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Department of Viticulture, University of Stellenbosch, South Africa

Effect of hot-water treatments on budburst and rooting of grapevine cuttings

by

C. J. Orffer and P. G. Goussard

Einfluß der Warmwasserbehandlung auf Austrieb und Wurzelbildung von Rebenstecklingen

Zusammenfassung. — Dreiaugenstecklinge der Rebsorten Salt Creek (Ramsey) und Jacquez (mittleres und unteres Auge geblendet) wurden 30 min lang partiell oder gänzlich in 50 °C warmes Wasser getaucht. Wurden die ganzen Stecklinge oder der basale Pol behandelt, so war die Wurzelbildung gegenüber der Kontrolle verzögert. Durch Warmwasserbehandlung des apikalen Pols wurden dagegen der Austrieb und die Bewurzelung beträchtlich beschleunigt und die Anzahl und Masse der Wurzeln vermehrt.

Introduction

Thermotherapy could be applied in freeing many kinds of plants and seeds from certain fungi, bacteria, mites, nematodes and insects (Brain 1929, Baker 1962, Coombe 1963, Hartmann and Kester 1975). During hot-water treatments (HWT) cuttings or rooted plants are subjected to temperatures high enough and of a duration long enough (Baker 1962, Hartmann and Kester 1975) to destroy the pathogen, but not so high as to injure plant tissues. In the South African grapevine industry the prevention of the spreading of the following organisms from infected to non-infected areas are of interest: phylloxera, budmites, nematodes with emphasis on the vectors of several virus diseases, *Phytophthora cinnamomi, Agrobacterium tumefaciens, Xanthomonas ampelina*[1]) and mycoplasma-like organisms[1]).

HWT succeeded in effective eradication of organisms without injury to plant material (Brain 1929, Lear and Lider 1959, Baker 1962, Coombe 1963, von Broemsen and Marais 1978). The vigour and yield (Orffer 1977, von Broemsen and Marais 1978) of treated vines surpassed those of the untreated in several experiments under conditions where disease organisms of known diseases were absent.

The tolerance of plant material to HWT is an important matter. Lignified vines tolerated immersion in hot water at 45 °C for 24 h, 50 °C for 2.5 h and 55 °C for 10 min (Goheen *et al.* 1973). Regarding effects of HWT on certain physiological processes in vine cuttings, it was noted that the former often induced earlier sprouting of buds (Orffer 1977, von Broemsen and Marais 1978). HWT of lignified cuttings resulted in inhibiting callus initiation if exposure exceeded 10 min at temperatures above 55 °C (Goussard 1977).

Effects of HWT on the rooting of grapevine propagating material need further elucidation. Experiments were conducted to determine the effects of hot water on rooting and budburst of grapevine cuttings.

[1]) Effect of HWT under investigation.

Material and methods

Dormant cuttings of Salt Creek (Ramsey) (Loomis and Lider 1971) and Jacquez were collected during autumn 1978, cut into lengths of 15—20 cm comprising of 2 internodes with 3 buds and subjected to HWT (50 °C for 30 min). After cooling in cold water all buds except the apical ones were removed. Treatments consisted of the following: (a) entire cuttings were exposed to hot water, (b) only the basal parts of cuttings, approx. 1/3 the length, (c) only the apical parts were treated, and (d) untreated control.

The cuttings were subsequently placed in glass containers with the bases submerged in water to a height of 1 cm. The water was renewed twice weekly and losses were regularly replenished. An advantage of water as a rooting medium is that root initiation and development can be regularly observed.

The experiment was carried out at an ambient temperature of 30 °C under continuous light conditions. 40 cuttings, handled in aliquots of 10, were included for each treatment and results tabulated after 40 d.

Results and discussion

In treatments (a), whereby entire cuttings were subjected to HWT, budburst was enhanced, but root initiation was conspicuously inhibited (Table). However, treatment of basal parts of cuttings only (b) failed to stimulate budburst but reacted in a delay of root initiation. The effect of HWT appears of a local nature and restricted to the tissues exposed. A conspicuous stimulation of budburst was achieved when apical parts of cuttings were exposed to a HWT (c), which coincided with a concomittant stimulation of root initiation and development. The effect was more marked with Salt Creek cuttings than with Jacquez cuttings.

The exact nature of factors responsible for slow root development caused by HWT is not known. The presence of actively sprouting shoots in treated cuttings and cuttings of which only the basal parts were treated was unable to overcome the initial inhibition of root development.

Delaying of root development could be a disadvantage in cases where buds are stimulated and transpiration proceeds actively in nurseries prior to root development

Effect of hot-water treatment (50 °C for 30 min) on rooting and budburst of cuttings of Salt Creek (S.C.) and Jacquez (Jac.)

Einfluß der Warmwasserbehandlung (50 °C, 30 min) von Stecklingen auf Wurzelbildung und Austrieb bei Salt Creek (S.C.) und Jacquez (Jac.)

Treatment	Budburst (d)		First rootlets (d)		Mean number of roots after 40 d		Mean mass of roots after 40 d (g)	
	S. C.	Jac.	S. C.	Jac.	S. C.	Jac.	S. C.	Jac.
(a) Entire cuttings	16	15	25	37	46	14	2.30	1.15
(b) Basal parts	20	19	27	33	50	18	7.45	1.62
(c) Apical parts	11	14	15	20	230	47	34.70	3.60
(d) Control	24	21	20	22	172	20	18.40	1.35

which could lead to dessication of cuttings and lower take percentages. If the retardation of root development is only of a temporary nature, slower root development might be an advantage, especially with hot-room callusing procedures. During stratification of grafts in callusing boxes, excessive root development is undesirable because of severe root breakages and losses during the planting out operation in the nursery.

Summary

Basal or apical parts of grapevine cuttings as well as entire cuttings were treated with hot water at a temperature of 50 °C for 30 min. Root initiation was delayed following HWT of entire cuttings and treatment of the basal parts only. HWT of the apical parts of cuttings resulted in a marked stimulating effect on time of sprouting, root initiation, mean number and mass of roots.

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Prof. C. J. Orffer
Dept. of Viticulture
University of Stellenbosch
Stellenbosch 7600
Republic of South Africa