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OBSERVATIONS CONCERNING THE CAPACITY OF ROSA CV. MR. LINCOLN SHOOTS IN DIFFERENT PHYSIOLOGICAL STATES TO BE STORED AT -1°C

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INTRODUCTION

The field production of rose plants requires a two year production cycle. Hardwood rootstock cuttings are planted in early winter and the resulting plants are T-bud grafted the following spring. During the second winter, the rootstock top is removed forcing the scion to grow during the second summer. The following autumn, shoots are cut from the finished crop prior to harvest and stored at -1°C until needed for the spring T-bud grafting operation. Many factors have been observed to influence the survival of these shoots in frozen storage. Traditionally, a high starch content as well as exposure to cool temperatures has been considered critical. In addition, the presence of new growth arising from the desired shoots in response to autumn rainfall has been noted to negatively influence shoot starch content and maturity such that successful storage is difficult. The objective of these experiments was to test the ability of rose shoots to be stored at -1°C when in different physiological states due to the presence of this new growth as well as being exposed to the cooling temperatures of autumn.

MATERIALS AND METHODS

1985

Sixty rose shoots of *Rosa* cv. Mr. Lincoln were cut from two different plant canopy positions on 16 October, 22 November, and 18 December 1985 and stored at -1°C (30°F). Shoot type A was from a previous growth cycle while shoot type B was the most recent growth which had arisen from shoot type A (see Table 1). Stem survival during storage was assessed on June 2, 1986.

1986

Sixty rose shoots of *Rosa* cv. Mr. Lincoln were cut from four different shoot types on 1 October and 20 November 1986 and stored at -1°C (30°F). Shoot type A was from a previous growth cycle while shoot type B was the most recent growth which had arisen from shoot type A (see Table 2). Shoot type C had either green or dark thorns, but no new growth on 1 October. On 20 November, shoot type C appeared mature and had either new growth or no new growth. Shoot survival during storage was assessed on March 10, 1987.

For both years, visual starch ratings were made for representative shoots taken on each sample date using hand sections and an iodine stain. For storage at -1°C (30°F), shoots were wrapped in wet newspaper and placed in plastic bags, the usual cultural practice. Percent live shoots was determined by visual observation, dead shoots being obvious due to discoloration or browning of the tissue and extensive mold growth. Weather data during the two experimental periods is summarized in Table 3.

RESULTS AND DISCUSSION

Several factors influencing the frozen storage capacity of rose shoots appear evident from the data. In 1985, the increase in starch content and % live from the 16 October to the 22 November sample date for both shoot types indicates that these characters are positively related (see Table 1). In addition, % live increased further for the 18 December sample date after exposure to freezing temperatures between 22 November and 18 December. This increase occurred without a rise in the visual starch rating for both shoot types indicating a role for temperature in storage capacity (see also Table 3).

In 1986, starch ratings were low for shoot type B when compared to shoot type C with green or dark thorns when shoots were cut on 1 October (see Table 2). This was apparently due to the presence of shoot type A which was actively growing from shoot type B. A maturity effect is also apparent in that shoot type C with dark thorns had a higher % live than shoot type C with green thorns, though neither supported new growth nor differed in visual starch rating. After exposure to freezing temperatures between 1 October and 20 November, all four shoot types had 100% survival indicating an overriding effect of temperature despite the presence of green, immature thorns on shoot type B and new growth on shoot type C (see also Table 3).

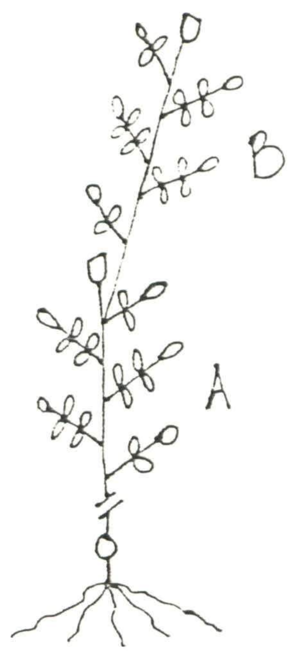
These data indicate that, when cuttings budwood before the occurrence of freezing temperatures, shoots with no new growth and dark thorns should be collected. As traditionally recommended, high visual starch ratings coupled with a mature appearance will aid in storage. After the occurrence of freezing temperatures later in the autumn, storage was successful for all shoot types studied. However, successful collection and storage of the youngest shoots that have finished flowering at this time will most likely be limited when early frosts are severe as that experienced in 1985 (see Table 3).

In order to separate the factors of shoot starch content, shoot maturity, and temperature, a model system could be used. Single shoot systems have been used to study photosynthate movement in rose plants (Y. Mor and A. H. Halevy. 1979. Physiol. Plant. 45:177-182). This system could be modified so that the mobilization of stored metabolites from old to new growth could be studied. Single node cuttings would be rooted and allowed to grow for several growth cycles. To begin an experiment, the plant would be pruned back to a five leaflet leaf on the first new shoot. Only one shoot would be allowed to grow from this shoot. In this way, the starch reserves and storage capacity of the old and new shoot, could be studied in reference to the stage of development of the new shoot. These plants would also be useful for controlled environment studies of the effects of temperature and photoperiod on these factors. During the experimental period for this study, photoperiod was also decreasing. Using a model system, the effects of these environmental factors upon the initiation of new growth and how this new growth affects the photosynthate reserves and the storage capacity of shoots from previous growth cycles could be separated. Thus more would be known about the confounding effects of autumn weather patterns which differ from year to year on budwood collection practices.

Table 1. Survival of budwood after storage from sample date to June 2, 1986 at -1°C.

Sample Date	Shoot Type[z]	% Live Stems After Storage	Visual Starch Rating[y]
October 16, 1985	A	0	0
	B	0	0
November 22, 1985	A	70	2.5
	B	36	2.5
December 18, 1985	A	100	3.0
	B	70	3.0

z



10-16-85 Shoot type B was flowering.

11-22-85 Shoot type A appeared mature.
Shoot type B had no petals.

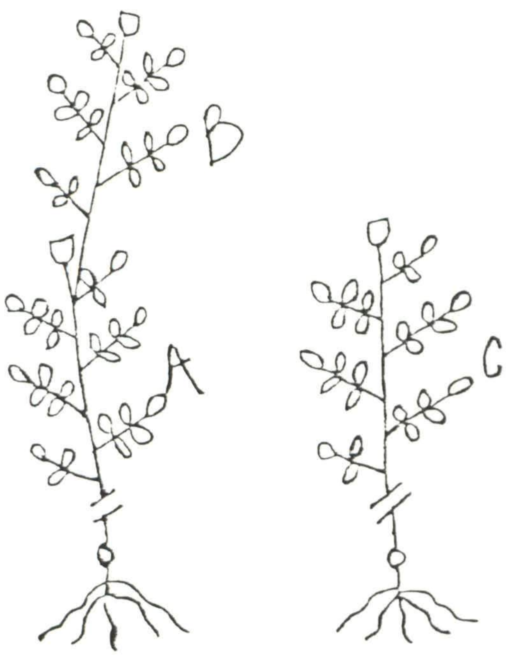
12-18-85 Shoot types A&B appeared mature.

[y]Scale 0 = no starch granules present
4 = starch granules in the full length of the medullary rays and xylem parenchyma

Table 2. Survival of budwood after storage from sample date to March 10, 1987 at -1°C.

Sample Date	Shoot Type^z	% Live Stems After Storage	Visual Starch Rating^y
October 1, 1986	A	3	0.5
	B	0	0.0
	C with green thorns	2	2.5
	C with dark thorns	66	3.0
November 20, 1986	A	100	3.0
	B	100	2.0
	C with new growth	100	3.5
	C with no new growth	100	3.5

z



10-1 -86 Shoot type A appeared mature. Shoot type B was flowering. Type C had either green or dark thorns and no new growth.

11-20-86 Shoot type A appeared mature. Shoot type B was beginning to appear mature, but had green thorns. Shoot type C appeared mature and either had new growth with visible flower buds or no new growth.

^{y}Scale 0 = no starch granules present
4 = starch granules in the full length of the medullary rays and xylem parenchyma

Table 3. Weather data from Overton, Texas during experimental periods in 1985 and 1986.

1985

September 16 to October 15 - Sample Date 1

average maximum 27°C (81°F)	high 33° (91°)
average minimum 13° (55°)	low 4° (39°)
rainfall 4.8 cm (1.9 inches)	

October 16 to November 21 - Sample Date 2

average maximum 23°C (73°F)	high 28° (82°)
average minimum 13° (55°)	low 3° (37°)
rainfall 30.2 cm (11.9 inches)	

November 22 to December 18 - Sample Date 3

average maximum 14°C (57°)	high 26° (79°)
average minimum 2° (36°)	low -10° (14°)
rainfall 22.1 cm (8.7 inches)	

1986

August 16 to October 1 - Sample Date 1

average maximum 32°C (90°f)	high 36° (97°)
average minimum 21° (70°)	low 11° (52°)
rainfall 15.0 cm (5.9 inches)	

October 2 to November 20 - Sample Date 2

average maximum 22°C (72°F)	high 33° (91°)
average minimum 10° (50°)	low -2° (28°)
rainfall 20.6 cm (8.1 inches)	