged. As with most plants, mulching the soil surrounding a *Phormium* plant is a wise idea and an all-purpose fertilizer applied in late winter is sufficient; however, we have found that some of the red foliage types will respond favorably to annual or periodic applications of phosphorus.

There are several diseases that can be devastating to New Zealand flax but most are either not abundantly present or can be managed through cultural practices. Plants will be more prone to root rots and other disease problems in heavy soils or when the plant's crown is buried. Plants arriving from New Zealand have been diagnosed with *Fusarium*, but this pathogen has not become a continuing problem. The *Phormium* leaf spot (*Gloeosporium*), so common in New Zealand, is not often seen in the United States and seems to be restricted to yellow-variegated cultivars such as 'Yellow Wave'. *Phormium* yellow-leaf virus has not been reported in California, but is prevalent and very damaging to plants in the North Island of New Zealand.

Several insects can inflict damage on *Phormium*. A white powdery crust at the leaf base is evidence of the presence of *Phormium* mealybug (*Balanococcus diminutus*). This insect is somewhat difficult to control and can disfigure a plant and reduce its vigor. It has been a pest of New Zealand flax since its discovery in California on the University of California Berkeley campus in 1906. Until the 1960s it appears that this insect was localized in the San Francisco Bay, but has now become more widespread. It seems particularly damaging to the new cultivars. The long-tailed mealybug (*Pseudococcus longisinus*) causes accordion-like growth that, while interesting looking, is permanently disfiguring to the leaf. Pealing open the leaf reveals the insect harbored within. This pest is less serious than the *Phormium* mealybug and relatively easy to control.

Other pests of *Phormium* include snails and gophers. Snails use the plant as a home to venture out from under cover of darkness and prior to the introduction of new cultivars rarely damaged the plants. The new cultivars are disfigured and weakening by snails chewing the leaves. Selective snail baiting within the crown of the plant can aid in the eradication of this pest. Gophers can and will consume the roots and crown of New Zealand flax and protection or eradication measures should be taken when this pest is present.

Grooming is essential to keep New Zealand flax plants attractive and presentable. As older leaves fade, yellow and tatter they should be pulled from the base or cut as closely as possible. In addition, any fans that do not exhibit the decorative qualities of the cultivar should be removed. The chimera-type variegation present in the new cultivars is prone to losing or changing the variegation pattern as new fans emerge. Usually these leaves turn green or bronze colored, much like the species. It is imperative that the entire fan with this foliage reversion be removed as it will often be the more vigorous and take over the entire plant.

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An Overview of a Computerized Production Program

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How does a complete software package for the horticulture industry work? What are the basic components and concepts that need to be understood to purchase and implement a successful package? In this paper we will look at these basic questions and attempt to answer them by using First Step Greenhouses and Plant Partner as an example.

First Step Greenhouses is a new annual bedding plant plug operation in Southern California. We use Plant Partner software from Starcom Computer Corp. to drive our business. The software handles many different functions including order entry, production planning, inventory control, shipping, production scheduling, and material needs.

For purpose of discussion we will divide the functionality of the software into two topics, sales and production. Sales deals with orders, item pricing, inventory, order collection, and shipping. The first step is to develop a sales catalog. This is a detailed profile of each item for sale including: container used, genus, variety, color, price, plant count per container, location grown, and sales window.

After the items are defined in the sales catalog and individual customers are setup, you can enter in specific orders. Information in orders identify the customer, ship date, purchase order, and shipping method. The order also details each item on order, the quantity, and pricing. You can also enter unique messages specific to the order or to individual items in the order. Reports such as packing slips, invoices, and sales history can then be run.

A master pick list is generated by the program to aid in order collection. This report lists all orders for the day or week. It is sorted by container, variety, then by customer's order. This helps speed collection by only going to that crop once and picking what's needed for all orders. The report also contains inventory information for each item; this helps to identify any shortages and prevents wasted time looking for nonexisting items.

The inventory function enables the user to track items from time of planting or purchase through to shipping. Inventory is first entered as a planted, initial, or purchased inventory. During the course of the crop numbers are deducted for spoilage and losses due to culture. Items on orders are then deducted from inventory as a committed quantity. Mathematically this is how it works: (beginning Inventory — spoilage or loss) = on hand quantity; (on hand quantity — committed or ordered