Table 3. Mean total application costs for herbicides and number of times Roundup (glyphosate) was applied in 1989.

Region	Spray Costs per acre	Spray Costs per hour	Granular Costs per acre	Granular Costs per hour	Applications of glyphosate
North[z]	$ 37	$6.78	$113	$6.29	4.0
Central	117	6.38	144	5.33	9.0
South	70	6.51	111	5.79	5.4
State	75	6.54	126	5.77	6.4

[z]Northwest, Big Bend, and North Florida combined.

level) were found between regions, respondents (12) from the three northern regions reported total spray costs of $37, the southern (29) respondents reported $70 and the central (14) respondents $117 per acre. However, fewer growers (48) reported using granular herbicides. They reported an average cost of $126 per acre for granular herbicide. As in the case of sprayable herbicides, the cost differences on a regional basis were marked, but statistically insignificant at the 5% level.

There are several potential sources for the differences. The hourly cost for applying herbicides varied little by region (Table 3). This implies similar labor and equipment charges. It may be assumed that the price of a specific herbicide is approximately equal throughout the state. Thus the major source of per acre cost variation was probably the amount of herbicide used per acre. The total amount used varies directly with the number of applications. The data concerning the most widely used herbicide supports this logic. Glyphosate application varied by region (significant at the 8.5% level). The respondents in Central Florida reported the greatest number of applications of glyphosate while those in the three northern regions reported the fewest. The cost per acre information is consistent with these findings.

Glyphosate is a postemergent herbicide. As reported earlier, a greater proportion of growers used postemergent herbicides as compared to preemergent products. Those growers who only used postemergent herbicides reported lower costs than those who used both pre- and postemergent products. The reason for this is not clear. Perhaps these circumstances were obtained because the use of postemergents was not affected by the use of preemergents.

In conclusion, nursery size played a major role in determining herbicide usage. Growers with small acreages were less likely to use herbicides. However, weed management practices are relatively homogeneous throughout Florida's woody ornamental industry despite differences in product line. Additional information about handweeding costs needs to be gathered so that the perceived cost benefits of herbicide usage can be accurately documented.

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POTENTIAL CUT FLOWER, CUT FOLIAGE PRODUCTION OF AUSTRALIAN AND SOUTH AFRICAN FLORA IN FLORIDA

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Abstact. **Two regions of the Southern Hemisphere - southern Africa and western Australia, contain a uniquely varied collection of native flora. Evaluation of many selections from this flora for potential cut flower, cut foliage production is continuing at the Agricultural Research Center on the Island of Maui. Although some species of the family *Proteaceae* have been tried in Florida in the past, hybrid rootstocks with resistance to *Phytophthora cinnamomi*, and further results of growing proteas under a wide variety of soils, rainfall patterns, and temperatures in Hawaii and Southern California may offer some new potential for Florida. *Protea cynaroides* (L.) L. and *Telopea specioissima* (Sm.) R.Br. are uniquely adapted to high rainfall areas, while reports from California indicate *Protea eximia* (Salisb. ex Knight) Fourc. and *Protea repens* (L.) L. are tolerant to temperatures of 20 degrees F. *Anigozanthos* Labill. is another example of a genus in which new hybrids deserve another look. A significant degree of resistance to "ink disease" is found in some cultivars.**

Commercial floriculture is big business in Florida, the U.S., and the world. At the 63rd International Floriculture Industry Short Course in Ohio, it was estimated that by the year 2000, the consumer market for floral products in Europe will go from $12 billion to $18 billion, in Japan, from $5 billion to $9 billion, and in the U.S., from $6 billion to $11 billion dollars.

In a continuing search for additional plant material that might be adapted to cut flower or cut foliage production, two countries in the Southern Hemisphere have a richly varied flora - many well deserving further evaluation. In South Africa, the family *Proteaceae* is represented with 330 species in 14 genera, and in Australia, the *Proteaceae* is represented with 42 genera and 860 species. Another interesting genus is the *Anigozanthos*, or kangaroo paw, with 11 species in the *Haemodoraceae* restricted to the south west corner of Western Australia (Elliot and Jones, 1982).

Proteas are commercial cut flower crops in South Africa (Vogts, 1982), Australia (Wrigley and Fagg, 1989), as well as U.S. (California (Criley, 1990), Hawaii (Ben-Jaacov and Ferreira, 1985; Criley, 1990; Parvin, 1985)) and New Zealand (Harre, 1988). New production areas are under development in Zimbabwe, Israel, Madeira, Tenerife and limited trials are reported in El Salvador (Parvin, 1991). Root diseases continue to be a limiting factor in protea production (Von Broembsen, 1989). Since the first 5 acre planting was established in Hawaii, across the street from the Maui Research Center in 1972, the protea industry has expanded to over 300 acres on the islands of Maui and Hawaii.

Kangaroo paws are commercially grown in Australia (Reid, 1988), California and Hawaii (Parvin, 1988), and the U.S. Dept. of Agric. has investigated their potential as pot plants and cut flowers (Roh and Larson, 1987).

Criley and Parvin (1991) recently reviewed cut foliage production research and commented on the increasing interest in exotic foliages.

Materials and Methods

Anigozanthos. Seed of *Anigozanthos manglesii* and *A. veridis* were sown and stage 4 tissue culture plantlets of "Bush Gem" hybrid kangaroo paws were transplanted to 3 in. pots in April, 1986. Plants were transplanted to field, June 15, 1986. The species first bloomed 6 months later, in December and January, while the hybrids started flowering in late March, 1987, continuing through July. Cut flower production was recorded. Flowering stems were cut when the first flower opened. Vase-life was recorded as the number of days until wilting occurred. Water and two commercial floral preservatives, Floralife and Florever were compared. Preservatives were used at the rate of 9 grams per liter.

Proteaceae. Since the beginning of the project in 1969, over 286 species and hybrids of 13 genera (7 from Australia and 6 from South Africa) have been grown and evaluated at the Maui Agricultural Research Center. Results from these evaluations and observations from growth in California, New Zealand, Australia and South Africa form the basis of comments and suggestions made.

Foliages. 25 species and hybrids of 7 genera were evaluated for vase life in 1990 and 1991. Ten stems of each were placed in two holding solutions: water and a commercial floral preservative, Floralife, at a concentration of 9 grams per liter. Daily observations were made on the number of stems judged to be acceptable during a 30 day test period.

Results and Discussion

Anigozanthos. The 2 species, *Anigozanthos manglesii* and *A. viridis*, averaged 12 flowering stems the first year, and 22 the 2nd year. The Bush Gem hybrids averaged 48 flowering stems the first year, and 68 stems the following year (Table 1). The 2 species had a vase-life of 3 to 4 weeks in water or floral preservative, while the hybrids produced up to 7 weeks of vase-life in floral preservatives. Flowering stems over 1 meter in length tended to wilt faster than stems under 1 meter, regardless of holding solution. The two species displayed a high incidence of "ink disease." This blackening of the foliage, which may lead to death of the plant, is now considered a generalized response to stress involving physiological factors such as water logging, salinity, frost, etc., and/or fungal pathogens such as *Alternaria, Puccinia,* and *Mystrosporium.* The hybrids using *A. flavidus* as one parent show a high degree of tolerance to ink disease and deserve wider testing in Florida.

Proteaceae. The protea family evolved in well drained, slightly acid soils from decomposed granite. Although most of the ornamental species are from areas with long dry summers and short wet winters, there are examples from summer rainfall areas.

Proteas prefer a sunny location, a pH range pf 5.5 - 6.5, excellent soil drainage, and air movement through the plant. With a gradual hardening off period, most proteas can tolerate a few degrees of frost. Recommendations for frost tolerance are based on observations in California. Those species able to survive temperatures below freezing include: *Leucadendron eucalyptifolium, L. salicifolium,* and *L. salignum*; *Protea cynaroides, P. eximia, P. grandiceps, P. laurifolia, P. magnifica, P. neriifolia* and *P. repens.*

As a result of 10 years of breeding and selection, the Vegetable and Ornamental Plant Research Institute, Fynbos Research Unit, Elsenburg, South Africa, has developed rootstocks resistant to *Phytophthora cinnamomi.* The goal is to develop grafted plantations on resistant understock, and top working in new cultivars as they become available. That Institute is also developing cultivars and systems of production for protea pot plants, in conjunction with the Volcani Institute in Israel. In California, some varieties of proteas are beginning to appear as tubbed specimens for the patio. Some *Banksia* from seed, and vegetatively propagated plants of *Laucadendron salignum, Leucospermum cordifolium, L. tottum, Protea cynaroides* and *P. magnifica* are popular choices.

Foliages. At the top of the list of potential new cut foliages comes a member of the protea family from West Australia, *Adenanthos sericeus.* This "Smoke Bush" has an average vase-life of 29.5 days in water or preservative. A hybrid *Leucadendron* from New Zealand, *L.* cv Pisa, lasted 27.5 days, and *L.* hy cv Safari Sunset and *L. salignum* cv Yellow Bird came in at 27 days. *Coprosma repens* produced an average vase-life of 26.8 days in water or floral preservative (Table 2).

With new hybrid kangaroo paws, resistant rootstocks in *Leucospermum* and *Protea,* and long lasting plant material with attractive foliages for cut, we look forward to expanded testing and evaluation under Florida conditions.

Table 1. Anigozanthos cut flower production, planted June 15, 1986.

Plant Material	Number of flowering stems 1987	1988
1. A. manglesii	14	26
2. A. viridis	10	19
3. "Bush Dawn"	21	73
4. "Bush Emerald"	27	65
5. "Bush Glow"	27	67
6. "Bush Haze"	27	84
7. "Bush Noon"	31	46
8. "Bush Ruby"	36	70
9. "Bush Sunset"	30	71

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Seed of the *Anigozanthos* species and Australian *Proteaceae* were obtained from Kings Park and Botanic Garden, West Perth, W.A. 6005, and D. Orriell Seed Exporters, 45 Frape Avenue, Mt. Yokine, W.A. 6060, Australia.

Protea seed were obtained from Parsley's Cape Seed, P.O. Box 1375, Somerset West, Cape 7130, South Africa.

Table 2. Vase life of selected cut foliages.

PLANT MATERIAL	AVERAGE DAYS VASE LIFE			
	DEC.		JUNE	
	WATER	PRSV.	WATER	PRSV.
1. ADENANTHOS SERICEUS	30	28	32	28
2. COPROSMA REPENS cv MARBLE QUEEN	30	24	29	24
3. COPROSMA REPENS cv VARIEGATA	27	22	31	23
4. GREVILLEA DIMINUTA	30	30	19	28
5. GREVILLEA HY cv IVANHOE	29	29	22	20
6. GREVILLEA HY cv POORINDA PETER	28	30	16	30
7. GREVILLEA LONGIFOLIA	18	20	14	22
8. GREVILLEA OBTUSIFOLIA	28	21	0	0
9. LEUCADENDRON ARGENTEUM	21	24	10	13
10. LEUCADENDRON EUCALYPTIFOLIUM	14	18	9	11
11. LEUCADENDRON HY cv INCA GOLD	19	28	21	24
12. LEUCADENDRON HY cv PISA	30	30	28	22
13. LEUCADENDRON HY cv RED GEM	25	29	21	28
14. LEUCADENDRON HY cv SAFARI SUNSET	28	30	21	29
15. LEUCADENDRON HY cv SYLVAN RED	15	23	27	24
16. LEUCADENDRON MERIDIANUM	30	30	17	20
17. LEUCADENDRON NOBILE	29	29	0	0
18. LEUCADENDRON SALIGNUM	20	28	16	14
19. LEUCADENDRON SALIGNUM cv RED DEVIL	15	27	0	0
20. LEUCADENDRON SALIGNUM cv YELLOW BIRD	30	30	28	21
21. LEUCADENDRON STELLIGERUM	22	29	0	0
22. MELALEUCA BRACTEATA cv REVOLUTION GOLD	12	14	8	11
23. PITTOSPORUM CRASSIFOLIUM	29	24	26	27
24. PITTOSPORUM sp. cv TOM THUMB	26	27	20	25
25. PITTOSPORUM sp. cv WENDEL CHANNON	25	26	28	27

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THE POLY-POT-PACK: ANOTHER TOOL FOR CONSERVATION OF RESOURCES DURING PRODUCTION OF CONTAINER-GROWN PLANTS

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Abstract. **Two modified nursery container systems [the poly-pot-cap (PPC) and the poly-pot-pack (PPP)], configured to a 15-cm diameter standard pot, were compared with a standard pot, with the potting medium surface exposed (OP) in the production of finished *Dieffenbachia maculata* (Lodd.) 'Compacta'. Each container in the series received 2.15 liters of a 200 ppm N solution, from a 24-8-18 fertilizer with micronutrients, intermittently during production with tap water supplying the balance of water required for plant growth. The PPC and PPP systems produced quality dieffenbachia plants comparable to OP-grown plants and utilized approximately 56% of the water required by plants in OPs.**

In a second experiment, 3 nutritional regimes (100, 200, and 300 ppm N) were evaluated and results indicate that use of a solution of 200 ppm N to provide 65% or more of the water required to finish dieffenbachia plants in PPPs confi-

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