May 26, 1976

To the Graduate Council:

I am submitting herewith a thesis written by Stephen Holtrey Street entitled "The Effects of the Ancymidol on Petunia hybrida Hort. 'Orchid Bouquet'." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Ornamental Horticulture and Landscape Design.

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Gary L. McDaniel, Major Professor

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THE EFFECTS OF ANCYMIDOL ON PETUNIA HYBRIDA HORT. 'ORCHID BOUQUET'

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Stephen Holtrey Street

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ABSTRACT

Differences in the response of *Petunia hybrida* Hort. 'Orchid Bouquet' to varying rates of ancymidol were found.

Plant size varied according to time of year grown; however, there was no impairment in the activity of ancymidol on plant retardation. Soil drench applications were more consistent in overall plant retardation than foliar spray applications. Height and foliar spread were reduced in proportion to the amount of active ingredient applied, up to a maximum of 66 ppm. Stem diameter, leaf and stem dry weight, bloom size, root fresh weight, and root dry weight were all significantly reduced by ancymidol treatments. The number of blooms and fresh weights of leaves and stems were not affected by ancymidol treatments.

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CHAPTER I

INTRODUCTION

The production of bedding plants was a $38,246,000 industry in the United States in 1970 (28). During that year bedding plants accounted for 7.8 percent of all American floriculture crops grown. Petunias made up 26.9 percent of all bedding plant units produced in the United States during the year 1970 (28). As a result of their popularity, petunias are considered to be a major spring crop by most greenhouse operators. However, in the production of petunias, the increased light intensity and warmer temperatures of spring (1,14,51) and the modern packaging systems with their small rooting areas, constant water, and high fertilizer rates contribute to excessive stretching and aid in the formation of poorly developed root systems for transplanting into the homeowners' gardens (1,51).

The purpose of this study was to investigate the effects of ancymidol on the growth and development of petunia plants and to determine the possible use of ancymidol as a growth retarding chemical for petunias during the production phase, where excessive stretching is a major problem.

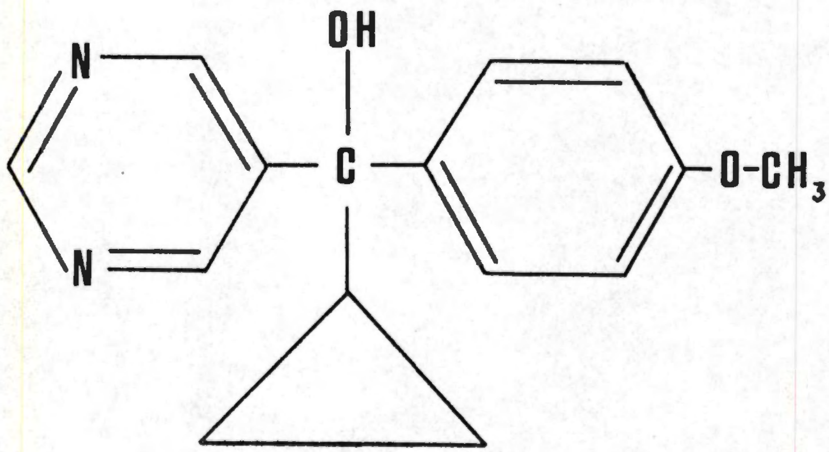
CHAPTER II

LITERATURE REVIEW

I. BACKGROUND

Growth retardants are a relatively new and diverse group of chemicals. Cathey (15) defines a growth retardant as a chemical that slows cell division and cell elongation in shoot tissue and regulates plant height without formative effects. Therefore, growth retardants are an entirely separate group of chemicals from growth inhibitors, which completely suppress plant growth and development (38). Cathey's study in 1964 (15) suggested that plant characteristics may determine the structural requirements for the activity of growth retarding chemicals. There was, however, no obvious correlation between taxonomic classification and the plant response to a particular growth retardant as cultivars of some species differed in their response to growth retarding chemicals. The plants most responsive to growth retardants were the plants which had elongated stems and grew slowly and constantly. Growth retardants were only slightly effective on plants that grew in flushes and plants that formed resting organs.

Ancymidol is a new growth retardant available on the commercial market, being introduced in 1970 (16). Patent problems have caused ancymidol to be marketed under several names: EL-531™, Quel™, A-Rest™, and currently Ancymidol (61). Ancymidol is a synthetic growth retardant and belongs to the substituted pyrimidine class of chemicals. Chemically its name is α-cyclopropyl-α (4-methoxyphenyl)-5-primidinemethanol. The chemical structure (2) is:



Ancymidol is marketed as a 4.5 percent emulsifiable concentrate as a 0.0264 percent solution. Both forms contain 0.2 percent Toximul (surfactant), a trismic buffer of pH 7, a fungistat and bacteriastat (3,61). Label clearance is established only for chrysanthemums, Easter lilies, and poinsettias (2,3,4).

Cathey (15) reported that petunia response to photoperiod, light quality, and night temperature was unaltered by growth retardant applications. However, Shoub et al. (60) in 1973 stated that light was essential for tulip scape inhibition by ancymidol.

Many authors describe ancymidol to be much more active in growth retardation than any other growth regulator (16,18,23,32,64) on a weight to weight or weight to volume basis. Five minutes contact with the leaf surface is sufficient for adequate control (16). Generally there is a visible response to ancymidol within a few days after treatment (4).

Cathey (16) and Vienravee and Rogers (64) reported more plant species were responsive to ancymidol treatments than any other growth retardant. This list of plant species included several that were previously unresponsive to any other growth retardant. However, species and cultivars differ in their response to ancymidol. The following plant species have shown varying cultivar responses to ancymidol treatments: chrysanthemums (25), dahlia (22), geraniums, lilies, marigolds, petunias, poinsettias, tulips (27), and several species of foliage plants and bedding plants (1,9,51,63,64).

Many authors state that ancymidol increases a plant's tolerance to adverse conditions, including air pollution, cold, drought, heat, frost, salinity and excessive fertilizer applications (15,19,20,37,51, 57,64).

II. FOLIAR SPRAY VS SOIL DRENCH APPLICATIONS

Growth retardation by ancymidol is dependent on several factors such as: environmental conditions, plant species, cultivar, cultural practices, timing and type of treatment and the rate of active ingredient applied (2,3,4,9,11,13,16,51,61,63). Ancymidol is reported to be equally effective in growth retardation when applied as a foliar spray or as a soil drench on petunias and lilies (23,30,41,48).

In experiments by Cathey (197) foliar sprays of ancymidol seemed to be more effective than soil drenches in growth retardation on geraniums and seedlings of several plant species. However, others report soil drenches to be more effective in growth retardation than foliar sprays on poinsettias (11,18,21,49), lilies, gomphrena, petunias, verbena, pansy, tulips (27), chrysanthemums (66), and several foliage plant species (16,64). Cathey (16) and Weisser and Sachs (66) report that chrysanthemum roots absorb ancymidol faster than the leaves. It should be noted, however, that most authors specify soil drenches to be the most accurate method of applying a given amount of active ingredient per plant. This is due primarily to the leaf overlap causing run-off problems associated with foliar applications (5,16,66). Erratic results can be obtained from soil drenches of ancymidol if it is applied to a dry potting mixture. This is due to irregular lateral movement of the soil drench in the mix (61).

Adams (1) reported in 1974 that the effect of ancymidol treatments on petunias lasted eight weeks. Cathey (16) described a two week effectiveness on hybrid tea roses and a six week retardation on poinsettias.

III. HEIGHT AND WIDTH

Ancymidol suppresses the height and width on a large number of plant species including chrysanthemums (24,25,32,33,36,40,66), dahlias (22), gloxinia (62), fuchsia (53,54), Easter lilies (23,31,41), several foliage plant and bedding plant species (1,16,39), poinsettias (32), pot carnations (35), Reiger begonias (59), and tulips (26,60). The reduction of height and width is dependent on the inhibition of cell elongation and cell division; however, the exact mode of action is not known (1,2,4,15,25,32,37,48,57,60,62,64,65).

Several authors have published reports of ancymidol increasing the branching of treated plants (1,12,18,51), while others report the number of branches to be unaffected by ancymidol treatments (22,40,54). Ancymidol treatments increased the portion of the total stem bearing dead leaves on 'Mid-Century' hybrid lilies (23) and thickened the stems of petunias and 'Neptune' chrysanthemums (1,36).

Johnson (35) and Farnham and Hasek (27) reported pot carnations and 'Paul Richter' tulip stems to be stronger after treatment with ancymidol, while Gill (31) showed that ancymidol treatments produced limber stems on 'Georgia' Easter lilies. Plan diameters were reduced on gloxinia (62), 'Mid-Century' hybrid lilies (23), and several chrysanthemum cultivars (25) following ancymidol treatments.

IV. LEAVES

Ancymidol reportedly does not affect the number of leaves produced on 'Princess Anne' chrysanthemums, oleander, and several species of foliage plants (39,54,64). Cathey (16) and Furuta _et al_. (30) state that ancymidol arrested leaf formation on some foliage plant species and on bougainvillia. Leaf expansion was arrested on ancymidol treated chrysanthemums (25), and petiole elongation was reduced on caladiums and peperomias treated with ancymidol (30).

Vienravee and Rogers (64) showed leaf size to be unaffected on several species of foliage plants treated with ancymidol, while the leaves of several plant species were broader after ancymidol treatments (57). Several authors describe a deeper green leaf coloration on the treated plants following ancymidol applications on several species of bedding and foliage plants (15,51,57,61,64), gloxinias (62), and pot chrysanthemums (25).

V. FLOWERING

Several researchers have shown that flowering was not delayed by ancymidol treatments in the following plants: most chrysanthemum cultivars (25), 'Mikkelson' poinsettias (21), 'Mid-Century' hybrid lilies (23), most fuchsia cultivars (53), petunias and hydrangeas (1, 15,58). Other authors report a flowering delay following ancymidol treatment on some fuchsia cultivars; 'Puritan', 'Neptune' and 'Princess Anne' chrysanthemums; 'Georgia' and 'Ace' lilies; and several cultivars of dahlia, poinsettias, bedding plants, and gloxinia (2,3,12,15,16,22). Ancymidol causes earlier flowering on pot carnations (35), several fuchsia cultivars (59), Hegg cultivars of poinsettias (49), bougainvillia and most geranium cultivars (9,15,30,57,63). Cathey attributed this earlier flowering to a modification of the cambial activity. This resulted in abnormal cell formation in the xylem and the disappearance of sclerenchymatous cells adjacent to the cortex, resulting in restricted growth. The restriction of growth presumably alters metabolism and creates conditions conductive to flower initiation (15).

Experiments by Larson and Kimmins (40) and Sachs _et al_. (53) revealed that ancymidol treatments had no effect on the number of flowers on poinsettias and fuchsia. However, DeHertogh and Blakely (22) and Moser (48) reported a reduction in the number of flowers on several dahlia cultivars and lilies following treatment with ancymidol. Sydnor et al. (62) reported that ancymidol reduced the bud count on one cultivar of gloxinia; however, flower size was increased under low light intensity. Research on oleander, azalea, hibiscus, gardenias, pot carnations, and some poinsettia cultivars show ancymidol treatments increased the number of flowers (35,54,57,58,63).

Ancymidol did not reduce the flower size in 'Georgia' Easter lilies (31), several chrysanthemum cultivars (39,40), 'Annette Hegg' poinsettias (12), pot carnations (35), and several dahlia cultivars (22). However, ancymidol has been shown to decrease flower size in several poinsettia cultivars (11,18), 'Neptune' chrysanthemums (36), and several cultivars of fuchsia (53), dahlia (22), and pot carnations (35).

VI. ROOTS

Ancymidol treatments, especially soil drenches, slow root development when grown in pots (15,16,27,53). Treatment time must be carefully selected to prevent root growth inhibition. The best time for treatment being at the growth stage where a white root network begins to form on the soil surface (16). Sachs et al. (53), in working with fuchsia, found that soil drenches visibly influenced root formation and perhaps altered root functions. Ancymidol treated roots grown in solution culture were shorter and thicker than the controls but the root weight increased. Potter (51) reported, however, that bedding plants grown under high light intensities and treated with growth retardants had more roots than untreated plants.

VII. DRY WEIGHT

Growth retardant-treated plants grown in soil weighed less than the controls due to the reduced stem length (15). Johnson (35) found that pot carnations treated with ancymidol weighed less than the controls. The percent dry weight was directly related to the concentration of ancymidol applied, with the most dwarfed plants weighing the least.

VIII. ORGANIC MATTER

Ball (8) and Larson _et al_. (42) reported that pine bark mixes offset the effects of soil drenches of ancymidol. However, foliar spray applications and doubling the rate of soil drenches tend to counteract this effect. Larson _et al_. (42) further theorizes that the bark actually ties up the ammonium radical, producing a product resistant to breakdown. In further studies using a potting mixture of two parts pine bark and one part sand, it was discovered that the top six inches of a twelve inch column retained 70 percent of the ancymidol applied (5).

Chrysanthemums grown in a potting mixture of one part soil, one part peat, and one part perlite were 31 percent shorter than the controls, with the mixture retaining enough growth retarding chemical to retard a second crop grown in the same mixture (55). However, other experiments show that 60 percent of the ancymidol applied to the same mixture was found in the leachate (5).

Durso (24) found that ancymidol gave greater reduction as the percent of peat in a potting mixture decreases. At a 0.05 milligram per 10 centimeter pot soil drench rate, plant growth was reduced 44 percent in a 100 percent peat media and 63 percent in a media containing 25 percent peat, 37 percent sand and 37 percent perlite (24).

IX. PHYTOTOXICITY

Many researchers have shown ancymidol to be phytotoxic to several plant species when applied as a soil drench and as a foliar spray (2,3,8,15,16,33,34,37,39,57). Soil drenches are reported to cause damage at high concentrations on 'Georgia' Easter lilies and several poinsettia cultivars (6,9,11,12,31). Foliar sprays have been shown to be phytotoxic to hydrangeas, gloxinias, and most cultivars of poinsettia, chrysanthemum, and lily (2,3,9,11,12,21,34,62).

The characteristic damage associated with phytotoxicity begins with a grey-green leaf coloration giving way to marginal chlorosis, necrotic spotting and a general yellowing of the leaves. Leaf epinasty usually occurs and general malformation of the leaves and flowers occurs in severe cases. The stems tend to accumulate a red pigmentation in most cases (3,9,15,34). It has not been proven that the active ingredient in ancymidol causes the phytotoxicity. Hasek (34) demonstrated that a four-fold reduction of the surfactant content in ancymidol caused no phytotoxic symptoms on chrysanthemums when compared to regular ancymidol treated plants. The activity per milligram of ancymidol applied to the plant appeared to be reduced when the surfactant content was reduced in foliar spray applications. It did not affect the activity of soil drench applications (34). However, Besemer (12) was not sure whether the phytotoxicity on poinsettias was caused by excessive surfactant alone or by excessive surfactant activating the active ingredient in ancymidol.

X. MODE OF ACTION

The mode of action of ancymidol is not understood. However, most authors agree that ancymidol must affect the isoprenoid pathway in some manner (47). Many researchers report that ancymidol slows growth by retarding cell elongation and cell division (9,32,60). Growth retardants have been shown to inhibit cell division in the subapical meristem vascular system, thus the apical meristematic tissue is unaffected and still functions (15,16,50,52). Cathey reported that the cambium and vascular elements on each side continue to divide over a much longer period than normal but the individual cell sizes and cell numbers are reduced and spongy parenchyma cells were less organized. Cathey also states that this change in the stem could alter the transport of many metabolities and essential growth substances to and from the apical meristem, therefore, growth retardants should be considered anti-metabolities. Cathey's hypothesis could also explain cultivar differences as one would not expect each cultivar to contain the same sequence of metabolic steps (15,16).

Einert (26) noted a reduction in the water requirements of ancymidol-treated pot plants, but not on cut flowers. Therefore, he hypothesized that retardation may be the result of a change in metabolic rates or changes in the levels of endogenous products such as ethylene or auxin.

Kuiper (37) hypothesized that steric factors, the strength of the hydrogen bonds, and Van der Waals forces determine the physiological activity of growth retardants and interfere with the growth of cells by cross linking DNA or by inhibiting gibberellins. The configuration of the enzyme complex in the plasma membrane could be affected, resulting in the change of ion and water transport across it; however, he could not demonstrate this concept.

Many researchers report gibberellins reverse the effects of ancymidol on plants (2,3,7,15,45,46,60). Leopold and Wright (45,46) report that ancymidol retarded the gibberellin-stimulated growth of lettuce hypocotyls, while exogenously added gibberellin reversed these effects. Auxin- and cytokinin-stimulated growth was only weakly retarded in experiments involving the *Avena* and *Xanthium* tests. Experiments have shown that ancymidol does not suppress the gibberellin biosynthesis in *Fusarium moniliforme* mold, nor does it inhibit amylase production in barley endosperm or retard *Rumex* leaf senescence where gibberellin biosynthesis is not involved (45,46). The general ability of gibberellins to reverse the effects of ancymidol suggest that ancymidol acts in part on the gibberellin stimulated growth system, but at a locus which discriminates between the growth and non-growth functions of gibberellins. Leopold hypothesized that ancymidol possibly depressed reactions which occur subsequent to the gibberellin - substrate reaction (45,46).

Asif (7) found that exogenously added zinc reversed the effects of ancymidol on Easter lilies and chrysanthemums. Foliar sprays of zinc increased plant height and leaf counts. He hypothesized that the zinc ion possibly causes a synergistic reaction with gibberellin, increasing plant height, and that the zinc ion might possibly counteract ancymidol by increasing the activity of naturally occurring gibberellin-like substances in the plant or by changing inactive gibberellins into active forms. He also hypothesized that zinc may reduce the degradation of the gibberellin by ancymidol or increase the auxin level in the plant. However, there is no information available regarding the reversal action of auxin on ancymidol.

CHAPTER III

MATERIALS AND METHODS

Different application methods and rates of the growth retardant ancymidol[1] were investigated to determine the effect on growth and development of the double flowering grandiflora petunia, Petunia hybrida Hort. 'Orchid Bouquet'. The project was conducted in an unshaded greenhouse in mid-summer at Knoxville, Tennessee. The greenhouse was cooled by an evaporative pad cooling system. Greenhouse temperatures were recorded 24 hours a day using a Model 14-7030 Tempscribe recorder.

Petunia seeds were germinated using standard procedures (6, 43). Seedlings with a foliage span of 5.1 centimeters were transplanted into 5.7 centimeter peat pots on June 24, 1975 and August 8, 1975 (these dates represent day zero (0) for their respective groups). A potting mixture of soil, peat, and perlite (2:1:1 by volume) was used. The pH of the potting mixture was 6.5 and contained 50 mohs of soluble salts (by Model RD-B15 Beckman Solubridge). No fertilizer was added throughout the experiment.

Ancymidol was applied at 0 + 14 days after transplanting for treatments one through seven and 0 + 14 and 0 + 35 for treatments eight through fourteen. Fourteen treatments constituted the experiment (Table 1).

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[1]Ancymidol was obtained from Eli Lilly and Company, Elanco Division, Indianapolis, Indiana, and is marketed in technically pure compounds of either a 4.5 percent emulsifiable concentrate or a 0.0264 percent solution. A-Rest™ is the registered trade-mark for ancymidol.

Table 1*

Ancymidol Treatments Applied to Petunia hybrida 'Orchid Bouquet'

Application Method	Quantity	Rate	Application Dates
1. foliar spray	2 ml.	Non-distilled water	0 + 14
2. foliar spray	2 ml.	66 ppm ancymidol	0 + 14
3. foliar spray	2 ml.	132 ppm ancymidol	0 + 14
4. foliar spray	2 ml.	264 ppm ancymidol	0 + 14
5. soil drench	22.5 ml.	66 ppm ancymidol	0 + 14
6. soil drench	22.5 ml.	132 ppm ancymidol	0 + 14
7. soil drench	22.5 ml.	264 ppm ancymidol	0 + 14
8. foliar spray	2 ml.	Non-distilled water	0 + 14 and 0 + 35
9. foliar spray	2 ml.	66 ppm ancymidol	0 + 14 and 0 + 35
10. foliar spray	2 ml.	33 ppm ancymidol	0 + 14 and 0 + 35
11. foliar spray	2 ml.	16.5 ppm ancymidol	0 + 14 and 0 + 35
12. soil drench	22.5 ml.	66 ppm ancymidol	0 + 14 and 0 + 35
13. soil drench	22.5 ml.	33 ppm ancymidol	0 + 14 and 0 + 35
14. soil drench	22.5 ml.	16.5 ppm ancymidol	0 + 14 and 0 + 35

*Treatments correspond with treatment numbers listed in Figures 1-10 of the results.

Active ingredients (a.i.) applied per pot were equal for soil drenches and foliar applications of the same parts-per-million (ppm) rating. On the 28th day after sowing all plants were transplanted into 25.4 centimeter azalea pots containing the 2:1:1 by volume potting mixture previously described. A completely randomized statistical design was used (44,56). Data on the number of leaves, plant height, and plant spread were collected on the following dates: 0 + 14, 0 + 21, 0 + 28, 0 + 35, 0 + 43, and 0 + 50 (2, 3, 4, 5, 6 and 7 weeks respectively). During the flowering period, 0 + 43 through 0 + 50 days, additional data were taken on the number of buds, number of blooms, average bloom size, and the time from initial treatments to first bloom. Measurements were taken on all plants and were reported as averages. Plant height was considered to be the average shoot height from the soil level, in centimeters. Plant spread was considered as the average foliage span of the plant at soil level in centimeters. Bud counts represent the total number of buds on individual plants each week. Buds were considered blooms when bud rupture occurred and petal color was seen. Bloom size was expressed as a mean diameter of all blooms on individual plants. Time from treatment to blooming was considered to be the number of days from treatment day to first bloom. At the termination of this experiment, plants were excised at soil level for stem diameter determination.

Root systems and potting mixture inside the 5.1 centimeter peat cups were carefully excised. Roots were washed using Fribourg's method (29). Fresh weights for each replication of five plants were determined. Roots were dried for 24 hours at 70° C for dry weight determination.

CHAPTER IV

RESULTS AND DISCUSSION

I. HEIGHT

High rates of single application soil drenches (treatments 6 and 7 of Table 1) were above the levels of petunia plant tolerance. Severe epinasty was observed within 48 hours after treatment and progressed to a general chlorosis with purple leaf coloration. Death of these plants due to phytotoxicity occurred less than two weeks following treatment.

No correlation was observed between height and methods of application with single application treatments 2 through 5 (Figure 1). However, rates used had a direct effect on height, with single-application treated plants 2, 4, and 5 being significantly shorter than the controls.

Method of application also had a significant effect in the split-application treatments 8 thru 14. Both foliar sprays and soil drenches tended to reduce plant height; however, soil drenches gave a greater degree of height reduction. The amount of height reduction by split-application soil drenches was directly proportional to the amount of active ingredient applied per plant, with the greatest amount of active ingredient giving the most height control.

Since soil drenches have been reported to be more effective

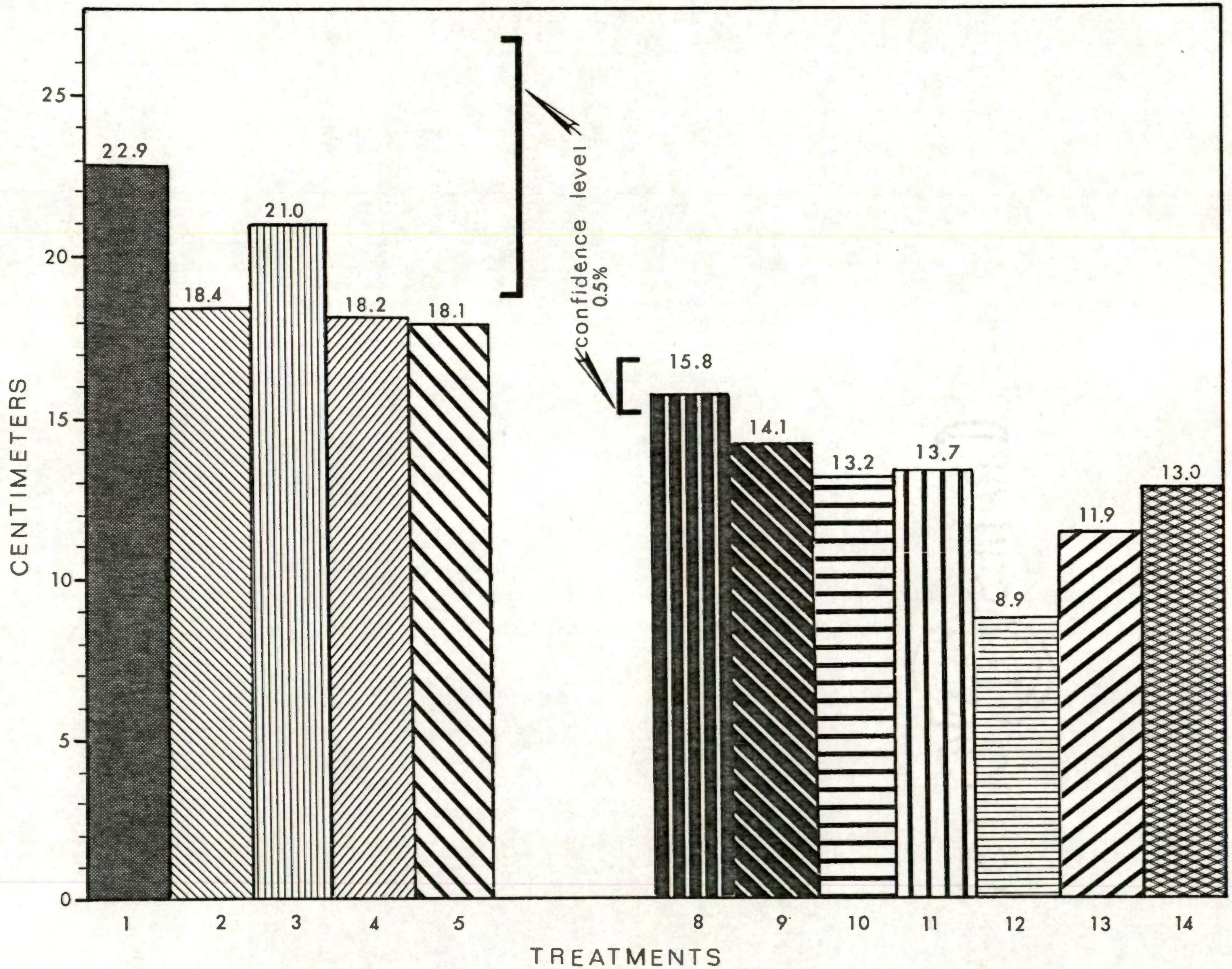

Figure 1. The Height of Petunia Plants Six Weeks following Treatments with Ancymidol.

in height control it was hypothesized that split-application of soil drenches might control plant height more effectively and uniformly than split-application foliar sprays. These data indicate that soil drenches of ancymidol are more predictable and control petunia growth more effectively than foliar sprays.

II. WIDTH

No significant interaction was observed between rates and methods of application in single-application treated plants (treatments 2 through 5 of Figure 2). There was, however; a significant interaction between width and amount of active ingredient applied in split-application treatments 9 through 14. The split-application soil drench treatment of 66 ppm (treatment 12) produced significantly shorter plants than the control.

Several authors have shown that ancymidol suppresses width in bedding plants (1,16,39). It was hypothesized, therefore; that low concentrations applied in split-applications would not significantly reduce plant width. These data indicate that split-applications of ancymidol reduce plant width in proportion to the concentration applied and this reduction is affected by the method of application.

III. LEAVES

No significant differences were observed between rates and method of application on leaf number (Figure 3). These data indicate that ancymidol does not effect the number of leaves per plant, and thus supports the conclusions of other workers (39,54,64).

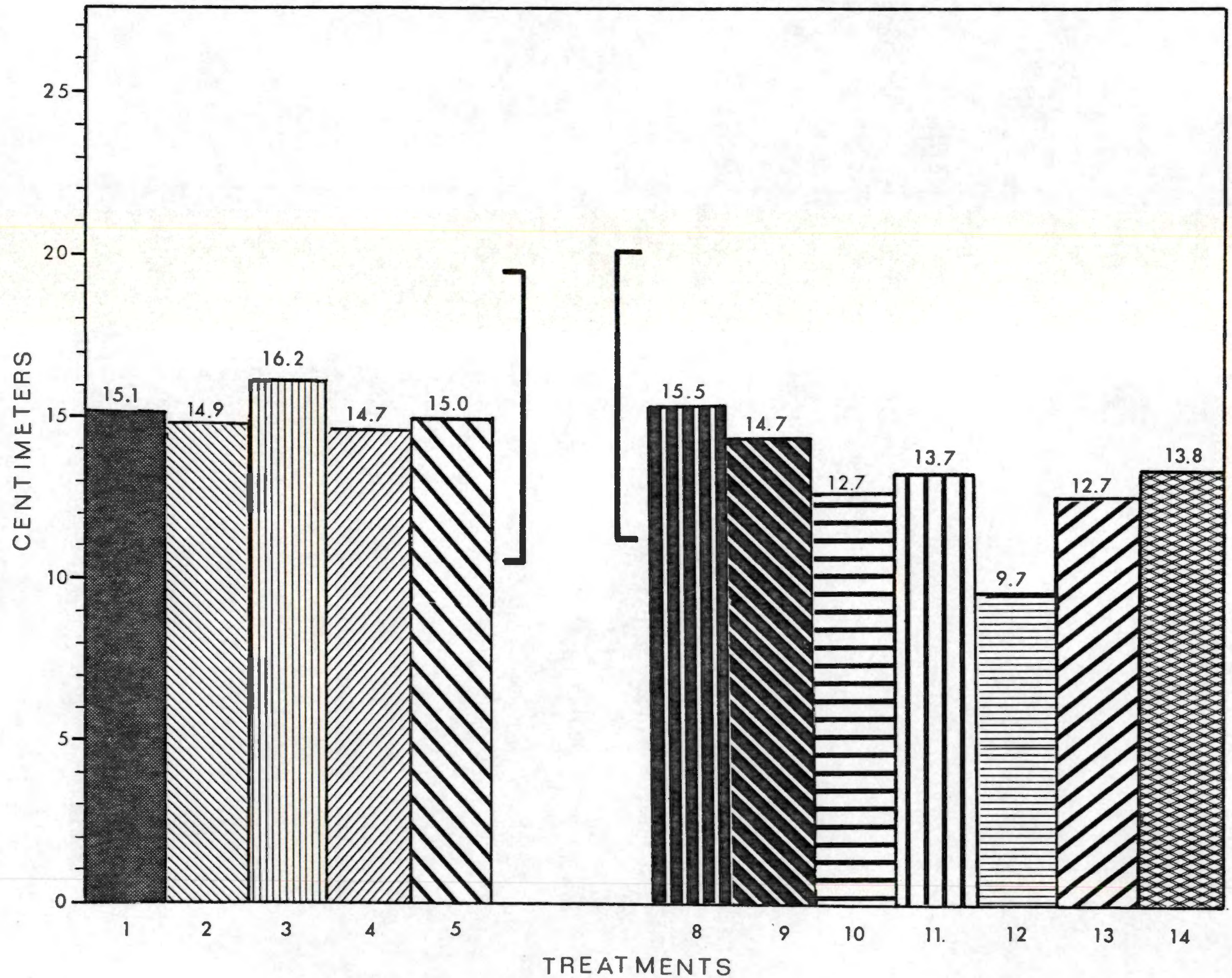

Figure 2. The Width of Petunia Plants Six Weeks following Treatments with Ancymidol.

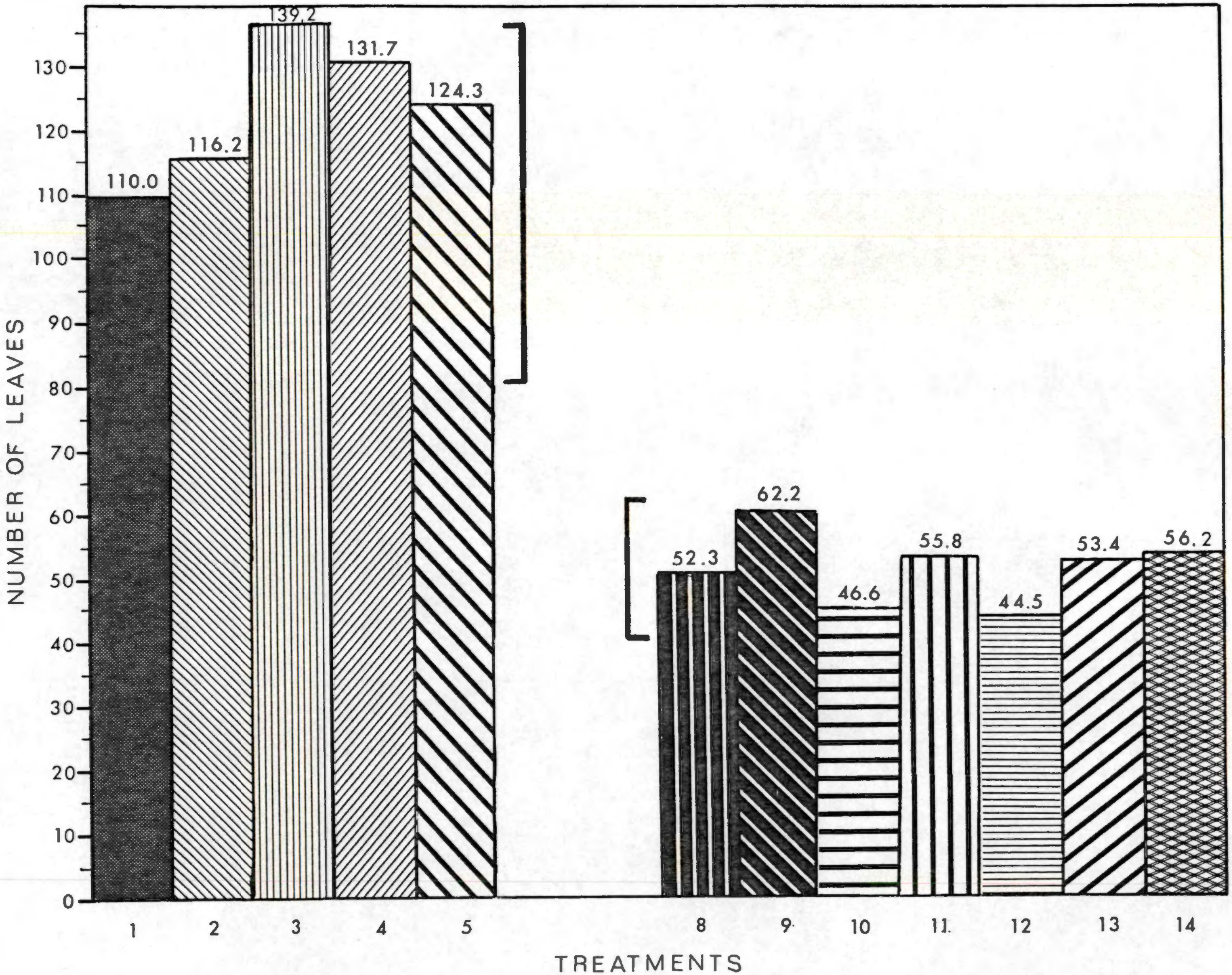

Figure 3. The Number of Leaves on Petunia Plants Six Weeks following Treatments with Ancymidol.

IV. BLOOM SIZE AND NUMBER OF BLOOMS

Bloom size was not affected by single-application foliar sprays of ancymidol (treatments 2, 3 and 4); however, single-application of soil drench, (treatment 5) did significantly reduce bloom size (Figure 4). Low rates of split-application foliar sprays (treatment 11) and split-application soil drenches at the 66 ppm (treatment 12) and 33 ppm (treatment 13) levels also reduced bloom size. Low rates of split-application soil drenches (treatment 14) increased bloom size significantly.

The number of blooms were not affected by rates or methods of application (Figure 5).

Ancymidol is reported to decrease bloom size (11,18,22,30,35, 36,53) and also the number of blooms (22,40,48,53,62). It seemed possible, however; that split-applications might avoid the undesirable effect on size and number of blooms. These data show that the effect on bloom size is related to the amount of active ingredient applied and to the method of application, but the number of blooms were unaffected.

V. STEM DIAMETER

Stem diameters were not affected by either single-applications of ancymidol (treatments 2 through 5 of Figure 6) or split-applications of foliar sprays (treatments 9, 10 and 11). However, split-application soil drenches at the 66 ppm (treatment 12) and 33 ppm (treatment 13) levels reduced stem diameter significantly.

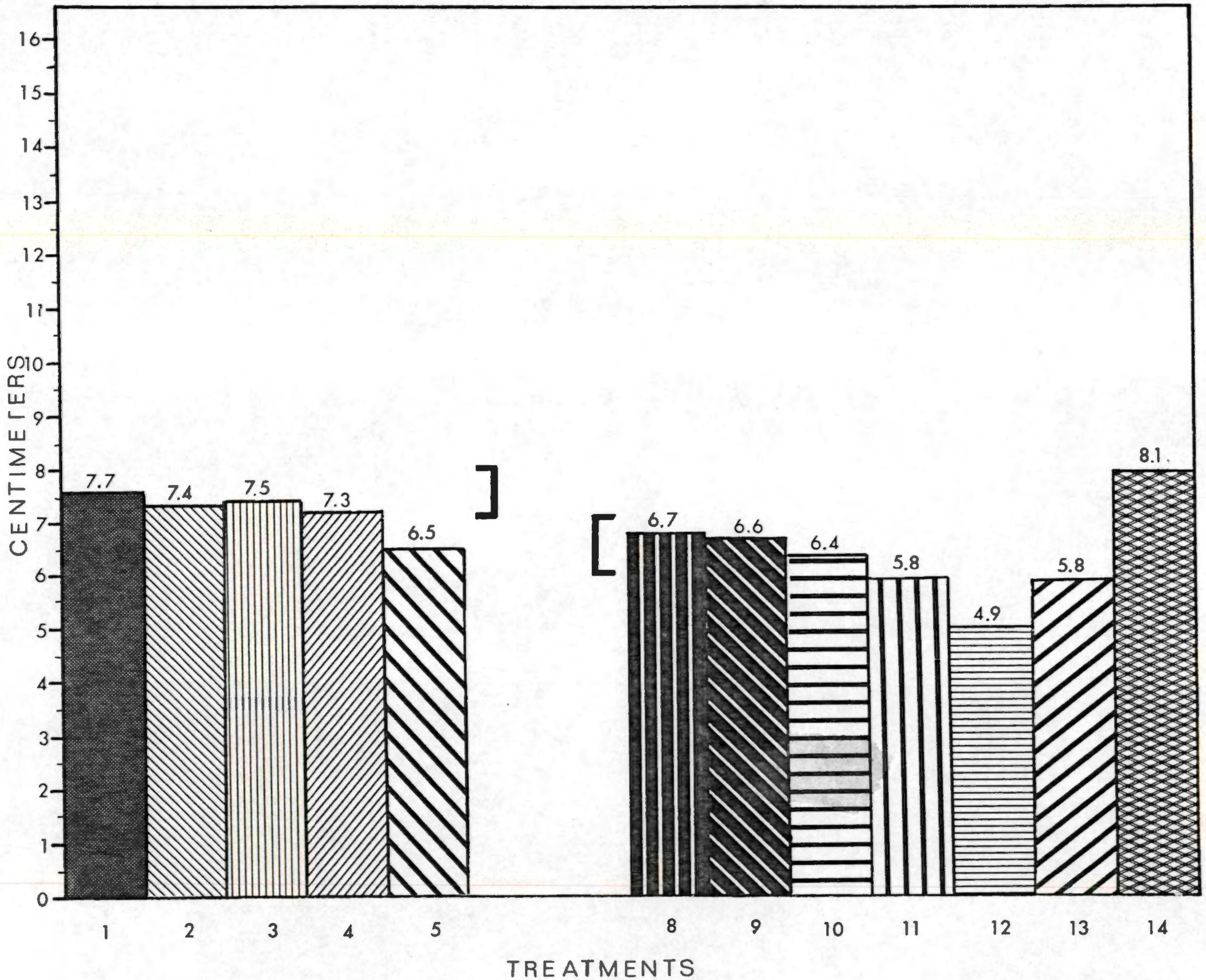

Figure 4. The Size of Blooms on Petunia Plants Six Weeks following Treatments with Ancymidol.

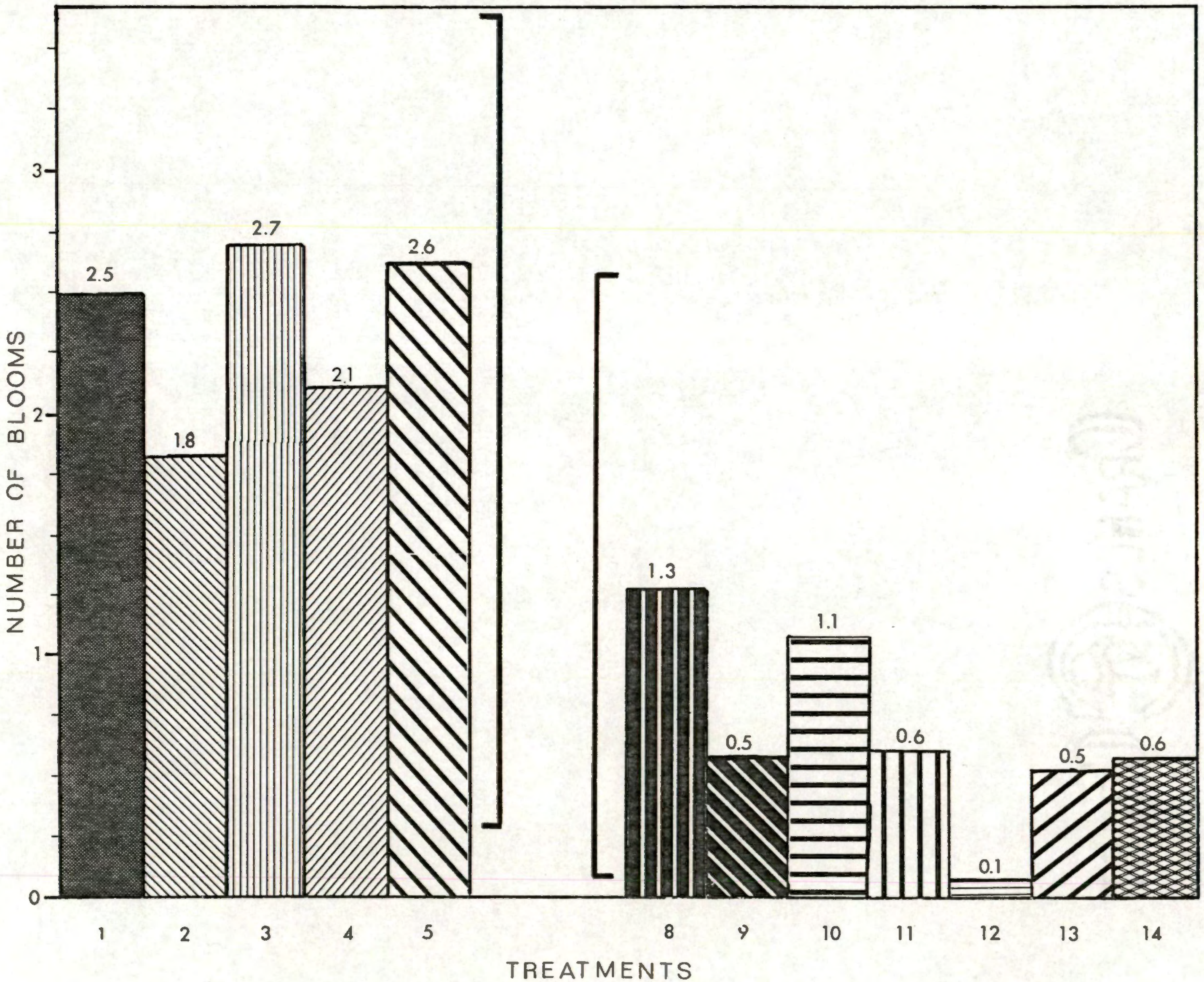

Figure 5. The Number of Blooms on Petunia Plants Six Weeks following Treatments with Ancymidol.

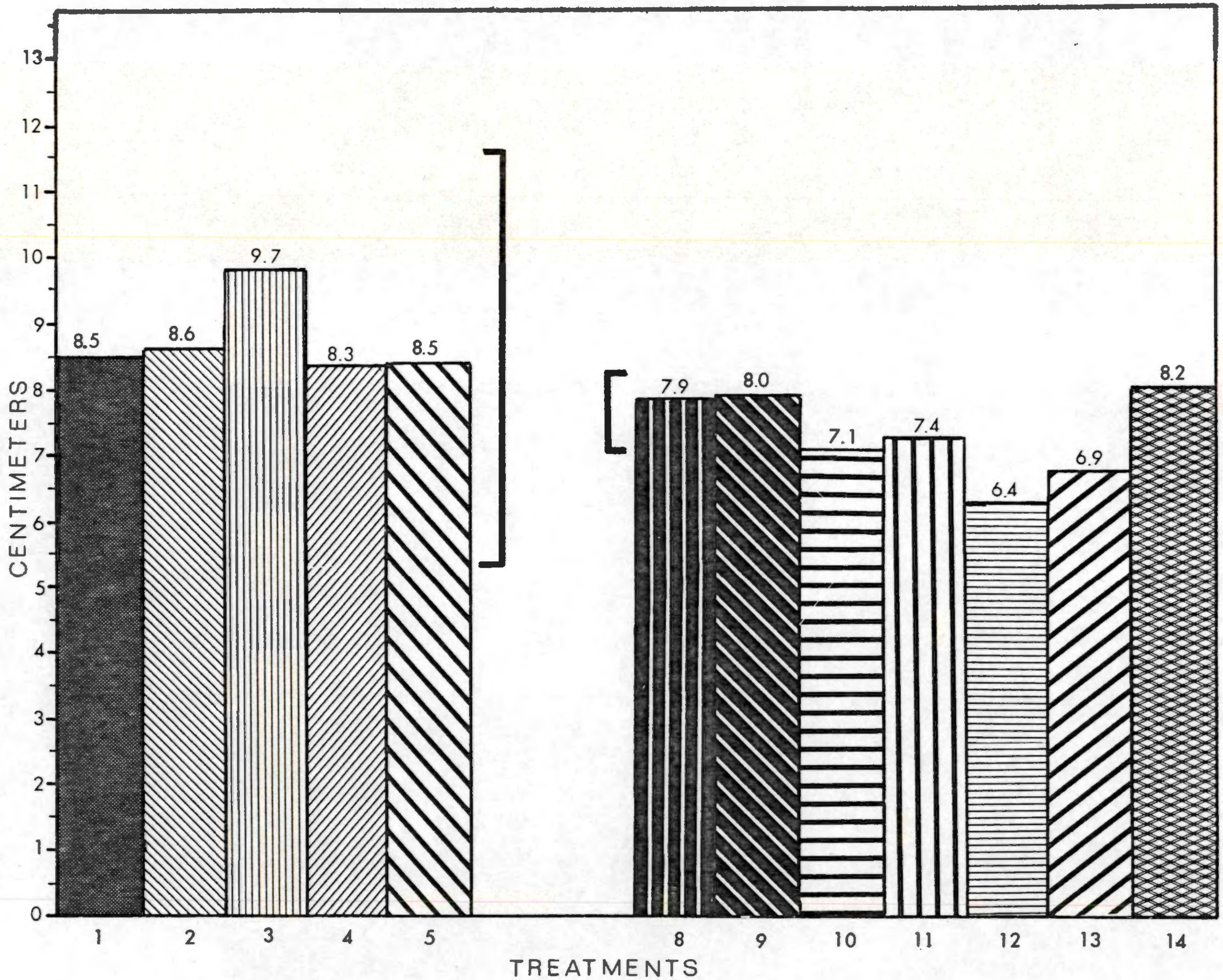

Figure 6. The Stem Diameter of Petunia Plants Six Weeks following Treatments with Ancymidol.

It has been shown that ancymidol thickens petunia (1) and chrysanthemum (36) stems. However, these data (Figure 6) show that split-application soil drenches at 66 ppm (treatment 12) and 33 ppm (treatment 13) adversely affected stem diameter, while foliar applications produced no significant effects.

VI. ROOT FRESH AND DRY WEIGHT

The split-application of foliar sprays at 66 ppm (treatment 9) reduced root fresh weight; but otherwise root fresh weight was not affected by either method or rate of application (Figure 7). Root dry weight was unaffected by single-applications of ancymidol (treatments 2 thru 5); however, split-application foliar spray (treatment 9) and split-application soil drench (treatments 12 and 14) significantly reduced root dry weight (Figure 8).

Several authors report soil drenches of ancymidol will retard root development (15,16,27,53), but that root fresh weight was increased (53). These data (Figure 7) show ancymidol reduced root fresh weight at the 66 ppm level. No explanation for this observation can be derived from these data except that ancymidol does not give predictable results.

VII. LEAF AND STEM FRESH WEIGHT LEAF AND STEM DRY WEIGHT

Leaf and stem fresh weight was not affected by either method or rate of application (Figure 9). However, significant reductions were found in leaf and stem dry weights (Figure 10). Single-application foliar spray (treatments 2 and 4) and single-application soil drench

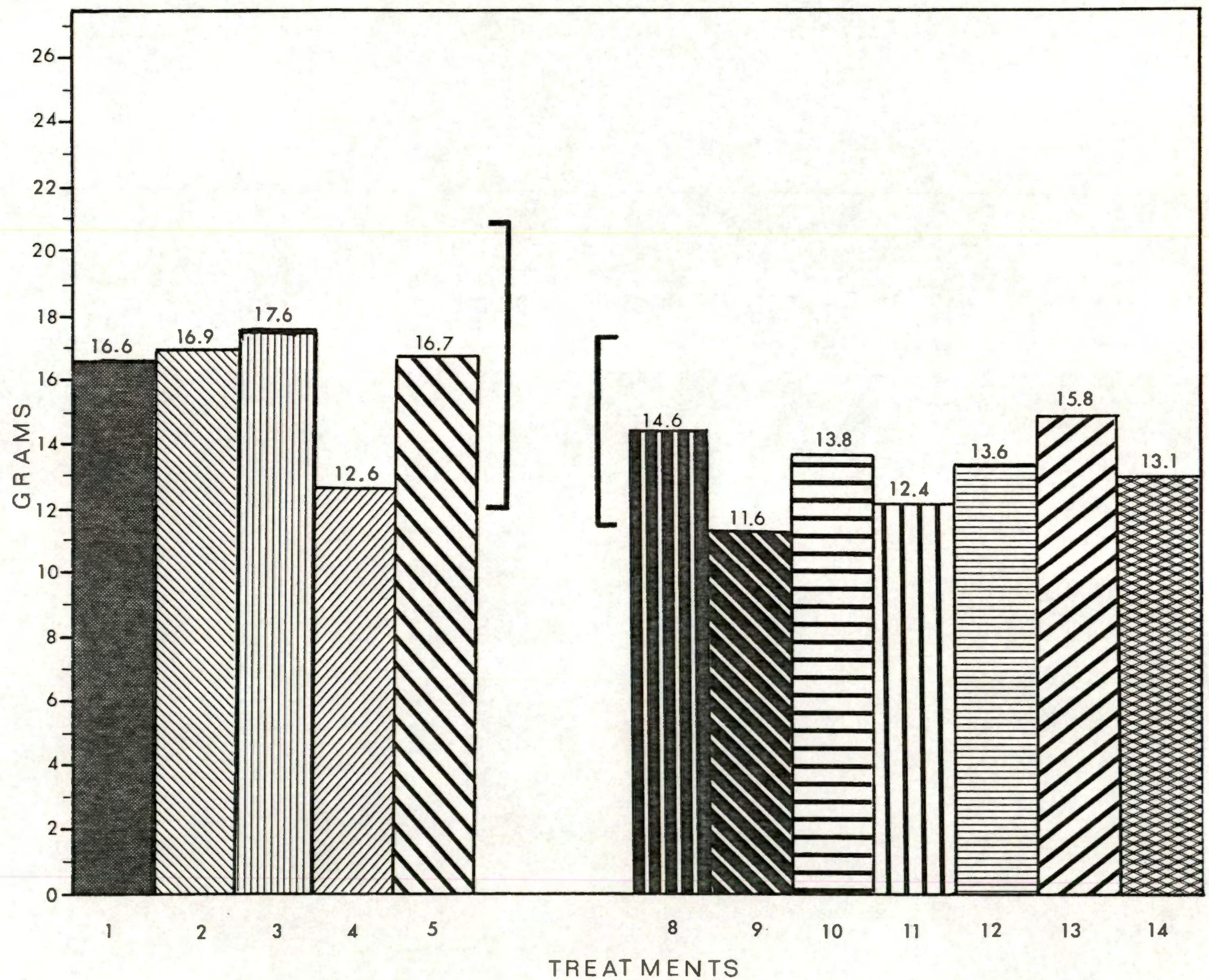

Figure 7. The Root Fresh Weight of Petunia Plants Six Weeks following Treatments with Ancymidol.

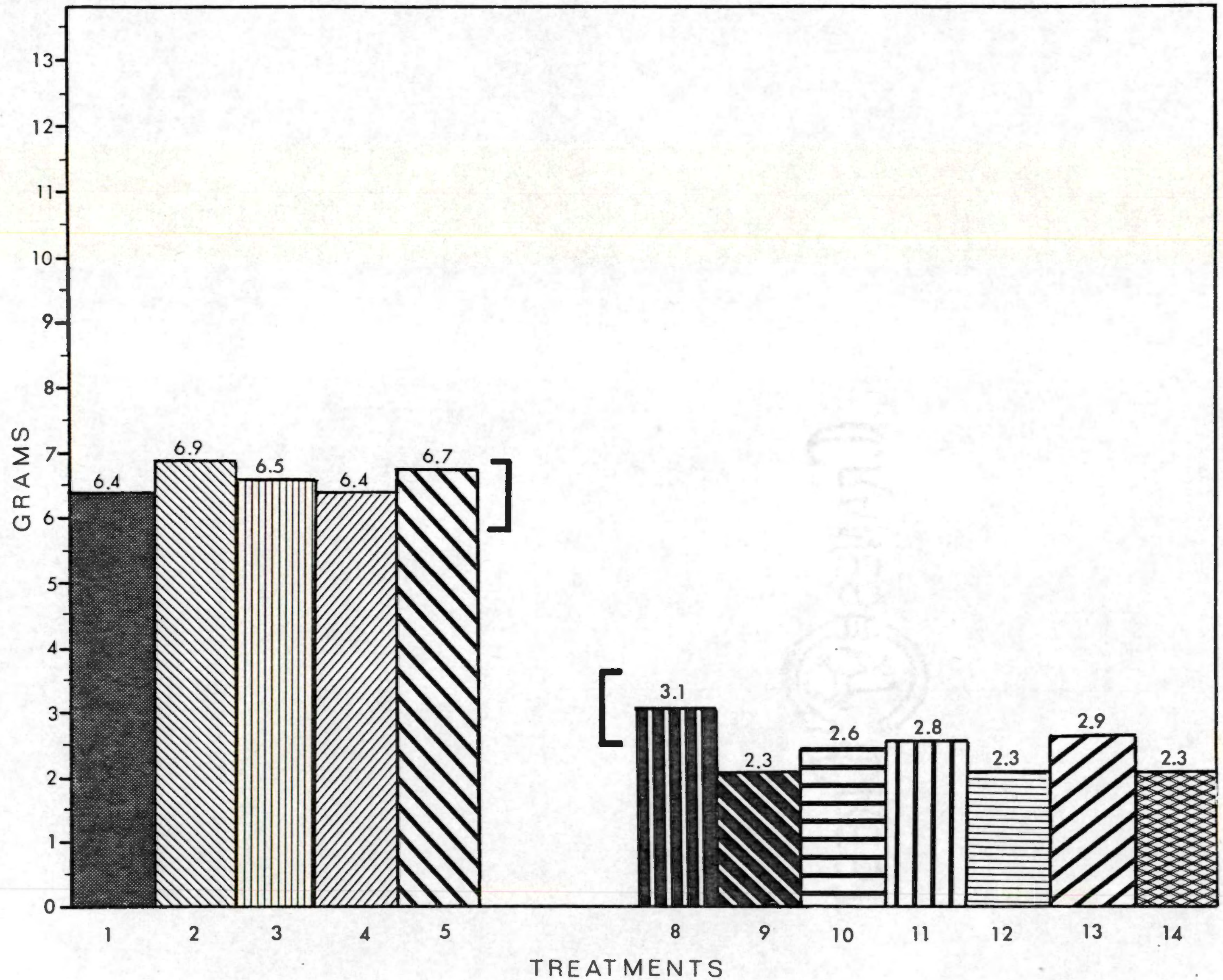

Figure 8. The Root Dry Weight of Petunia Plants Six Weeks following Treatments with Ancymidol.

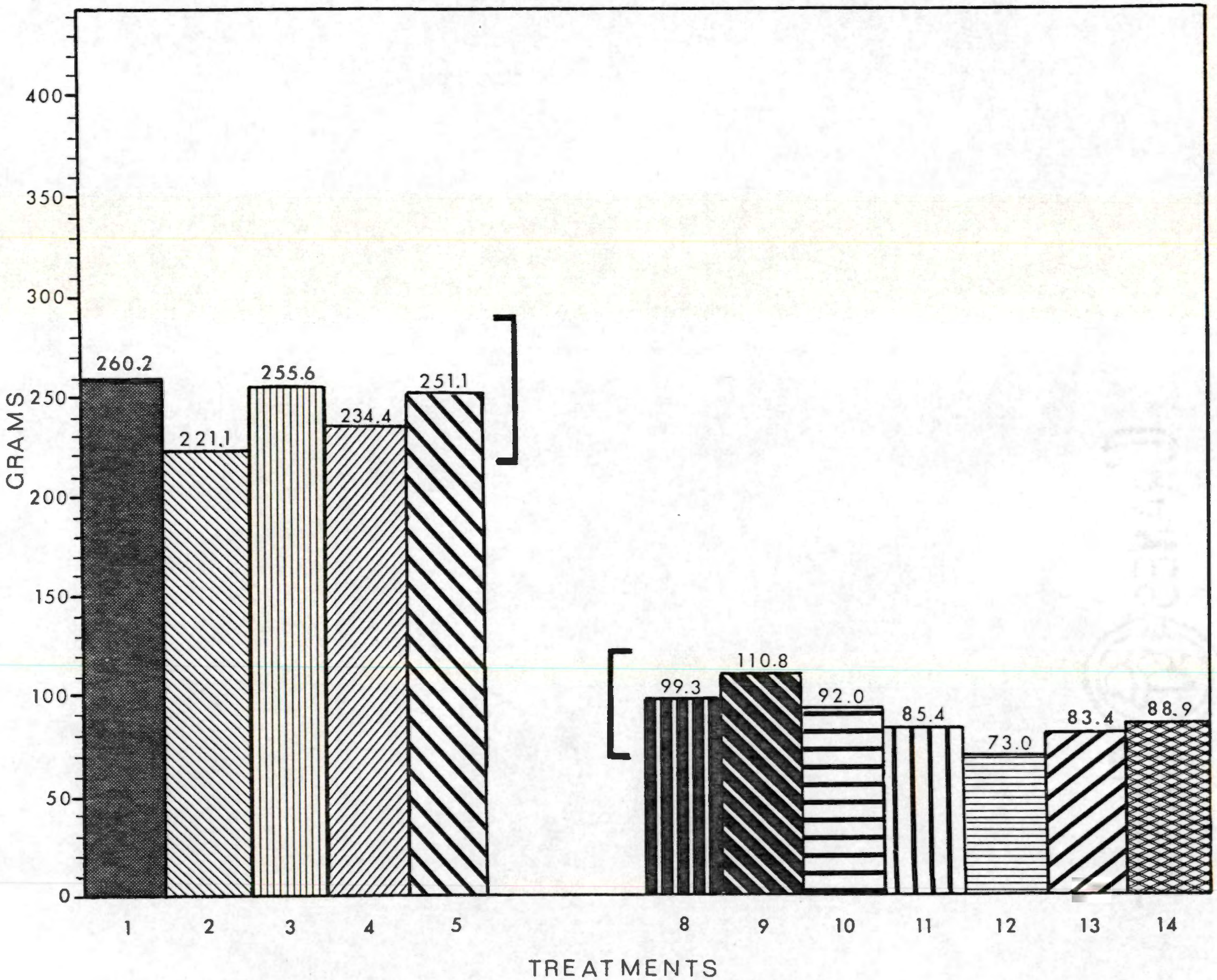

Figure 9. The Leaf and Stem Fresh Weight of Petunia Plants Six Weeks following Treatments with Ancymidol.

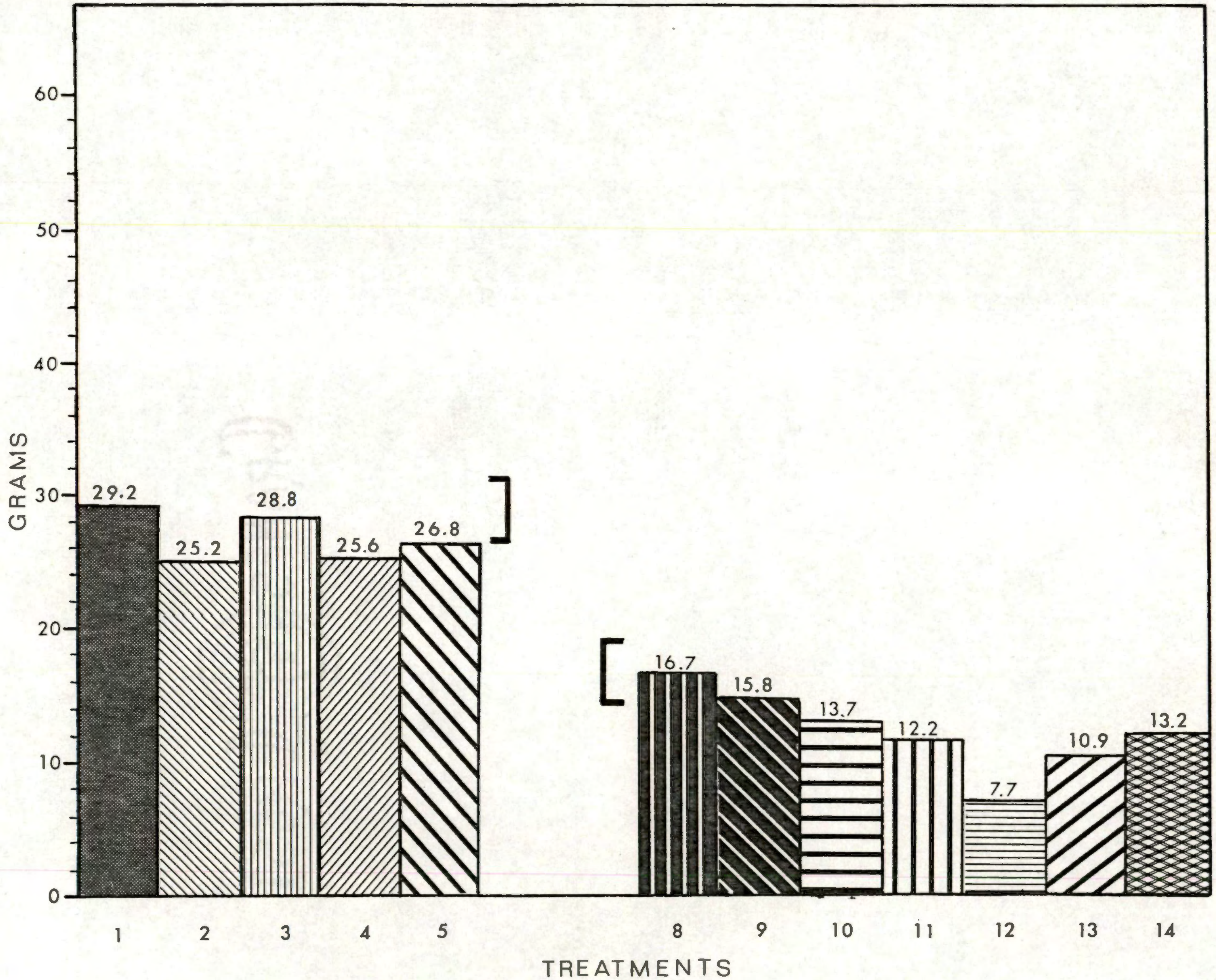

Figure 10. The Leaf and Stem Dry Weight of Petunia Plants Six Weeks following Treatments with Ancymidol.

treatment 5 reduced dry weight. Split-application foliar sprays and soil drenches both reduced leaf and stem dry weight; however, soil drench applications gave a greater degree of dry weight reduction proportional to the amount of active ingredient applied.

Ancymidol reportedly decreases plant fresh and dry weight due to the reduction of internodal length (15,35) with the percent dry weight inversely related to the concentration of ancymidol applied (35). These data show ancymidol to be ineffective in reducing leaf and stem fresh weight, regardless of rate or method of application. However, a decrease in leaf and stem dry weight is found to be inversely related to the concentration of the chemical applied and is dependant on the method of application.

VIII. EXPERIMENTAL VARIABILITY

Variability in height, width, etc. was observed in the control plants. This variability is attributed to the hybridizing process by which petunia seeds are produced. Thus genetic variability might be a very important factor in the irregular action of ancymidol on petunias, especially Petunia hybrida Hort. 'Orchid Bouquet'.

Time of year the petunia plants were grown is important in overall petunia performance. As can be observed in Figures 1 through 10 there are two separate groups. Plants in treatments 1 through 5 were grown from June to August while plants in treatments 8 through 14 were grown from August to October. Petunias are affected by daylength, light quality and temperature, with a minimum of ten hours of light and temperatures over 56^{o} F necessary for bud initiation and development (6,43). Petunias grown in the early spring are in a naturally short daylength during their early growth. Thus they develop as compact well branched plants that do not flower rapidly. Petunias grown in late spring are in natural long day conditions that cause elongation, single stems and early flowering (43). Plants given treatments 1 through 5 would therefore naturally be taller, weigh more, produce more leaves, etc. due to the long day conditions and warmer temperatures. Plants given treatments 8 through 14 would be somewhat retarded as opposed to treatments 1 through 5 by naturally short daylength and cooler temperatures.

CHAPTER V

SUMMARY AND CONCLUSIONS

A study on the effects of various rates of ancymidol on the morphological characteristics of <u>Petunia hybrida</u> Hort. 'Orchid Bouquet' was carried out from June 1975 to October 1975.

Soil drench applications of ancymidol resulted in a greater degree of height reduction, proportional with the amount of active ingredient applied per plant. Foliar spray applications also reduced height but in a non-predictable manner.

Foliar spread or width of the plant was reduced by soil drench applications, with the amount of reduction proportional to the amount of active ingredient applied per plant. However, the number of leaves per plant were not affected by ancymidol treatments. Split-application foliar sprays or soil drench treatments of ancymidol significantly reduced bloom size, except at the low rate soil drench level where bloom size was increased. However, the number of blooms was not affected by the rate or method of application.

Stem diameter was not affected by foliar sprays of ancymidol but soil drench applications significantly reduced the diameter at soil level. Root fresh weight was only affected by split-application foliar sprays, while root dry weight was significantly reduced by both foliar spray and soil drench applications.

Leaf and stem fresh weights were not affected by either method or rate of application. However, all applications of ancymidol reduced leaf and stem dry weight to some extent, with split-application soil drenches giving the greatest degree of weight reduction.

In summary, the rate of application, the method of application, and possibly seedling variability, are important factors in the growth regulating actions of ancymidol on <u>Petunia hybrida</u> Hort. 'Orchid Bouquet'. The results suggest that ancymidol is not a good growth retardant on <u>Petunia hybrida</u> Hort. 'Orchid Bouquet'. Further investigations such as regression analysis of hybrid petunia seedling variability and a variety trial of petunia responses to ancymidol are warranted.

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