Making Pineapple Lilies for the World©

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INTRODUCTION

My venture into the world of breeding, selecting, and commercializing pineapple lilies (*Eucomis comosa)* began in 1995. I sowed a few hundred seeds collected from a bed in the South African collection of the Auckland Regional Authority Botanical Gardens. The project was inspired by a visitor from Japan who, upon viewing these delightful plants, asked me to supply him with 5,000 bulbs. I committed to growing them if he guaranteed to buy them, and so it all started. Within three growing seasons I had a field full of flowering bulbs showing great diversity of foliage and flower types. In 1998 I made my first selections and exported my first consignment of bulbs as a mixed strain. This project has now grown to a global exercise, with breeding and selecting done in New Zealand then starter bulbs being shipped off to locations in the Northern Hemisphere to be finished off in the natural cycles for their growing seasons, completely opposite to us in the Southern Hemisphere. This paper sets out to describe the techniques I used to bring the crop from a breeder's dream to a venture that generates regular income as well as a great sense of satisfaction.

ORIGINS, TAXONOMY, AND DESCRIPTION

The genus *Eucomis* belongs to the family Hyacinthaceae. There are 11 species endemic to Southern Africa. The species *E. comosa* is from an area that receives summer rainfall. The range of natural habitat extends from coastal plains to higher elevations in and around the Drakenburg Mountains of Natal. They are perennial, bulbous herbs that are deciduous. In winter, foliage dies back to form a tunicate bulb, which has a long growing season from early spring until hard frost occurs. Foliage is linear-lanceolate to spatulate and ranges in colour from bronze to green. Flowers range from whitish, greenish, to pink. They are arranged in a terminally infertile (coma) bracted raceme on scapes that vary in length. Flowers contain a waxy ovary with six stamens attached at the base. Often they have a faint fragrant scent. The pollen attracts honey bees, bumble bees, flies, and occasionally small birds (e.g., wax eyes) to pollinate flowers. Ovaries swell and often darken in color, and the sequence from flowering to seed becoming ripe is approximately 10 weeks. The coma infertile bracts are one of the main characteristic features of the plant (Fig. 1).

Hybridization. With flowers containing both sexes it is a daunting task to consider emasculation and controlled hand pollination. Therefore I have opted to use natural pollination and to collect seed from the superior progeny. This requires more plants to be grown on to flowering stage and successive years of selecting and sowing. Other than strategic placement of pollen parents, success depends on the work of the bees, a careful eye for selection, and patience. I have found that the original population gave sufficient diversity for a working platform and 12 years of selection pressure being applied have created a population with a more narrow range of features. Selection work is now more a matter of refining commercial attributes rather than giving rise to amazing new finds.

Figure 1. Selection made for cut flower use.

SELECTION

This has been the area where I have been able to apply previous experience in working with other plant breeders over the years to commercialize their dreams. My approach has been more pragmatic than just aesthetic. Here are some of the compulsory selection parameters I have applied to my breeding.

Bulbs Must Produce Offsets Freely. If they do not naturally multiply well they have no use in our production system, so I only plant flowering size bulbs with propagation potential for further evaluation.

Flowers Should Be Densely Arranged on the Scapes. This was a preference from my original customer but still holds true with general opinion on the preferred appearance of the flowers.

Scapes Should Stand Up Well to Wind and the Weight of the Developing Ovaries. This is one of the main selling points we promote because many gardeners have had the unsatisfactory experience of *E. pole-evansii* collapsing soon after scapes are fully expended.

Good Fruit Set. We have found that some selections do set fruit more readily than others. Since the plants can be enjoyed through the process of foliage expanding and changing color to flowers opening and fruits forming, this is a necessity for our pot plant and cut flower selections. Where fruit set is not so uniform the selection must exhibit some other outstanding features. These usually fit into our garden bulb range.

Coma Bracts in Proportion. First the top bracts must be evident or they are not a pineapple lily. For cut flower production we have opted for top knots that are the same diameter as the flower raceme. For the general garden series we have purposely selected a group with very predominant tops.

When we are satisfied with these prerequisites we then set about to fill gaps in our three categories: potted plant range under 50 cm, cut flower range over 60 cm, and a general garden bulb range where distinctive features in foliage or flower form are the main attraction. With the combination of various foliage and flower colors we find we can add six to eight selections to each category. From a commercial viewpoint for catalog listings we do not want more than eight in each category and we will phase selections out as new ones are added.

PROPAGATION

Asexual multiplication is the only practical way for increase because there is too much diversity in seed populations even after our 12 years of refining the strain. The most obvious technique for multiplication is offsets from mature bulbs (Figs. 2 and 3).With some selections we have achieved over 15 offsets per bulb. However when numbers of parent bulbs are still small other options include bulbs sectioning, leaf cuttings, coma bract cuttings, and for initial acceleration of numbers tissue culture (Fig. 4). We only use tissue culture to build up parent stock of clones showing definite promise because the returns we receive from bulbs sales do not warrant ongoing use of tissue culture as a means of propagation. Offsets are removed at time of harvest and stored in bulb racks dry until planting commences in early spring. They are given no special chemical treatments and are stored at ambient temperature under cover, protected from frost or freezing temperatures. It takes one to two growing seasons for offsets to reach a flowering size bulb of 18–20 cm in circumference.

Bulb sections are made from dormant bulbs in July or August (winter) depending on availability of greenhouse space in the spring. The bulbs are dissected in half then into 1-cm-wide wedges that are separated into 1-cm sections with approximately 3 cm of leaf scale attached to the basal plate. They are air-dried for at least 24 h prior to sticking into a well-aerated mix. Cuttings are placed tight into trays since they are replanted once roots and new leaves start to form. It usually takes 10 weeks when no bottom heat is used. We find the few weeks saved by using supplementary heating is not warranted. Bulb sections will grow into 6- to 10-cm circumference bulblets after one growing season and require another season to reach flowering size.

Leaf cuttings should be taken as food stores are moving up into the plant from the bulb prior to flowering. After flowering, energy is exhausted from leaves and taking cuttings late in the season will not yield good bulblet growth before the onset of winter. Coma bracts taken from the flower stalks will root readily and give multiple bulblets. Some light mist and shading from full sun gives adequate survival

Figure 2. Propagation by bulb sectioning and division of bulblets.

rates. A sensor controlled mist bench with bottom heat will give the best results. We cut leaves in 3 × 3 cm sections planting them in a bark and pumice propagation mix ensuring that the proximal end is facing up. Coma bracts are plucked and stuck into the same mix and environment as leaf cuttings. Bulblets from leaf and coma bracts only reach peanut size after the first growing season and often require two further growing seasons to reach flowering size bulbs. Tissue cultures may be initiated from sterilized bulb scales, leaf bases, or flower stalks. There seems to be no difficulty with multiplication rates in culture and plantlets are weaned in the spring to give an adequate growing season with the goal of producing a 6-cm-circumference minimum-size bulb. It usually takes three growing seasons to get flowering size bulbs from tissue culture plants. A similar time is required when making leaf cuttings.

BULB PRODUCTION

Eucomis are not unlike other bulbs in their horticultural requirements. Our production is designed to suit our soil type and relative small scale of operation. We do not produce the volumes that are required to justify mechanical planting and harvesting. Nor do we have access to a sandy soil, which allows for easy cleaning of lifted bulbs. Therefore we have opted to use a system of strata culture planting on cut sections of shade cloth net sandwiched with *Pinus radiata* sawdust. This allows for easy lifting by hand and fast cleaning and offers good weed control during the growing season. The nitrogen draw down effect of the sawdust is compensated by use of slow-release fertilizers that are high in nitrogen content to aid in break down of the sawdust. There are very few pests and disease problems with this crop;

Figure 3. Selection of planting stock from bulbs, bulblets, and scales.

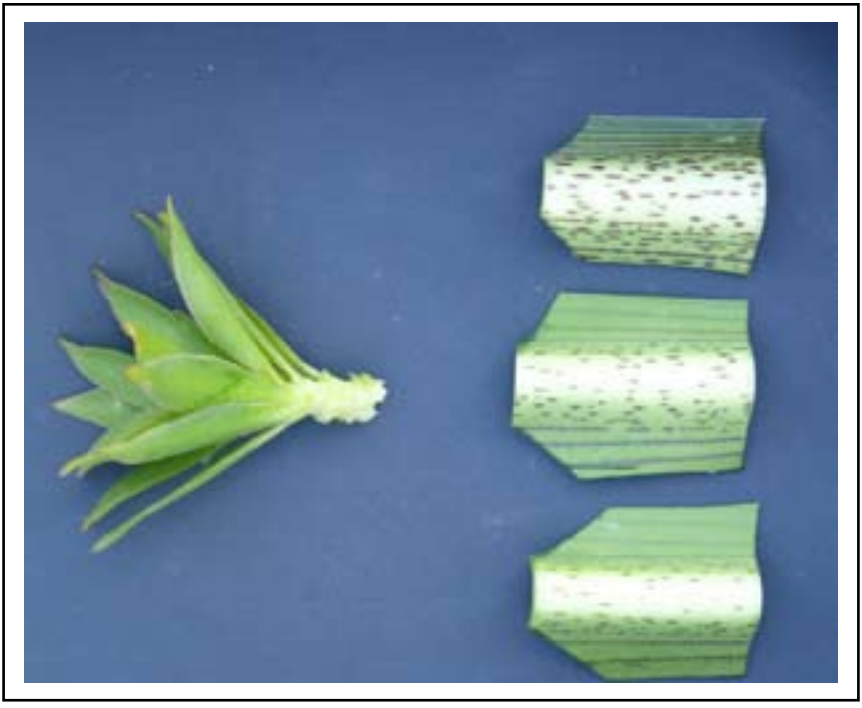

Figure 4. Leaf and coma bract cuttings.

therefore we do not use chemical sprays during production, and we reuse the growing beds for two to three seasons, altering our fertiliser regime according to the stage of breakdown of the sawdust. Due to our windy climate we have to spread a thin layer of composted pine bark over the sawdust to stop it migrating with the wind.

On harvest, bulbs have remaining foliage removed and roots trimmed to stubs, allowing washing to remove any soil or media. After washing the bulbs are dipped in a synthetic pyrethroid insecticide to kill any thrips that may be overwintering in bulb scales. They are then surface dried in tunnel houses and packed in onion bags and heavy cardboard boxes for export. Bulbs for the local market are stored in wire bulb racks in a shed at ambient temperatures until ready for planting in the spring. Some sprouting may occur during spring storage if planting is delayed, but it does not harm the performance of the bulbs.

TESTING

I am choosing selections for pot plant forcers, cut flower growers, and home gardeners. Therefore I have to experience production or growing in each mode before releasing a selection. Potential selections must go through this initial testing before we decide to bulk up to commercial numbers. This is particularly true of cut flower selection where we plant out production beds of 300 to 400 flowering-size bulbs and leave them in the ground for two seasons. During this test production phase we are looking at flower yield, pack out rates, and market acceptability. There is revenue and important commercial feedback from this exercise by selling at the wholesale flower markets. More importantly efforts from the carrying out of tests are rewarded by having fist-hand experience with performance, plus I end up with a considerable amount of parent stock after two growing seasons. For the selections that didn't make the cut we have some deep holes where they are buried.

Selections deemed suitable for outdoor or tunnel-house production of flowering potted plants are grown in 15-cm pots with a range of planting times to extend the selling season. The later they are planted the quicker they are to flower and flower height can also be affected. I have also been experimenting with plant growth regulators to reduce the scape length. Early indications are that paclobutrizol is effective on *E. comosa* hybrids but we still need to refine application rates and method with each cultivar. Where possible I test market these direct to the public through gate sales or in conjunction with talks to gardening groups. Selections deemed as our garden bulb selections (sold as dry bulbs in garden centers or by mail order) are planted out in groups of 20 bulbs in garden beds and left for two seasons. This not only offers a showcase for visitors but it serves as an excellent setting for photographic work.

RELATIONSHIPS AND DISTRIBUTION

Ornamental horticulture is the art of combining the science of growing with the desires of people. As I have set out to sell my selections to anyone in the world who has the wealth and desire for my creations, I have a range of different aesthetic preferences and business approaches to cater for. My early relationship with a flower bulb Japanese importer who sold a premium product through mail order houses is quite different from the trade I have in the U.S.A. with a broker who sells to the mega nurseries who sell to the mega retailers. Now that I have ventured into the European market I need to see how my programme fits with the Dutch, who are the dominant players in the bulb trade. I am pleasantly surprised at the innovative approach an Irish propagator has found for use of my lines.

New Zealand plant breeders and bulb growers are not only a long way from the market place but we are celebrating summer (December to March) at a different time of the calendar year to the northern market. This makes life interesting as the main demand in the Northern Hemisphere for planting summer flowering bulbs is February to April. This is just the time when my *Eucomis* is in full leaf and about to transfer all those food stores from the leaf to create a fattened bulb. It's a senseless time for me to lift my crop. So I have built up a routine of selling unfinished bulbs to growers in the Northern Hemisphere in early June. This is a compromised time slot, which allows me to lift with reasonable bulb development just at the tail end of the Northern Hemisphere planting season. Fortunately *Eucomis* does not have any dormancy requirements to meet, and they resume growing again 3 to 4 weeks after planting. When you look at the time taken to release a new selection, this seemly disadvantageous situation turns into a strategic advantage, allowing two growing seasons out of an 18-month period. Therefore once the New Zealand-grown bulbs die down in their new northern winter (December) they are ready for harvest and sale at the normal time. There are niche markets that want flowering size bulbs out of the normal season, and in these cases Southern Hemisphere-grown bulbs can be planted in June in the north and flower in October/November. However the weight of a flowering size bulb does prohibit this window of opportunity from being very profitable. The cost of production is also prohibitive.

At the moment we sell our smallest grade 6–10 cm to a bulb grower in the U.S.A. who grows the bulbs for 18 months in the ground before harvesting. We sell the next size up, 10–16 cm, to a Japanese bulb grower who lifts them after 6 months. Then we sell a grade that is nearly flowering size (16–18 cm) to Ireland where they pot them and hold them over the dormant period in winter for a quick start in the spring by forcing with supplemental heat. The cost of freight, price of growing space, and grower creativity are all factors that have seen this distribution mix evolve.

TIMELINE AND CONCLUSION

It all takes time, and in a way this is my security that I won't quickly be overtaken by a swarm of other opportunistic breeders and propagators. Here's what it takes to make a new cultivar of *Eucomis* for the world (Northern Hemisphere).

Year 1: The birds and bees do their thing and pollinate from elite selections.

Year 2: Sow seed in the spring into deep seed trays or seed beds.

Year 3 and 4: Bulbs grow to flowering size.

Year 5: Flowering size bulbs with good quantities of offsets are planted out and those with potential are selected.

Year 6–7: Divide selected bulb into 5–12 bulbs of various sizes and plant out to evaluate as a small group.

Year 8–9: Put into bulk-up mode using all means of propagation.

Year 10: You will have a few thousands bulbs for first release to partners in Northern Hemisphere who will grow and acclimatize.

Year 11 or 12: First commercial release to end users.

Year 15: Starting to make a profit from bulb sales or royalties from protected cultivar.

So why make pineapple lilies for the world? Well the market in New Zealand is just too small to take quantities you need to produce to cover the effort. New Zealand has a great climate and soils to do the innovating however we have high cost in production and transport so relationships abroad are important. These may just be partner nurseries or through license agreements for protected cultivars. At the end of the day we need to gain a profit in order to feed our passion for creating with plants as our means of expression.

LITERATURE CITED

Govender, D., H. Baijnath, and **Y. Singh.** 2000. *Eucomis* — An elite éclat of excellence. Herbertia 55:52–57.

Hartley, G., and **A.A. DeHertogh.** 2000. *Eucomis* — A horticultural review of the genus. Herbertia 55:58–63.

Delange, H., S. Tenant, P. Botha, C. Klien, and **G. Nichols.** 1989. Micropropagation and the trade in indeginous medicinal plants. Veld and Flora 75:60–61.

Welsh, T.E., and **J. Clemens.** 1992. Protected cropping of *Zantedeschia* tubers and cutflowers in New Zealand. Acta Hort. No.319:335–339.