made us interested in further comparisons among the cultivars. Further comparisons are possible by repeated application of the test to a reduce number of treatments. Unfortunately, the comparisons are not independent and the significance level of the test changes in an unknown way (3). Though the probability level is not exact, treatment differences can be investigated. If the null hypothesis is rejected, the original sums of ranks are ordered and contiguous sums of ranks selected. Data for the reduced numbers of treatments would be re-ranked and the modified Friedman test applied to the new sums of ranks. For our example, Foch differs from the other three cultivars.

To illustrate the sensitivity of the Friedman test, given 1 plant from 3 treatments in 3 blocks, the treatments are different at the 5% probability level if the cultivars are ranked in the identical order for all 3 blocks. Several authors give the exact distribution of T for 3 treatments with 2 to 15 blocks and 4 treatments with 2 to 8 blocks (1,5). The chi-square approximation tends to be conservative (3). Conover gives several modifications of the Friedman test, including an extension to the incomplete block design (3).

The modified Friedman test is an easy test for analyzing ranked data from a randomized complete-block design. Using this test, quantitative data may be analyzed without checking the assumptions of normality of homogeneity of variance. We encourage horticultural researchers to check assumptions and use tests appropriate to their data. Non-parametric tests provide simple, adequate analyses in many experiments where a F-test is unnessary or inappropriate.

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In Vitro Propagation of *Kalanchoe*[1]

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We have achieved a rapid (4-6 weeks from culture initiation to potted plantlets) *in vitro* method for clonal propagation of *Kalanchoe bossfeldiana* Poelln. The resulting potted plants have increased branching and shorter internodes than plants established by conventional propagation methods, making them commercially desirable. This *in vitro* method has potential for rapid propagation of new *Kalanchoe* cultivars, as each leaf, shoot tip, and stem section could be used as an explant for culture. This plant is widely available and is ideal for classroom demonstration of tissue culture.

Leaves, stem sections, and shoot tips were excised from greenhouse-grown plants and washed in warm, soapy water, rinsed, surface sterilized for 10 min in a 15% (by volume) solution of sodium hypochlorite plus 2 drops/100 ml of the surfactant Tween-20, and then rinsed 3 times in sterile water. Sections of leaf blade (15 × 15 mm), stem (15-20 mm) and shoot tips with 2-4 primordial leaves (1-2 mm) were placed in culture and incubated in 16 hr photoperiod (20 $\mu Em^{-2}s^{-1}$) at 27 ± 2°C.

Initial comparisons were made between agar-solidified and stationary liquid medium in which the explant was supported on a filter-paper platform. The culture medium for all experiments contained Murashige and Skoog inorganic salts (1) and in mg/liter: myo-inositol, 100; adenine sulfate·$2H_2O$, 80; thiamine·HCl, 0.4; $NaH_2PO_4 \cdot H_2O$, 120; sucrose, 30,000; indoleacetic acid (IAA), 1.0; kinetin, 1.0; and Bacto-agar, 6,000. The pH was adjusted to 5.7 prior to autoclaving 15 min at 121°C.

Root initiation was tested with the above basal medium and 0, 0.5, 1.0, 2.0 mg/liter indolebutyric acid (IBA) and napthaleneacetic acid (NAA) at 0, 0.5, 1.0, and 2.0 mg/liter in the absence of kinetin. Ten to 20 explants were cultured per treatment.

Within 3 weeks, bud and shoot initiation occurred from leaf, stem, and shoot explants. The average number of plantlets per culture tube at 4 weeks was: 35, stem (liquid); 25, stem (agar); 33, leaf (liquid); 60, leaf (agar). Leaf cultures on agar-solidified medium gave the best plantlet formation. Shoot formation could perhaps be increased by other cytokinins at different concentrations. Shoot tips were then tested against leaf segments on agar-solidified medium. Shoot tips gave 60-100 plants/tube, and appeared to be a preferred explant source (Fig. 1). In addition, where leaf segments served as an explant source there was a 10-20% contamination rate as compared to 0% for shoot tips.

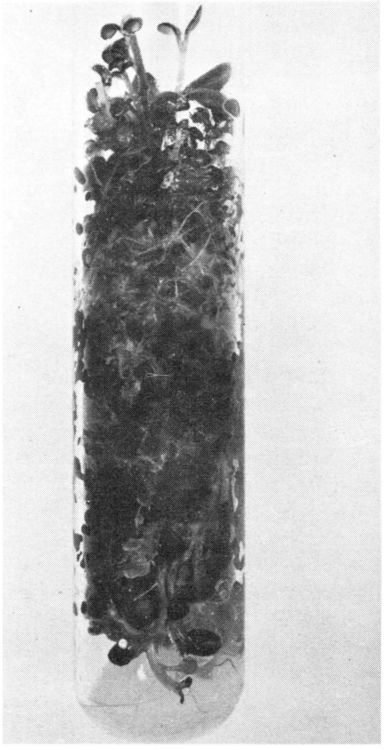

Fig. 1. *Kalanchoe* shoot tip after 5 weeks in culture.

Shoots formed roots on all IBA levels tested, but best root and shoot development was achieved at 1 mg/liter. Rooting was reduced at all levels of NAA. *Kalanchoe* shoots with or without roots were directly transplanted to Redi-earth in 1.9 cm^2 seedling flats under 2 layers of shade cloth in the greenhouse with 99% survival.

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