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MORPHOLOGICAL AND PHYSIOLOGICAL INDICATORS OF WATER STRESS ON *ROSA MULTIFLORA* UNDER DIFFERENT WATER REGIMENS

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INTRODUCTION

The study of water stress effects on the growth of the *Rosa multiflora* rootstock and the T-bud graft procedure are of great importance to the rose industry in East Texas. Approximately 26% of the total costs for a single operation goes into the T-bud grafting procedure. The objective of this study was to establish water stress treatment regimens with known morphological and physiological characteristics so that the effects of water stress on T-bud grafting could be studied.

MATERIALS AND METHODS

Rosa multiflora cuttings were disbudded except for the two top eyes and rooted in perlite under intermittent mist for a period of four and a half weeks in June 1988. Cuttings were then established in one gallon containers with a potting mix consisting of 4 parts of bark screened to 0.5 inch, 1 part of fine sand, lime, gypsum, and trace elements. Osmocote (0.35 oz) was applied on the surface of each pot. Plants were allowed to grow in a glasshouse covered with 50% saran shade cloth for a period of 4 to 5 weeks prior to the beginning of the experiment. Conditions in the glasshouse were 72° F average night temperature with a 90° F average daily maximum. Pots were covered with aluminum foil and polyethylene to avoid evaporation from the media while gravimetric measurements were taken every day to assess water usage. Based on the gravimetric measurements, three different watering regimens were imposed consisting of non-stress, moderate, and high stress treatments.

Two types of measurements were observed and recorded every four days beginning when the stressed treatments were initiated. The first type consisted of measuring physiological parameters of the plant including leaf water potential, transpiration, and stomatal conductance. These were taken between 12:00 and 3:00 p.m. (noon) when sunlight intensity and water stress was highest and leaf water potentials were taken at 4:30 a.m. (pre-dawn) the following morning when water stress was lowest.

The second type of measurements made were of morphological parameters. Leaf area of a most recently fully expanded leaf per plant was measured on two occasions. At the end of the experiment on day 37, plants were harvested and

internode length, total plant leaf area, leaf number, and shoot and root dry weight were assessed. Analysis of variance procedures were used to discern treatment differences.

RESULTS AND DISCUSSION

Ten days after stress treatments were started, there were no differences in noon or pre-dawn leaf water potential (Figures 1 and 2), transpiration, or stomatal conductance (data not shown). However, leaf area of the most recently fully expanded leaf was reduced on plants under water stress when compared to adequately watered controls (Table 1). Noon water potential measurements were less on stressed than control plants by day 22 while still recovering overnight (Figure 1). Differences in overnight recovery (pre-dawn water potential) were not observed until day 34 (Figure 2). By the end of the experiment, water stress treatments resulted in a 50% reduction in total growth was observed for total leaf area, internode length, and shoot and root dry weight (Table 2). There was no difference, however, in total leaf or shoot number when comparing stressed and non-stressed plants (data not shown).

Leaf area and internode length appear to be sensitive and easily measured indicators of water stress in roses. This experiment is being repeated at the present time to check previous results. In addition to this, another study is being performed to see how these different watering regimens affect T-bud graft survival. Knowing how the water status of rootstock plants affects budding survival rates will help producers better schedule the budding operation. Budding could then be either planned around rainfall events or irrigation could be used to maintain optimum plant water status conditions during the spring budding period.

Table 1. Mean area of the most recently fully expanded leaf on Days 10 and 25 after the start of stress treatments.

Watering treatment	Leaf area (cm^2) Day 10	Day 25	Day 10 vs. Day 25
No stress	23.8 a[z]	28.1 a	**[y]
Moderate stress	14.3 b	17.3 b	*
High stress	13.7 b	15.0 b	NS

[z]Mean separation within columns using Fisher's Protected LSD 5% level. means followed by the same letter are not significantly different.

[y]NS, *, **, nonsignificant or significant at the 5% or 1% level, respectively.

Table 2. Mean growth measurements on Rosa multiflora 'Brooks 56' plants after exposure to three water regimens for 37 days under greenhouse conditions.

Watering treatment	Internode length (cm)	Total plant leaf area (cm^2)	Stem dry wt. (g)	Root dry wt. (g)
No stress	3.70 a[z]	1775.87 a	12.68 a	5.32 a
Moderate stress	3.13 ab	1007.53 b	8.36 b	3.64 b
High stress	2.73 b	850.42 c	6.71 c	2.90 c

[z]Mean separation within columns using Duncan's multiple range test. Means followed by the same letter are not significantly different.

FIGURE 1.– LEAF WATER POTENTIALS

NOON MEASUREMENTS

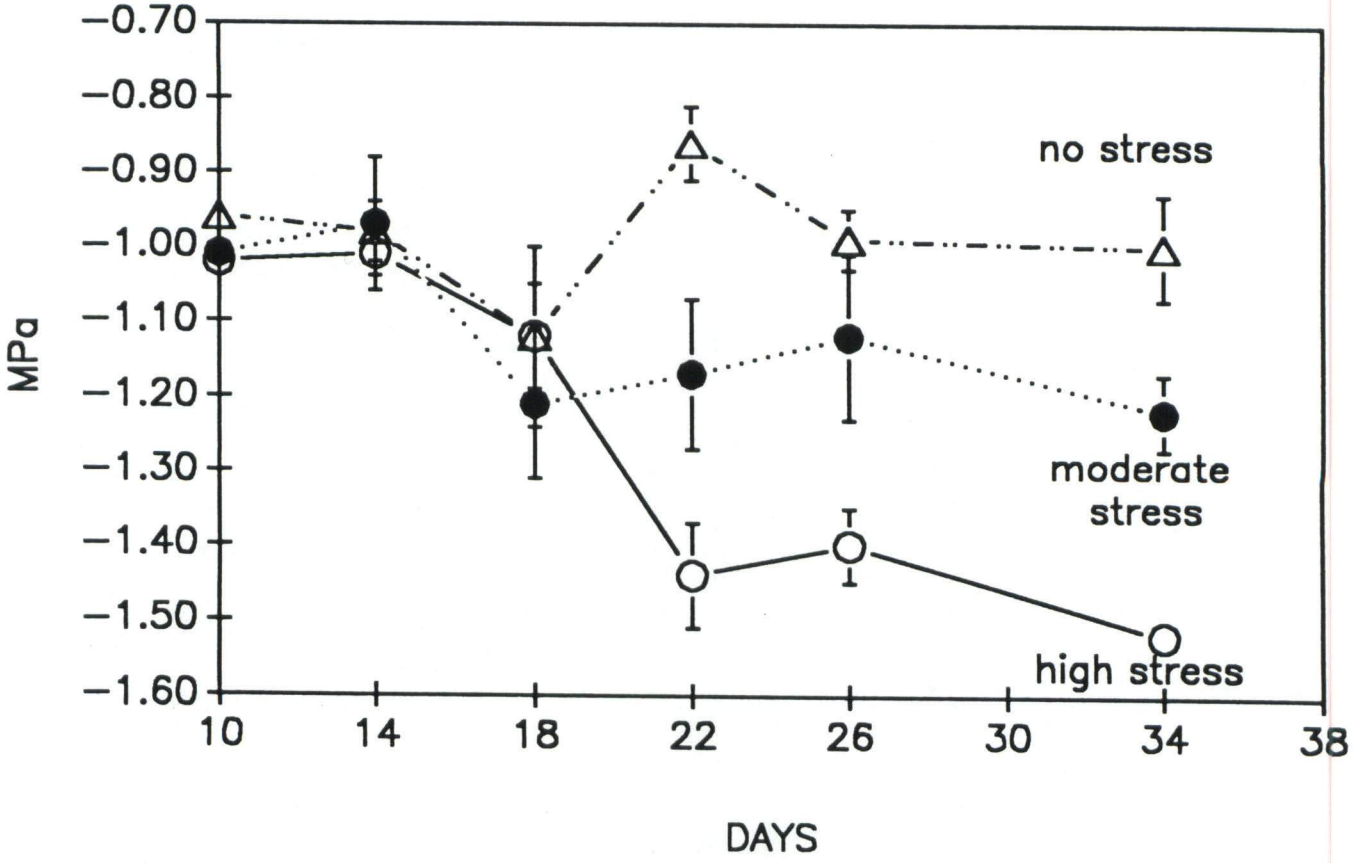

FIGURE 2.– LEAF WATER POTENTIALS

PRE–DAWN READINGS