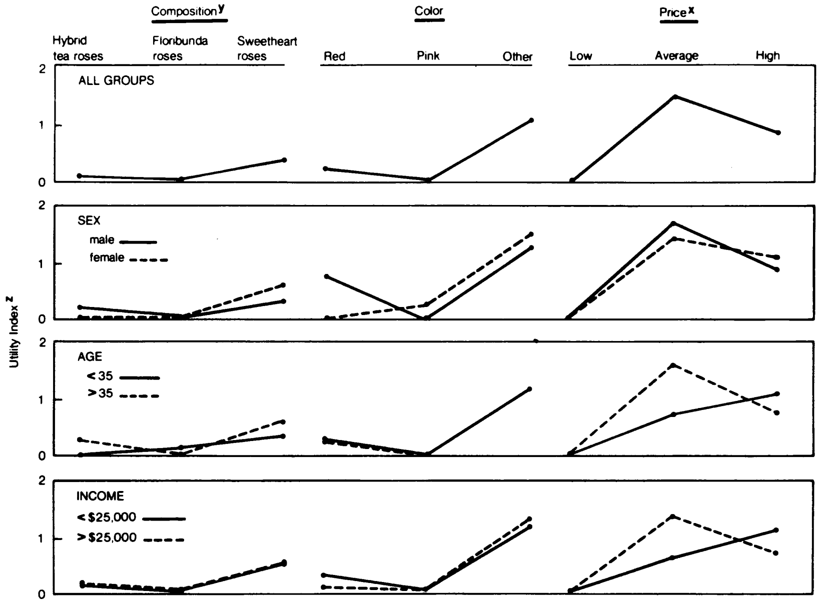

z Utility index represents a relative utility score for purchasing components in each experiment where the lowest component value was set at a base value of 0.

y All product choices contained daisy pompom chrysanthemums, carnation, baby's breath, and leather leaf.

x Low=$3.95; Average=$5.95; High=$7.95.

Fig. 3. Relative utility scores for composition, color, and price levels of loose bunch products, experiment 3.

tively. The pink roses were judged the least attractive. Males were the only segment to have a strong preference for red roses mixed in the loose bunch.

The $5.95 loose bunch was the most acceptable, and the $7.95 loose bunch met price resistance (Fig. 3). The ideal product offering was the orange sweetheart rose in a mixed bunch and priced at $5.95.

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Effects of Temperature on the Germination of Selected Wildflower Seeds[1]

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Additional index words. Coreopsis tinctoria, Ipomopsis rubra, Linum perenne, Asclepias tuberosa

Abstract. **Seeds of *Coreopsis tinctoria* Nutt., *Ipomopsis rubra* (L.) Wherry, *Linum perenne* L., and *Asclepias tuberosa* L. were germinated under constant light at 155 ± 10 $\mu Em^{-2}sec^{-1}$ on a thermogradient plate to determine optimum temperatures for germination. Optimum temperatures were 30°C for *C. tinctoria,* 25° for *L. perenne* and 30° for *A. tuberosa. I. rubra* exhibited poor germination at all temperatures in light. *C. tinctoria, L. perenne* and *A. tuberosa* germinated within temperature ranges of 15° to 35°, 15° to 25°, and 25° to 35°, respectively. *A. tuberosa* was the slowest germinating of the 3 species.**

Wildflowers are used widely in low maintenance landscapes such as roadsides, municipal open spaces, and as bedding plants and cut flowers. Several seed companies now specialize in the production of wildflower seeds. Little information (1) is available on the germination of wildflowers. This study considers the effect of temperature on percent germination under continuous light.

Seeds of *Coreopsis tinctoria* (golden wave), *Ipomopsis rubra* (standing cypress), *Linum perenne* (blue flax), and *Asclepias tuberosa* (butterfly flower) were obtained from Environmental Seed Producers, Inc. (ESP), El Monte, Calif. Before shipment from California, the seeds were stored in cloth bags at 18° to 21°C. Initial seed germination of *C. tinctoria, I. rubra, L. perenne* and *A. tuberosa* was 94%, 43%, 92%, and 69%, respectively. After the seeds were received, they were stored at 10° for 2 weeks. Fifty seeds of each species were placed on three 4.25-cm Whatman filter papers moistened as needed with distilled water in plastic Petri dishes. Petri dishes were oriented on the thermogradient plate at 15°, 20°, 25°, 30° ± 1°, and 35° under continuous Cool White fluorescent lamps at 155 ± 10 $\mu Em^{-2}sec^{-1}$. Filter paper surface temperatures were measured daily with a Bailey Bat-4 thermometer. Germination was monitored daily for 14 days by noting radicle length greater than 1 mm; germinated seedlings were removed from the Petri dishes. The experiment was repeated 3 times.

Arc-sine transformations were made on the final percentages, and means were compared using Duncan's multiple range test. Mean days to germination (MD) were calculated for each species at each temperature in order to quantify germination rate (1, 3). Mean days represent the average number of days required for radicle emergence. The optimum germination temperature of each species may be defined as that temperature at which the highest percent of germination is attained in the shortest time, below and above which germination is delayed but not prevented (1, 2).

It has been shown that under different time intervals a different temperature may be optimal according to the usage of the term (2). For the selected species in this study, 2 weeks was determined to be sufficient time for germination to occur. Also, it should be recognized that optima defined under constant temperature may give misleading information about field germination under varying diurnal temperature fluctuations (1). The range of temperatures at which the highest percent germination occurs is shown in Fig. 1; the one temperature among the various treatments (15°,

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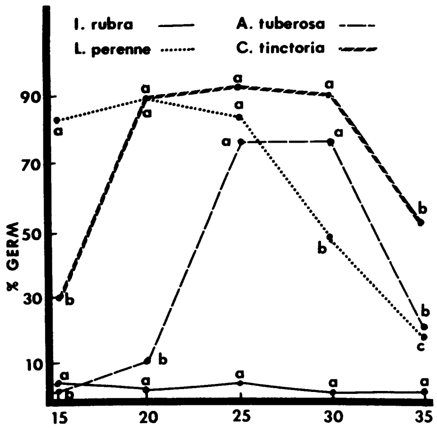

Fig. 1. Total percent germination of *I. rubra, L. perenne, A. tuberosa,* and *C. tinctoria* at 15°, 20°, 25°, 30° and 35°C over a 14 day period. Mean separation within species by Duncan's multiple range test, 5% level.

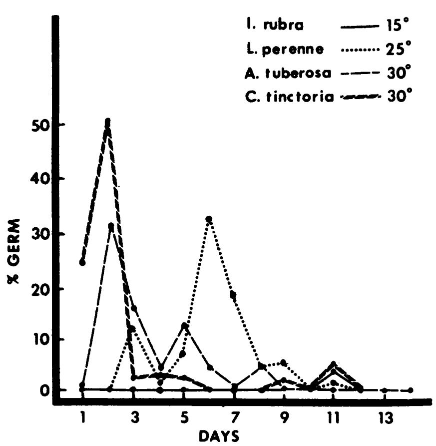

Fig. 2. Daily percent germination of *I. rubra, L. perenne, A. tuberosa,* and *C. tinctoria* at each optimum temperature over a 14 day period.

20°, 25°, 30° and 35°C) at which the highest daily percent germination was attained in the shortest length of time for each species is depicted in Fig. 2 (1, 2). Speed of germination, coupled with a high daily percent germination, are in compliance with our definition for optimum temperature (1, 2).

C. tinctoria had an optimum germination temperature of 30°C (Fig. 2) and germinated over a temperature range of 20° to 30° (Fig. 1). Germination occurred at 15° and 35° after an additional week on the thermogradient plate. *C. tinctoria* germinated most rapidly at 30° with a 2.30 MD.

I. rubra seed germination was less than 4% and, consequently, neither temperature differences nor an optimum germination temperature were observed (Fig. 1, 2). The few seeds that germinated did so at 15°C with a 3.66 MD.

L. perenne seeds germinated at an optimum temperature of 25°C within the cooler temperature range of 15° to 25° (Fig. 1, 2). They germinated less rapidly than the other species, and had a MD of 6.02.

A. tuberosa germinated at an optimum temperature of 30°C (Fig. 2) over a narrow temperature range of 25° to 30° (Fig. 1). *A. tuberosa* exhibited the slowest germination rate with a 19.70 MD. Our data for *A. tuberosa* indicated a higher percent germination in a shorter length of time than reported by Salac (3). Some of these differences may be attributed to geographical origin of the seeds used in the study, age of the seeds, harvest maturity, and conditions of storage from time of harvest until experimental use.

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Sensitivity and Symptomology of Marigold Cultivars Exposed to Acute Sulfur Dioxide[1]

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Additional index words. Tagetes, air pollution

Abstract. **Thirty-nine cultivars of marigold (*Tagetes* spp.) were exposed to sulfur dioxide to determine their relative sensitivity. Flowering plants were fumigated at 1 ppm SO_2 for 4 hours or at 2 ppm SO_2 for 2 hours. The average foliar injury for all leaves on individual plants ranged from 42.3% for 'Crackerjack Mix' at 2 ppm SO_2 to 0.0% for 'Cupid Yellow' at 1 ppm SO_2. Foliar necrosis appeared as a gray to white marginal and/or interveinal scorch 1 day after exposure. There was a tendency for interveinal necrosis to be near the midvein. The extra-floral nectaries which line the leaf margins of marigold were scorched in 15 of the 39 cultivars. This injury may be of diagnostic value. Sepals were very sensitive to SO_2. Sepal injury appeared as a pinpoint scorch and as tip burn, and was apparent in some cultivars when no foliar injury occurred.**

Comparisons of cultivar sensitivity to controlled levels of SO_2 have been infrequent (8). Ornamental plants which have been investigated include petunia, begonia, coleus, chrysanthemum, marigold, snapdragon, and poinsettia (1, 3–10). In some cases, only 2 or 3 cultivars were used in a comparison. To facilitate planting recommendations for area where high concentrations of SO_2 are common, a more complete screening of cultivars in necessary. Extensive cultivar evaluation is also valuable to breeders who wish to identify pollution-insensitive plant material, and to physiologists who want to clarify the mechanism of sensitivity responses.

Marigold was classified as sensitive to SO_2 by O'Gara in 1920, as cited by Thomas et al (11). More recently, the cultivars 'Diamond Jubilee' and 'Petite Mixture' were uninjured following exposure of up to 4 ppm SO_2 for 2 hr (1) and were categorized as tolerant to SO_2. Injury to marigold has been described as typical (2) and is similar to SO_2 injury on most plant types. Foliar necrosis is generally interveinal, and often the injury is close to the midvein. Physiological work by Sanders and Reinert (9) indicated chronic exposure to SO_2 at 0.3 ppm reduced growth in 'King Tut' marigold, but SO_2 in combination with other pollutants enhanced growth. This study was initiated to determine relative differences in sensitivity of numerous marigold cultivars to acute SO_2.

Seed of 39 marigold cultivars was sown in the greenhouse in flats filled with vermiculite on April 13, 1981, and transplanted 1 week later into Speedling flats (5 × 5 cm cell size) containing a transplant medium of 1 Florida

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