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# Evaluation of Bird of Paradise (*Strelitzia reginae*) for southern dry zone of Karnataka

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## ABSTRACT

The commercial cultivation of Bird of Paradise (*Strelitzia reginae*), a potential exotic flower crop is gaining importance. It is a brilliant tropical cut flower native to South Africa. It is a less known cut flower with high potential but grown on small scale to satisfy special market demands. A field evaluation trial was taken up during 2003-09 at CHES, Hirehalli, Karnataka to study the performance of Bird of Paradise in southern dry zone of Karnataka. The plants flowered within two years of planting. Flowering occurred throughout the year with maximum flowering during December–March. Growth and spike yield indicated that Bird of Paradise is a promising crop for southern dry zones of Karnataka.

**Key words:** Bird of Paradise, evaluation, growth performance, spike yield, exotic cut flower

## INTRODUCTION

Bird of Paradise (BOP-*Strelitzia reginae* Banks), also known as Crane flower, is one of the brilliant exotic cut flowers in the world. It is highly attractive, long lasting and excellent for indoor display. Its fascinating blooms are sold as cut flowers. It is a tropical flower, a general term used to designate a group of species native to tropical and subtropical areas of the world and which are different from traditional floral products such as roses, chrysanthemums and carnations. This category also includes gingers (*Alpinia* sp.), heliconias (*Heliconia* sp.), anthuriums (*Anthurium* sp.) and sometimes orchids. Tropical flowers are perceived by many flower consumers as exotic and unusual, and should have an excellent market potential, particularly in temperate countries. However, their introduction and spread have not been as fast or simple as expected (Pizano, 2005).

Bird of Paradise is an evergreen perennial plant grown in the regions having moderate climatic conditions. It occupies a place of pride in a garden and an important ornamental plant for landscaping. Not only the floral spikes excellent for indoor display but leaves are very good for flower arrangements. It is one of the most popular tropical flowers used in arrangements. Once established, it flowers round the year. It grows wild in the Eastern Cape (South Africa), where the climate is mild with rain distributed throughout the year. In US, it is widely used as an ornamental in Southern California and Florida and is the official flower of the City of Los Angeles. The genus *Strelitzia* belongs to Strelitziaceae and has five species in the genus which is classified under Musaceae. Since it is an introduced crop from South Africa with excellent market potential, it is important to evaluate this exotic crop for growth and yield *per se* to realize higher yields and marketable quality of cut flowers. The variation in this species has not been explore. The aim of the present study is

to evaluate the BOP collections for growth and spike yields and assess the performance in southern dry zone of Karnataka and identify the best suited genotype for commercial cultivation.

## MATERIALS AND METHODS

A field experiment was carried out during 2003-2009 at the Central Horticultural Experiment Station, Indian Institute of Horticultural Research, located at Hirehalli, Tumkur district of Karnataka State. The Bird of Paradise plants (44 collections) collected from nurseries in and around Bangalore were field planted in 2003 at a distance of 2.8 m × 2.8 m. The soil of the experimental plot was clay loam, having organic carbon 0.67 per cent, 238 kg/ha available N, 81 kg/ha available P and 379 kg/ha available K with 6.72 pH. The fertilizer at the rate of 220:70:140 kg NPK/ha was applied in four equal doses in the months of January, April, July and October every year to all the treatments during the period of experimentation. Observations on plant growth and spike yield and floral parameters were recorded. Growth, yield and floral parameters were recorded yearly from 2003 – 2009. The term 'fan' is used for the each clump in bird of paradise plant.Canopy is measured in both the directions namely north-south (NS) and east-west (EW). Floral observations were recorded at monthly intervals. Statistical analysis was done for pooled data from 2006-2009 for growth parameters and 2008-09 for spike yield and floral parameters.

## RESULTS AND DISCUSSION

### Growth parameters

The mean performance of bird of paradise collections with respect to growth parameters has been presented in Table 1. Wide range of variation was noticed in plant height from 103.25 (BOP 25) to 161.75 cm (BOP 33). Based on plant height, the BOP collection can be categorized into 3 groups viz., Tall (> 140 cm), Medium (120-140 cm) and dwarf (<110 cm). Collections BOP 7, BOP 14, BOP 15, BOP 26, BOP 33, BOP 41, BOP 45 and BOP 15 fall under tall category. BOP 25 and BOP 47 can be grouped under dwarf category. While the rest exhibited medium height between 110 to 140 cm.

Leaf production is critical for flower production as each leaf harbors a flower primordia. Number of leaves per plant ranged from 82 (BOP 50) to 483 (BOP 33). Development of inflorescences of *Strelitzia reginae* was reported to be directly related to temperature and number of leaves. 51-55 leaves reported to contribute for good flower production (Haouala and Zouari, 2001).

Leaf length and lamina length directly influence photosynthesis. Leaf breadth exhibited wide variation with narrow leaves (2.67 cm) to broad leaves (14.17 cm). BOP 15 (12.98 cm) and BOP 50 (11.69 cm) recorded significantly higher leaf breadth whereas BOP 17 recorded narrow leaf breadth of 3.43 cm. BOP leaves are used as filler material by florists in floral arrangements. Broad leaves with ovate shape are preferred by the florists for floral arrangements. Clump production interms of number of fans (clumps) per plant was wide with 7.5 (BOP 50) to 65.50 (BOP 26) with mean of 23.92 fans/pl. The propagation by division of clumps is generally preferred as the plants propagated by the said method come to bearing within a year of planting compared to those plants propagated by seeds. The genotypes with more clumps per plant will yield more plants per unit. Majority of the collections expressed clumping intensity between 20 and 35/pl. Clump divisions flower faster than plants grown from seed. Canopy size was more in BOP 26 (504 $cm^2$) and least in BOP 50 (100.98 $cm^2$). Canopy increases with the increase in clump production. Hence, it is recommended that minimum 2 m spacing should be maintained at the time of planting.

### Spike and floral parameters

The plants flowered within two years of planting. Flowering occurred throughout the year with maximum flowering during December-March. The

**Table 1:** Mean performance of BOP collections with regard to growth parameters

| BOP | Plant height (cm) | No. Leaves/ plant | Leaf length (cm) | Leaf breadth (cm) | No. of fans/plant | Canopy NS x EW ($cm^2$) | Spike/leaf ratio |
|---|---|---|---|---|---|---|---|
| BOP 3 | 116.50 | 141.75 | 88.67 | 7.00 | 12.00 | 198.00 | 0.43 |
| BOP 4 | 121.75 | 183.00 | 126.33 | 8.91 | 22.50 | 306.00 | 0.47 |
| BOP 5 | 123.00 | 207.50 | 111.73 | 7.36 | 21.00 | 205.50 | 0.26 |
| BOP 6 | 143.75 | 307.00 | 168.47 | 9.24 | 27.00 | 342.00 | 0.16 |
| BOP 7 | 158.75 | 198.00 | 127.13 | 6.12 | 18.00 | 342.00 | 0.07 |
| BOP 9 | 116.00 | 191.00 | 152.13 | 6.63 | 22.50 | 208.50 | 0.50 |
| BOP 10 | 117.75 | 333.00 | 146.33 | 4.69 | 37.00 | 315.00 | 0.31 |
| BOP 11 | 125.50 | 246.00 | 112.53 | 7.23 | 23.50 | 225.00 | 0.61 |
| BOP 12 | 128.25 | 197.75 | 150.93 | 9.13 | 21.50 | 246.50 | 0.60 |
| BOP 13 | 136.75 | 306.75 | 173.47 | 5.75 | 47.00 | 262.50 | 0.37 |
| BOP 14 | 146.50 | 202.00 | 118.20 | 10.04 | 21.50 | 280.50 | 0.44 |
| BOP 15 | 140.50 | 224.75 | 131.23 | 12.98 | 21.00 | 248.00 | 0.45 |
| BOP 16 | 139.75 | 254.25 | 123.27 | 10.23 | 34.50 | 370.00 | 0.63 |
| BOP 17 | 124.50 | 133.25 | 84.27 | 3.43 | 17.00 | 161.29 | 0.53 |
| BOP 18 | 118.25 | 85.75 | 90.40 | 9.28 | 10.50 | 107.06 | 0.21 |
| BOP 21 | 124.75 | 140.50 | 103.20 | 9.33 | 20.00 | 210.00 | 0.51 |
| BOP 22 | 124.25 | 264.75 | 137.07 | 8.54 | 24.50 | 315.00 | 0.27 |
| BOP 23 | 136.50 | 278.25 | 168.93 | 7.39 | 30.00 | 306.00 | 0.22 |
| BOP 24 | 137.25 | 264.75 | 151.47 | 7.99 | 27.50 | 240.00 | 0.06 |
| BOP 25 | 103.25 | 137.50 | 90.87 | 8.83 | 17.50 | 162.50 | 0.61 |
| BOP 26 | 140.00 | 316.25 | 252.33 | 7.49 | 65.50 | 504.00 | 0.45 |
| BOP 28 | 110.75 | 205.75 | 102.87 | 8.19 | 23.00 | 150.00 | 0.48 |
| BOP 29 | 115.25 | 237.00 | 99.73 | 8.42 | 18.00 | 176.80 | 0.31 |
| BOP 31 | 126.75 | 265.25 | 138.20 | 8.20 | 29.00 | 232.50 | 0.51 |
| BOP 32 | 118.25 | 213.75 | 121.73 | 8.32 | 24.50 | 183.54 | 0.49 |
| BOP 33 | 161.75 | 483.50 | 122.00 | 9.24 | 31.00 | 342.00 | 0.19 |
| BOP 34 | 134.00 | 573.00 | 148.73 | 8.62 | 33.50 | 247.50 | 0.09 |
| BOP 35 | 123.00 | 249.50 | 139.27 | 6.44 | 26.00 | 162.50 | 0.25 |
| BOP 37 | 117.00 | 215.25 | 123.39 | 6.27 | 23.00 | 188.50 | 0.29 |
| BOP 38 | 126.50 | 408.00 | 99.23 | 6.04 | 28.00 | 251.10 | 0.18 |
| BOP 40 | 140.25 | 312.00 | 151.33 | 6.68 | 33.50 | 229.10 | 0.20 |
| BOP 41 | 142.25 | 302.00 | 127.37 | 6.80 | 21.00 | 243.35 | 0.51 |
| BOP 42 | 112.25 | 211.00 | 143.67 | 5.44 | 23.50 | 213.00 | 0.32 |
| BOP 43 | 123.00 | 316.75 | 146.33 | 5.10 | 27.00 | 217.50 | 0.28 |
| BOP 44 | 137.00 | 347.25 | 140.93 | 6.45 | 28.50 | 325.68 | 0.22 |
| BOP 45 | 143.00 | 423.75 | 156.77 | 8.64 | 21.00 | 357.12 | 0.26 |
| BOP 46 | 126.50 | 158.25 | 132.13 | 8.04 | 16.50 | 231.04 | 0.14 |
| BOP 47 | 109.25 | 299.25 | 134.77 | 6.75 | 25.50 | 167.70 | 0.26 |
| BOP 48 | 131.75 | 326.00 | 128.60 | 5.56 | 9.00 | 196.50 | 0.26 |
| BOP 50 | 117.25 | 82.00 | 72.93 | 11.69 | 7.50 | 100.98 | 0.17 |
| BOP 51 | 158.25 | 265.00 | 98.87 | 9.45 | 12.00 | 210.16 | 0.39 |
| BOP 53 | 122.00 | 261.75 | 110.57 | 6.57 | 12.50 | 182.09 | 0.06 |
| BOP 54 | 116.75 | 266.50 | 123.40 | 5.24 | 13.50 | 141.60 | 0.14 |
| Mean | 128.75 | 256.67 | 129.58 | 7.67 | 23.92 | 238.51 | |
| CD 5% | 13.1 | 112.9 | 33.03 | 1.03 | 5.47 | 20.22 | |

*Canopy measurement at the 6th year

flowering pattern recorded is presented in Fig.1. Three peak months of flowering was observed i.e., March, May and September. After May there was gradual reduction in flowering and the flowering rate accelerated from November. Inflorescence yield recorded month wise showed that flowering was maximum during December-March (Fig.1). In Heliconia, which is related to bird of paradise belonging to sterilitziaceae, flower production generally started in April or May with a peak between July and September, and a decline in October and November, ceasing when the temperatures dropped below 10 °C (Broschat *et al.*,1984).

Besemer *et al.* (1981) reported that flower production peaked from October to December and again in spring in 20 *Strelitzia reginae* clones. Total annual flower production increased on average by 51% from one year to the next. Similarly Criley *et al.* (2003) evaluated four cultivars of Heliconia namely, Eden Pink, Garden of Eden, Macas Pink and Candy Cane over a 2-year period to determine their seasonality of flowering and productivity reported that it produced flowers throughout the year.

**Spike and floral parameters**

Mean performance of BOP collections with respect to the spike and floral traits have been presented in Table 2. Spike length is an important parameter in deciding the market value of this cut flower. Spike length was significantly higher in BOP 16 (113.67 cm) followed by BOP 33 (109 cm) and BOP 38 (101.87 cm) with a mean length of 82 cm. BOP 3 and BOP 16 recorded higher inflorescence length where the florets are located. BOP collections BOP 44, BOP 48 and BOP 53 recorded more than 11 cm inflorescence diameter. BOP 31 and BOP 41 had sturdy spike. Wide variations were observed with respect to spike yield. Spike yield

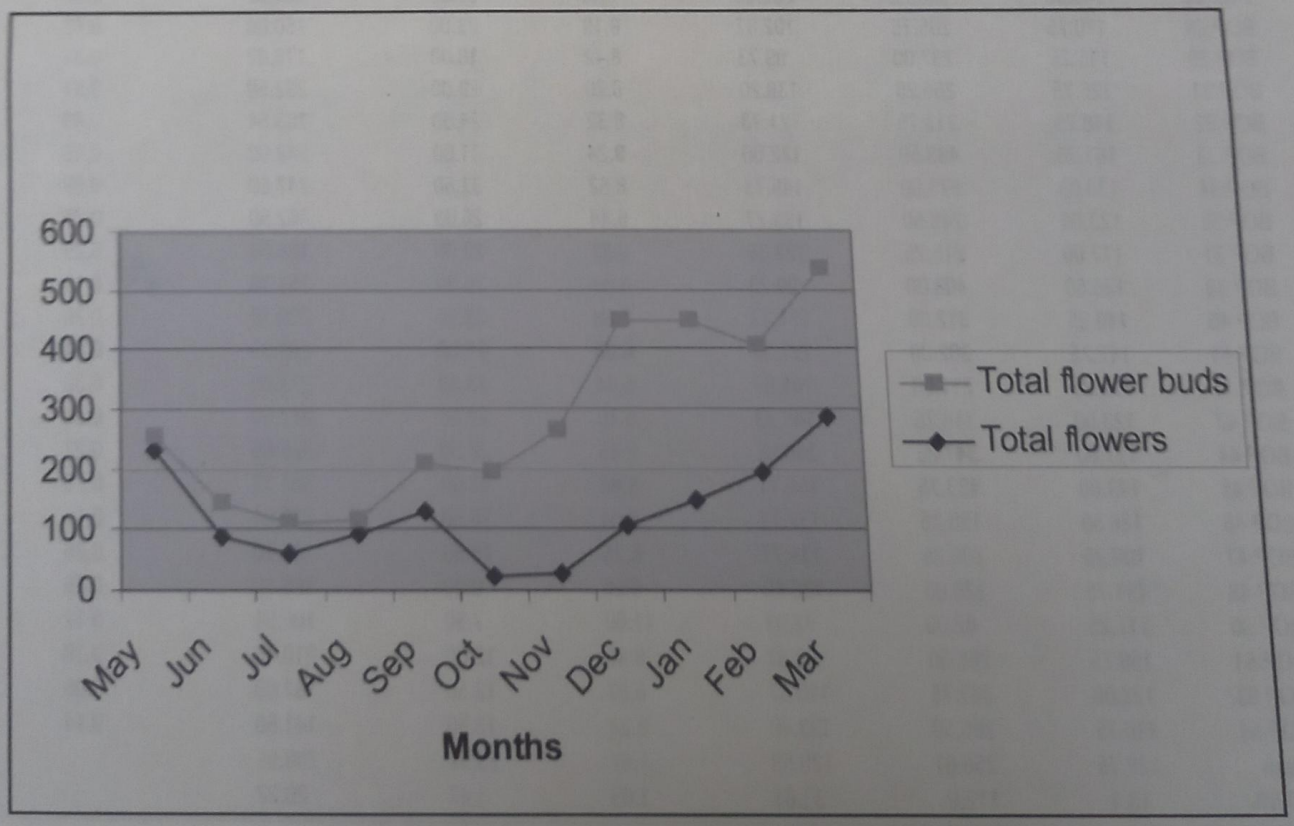


**Fig. 1:** Flowering pattern in bird of paradise in different months

**Table 2:** Mean performance of BOP collections with regards to spike and floral parameters

| BOP | Spike length (cm) | Spike diameter(cm) | Inflorescence length(cm) | Inflorescence diameter(cm) | Thickness of flower stalk (cm) | No. of florets /Spike* | Spike yield/plant |
|---|---|---|---|---|---|---|---|
| BOP 3 | 62.13 | 3.42 | 20.68 | 8.43 | 6.08 | 8.20 | 61.50 |
| BOP 4 | 88.80 | 4.50 | 16.98 | 10.00 | 9.56 | 8.00 | 85.50 |
| BOP 5 | 78.78 | 4.54 | 17.01 | 9.63 | 7.60 | 7.40 | 54.00 |
| BOP 6 | 77.72 | 4.40 | 18.82 | 9.20 | 7.25 | 6.50 | 50.00 |
| BOP 7 | 90.84 | 3.72 | 13.08 | 7.93 | 8.75 | 5.00 | 14.50 |
| BOP 9 | 83.84 | 4.91 | 14.71 | 10.73 | 6.17 | 8.20 | 95.50 |
| BOP 10 | 60.84 | 4.23 | 15.27 | 8.70 | 6.28 | 7.50 | 103.50 |
| BOP 11 | 62.44 | 4.78 | 14.73 | 10.33 | 7.01 | 7.10 | 150.00 |
| BOP 12 | 93.44 | 4.04 | 17.23 | 9.13 | 8.08 | 10.30 | 118.50 |
| BOP 13 | 74.60 | 4.63 | 17.75 | 9.60 | 6.79 | 8.10 | 112.50 |
| BOP 14 | 67.84 | 4.80 | 17.34 | 10.40 | 7.53 | 7.30 | 88.50 |
| BOP 15 | 80.50 | 5.12 | 15.07 | 10.23 | 7.18 | 6.30 | 100.50 |
| BOP 16 | 113.67 | 5.00 | 19.13 | 10.40 | 7.21 | 9.60 | 160.50 |
| BOP 17 | 53.10 | 4.60 | 16.56 | 9.60 | 7.17 | 7.27 | 71.00 |
| BOP 18 | 105.84 | 4.85 | 13.89 | 9.90 | 8.75 | 8.00 | 18.00 |
| BOP 21 | 106.17 | 4.32 | 16.53 | 8.63 | 7.15 | 7.10 | 72.00 |
| BOP 22 | 95.40 | 4.80 | 18.24 | 10.40 | 7.20 | 8.48 | 71.50 |
| BOP 23 | 86.27 | 4.56 | 16.84 | 9.67 | 6.78 | 7.10 | 60.50 |
| BOP 24 | 99.15 | 4.77 | 14.63 | 9.53 | 7.54 | 9.90 | 16.00 |
| BOP 25 | 68.24 | 4.73 | 15.68 | 10.20 | 7.21 | 7.30 | 83.50 |
| BOP 26 | 95.00 | 4.94 | 16.52 | 10.53 | 6.60 | 8.44 | 142.50 |
| BOP 28 | 98.70 | 5.42 | 16.08 | 10.83 | 6.65 | 8.15 | 99.50 |
| BOP 29 | 71.34 | 4.20 | 16.14 | 9.75 | 6.91 | 6.10 | 73.00 |
| BOP 31 | 93.00 | 4.72 | 14.50 | 10.20 | 10.08 | 9.75 | 134.00 |
| BOP 32 | 67.80 | 4.76 | 16.80 | 9.30 | 6.78 | 7.80 | 105.50 |
| BOP 33 | 109.00 | 5.16 | 17.09 | 9.97 | 6.95 | 7.33 | 94.00 |
| BOP 34 | 74.10 | 4.66 | 15.91 | 10.03 | 6.42 | 8.60 | 52.00 |
| BOP 35 | 64.10 | 4.93 | 16.47 | 10.47 | 6.72 | 8.00 | 61.50 |
| BOP 37 | 71.17 | 4.51 | 16.39 | 10.07 | 6.85 | 8.50 | 62.50 |
| BOP 38 | 101.87 | 4.64 | 16.24 | 9.80 | 7.20 | 8.17 | 73.00 |
| BOP 40 | 77.50 | 5.00 | 15.78 | 9.53 | 7.38 | 9.25 | 61.00 |
| BOP 41 | 83.10 | 5.22 | 16.13 | 9.93 | 10.58 | 10.30 | 154.00 |
| BOP 42 | 77.04 | 4.69 | 16.49 | 10.80 | 6.83 | 7.35 | 66.50 |
| BOP 43 | 81.67 | 4.83 | 16.91 | 10.67 | 7.43 | 6.95 | 88.50 |
| BOP 44 | 75.83 | 5.04 | 17.11 | 11.07 | 7.39 | 9.65 | 75.00 |
| BOP 45 | 96.25 | 4.73 | 16.27 | 10.50 | 7.18 | 11.40 | 109.50 |
| BOP 46 | 96.60 | 4.97 | 16.60 | 10.07 | 5.90 | 6.70 | 22.00 |
| BOP 47 | 78.80 | 4.60 | 15.73 | 10.20 | 7.40 | 6.55 | 78.00 |
| BOP 48 | 74.10 | 4.47 | 15.68 | 11.00 | 8.85 | 10.10 | 85.00 |
| BOP 50 | 80.00 | 5.17 | 15.16 | 11.60 | 6.73 | 6.60 | 14.00 |
| BOP 51 | 74.20 | 4.20 | 13.27 | 10.80 | 7.45 | 7.70 | 104.50 |
| BOP 53 | 75.70 | 4.98 | 18.89 | 11.60 | 8.05 | 5.50 | 15.50 |
| BOP 54 | 78.00 | 5.00 | 13.30 | 8.75 | 5.80 | 9.30 | 37.00 |
| Mean | 82.45 | 4.69 | 16.27 | 10.00 | 7.34 | 8.03 | 80.42 |
| CD 5% | 7.24 | NS | 2.36 | NS | 2.38 | 1.18 | 11.61 |

(No. of spikes/plant) was highest in BOP 16 (160.50) followed by BOP 41 (154). A report on harmonic model, consisting of growth and seasonal components, accounted for 80% of the variation in flower production of *Strelitzia reginae*. (Kawabata *et al*., 1984).

Number of florets per spike is an important attribute and it varied in the collections. Mean number of florets/spike was lowest in BOP7 (5.00) and BOP 53 (5.50) and highest in BOP 45 (11.40). High spike to leaf ratio was recorded in BOP 9, BOP 11, BOP 14 and BOP 21. Several clonal selections of *Strelitzia reginae* were made by Besemer *et al*. (1981) over 2 years, based on criteria such as stem length, wide leaves, medium-sized flowers and a green stem neck, high flower to leaf ratio, medium height and different coloured stem neck.

From the analysis and mean performance of the BOP collections, it is evident that there is a significant variation among them for various characteristics. The performance of these collections is good with regard to growth, vigour, spike yield and floral parameters. BOP 25 and BOP 47 are dwarf types and majority of the collections in the present study are medium in plant height. BOP 15 and BOP 50 recorded significantly higher leaf breadth compared to others. BOP 16, BOP 33 and BOP 38 had spike length > 100 cm whereas BOP 12, BOP 41, BOP 45 and BOP 48 produced more florets/spike. BOP 16 and BOP 41 (154) are high yielding producing more spikes per plant. There is wide scope for selection of superior clones through performance of their progenies and popularization for commercial cultivation in southern dry regions of Karnataka.

## REFERENCES


Besemer, S. T., McNairn, R. B. Halevy, A. H. 1981. Studies of bird-of-paradise clonal selections. Part II. Flower production. Flower and Nursery Report Winter, 1-3.

Broschat T.K., H.M.Donselman, Will, A.A. 1984. 'Andromeda' and 'Golden Torch' heliconias. *Hort. Science,* **19(5)**:736-737.

Criley, R.A., J.Y.Uchida, Fu, Z.Q. 2003. Productivity and periodicity of flowering in *Heliconia orthotricha* cultivars. *Acta Horticultura,* **624**: 207-212.

Kawabata, O., Criley, R. A., Oshiro, S.R. 1984. Effects of season and environment on flowering of bird of paradise in Hawaii. *Journal of the American Society of Horticultural Science,* **109(5)**:706-712.

Pizano, M 2005. International market trends - tropical flowers. *Acta Horticulturae,* **683**:79-86.

Haouala, F., Zouari, M. 2001. *Strelitzia reginae:* Effects of vegetative development on inflorescence production in open-air culture. *PHM Revue Horticole.*, **426**:30-33.


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