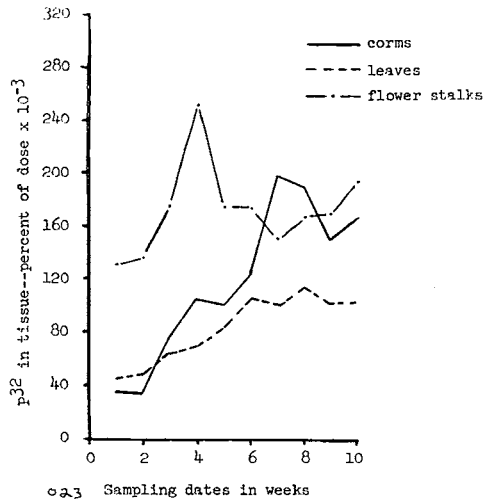

Fig. 4.—P32 in corm, leaf and flower stalk tissue as percent total applied dose at various sampling times following treatment initiation.

and redevelopment of the storage organ, there is relatively little change in the percent translocatible elements in these storage tissues at any time. Total amounts of these elements must vary, however, and thus there must be a net translocation from bulbs and corms to leaf and flower organs during their rapid developmental stages and a later retranslocation of these elements back to daughter bulbs and corms with senesence of the above ground plant parts.

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EFFECTS OF METHODS OF CUT, HEAT TREATMENT AND PLANTING PLACEMENT ON FORCING CALADIUM, SPP., 'CANDIDUM.'

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ABSTRACT

A 5x2x2 factorial experiment in randomized block design was utilized to test 5 tuber-cut methods, 2 planting placement methods and 2 pre-plant heat treatments on tubers of *Caladium spp.* 'Candidum.'

Visual grade did not change due to cut method, but cut methods increased number of leaves and decreased leaf size.

Deterimental effects of 104° F oven storage of tubers persisted throughout the experiment. Characteristic pigmentation of 'Candidum' was sensitive to high storage temperature, physical damage or loss of apical bud and inverted planting placement. Upright planting produced better color-quality than inverted placement.

INTRODUCTION

Caladium production in Florida has increased rapidly since 1949. Smith (9) reported sales increased from $149,376 in 1949 to $758,251 in 1959, with number of large growers increasing from 7 to 38 in Highlands County.

Growth characteristics of caladiums currently restrict them to seasonal sales, but they possibly could be forced to reduce seasonal sales restriction and, therefore, this experiment was established to determine possible tuber-forcing methods.

REVIEW OF LITERATURE

Under normal planting conditions the central or apical eye of caladium tubers breaks first (8). Many growers ream out this apical eye,

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forcing lateral eyes without cutting tubers. Cutting tubers into 3 or 4 pieces and placing "back-to-back" or removing the central eye before cutting tubers was reported to yield more shoots and leaves of uniform size.

Conover et al (4) observed in 2 of 5 varieties tested that lateral buds broke freely on whole tubers planted upright, but according to Ball (2) more buds developed uniformly if tubers were planted with eyes facing down.

Apical dominance in potatoes has been attributed to morphological advantages of apical eyes (1), but Michener (6) proposed that indole-3-acetic acid (IAA) produced by larger buds caused lateral-bud inhibition.

Little is known about optimum-forcing temperatures for caladiums. Reports in the literature on ideal temperatures range from 65° F miniumum to 90° F (8).

Rhoades (7) found that hot water dips of 40 minutes duration at 43° C and 45° C did not retard germination, but 'Candidum' growth was delayed slightly in early-growth stages by a 50° C soak for 25 minutes, although tubers outgrew this effect in 2 months.

Conover et al (4) found that oven storage for 1 week at 104° F increased germination speed and number of leaves produced for varieties 'Lord Derby' and 'Spangled Banner.'

Tubers forced in January usually take 6 to 8 weeks and in May take 4 to 6 weeks to produce salable plants (8). Ball (2) stated that a salable plant could be produced in 4 to 5 weeks at 80-85° F temperatures with high humidity.

Methods and Materials

A 5x2x2 factorial experiment in randomized block design was initiated November 19, 1963 to test 5 tuber cuts, 2 planting-placement methods and 2 pre-plant heat treatments on germination and growth of *Caladium spp.* 'Candidum.' Tuber-cut methods were whole tuber (C_1), central eye scooped (C_2), central eye scooped and remaining portion quartered (C_3), seed-piece chips (C_4) and quartered only (C_5). Tubers were place upright (P_1) and inverted (P_2) and temperature treatments were 40° C (H_1) and room temperature (H_2) 8 days prior to planting. Treatments were replicated 5 times with one tuber per 4 inch plastic azalea pan as an experimental unit.

'Candidum' tubers, 1½ to 2½ inches in diameter were dug, November 16, 1963, spread upright, washed with tap water to remove mulch and debris and air dried until treatments began November 19 with upright position maintained

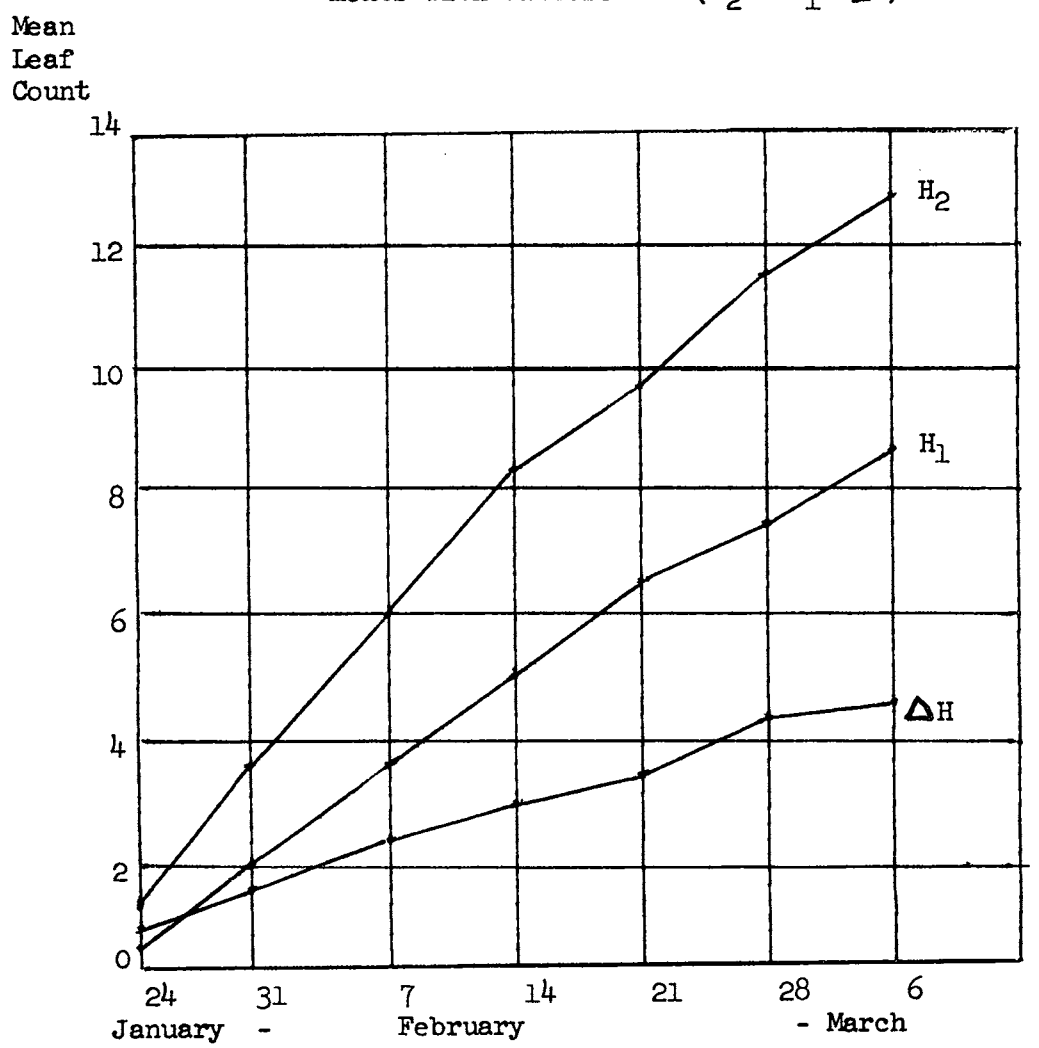
Table 1. Effects of Cut Methods on Leaf Count and Growth Measurements of Caladium spp. 'Candidum'

CUT METHOD	Leaf Count			Growth Index		Leaf Index	Color Quality
	1/31	2/7	3.6	2/7	3/6		
C_1, Whole Tuber	1.1	2.4	6.5	14.4	22.4	17.7	3.20
C_2, Scooped	3.1	4.6	10.7	14.9	22.1	13.4	3.10
C_3, Scooped/¼'d	2.5	4.3	10.3	12.0	18.6	11.7	3.13
C_4, Chipped	3.5	5.9	13.6	11.8	16.6	10.4	2.32
C_5, Quartered	3.9	6.3	12.3	15.3	19.8	12.3	2.60
LSD .05	1.9	2.1	2.8	NS	2.4	1.6	0.57
.01	2.4	2.6	3.4	--	3.2	2.1	0.76

during heat treatment. On November 27 they were cut, labled, placed on paper towels to dry for 24 hours and planted about ½ inch deep. team-sterilized potting soil consisted of compost, German peat and soil in 1:1:1 by volume mixture.

Data included weekly leaf counts beginning January 24, 1964, and visual grade, evaluated March 6, (Figure 2). Visual grade ratings were: 1—poor growth and few leaves cull, 2—small leaves and short growth, poor appearence, 3—medium-sized leaves, fair appearance, salable, and 4—medium to large leaves, bushy, excellent appearance. Visual grades were evaluated by 3

FIGURE 1. Mean weekly leaf count for Heat Treatments with differences (H_2 - H_1 = ΔH)



H_1, 104 F oven storage for 8 days

H_2, room temperature storage for 8 days

researchers and averaged. Color-quality grade was determined March 7, (Figure 3) based on a range of 1-5 with 1 representing maximum leaf greening and 5 maximum amount of white with green veins and 3 intermediate grades. Growth index $\frac{(\text{height} + \text{width})}{2}$ in cm and leaf size index (average of diagonal length plus width in cm) of the apical leaf was measured February 9 and March 11.

Results

Visual grade was not affected by cut methods, but color-quality grades for whole, scooped and scooped/quartered tubers were better than chipped and C_1 was better than quartered tubers (Table 1). Grid counts for C_1 and C_2 were higher than for C_3 and counts for C_1, C_2 and C_5 were larger than for C_4.

C_1 produced fewer leaves than other treatments except C_3 on the first 2 dates and fewer than all other cut methods on March 6. C_4 produced more leaves than C_2 and C_3 by March 6. Growth index (Table 1) did not differ due to cut methods on February 7, by March 6 C_1 tubers and C_2 and C_5 tubers produced larger top growth than C_4 and C_1 and C_2 produced more top growth than C_3.

Whole tubers produced much learger leaves than other cut methods and scooped tubers produced larger leaves than scooped/quartered ones (Table 1). Scooped and quartered tubers produced larger leaves than chipped tubers.

Detrimental effects to tubers of 104° F storage for 8 days were evidenced by reduction of grades and growth measurements from H_2 to H_1 (Table 2). Figure 1 shows that detrimental effects of heat treatment (H_1) were persistent and were not overcome by experiment termina-

Table 2. Effects of Heat Treatment and Planting Placement on Leaf Count, Visual Grades and Growth Measurements of *Caladium spp.* 'Candidum'

		Heat Treatment		LSD		Placement	
DATA	Date	104°F. H_1	Room Temp. H_2	.05	.01	Upright	Inverted
Leaf Count	1/31	2.0	3.6	1.1	1.5	3.1	2.5
	2/7	3.5	5.8	1.3	1.7	4.9	4.5
	3/6	8.5	12.8	1.8	2.4	11.2	10.5
Visual Grade	3/6	2.1	2.9	0.1	0.3	2.5	2.4
Grid Count	3/6	7.5	11.4	1.2	1.6	9.5	9.3
Growth Index	2/7	10.7	16.8	2.3	3.1	13.8	13.6
	3/6	17.6	21.8	-	2.0	19.7	19.7
Leaf Index	3/6	12.0	14.2	1.0	1.3	12.8	13.4
Color Quality	3/7	2.34	3.36	0.36	0.48	3.42	2.28

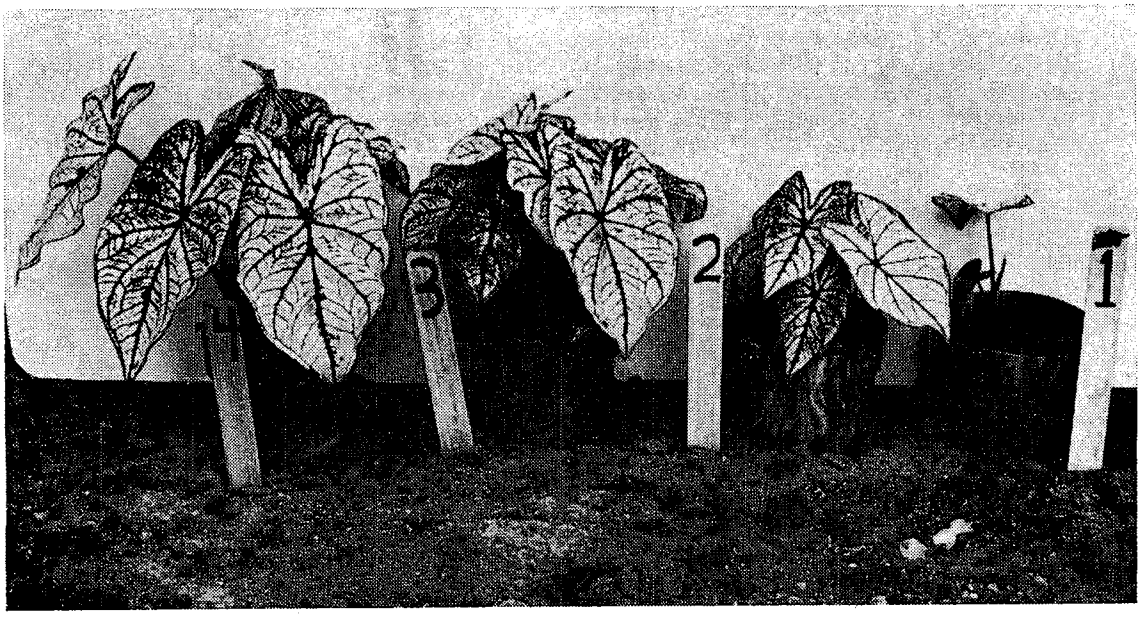


Fig. 2.—Standards for visual grading system used in determining growth of Caladium spp. 'Candidum.'

tion. The curve for difference between means (Delta H) indicated progressively increasing differences between heat treatment and room storage.

Upright placement increased color-quality grade over inverted placement (Table 2).

Discussion

Visual grade did not change due to cut treatment probably because grading included such factors as plant size, number of leaves, grid count and quality rating, which could be combined in various ways to give different type plants similar grades.

Morrison (3) reported that immature, first leaves of caladiums rarely show characteristic color and are usually green. This may explain poorly colored leaves from chipped tubers which produced many breaks with small, physiologically immature leaves. Quartered tubers also produced smaller leaves with lower color quality than whole tubers. White color of variegated leaves has been attributed (10) to chlorophyll breakdown by chlorophyllase. Aspigenin, a white flavone found in white petals of snapdragons and probably in all living cells, could be responsible for white variegation in 'Candidum.' Respiration activity of wound healing (5) and disruption of apical auxin synthesis (10) by cutting tubers may have shifted the chlorophyll/aspigenin ratio toward increased chlorophyll production and greener leaves. Two months after experiment termination, plants with poor coloration developed characteristic white variegation on new leaves, suggesting that detrimental effects to pigment development by chipping or quartering was temporary.

Chipped tubers produced compact plants having many small leaves probably because chipping isolated lateral buds which has been reported to force many buds to break per tuber with a corresponding reduction in per bud carbohydrate reserve and depletion of stored material by wound healing (5). Whole tubers produced few, large leaves while scooped and quartered plants had intermediate growth characteristics. Whole tubers produced one main bud which had maximum stored carbohydrates available resulting in large growth of the one bud and apical dominance which suppressed growth of laterals.

Plants from scooped/quartered tubers produced growth and reduced leaf count compared to scooped or quartered tubers (Table 1,) due probably to high respiration rate for suberin formation and wound healing (5), absence of apical auxin in each tuber quarter (6) an observed fungus infection or combinations of these

Fig. 3.—Color-quality grading standards for rating Caladium spp. **'Candidum.'**

factors. Detrimental effects on leaf count were overcome by March 6. Fungus attack apparently affected leaf count of chipped tubers since they showed only as many leaves as other cut methods, except whole tubers.

Factors possibly causing detrimental effects of high temperature include dehydration of bulbs affecting starch formation, increased respiration, decrease in internal permeability of cells affecting gaseous exchange, loss of metabolic and free water, adverse effects of temperature on auxin and content and effects on enzymes and proteins.

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