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CHANGES IN LEAF WATER STATUS IN GRAPEVINE GRAFTINGS TREATED WITH GROWTH REGULATORS

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Abstract: The effect of foliar application of plant growth regulators, paclobutrazol (1000 mg/L), chlorcholine chloride (200 mg/L) and gibberellic acid (100 mg/L) on leaf water status in grapevine graftlings of cv Cardinal was investigated. After stratification and waxing, young vines were planted into vegetation pots and grown in a glasshouse. Foliar treatments were applied once, twice or three times during the vegetative period, starting on 25 July and every 15 days thereafter. Values of total water potential (Ψ_L) and of relative water content (RWC) were measured over the same period. Results indicate a tendency of increased Ψ_L values in leaves of plants repeatedly treated with a growth inhibitor paclobutrazol (-1.18 Mpa) compared with untreated (-1.36 Mpa) as well as plants treated twice with gibberellic acid (-1.37 Mpa). RWC in leaves was significantly increased in the second half of the vegetative period when paclobutrazol was applied twice (78%) in comparison with control (75%). Values of both investigated indices point to a more favourable water status of plants treated during the vegetative period with growth inhibitors compared with untreated and plants treated with gibberellic acid.

Key words: grapevine planting material, growth regulators, leaf area, total water potential, relative water content.

I n t r o d u c t i o n

The use of the growth inhibitors resulted in the achievement of significant results in regulating the process of growth and maturation of different fruit species.

The primary effects of their application on plants reflect in the inhibited prolongation of young shoots, i.e. reduced growth which is the result of gibberellic acid biosynthesis inhibition. The degree of growth reduction depends

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on the concentration, time and method of the use of inhibitors. Secondary effects of their application reflect in the changes of photosynthetic activity, chlorophyll content (Davis et al. 1988), respiration, carbohydrate content (Steffens et al. 1983; Wang et al. 1986) and stress tolerance (Steffens et al. 1983; Swietlik and Miller, 1983; Lorenzi and Giulivo, 1985). The plant water regime determines the direction and intensity of a series of physiological processes, on which the quantity and quality of grown plants yield depends. The research was conducted on grapevine graftings in the periods of formation of root system and development of young shoots, when the plant water status is of great significance for rhyzogenic processes and vegetative development of grapevine graftings.

Material and Methods

These studies were conducted in a controlled environment (vegetative pots).Graftings of cv Cardinal onto rootstock Kober 5BB were used as experimental material.

The following growth regulators were used in this trial:

1. Paclobutrazol, at a concentration 1000 mg/L
2. Chlorcholinchloride, at a concentration 200 mg/L
3. Gibberellic acid, at a concentration 100 mg/L

Depending on the treatment, regulators were applied to graftings once, twice or three times during the vegetative period, starting on 25 June at 15-day intervals.

The treatments applied were as follows:

1. Paclobutrazol applied once (PC1), twice (PC2), or three times (PC3)
2. Chlorcholinchloride applied once (CC1), twice (CC2), or three times (CC3)
3. Gibberellic acid applied once (GA1), twice (GA2), or three times (GA3)
4. Control (C), untreated plants

Applications of GA as well as pure water served as untreated reference for observing the effect of treatments using the above growth inhibitors.

Leaf area was measured with the method of "round slices" (Jelenic and Džamic, 1989). Total water potential in leaf was determinated with "pleasure chamber" (Sholander et al. 1965). Relative water content (RWC) in the leaf was determined with gravimetrical method (Slatyer and Barrs, 1965). Measures were conducted in the period of August, September and October.

Results and Discusion

Average leaf area

The use of paclobutrazol and chlorcholinchloride caused the reduction of leaf area in the treated grapevine graftings. The reduction of leaf area in the CC2 treatments was statistically very significant and in the CC3 and PC2 treatments

significant, (Table 1). With similar concentrations of paclobutrazol Tukey, 1986; Intrieri, 1986; Sansavini et al., 1986, also state significant reduction of leaf area. Coombe, (1967) reports the occurrence of smaller, thicker and darker leaves after the chlorcholinchloride treatment in comparison with the untreated ones. Gibberelic acid treatments exhibited opposite effects on the leaf area. In GA2 treatment the increase of leaf area was statistically significant compored with the control.

T a b. 1. - Leaf area cv. Cardinal/Kober 5BB graftings (cm^2)

Treatment	PC1	PC2	PC3	CC1	CC2	CC3	GA1	GA2	GA3	C
Leaf area	61.40	60.63	62.30	61.46	59.30	60.00	65.00	67.88	65.99	64.35
$Lsd_{0.05}$	3.4735									
$Lsd_{0.01}$	4.8447									

Total water potential (Ψ_L)

The values obtained by measuring Ψ_L in August, September and October did not differ significantly among the tested treatments, (Table 2). A mild tendency of total water potential increase in the leaves of multiple treated growth retardants was noticable. If we observe average values of total water potential for the tested period, higher Ψ_L values in the plants with multiple paclobutrazol (-1,22 MPa; -1,18 MPa) and chlorcholinchloride (-1,22 MPa; -1,23 MPa) treatments were clearly noticable. So far, research results show that after the use of paclobutrasole water potential of the treated plants was increased (Atkinson and Crips, 1983; Swietlik and Miller, 1983).

T a b. 2. - Total water potential (Ψ_L) in the leaf cv. Cardinal / Kober 5BB graftings, (-MPa)

Treatment	August	September	October	Average
PC1	1.10	1.32	1.27	1.23
PC2	1.20	1.22	1.22	1.21
PC3	1.12	1.22	1.18	1.17
CC1	1.18	1.32	1.26	1.25
CC2	1.25	1.12	1.22	1.20
CC3	1.18	1.22	1.23	1.21
GA1	1.32	1.42	1.36	1.37
GA2	1.38	1.32	1.37	1.36
GA3	1.22	1.35	1.32	1.30
C	1.35	1.35	1.36	1.35
$Lsd_{0.05}$	0.2927	0.2762	0.3601	
$Lsd_{0.01}$	0,4082	0.3851	0.5021	

Relative water content (RWC)

The results of measuring RWC conducted in August showed that the used growth retardants did not cause significant changes in RWC in comparison with untreated plants. Measuring conducted in September showed that RWC value was

much greater in the PC2 treatment comparedwith the untreated plants, (Table 3). In October in the leaves from PC2, PC3, CC2, CC3 treatments RWC values were significantly higher than the untreated plants. Fletcher and Nath (1984) also state that the plants treated with growth retardants have higher water content in leaves in comparison with untreated plants, more rational water consumption and that they are more tolerant to drought.

T a b. 3. - Relative water content (RWC) in the leaf cv. Cardinal / Kober 5BB graftings (%)

Treatment	August	September	October	Average
PC1	83.22	76.68	74.84	75.76
PC2	83.12	78.58	76.74	77.66
PC3	85.25	76.66	76.24	76.45
CC1	83.60	75.18	76.04	75.61
CC2	82.75	76.75	76.44	76.60
CC3	82.32	78.05	76.52	77.29
GA1	72.28	76.35	74.78	75.57
GA2	81.35	74.90	75.70	75.30
GA3	82.32	75.30	74.92	75.11
C	82.85	75.65	74.70	75.18
$Lsd_{0.05}$	2.0722	2.5516	1.4365	
$Lsd_{0.01}$	2.7509	3.5580	2.0032	

Paclobutrazol applied once (PC1), twice (PC2), or three times (PC3)
Chlorcholinchloride applied once (CC1), twice (CC2), or three times (CC3)
Gibberellic acid applied once (GA1), twice (GA2), or three times (GA3)
Control (C), untreated plants

Since the more favourable water regime was stated in the treatments in which a significant inhibition of leaf areas was realized as well, more efficient water consumption could be related to the reduction of transpiration area. Some researches also point to some significant changes of ABA status and transpiration reduction in the plants treated with preparations from the triasole group, which also includes paclobutrazol (Asare-Boamah et al. 1986).

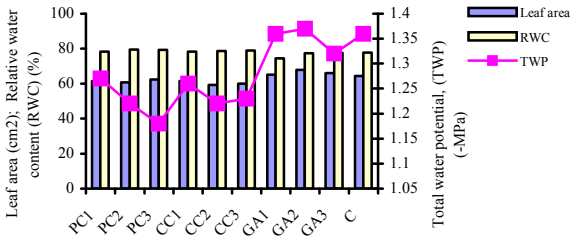

Fig. 1. - Changes in leaf area, relative water content and total water potential of cv. Cardinal / Kober 5BB graftings as function of application of growth regulators, paclobutrazol (PC), chlorholine chloride (CC) and gibberellic acid (GA)

Conclusion

Multiple foliar application of paclobutrazol (1000 mg/L) and chlorcholinchloride (200 mg/L) lead to the reduction of leaf area of the treated plants. In the same treatments, changes of leaf water potential were also established: Ψ_L was slightly increased compared with untreated plants, and RWC values in the leaves of treated plants were significantly higher in comparison with untreated plants, (Figure 1). GA treatments showed opposite effects on the tested indices from the applied growth retardants. The exhibited plant reaction can be significant in stressful situations – drought, as well as in the conditions of poor supply of plants with water.

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PROMENE VODNOG REŽIMA LISTOVA LOZNIH KALEMOVA TRETIRANIH REGULATORIMA RASTENJA

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R e z i m e

Ispitivan je uticaj folijarne primene biljnih regulatora rastenja, paklobutrazola (1000 mg/l), hlorholinhlorida (200 mg/l) i giberelinske kiseline (100 mg/l), na vodni režim listova loznih kalemova stone sorte kardinal. Mlade biljke su nakon startifikovanja i parafinisanja zasađene u vegetacione sudove i gajene u stakleniku. Tretiranja su obavljena folijarno, jednom, dva i tri puta u toku vegetacije, počev od 25. juna sa razmakom od 15 dana. U tom periodu merene su vrednosti ukupnog potencijala vode (Ψ_L) i relativnog sadržaja vode (RWC) u listovima. Dobijeni rezultati ukazuju na tendenciju povećanja vrednosti ukupnog potencijala vode u listovima biljaka višekratno tretiranih inhibitorom rastenja, paklobutrazolom (-1,18MPa) u poređenju sa netretiranim (-1,36 MPa) i biljkama dvokratno tretiranim giberelinskom kiselinom (-1,37 MPa). Relativni sadržaj vode u listovima je značajno povećan u drugom delu vegetacije, pri dvokratnom tretmanu paklobutrazolom (78.58%) u poređenju sa netretiranim biljkama (75.65%).

Vrednosti ispitivanih pokazatelja vodnog režima ukazuju na bolju snabdevenost vodom biljaka koje su u toku vegetacije tretirane inhibitorima rastenja u poređenju sa netretiranim i biljkama tretiranim giberelinskom kiselinom.

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