Research Report

New Tropical Ginger Cut Flowers

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The objective of this research was to manipulate the natural flowering time of two tropical ginger species in order to produce inflorescences out of their normal season of bloom. One impact of this work would be better prices during the off-seasons for these two species.

The Golden Beehive ginger (*Zingiber spectabile*) normally flowers in Hawaii in the July-August time period, with the bracts turning from gold to a brilliant red during August – September as the inflorescence ages. Corner's dwarf torch ginger (*Etlingera corneri*) with red bracts flowers beginning in late April into late May, but the inflorescences have a long life of several weeks beyond this period when left on the plant. Originally, a pink-bracted species was to have been used, but sufficient rhizome propagation material was not available.

Manipulation of Flowering

Rhizomes of both species were collected at the Harold Lyon Arboretum in September 2007 and rooted in shallow flats of peat-cinder. They were transplanted into 18" x 8" Patio Planters, a molded wood fiber container holding approximately 1.3 ft^3 medium, in January 2008. Details of the medium and fertilization were reported in the first progress report.

Fifteen plants of each species were held under supplemental illumination providing 16 hour long days in a greenhouse from January until late April while the remaining 15 plants of each species was placed in a 30% shade saranhouse at the same time. In late April, 5 pots of each species from each growing condition were transferred to short day conditions (15 hour nigihts), another 5 transferred to the opposite growing condition, and the remainder left in the original setting. This provided us with plants receiving long days, short days, and natural day lengths for the next 8 weeks when all plants were given natural day lengths (13.5 hr at Hawaii's latitude). During this period, the plants were busily elongating their leafy stems and developing new ones. One *Zingiber* plant aside, no plants of either species flowered in their first year, but a large mat of rhizomes developed.

The course of the experiment was interrupted in October 2008 by renovation of the greenhouse and saranhouse, and plants were moved to similar conditions in other structures. Irrigation failure apparently doomed plants in one glasshouse as many stems desiccated and had to be removed, but the plants did recover. Plants in the saranhouse were also water-stressed until the situation was corrected. Plants in the short day greenhouse were in good condition and put on too much growth to be covered with black cloth, so were provided long day illumination from the beginning of November through mid-March 2009. The other plants (saranhouse, greenhouse) received natural daylengths as renovations did not permit lighting or setting up for black cloth.

In April 2009, *Etlingera* plants that had received long days did not flower while those under natural daylengths produced a number of inflorescences. Several of the greenhouse plants produced upwards of 15 inflorescences, an unexpected result given their previous stress. The conclusion we draw from these results is that flowering was inhibited by the long days, while plants undergoing a long period of short days flowered naturally, and at approximately the same time as sister plants at the Lyon Arobretum. Their failure to flower in 2008 was probably because they had not attained sufficient mass from being planted out in January as single stem plants.

The *Zingiber* plants provided long days through the winter produced a couple of small inflorescences in April-May, but did not send up normal inflorescences until late August 2009. Plants given natural daylengths in the greenhouse and saranhouse sent up inflorescence stalks in July, approximately the same time as sister plants in the Lyon Arboretum. From these data, we conclude that a short day period is probably necessary and that it must be followed by a long day period as plants given nearly continuous long days did not flower well. What remains to be elucidated is how long a period of short days is necessary as the period of 12-hour daylengths that these plants received after the lights were turned off was only a couple weeks before days began to lengthen noticeably in April. As with the *Etlingera*, the *Zingiber* plants did not flower in their first year since the mass of rhizome to support inflorescence development was still quite small, with only 6 leafy stems produced in the first 4 months after planting (see earlier report for growth curves).

In brief, each ginger has a potential to be manipulated for out-of-season flowering. The short day requirement is absolute for *Etlingera corneri* and likely so for *Zingiber spectabile*. Since both species produce leafy stems 8 to 10 feet in height, the real problem in providing the short day condition in most standard height growing structures.

Vase Life

Since inflorescence numbers were lower on our potted plants, we gathered inflorescences from mature plants at the Lyon Arboretum to evaluate for vase life. Both are thick, tough-stemmed inflorescences arising from the rhizome mat, and maintaining an attractive appearance on the plant for up to 10 weeks. It was not known what their vase life would be once cut, as similar stemmed heliconia species do not take up water readily and soon dry out.

The first batch of *Etlingera* inflorescences were cut at two different stages of maturity, one set with inner bracts still tightly enclosed by the out ones, and the other with true flowers showing in the axils of the outer bracts. The latter had an average vase life of 11.7 days versus 9.6 days for the less mature inflorescences. In a second experiment, after cutting and cleaning, we dipped inflorescences in water, N-6-benzylaminopurine (N-6-BA) (200 ppm) or a solution of N-(phenylmethyl)-1H-purine-6-amine (PMA) with GA4+7 (200 ppm each). In this experiment with mature inflorescences, the PMA +GA4+7 lasted for 14.5 days versus 13 days for the N-6-BA and control inflorescences. Since some heliconia vase life studies had used sprays of N-6-BA to prolong inflorescence life, we tried aerosol mists of water and 200 ppm N-6-BA on a third batch of inflorescences that were harvested from our greenhouse plants. Unfortunately, the high temperatures of the greenhouse had aged these inflorescences and our results showed only 6.5 days vase life for the water controls and 10.6 days for the N-6-BA treated inflorescences. This suggests re-examination of the cytokinin treatments as both the dip and sprays appeared to offer some increased vaselife.

Only one run of *Zingiber* inflorescences was evaluated for vase life. Inflorescences gathered from the Lyon Arboretum in August, some 4 to 6 weeks after their July emergence, were washed in soapy water to remove insects and debris, then rinsed in cold water and trimmed to about 40 stem lengths. A control set was held in deionized water changed every 3 days when data were recorded. Another batch was held

for 24 hours in 3% sucrose, then placed in deionized water that was changed when data were taken. The third batch was pulsed in 200 ppm GA4+7, then held in deionized water that was changed when data were taken. Stem bases were not retrimmed when data were taken. Fresh weight measurements showed a decline over the duration of the experiment, but water was drawn up by the stems. At discard time, the sucrose and GA4+7 treatments had both lost 28% of their original fresh weight and bracts had withered and dried. Both of these treatments were largely unusable by their 8th day. The water control inflorescences had an average vase life of about 14 days and had lost only 14% of their original fresh weight. A complicating factor in this experiment was an unequal proportion of large and medium size inflorescences among the three treatments, with more of the medium size in the GA4+7 treatment and more of the large inflorescences in the water control. As with the *Etlingera*, it appears that the larger and heavier inflorescences have a longer vase life as close examination of data for the sucrose and GA4+7 treatment shows that the larger inflorescences in these treatments outlasted the medium-sized inflorescences, but not quite to the same period as the water controls.

If two weeks can be reliably attained for vase life of each species after harvest, each has a good opportunity in the flower markets for tropical cut flowers. Despite their fleshy bracts neither produced objectionable decaying odors as they aged. Larger, more mature inflorescences, although heavier to handle and ship, have a longer vase life than smaller or less mature inflorescences. It does not appear that our post-harvest treatments extend the vase life of the *Zingiber spectabile*, although research in Brazil suggests that cool holding temperatures and anti-ethylene compounds may extend shelf life. Cytokinins are well-known for their retardation of senescence in leaves and should be evaluated further for their effects on the bract structures of inflorescences.

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