TECHNICAL SESSIONS

Thursday Morning, December 2, 1971

The twenty-first annual meeting of the Eastern Region of the International Plant Propagators' Society convened at 9:00 a.m. in the Azalea Room of The Golden Triangle Motor Hotel, Norfolk, Virginia. Mr. William Flemer III served as moderator.

MODERATOR FLEMER: On behalf of President Tom Pinney, Jr., I want to welcome you all to the 21st annual meeting of our Society. We are going to start right in on this morning's program and the first paper is by Joseph Dallon, Jr. and is entitled, "Culturing Geraniums from Seed". The paper will be presented by Dr. Hess.

CULTURING GERANIUMS FROM SEED

JOSEPH DALLON, JR. AND DOMINIC DURKIN

Rutgers University
New Brunswick, New Jersey

Abstract. Geraniums (*Pelargonium hortorum* Bailey cv Carefree Deep Salmon) were cultured from seed to maturity using growth retardants, and environmental conditions known to affect flowering in a number of plant species High intensity lights and growth retardant treatments were effective in reducing the time required to flower. Geraniums normally require an average of 100 - 115 days to flower, depending on the variety. A study of shoot tip morphogenesis revealed that flowers are initiated at the seventh week, indicating that the process of flower differentiation and development in geraniums is a relatively slow one.

INTRODUCTION

The production of geraniums from seed is a relatively new practice, which was initiated by a group of plant breeders in Holland. Subsequently, researchers in the United States became interested in the subject and were first to develop a true breeding geranium from seed (7). However, in spite of the successes in producing newer geranium varieties from seed, there were a number of problems associated with these plants, among which were: (1) low germination percentage, (2) excessive height and spread, (3) lack of uniformity in flowering, and most significant of all (4) excessively long growing period required before the production of flowers. This remains a problem.

Inasmuch as the geranium ranks high in its commercial value as a bedding plant and has good potential as a pot plant, it would be desirable to gain more information on the control of flowering, thus permitting quicker flowering.

Germination. The major seed producers have indicated that seed germination percentage is generally high (above 80%). However, it has been our experience that under normal greenhouse conditions the germination percentage varies among seed lots and sources, ranging from a low of 16% to a high of 84%. Germination of 100% can be obtained when the tip of the cotyledonary end of the seed is removed, a clear indication of seed coat dormancy. Since this process is obviously too time-consuming for the commercial operation, seeds are scarified. Comparative results of germination in clipped versus unclipped seeds are shown in Figure 1.

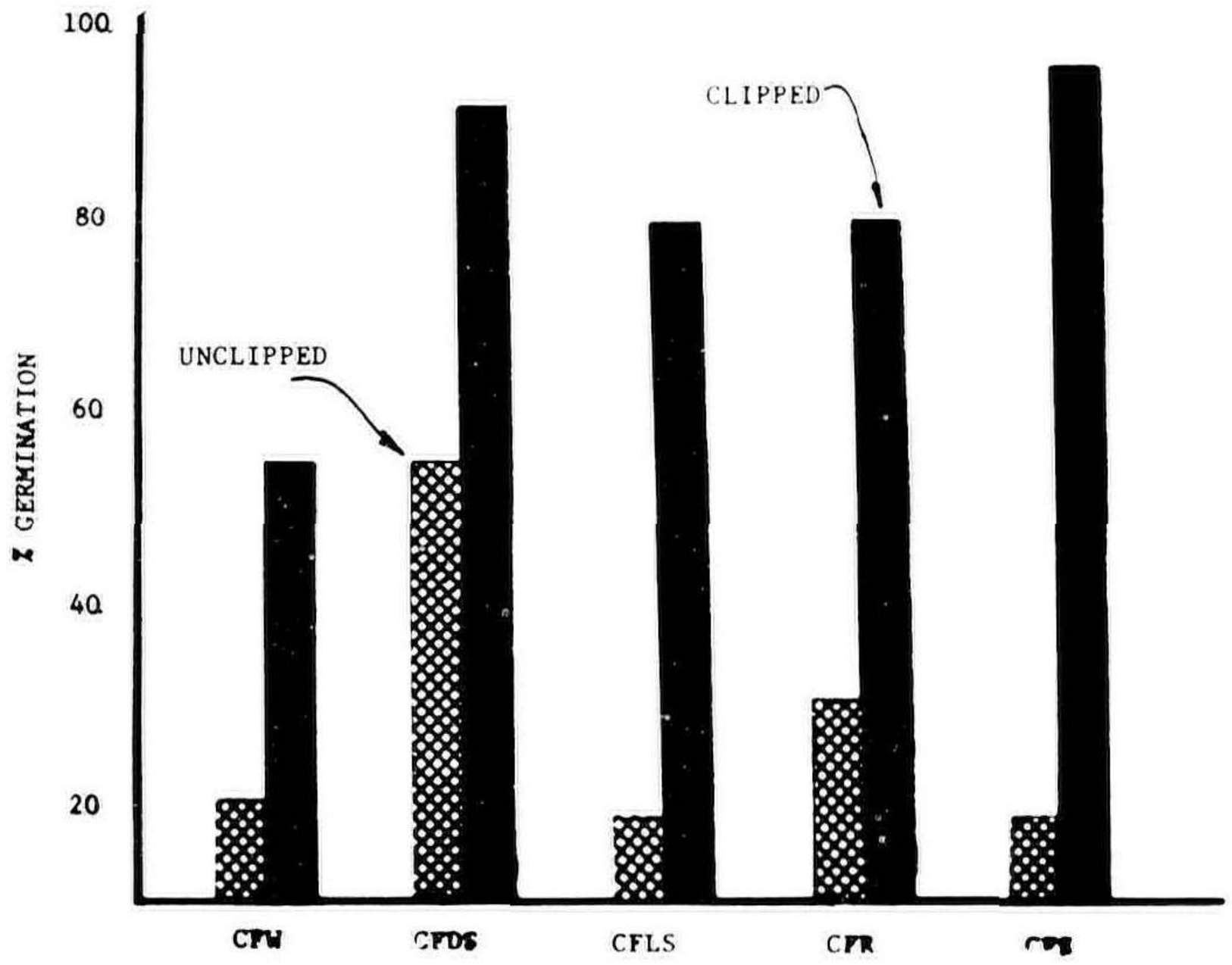

Fig. 1. Comparative germination results in five Carefree varieties in clipped versus unclipped seeds. (CF=Carefree,=DS Deep Salmon, LS=Light Salmon, R=Red, S=Scarlet, W=White).

In germination tests of seed lots obtained in September, 1970, unclipped seeds were germinated in petri dishes and in several mixes (Table 1). The germination percentage of seeds sown in Redi-Earth (a commercial mix) was significantly higher than that obtained in all the other mixes and of that obtained in petri dishes. The same type of response was obtained in subsequent tests, an indication that germination in geranium may be affected by conditions in addition to seed coat dormancy. Nevertheless, the survival rate of seedlings was always above 95% (6, 8) when grown in a mixture containing equal parts (by volume) of top soil, peat, and perlite.

Table 1. Germination percentages obtained with geranium seeds sown in various mixes in controlled environment.

Germination Medium	Number Sown	Percent Germination
Redi-Earth	100	92
Terralite	100	67
Sand + peat	100	69
Peat	100	73
Soil + peat	100	68
Petri dishes	100	73

Flowering Response. With the use of Cycocel as a drench it has been possible to reduce the time required for flowering (1, 3, 10) in addition to reducing the height and spread of geraniums at maturity (7, 10). However, the time reduction is slight and it is not known whether Cycocel has its effect on hastening the induction, initiation, or developmental process. The time of floral differentiation was determined using seeds that were sown in May, 1971. The vegetative process persisted for 5 weeks after sowing; the early floral differentiation stage could be recognized at 6 weeks, and flower primordia could be seen at the 7th week, (Figures 2-5). These results may not be typical for the normal propagation period of seed geraniums, which is mid-February.

The most significant aspect of flowering in geraniums lies in the fact that it does not matter whether flowering occurs in 90 days or in 120 days, the initial flower is almost always produced at the 18th node[1], regardless of temperature, fertilizer level, growth regulator, or photoperiod treatment, suggesting the presence of a very rigid flowering mechanism.

When geranium seedlings started in January, 1971, were grown under high intensity lights (General Electric cool white, plus 60 watt incandescent lamps to give 2000 footcandles), flowers were produced earlier in an 8 hour photoperiod than in seedlings that were grown with natural light alone under the same photoperiod, (Table 2). This difference in flowering response might be due to increased photosyn-

[1]Unpublished data. Carlson *et. al* (1) observed that flowers were initiated in 'Nittany Lion Red' in 13 weeks when the seeds were sown on May 12 and the plants were grown under natural photoperiod. Carefree cultivars sown at this time would produce approximately 24 nodes in 13 weeks This might be taken as an indication that 'Nittany Lion Red' flowered at the 24th node

thates resulting from the higher light intensity and the increased temperature resulting therefrom.

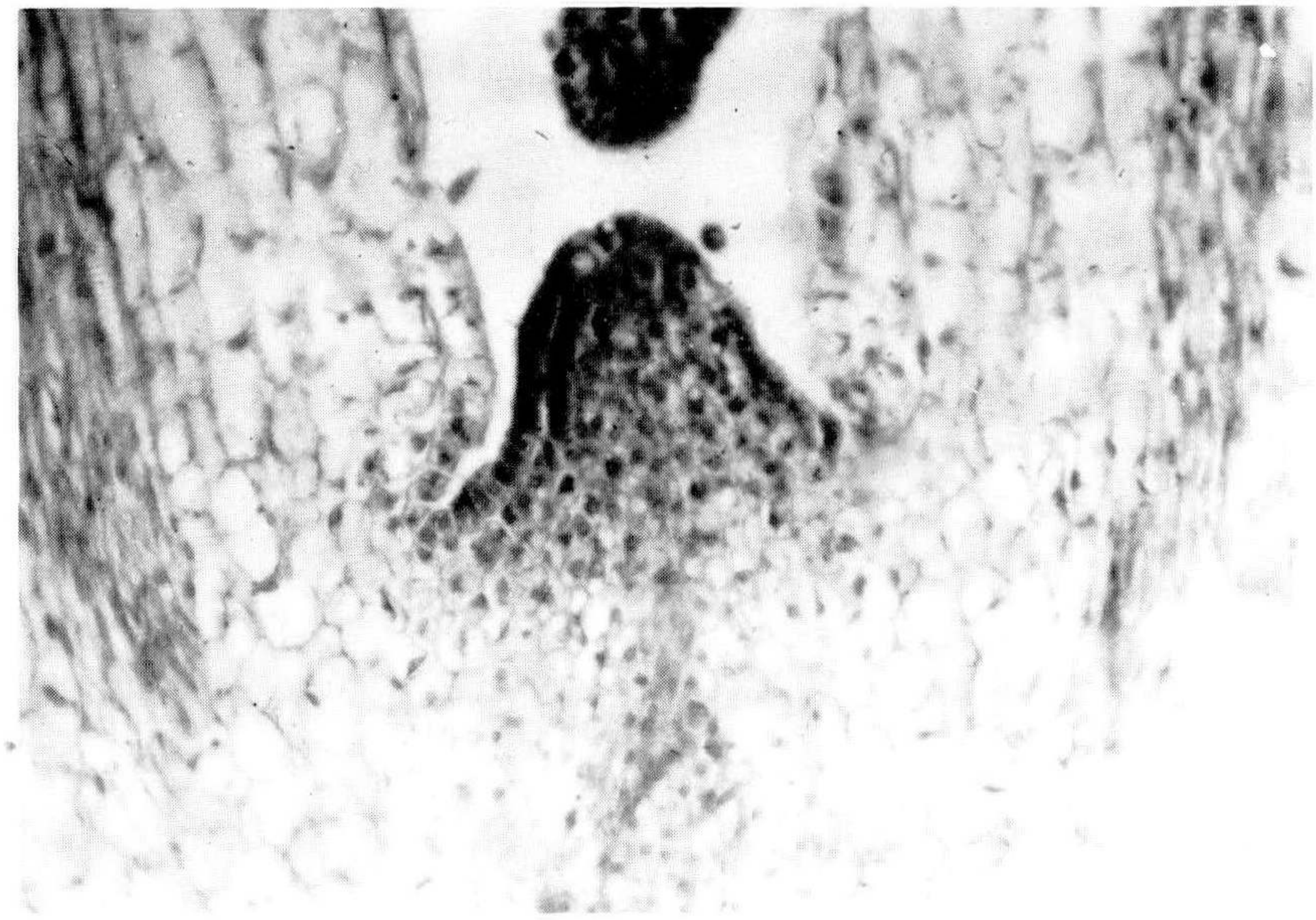

Fig. 2. Completely vegetative condition of shoot tip after 2 weeks of growth.

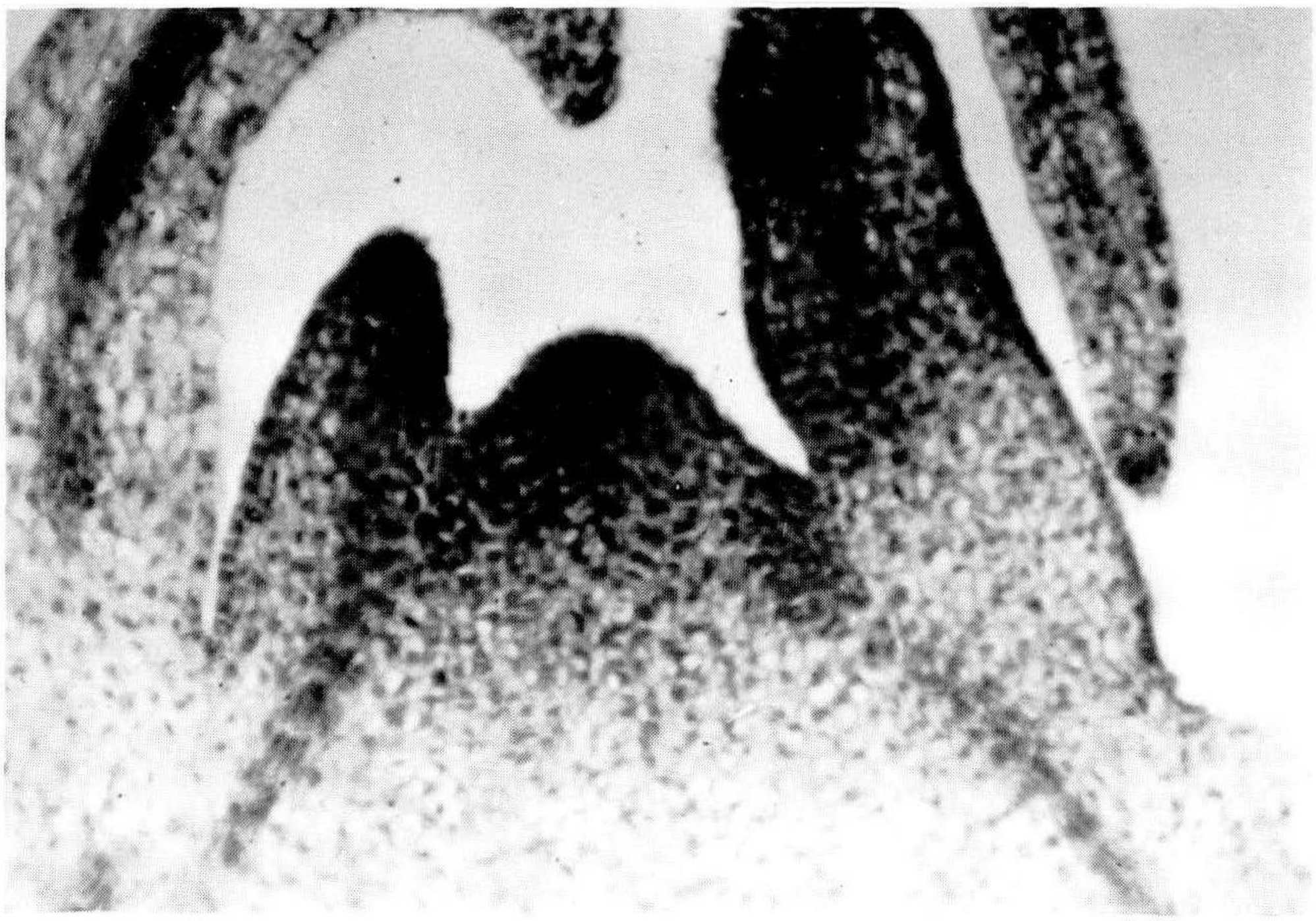

Fig. 3. Late vegetative stage in the shoot tip. This stage marks the transition period at the end of 5 weeks of growth.

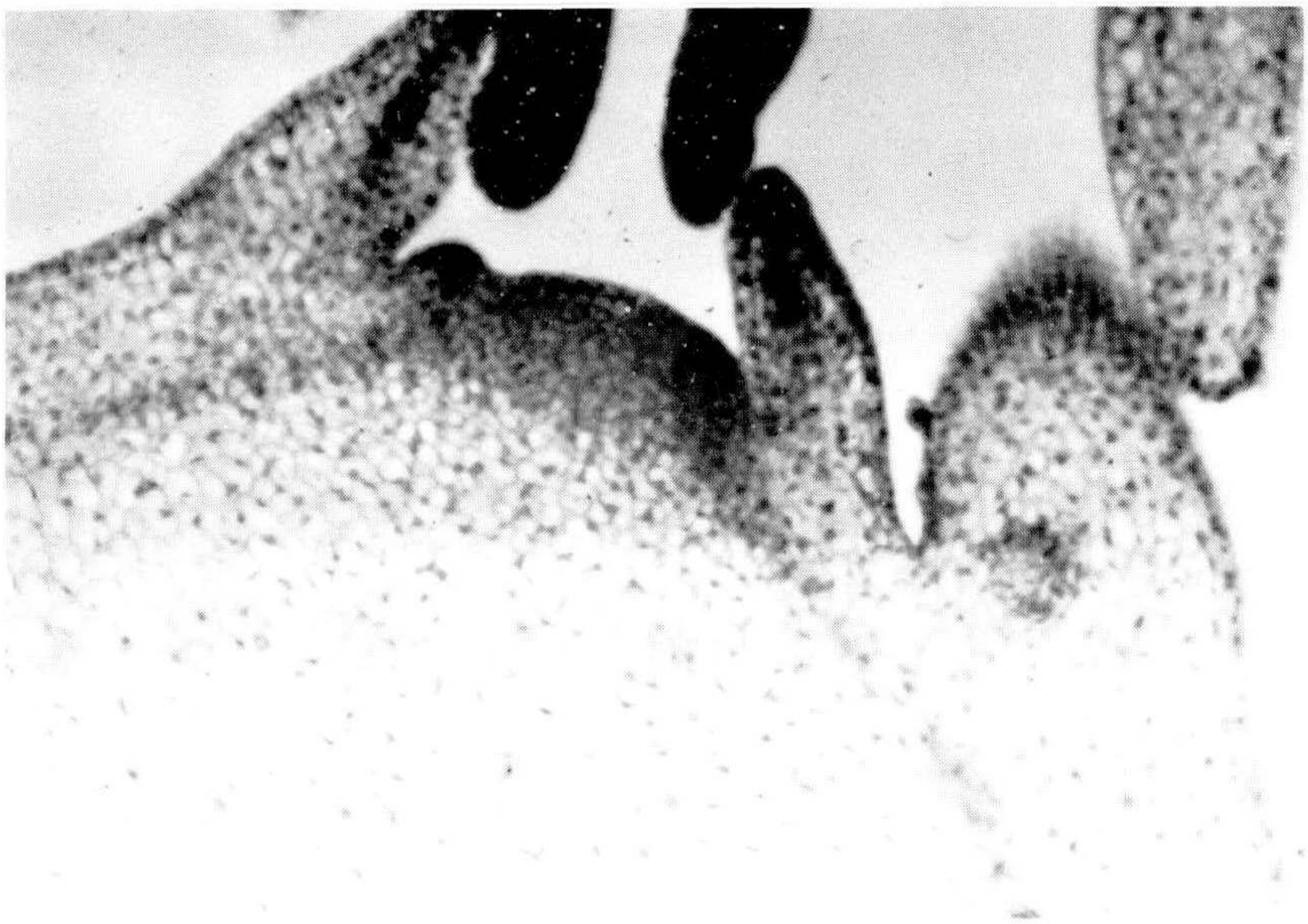

Fig. 4. Early stage of floral differentiation after 6 weeks of growth.

Fig. 5. Early stage in the formation of the flower part.

Table 2. The influence of high intensity light on the promotion of earlier flowering in seed geraniums, cv. Carefree Deep Salmon.

Treatment	Photoperiod (Hrs.)	Number of days to flower	Node no.
Natural daylight	8	115	18.3
Natural daylight + high intensity light	8	97	18.8

Height and spread of geraniums at maturity varies with the rate of growth over the entire growing period, particularly during the early stages, and this seems to be proportional to the light intensity and the temperature. During the high light intensity periods the plants are taller and broader and flower earlier, while during low light intensity periods they are shorter and more compact and flower later (8, 12). The earliness of flowering in geraniums relative to light intensity and temperature has previously been reported (9, 11). However, it has not been reported elsewhere that flowering occurs at the same node under both conditions (high and low light intensity).

SUMMARY

Based on our results from studies on shoot tip morphogenesis, it appears that floral initiation in geraniums begins early enough to allow for earlier flowering. The slowness in the final response appears to be due (at least in part) to a slow process of differentiation and development. The results of previous work with geraniums in response to photoperiod, cold treatment, nutrition, and temperature (2, 6, 12) indicate that environmental manipulations have been substantially ineffective in hastening flowering. The solution to producing earlier flowering in geraniums grown from seed may be found through physiological or biochemical manipulations, but the long term solution may be through efforts in breeding. Until such time, the best known response can be obtained in an average of 100 to 115 days using commercial preparations for germinating the seeds and growing the plants in a medium consisting of equal parts of top soil, peat, and perlite containing 15 pounds of superphosphate per cubic yard at a pH of 6.5—6.8. The fertilization program should consist of the following: (a) **Transplant Stage:** 6 ounces each, KNO_3 + NH_4NO_3 per 100 gallons of

water; and (b) **Established Plants:** 15-15-15 or 20-20-20 at 200 ppm nitrogen once per week during low light intensity periods and 2 to 3 times per week during high light intensity periods. As a preventive measure against root rot, Dexon (35%) may be applied at bi-monthly intervals at ¼ pound per 100 gallons of water.

ACKNOWLEDGEMENT: Seeds for this work were provided by the Pan American Seed Company.

LITERATURE CITED

1. Carlson, W. H., S. M. Cohan, and R. Craig. 1969. Personal communication.
2. Carpenter, W. J., and R. C. Rodriguez. 1971. Early flowering of geranium cv. Carefree Scarlet by high intensity supplemental light treatment. *Hort. Sci.* 6:206-207.
3. _____, and W. H. Carlson. 1970. The influence of growth regulators and temperature on flowering in seed propagated geraniums. *Hort. Sci.* 5:183-184.
4. Cathey, H. M. 1964. Physiology of growth retarding chemicals. *Ann. Rev. Pl. Physiol.* 15:271-302.
5. _____, and N. W. Stuart. 1961. Comparative plant growth retarding activity of Amo-1618 and CCC. *Bot. Gaz.* 133:51-57.
6. Craig, R., and D. E. Walker. 1963. The flowering of *Pelargonium hortorum* Bailey seedlings as affected by cumulative solar energy. *Proc. Amer. Soc. Hort. Sci.* 83:772-776.
7. _____, and _____. 1959. Geraniums from seed. *Penn. Flower Growers Bull.* 97:1-3.
8. Holcomb, J., and J. W. White. 1968. Cycocel for height control of fast-crop seedling geraniums. *Penn. Flower Growers Bull.* 203:4-5.
9. Larson, R. A., and M. L. McIntire. 1968. The control of growth and flowering of seedling geraniums. *Publ. Dept. Hort. Sci. North Carolina State Univ.* 12 p.
10. Lindstrom, R. S. 1967. F_1 hybrid geraniums. *Mich. Florist* 439:12-14.
11. Payne, R. M. 1969. Effects of cycocel treatment and direct sowing method on growth and flowering of seedling geraniums. *Agr. Res. Okla. State Univ. Progr. Repr.* No. P-623:1-19.
12. Wilkins, H. F., and R. E. Widmer. 1968. Cultural experiments with F geranium cultivars. *Sci. Ser. Minn. Agr. Exp. Sta.* No. 6396. 8 p.
13. Zimmerman, R. H., D. T. Krizek, W. A. Bailey, and H. H. Klueter. 1970. Growth of crabapple seedlings in controlled environments: Influence of seedling age and CO_2 content of the atmosphere. *J. Amer. Soc. Hort. Sci.* 95:323-325.

MODERATOR FLEMER: Thank you very much, Charlie, for this discusion; tell Joe we are sorry he could not be with us. The next paper will be presented by Paul Read who will tell us how to propagate the new University of Minnesota hardy azaleas which are astoundingly hardy out in that bitter cold area of the Midwest.

PROPAGATING THE NEW UNIVERSITY OF MINNESOTA HARDY DECIDUOUS AZALEAS[1]

RICK HENNY AND PAUL E. READ

Department of Horticultural Science
University of Minnesota
St. Paul, Minnesota

Abstract. Cuttings from selected clones of deciduous azaleas, specifically hybrids resulting from reciprocal crosses of *Rhododendron* x *kosterianum*[2] x *R. roseum*, which are winter hardy in Minnesota, were successfully rooted with plastic-tent propagation. Rooting under mist was unsuccessful because of hard water and subsequent salt buildup on cuttings Best rooting occurred in a 1:1 peat-vermiculite or a 1·1 peat-perlite medium, but no single rooting compound gave consistently superior results Succulent cuttings in the elongation stage of growth, having expanding leaves, and cuttings with fully expanded leaves but no terminal bud formation rooted well

INTRODUCTION

Many desirable ornamental plants cannot be widely used in the Midwest due to a lack of sufficient winter hardiness. Such was the case of many deciduous azaleas until the University of Minnesota developed hardy plants from reciprocal crosses of *R.* x *kosterianum* x *R. roseum*. These plants have withstood mid-winter temperatures to —35° F. in open field conditions and bloomed profusely the following spring in various shades of pink. However, until recently, difficulty in asexual propagation has prevented multiplication of desired plants.

---

[1]Miscellaneous Journal Series Article No 1430 of the University of Minnesota Agricultural Experimental Station

[2]*R. kosterianum* is the specific name referring to the cross, *R. japonicum* x *R. molle*, (mollis hybrids) as a collective group.