

Effect of growth regulators and heat on germination of Tokay grape seeds

by

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Der Einfluß von Wachstumsregulatoren und Wärmebehandlung auf die Keimung von Samen der Rebsorte Tokay

Zusammenfassung. — Samen der Rebsorte „Tokay“, die 24 Stunden in Wasser mit Temperaturen von 27 ° bis 54 °C getaucht worden waren, beendeten die Dormanz nicht. KGA_3 hob die Dormanz bei 50% der Samen auf, während Behandlung mit 100 ppm Morphaktin oder mit 5000 ppm Ethephon die Keimung erhöhten. Die Anwendung von SADH, CCC und ABA war jedoch wirkungslos. 1 ppm KGA_3 verursachte bei angeritzten dormanten Samen eine Keimung von 33%. SADH steigerte die Keimungsrate der nicht-ruhenden Samen, während ABA, BOA, CCC, Äthylalkohol und Schwefelsäure die Keimungsrate herabsetzten.

Introduction

In a previous study by YEOU-DER *et al.* (1968) short-term soaking in warm water did not substitute for the cold requirement in terminating rest of grape seeds. However, soaking in potassium gibberellate (KGA_3) completely replaced the cold requirement (YEOU-DER *et al.*, 1968). In the present work, termination of rest as influenced by soaking seeds in water at several temperatures, and by application of growth regulators was studied. The influence of scarification on seed rest was also followed. Also the effect of various growth regulators on germination of nonresting seeds was examined.

Materials and Methods

Seeds were collected from ripe berries of 'Tokay' grapes from a University of California vineyard at Davis on November 25, 1970. Seeds were dried at 24—27 °C for 2 weeks, after which some were stored at room temperature in air-tight bottles containing a desiccant and others were placed at —10 °C to keep them in a resting condition until used.

After the various treatments, the seeds were planted in vermiculite in plastic pots, 50 seeds per 4-inch pot. Plants were grown in a growth chamber with a day temperature of 30 °C and a night temperature of 18 °C, and relative humidity of 60 to 65%. There was a 12-hour light period each day. The number of germinating seeds in the pots was observed daily, and the cumulative germination in each treatment was recorded. Seeds were considered to have germinated when the hypocotyl appeared above the soil surface.

For the heat treatments, seeds were enclosed in cheesecloth bags which were immersed in water circulating in temperature baths.

Experimentation and Results

Experiment 1: Effect of various temperatures on termination of rest of seeds

On December 24, 1970 seeds were immersed for 24 hours in water at 27, 38, 43,

49, and 54 °C. Also, some seeds were soaked in cold tap water for 24 hours at room temperature. The seeds were planted on December 28, 1970. There were four replicate pots per treatment. None of the treatments was effective in terminating rest.

Experiment 2: Effect of growth regulators on termination of rest of seeds

The experiments were started on January 1, 1971. Resting seeds were soaked 28 hours at room temperature in 500 ppm SADH (succinic acid-2,2-dimethylhydrazide), 500 ppm BOA (benzothiazole-2-oxyacetic acid), 500 ppm CCC [(chloroethyl)trimethyl ammonium chloride], 500 ppm ethephon [(2-chloroethyl)phosphonic acid], 5,000 ppm KGA_3 , 100 ppm ABA (abscisic acid), and a morphactin (IT 3456) at 100 and 1,000 ppm. For the control, seeds were soaked in tap water for 28 hours at room temperature. At the end of the soaking, the solutions were drained from the seeds, and the seeds were planted. Each treatment was replicated twice. The experiment was completed on January 23, 1971.

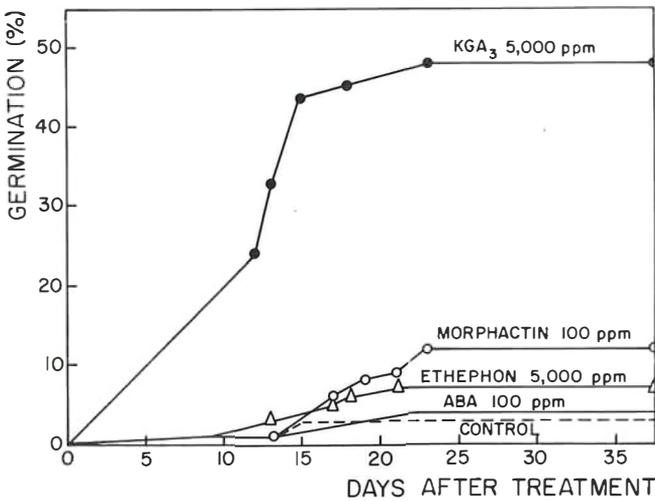


Fig. 1: Effect of various growth regulators on termination of rest in 'Tokay' grape seeds after a 28-hour immersion in growth regulator solutions.

Wirkung von 28stündigem Eintauchen in Lösungen verschiedener Wachstumsregulatoren auf die Beendigung der Dormanz von Samen der Rebsorte Tokay.

The KGA_3 treatment broke rest in about 50% of the seeds (Fig. 1). Morphactin at 100 and ethephon at 5,000 ppm also enhanced germination somewhat, but SADH, CCC, and ABA treatments were ineffective. In the morphactin treatment, many of the radicles grew upward out of the soil, and were desiccating. No seeds treated with BOA at 500 ppm or morphactin at 1,000 ppm germinated.

Experiment 3: Effect of various growth regulators on termination of rest of scarified seeds

After seeds stored at -10 °C were warmed to room temperature, the plumular end of the seeds were scarified on a rotating disc to expose the endosperm to ensure that the hormones penetrated into the seed. On March 24, 1971, seeds were soaked for 24 hours at room temperature in ABA, SADH, ethephon, KGA_3 , and morphactin, each at 1, 10, and 100 ppm. Final readings of seed germination were made on May 3, 1971. Each treatment was replicated 4 times.

Only the KGA_3 treatment broke rest of the seeds, but even at 1 ppm that was very effective (Fig. 2). Other chemicals entered the seed, but none hastened termina-

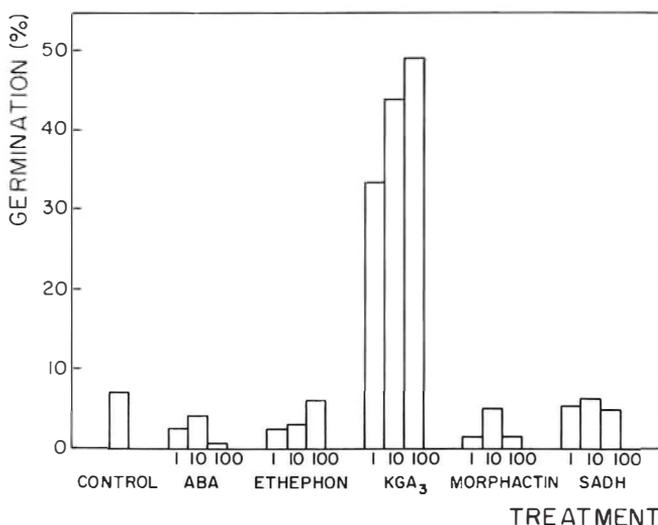


Fig. 2: Effect of various growth regulators on termination of rest of scarified seeds of 'Tokay' grape seeds after a 24-hour immersion in growth regulator solutions.
Wirkung von 24stündigem Eintauchen in Lösungen verschiedener Wachstumsregulatoren auf die Beendigung der Dormanz von angeritzten Samen der Rebsorte Tokay.

tion of rest. In the few morphactin-treated seeds that germinated, many radicles grew nearly upward.

Experiment 4: Effect of various growth regulators on germination of non-resting seeds

On December 24, 1970, resting seeds were mixed with moist sponge rock in polyethylene bags and then stored at 4 °C for 6 weeks. After this stratification, the seeds were soaked at room temperature for 24 hours in KGA₃ at 5,000 ppm, ABA at 100 and 1,000 ppm, SADH at 5,000 ppm, BOA at 5,000 ppm, and morphactin (IT 3456) at 100 and 1,000 ppm. Also used were ethanol at 10, 50, and 95% and sulfuric acid at 3.6 N. Control seeds were soaked in cold water for 24 hours. Each treatment was replicated twice.

Only SADH at 5,000 ppm increased the percentage of germination (Fig. 3). Ethephon and KGA₃ had no effect when compared to the control, but ABA, BOA, CCC, morphactin, all concentrations of ethyl alcohol, and sulfuric acid decreased the percentage of germination. In the ABA and morphactin treatments, the decrease may have been due to the ethyl alcohol in which they were dissolved.

Discussion

All heat treatments failed to break seed rest, in sharp contrast to resting grape buds in which heat completely terminates the rest period (WEAVER *et al.* 1968).

The fact that ethephon slightly enhanced germination of resting seeds is not surprising, as treatment with ethylene also terminates rest of many seeds (PRATT and GOESCHL 1969). Ethephon penetrates the plant tissues, and then breaks down into ethylene. Although previous reports have mentioned only that morphactin inhibits germination (SCHNEIDER 1970), in our study 100 ppm somewhat hastened termination of rest. The fact that many of the morphactin-treated seeds that germinated had radicles protruding from the soil reflects the ability of morphactins

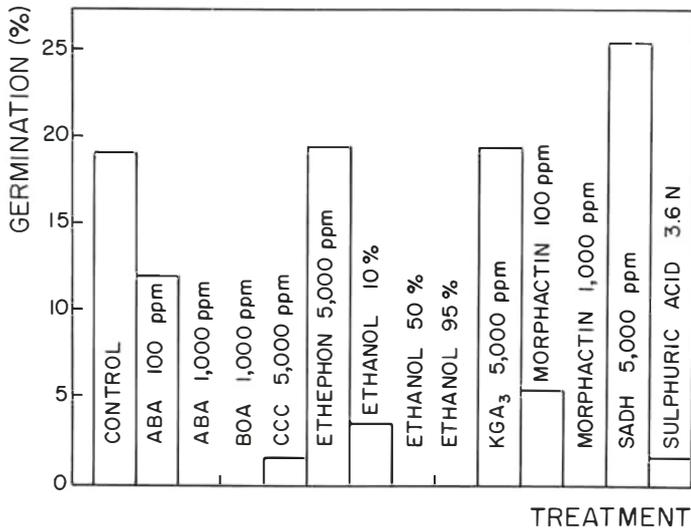


Fig. 3: Effect of various growth regulators on germination of nonresting 'Tokay' seeds after a 24-hour immersion in growth regulator solutions.

Wirkung von 24stündigem Eintauchen in Lösungen verschiedener Wachstumsregulatoren auf die Keimung nichtruhender Samen der Rebsorte Tokay.

to destroy geotropism. Hence the radicles grow in the direction they are pointed at planting time (KHAN 1967).

The fact that only 1 ppm KGA₃ was required to break rest of scarified seeds indicates how difficult it is for the compound to penetrate the seed coat. With seed coats intact, 8,000 ppm of KGA₃ is required for maximum termination of rest of grape seeds (YEOU-DER *et al.* 1968). Germination of scarified seeds was not stimulated by morphactin application, and it is reasonable to assume that high levels of the compound entered the seeds, and that such levels were inhibitory.

Only SADH stimulated germination of the non resting seeds. This compound has also been reported to hasten growth of buds (WEAVER *et al.* 1968).

Summary

Immersing seeds of 'Tokay' for 24 hours in water ranging from 27 ° to 54 °C failed to terminate rest. KGA₃ terminated rest in 50% of the seeds, and morphactin at 100 ppm and ethephon at 5,000 ppm resulted in some enhancement of germination. However, SADH, CCC, and ABA treatments were not effective. KGA₃ at 1 ppm caused 33% germination of scarified resting seeds. SADH increased the germination rate of nonresting seeds, but ABA, BOA, CCC, ethyl alcohol, and sulphuric acid decreased the rate.

Literature Cited

- KHAN, A. A., 1967: Physiology of morphactins: Effect on gravi- and photo-response. *Physiol. Plant.* 20, 306—313.
- PRATT, H. K. and GJESCHL, J. D., 1969: Physiological roles of ethylene in plants. *Ann. Rev. Plant Physiol.* 20, 541—584.
- SCHNEIDER, G., 1970: Morphactins: Physiology and performance. *Ann. Rev. Plant Physiol.* 21, 499—526.

- WEAVER, R. J., 1972: Plant growth substances in agriculture. Freeman and Co., San Francisco.
- —, YEOU-DER, K., and POOL, R. M., 1968: Relation of plant regulators to bud rest in *Vitis vinifera* grapes. *Vitis* 7, 206—212.
- YEOU-DER, K., WEAVER, R. J., and POOL, R. M., 1968: Effect of low temperature and growth regulators on germination of seeds of 'Tokay' grapes. *Amer. Soc. Hort. Sci.* 92, 323—330.

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