

PERFORMANCE OF 'STARKSPUR SUPREME DELICIOUS'

C6, P.2, P.16 and P.22 are good rootstocks for 'Delicious' production in Quebec. Trees on these rootstocks are sufficiently small to manage from ground level. However, with 'Starkspur Supreme Delicious' as the scion cultivar, only M.26 EMLA, MAC.9 and MAC.39 have been cold hardy. These combinations are quite yield efficient, prime requirements for any apple grower.

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Seed Germination of Ribes Hybrids¹

J. R. GOODWIN AND KIM E. HUMMER²

Abstract

Germination of the seed of two *Ribes* x *nidigrolaria* Bauer & Bauer cvs. Jostaberry and ORUS-6 varied with pregermination treatment and genotype. Cleaned seed and seed remaining in the berry were prechilled and germinated. Prechilled cleaned seeds gave the most complete and rapid germination. The median response time of seeds in this treatment was 12.3 days. About 42% of cleaned seed of both genotypes germinated after prechilling at 5°C for 12 weeks. Seeds from the decomposing berry treatments had significantly less germination (16% or lower) with or without a prechilling treatment. This study verifies that prechilling from four to twelve weeks improves germination of cleaned *Ribes* seed and suggests that sowing decomposing berries is not an efficient technique for laboratory germination.

Introduction

Poor germination in seeds of temperate fruits may be caused by inhibitory or impermeable properties of the seed coat, embryo immaturity or combinations of both (5, 14, 15). Germination tests of *Ribes* have given widely

varied results suggesting that the methods tested have not fully broken dormancy (2, 9). Several reports recommend allowing seeds to remain in fermenting fruit pulp (12, 13). Seeds in these berries would be released to germinate after the berry had decomposed and the bacteria and fungi involved in the decomposition process had degraded the seed coat. Quick (19), working with North American *Ribes* species, reported that the best germination was obtained after three or more months of prechilling. Others also reported better germination in *Ribes* after prechilling (1, 16, 17, 18, 20). Prechilling could allow a rudimentary embryo to mature or inhibitory substances in the seedcoat to be metabolized (6). Despite the horticultural importance of *Ribes* crops (black and red currants, gooseberries) in Europe, neither the International Seed Testing Association nor the Association of Official Seed

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²Biological Science Research Technician and Research Leader, USDA-ARS NCCR, 33447 Peoria Road, Corvallis, OR 97333.

Analysts have published germination protocols for the genus (3, 9).

Black currants (*R. nigrum* L.) have been crossed with European (*R. uva-crispa* L.) or American gooseberries (*R. hirtellum* Michx.) to produce less pungent, thornless hybrids resistant to mildew. R. Bauer of the Erwin Baur Institute in Germany produced a cross of ('Long Bunch' x *R. divaricatum* Dougl.) x ('Silvergieters' x 'Grüne Hansa') which he named 'Jostaberry' (4, 10). The term "Josta-type" now generally refers to black currant x gooseberry hybrids. George Waldo, former U. S. Department of Agriculture, Agricultural Research Service (USDA-ARS) small fruit breeder, also crossed black currants with gooseberries. Specific pedigrees for these crosses are not known. His selection ORUS-6 and the 'Jostaberry' are present in the *Ribes* collection of the USDA-ARS National Clonal Germplasm Repository at Corvallis, OR.

The objectives of this study were to determine the effect of prechilling on seed germination of Josta-type hybrids and to determine if the process of berry decomposition would increase their germination. These two hybrid cultivars were chosen for this study since they encompass genes from both black currants and European and American gooseberries. An effective protocol for these hybrids could have wide applicability.

Materials and Methods

Open-pollinated berries of two *Ribes* hybrids, 'Jostaberry' (Corvallis local number RIB 214) and ORUS-6 (RIB 16) were harvested on 18 July 1991 from the field collection at the Corvallis Repository. Berries were collected from two plants of each genotype. The berries were placed in plastic bags and stored at 2°C for five days, rinsed in tap water and dried at room temperature for 24 hours.

Experimental treatments included fresh seeds, prechilled seeds, fresh

berries, and prechilled berries. In an effort to include the same number of seed in the berry treatments as in the seed treatments, ten berries from each genotype were dissected to determine the mean number of seeds per berry. The number of seeds per berry was not significantly different between the two genotypes. ($p = 0.94$). Means and standard deviations for ORUS-6 and 'Jostaberry' were $8.7 (\pm 6.55)$ and $8.5 (\pm 5.08)$. For the fresh and prechilled seed treatments, seed was cleaned from harvested berries on 24 July using a blender. Pulp and floating seeds were decanted and discarded. Cleaned seeds and whole berries were tested for germination immediately in the fresh treatments, by placing either seeds or berries on moist sand in germination boxes in the germinator. The boxes of seed or berries for the prechilled treatments were held at 5°C for 12 weeks prior to placement in the germinator.

Fresh berries decomposed for two months at 10/25°C before seeds were extracted. Prechilled berries decomposed for a total of five months, three of which were at 5°C and two at 10/25°C. After extraction from the moldy decomposed berries, seeds were surface sterilized for 1 minute using 1.6% sodium hypochlorite solution to reduce fungal contamination during the subsequent seed germination test. Because cleaned seeds were not surface sterilized in the fresh and prechilled seed treatments, a brief immersion in a weak solution was used for the extracted seeds. After rinsing the extracted seeds in running tap water, they were tested for germinability.

During prechilling, containers holding seeds or berries were opened once each week for 15 seconds to change the air of the germinating boxes. The treatments were assigned as a completely randomized design with four replications of 50 seeds in each treatment. Treatment replications were randomly assigned to shelves within

the germinator, within the limit that the four replications of any one treatment were on four different shelves. In the berry treatments each replication consisted of five berries. The number of seeds in the berry treatments was close to, but did not necessarily equal 50, since treated berries were left intact and seeds were not extracted until after the berries had decomposed.

All seeds were germinated on autoclaved sand moistened with deionized water (approximately 65 g sand plus 20 ml H₂O). The substrate had a pH of 6.5. Each replication was placed in a sterilized acrylic germination box (11 x 11 x 3 cm). The box was then placed inside of a sealable plastic bag to assure a high humidity environment around the seeds and berries. Seeds were removed from the germination boxes as they germinated. Germination was defined as the emergence of a 5 mm radicle.

Germination tests were performed in a Hoffman SG 30 germinator. Temperatures alternated between 10 and 25°C, with the cooler temperature maintained for 10 hours of every 24 hour cycle. Lights were on within the germinator for 12 hours during the warm period. Mean photosynthetic photon flux and relative humidity in the germinator were 38.9 (± 10.0) $\mu\text{E s}^{-1}\text{m}^{-2}$ and 64.7 (± 14.26)%.

Data were analyzed using Number Cruncher Statistical System (8). Analysis of variance was calculated on arcsin transformed and untransformed data with the general linear model. Significant differences ($p = .05$) of treatment means were determined by Fisher's LSD, when the F statistic was significant. Because data transformation did not effect significance, the results are reported for untransformed data.

Results

Fungal development was obvious in the fresh berry treatments within 24 hours of the start of the experiment

and all fresh berries supported abundant fungal growth within one week. Fungal development lagged by at least 10 days in the prechilled berry treatments. No seeds germinated in any of the berry treatments during berry decomposition. Seeds extracted from decomposed berries appeared to be sound, were firm, and were still surrounded by the translucent, gelatinous endocarp. Evidence of fungal degradation of these seeds was not visible to the eye.

Percent germination varied with both genotype and treatment. The interaction between genotype and seed pregermination treatment was significant so individual treatment means could not be statistically separated. Comparisons of pooled treatment means indicated that prechilled seed had significantly higher percent germination than did the other three treatments (Fig. 1A). For ORUS-6, prechilling cleaned seeds was the only method that promoted seed germination. Prechilling cleaned 'Jostaberry' seeds also resulted in better germination for this cultivar, though seeds germinated in all treatments. Pooled genotype means indicated that 'Jostaberry' seed germination (23.1%) was significantly greater than that of ORUS-6 (11.5%) over all pregermination treatments.

The interaction of genotype and pregermination treatment significantly influenced the rapidity with which seeds began germinating. Seeds of both cultivars began germinating shortly after being placed in the germinator if they had been cleaned and prechilled. Prechilled seeds began to germinate after 5.6 days whereas 38 or more days were required for germination in the other treatments (Fig. 1B). Prechilling promoted germination in 'Jostaberry' seeds whether cleaned or left in the berry. Germination of cleaned ORUS-6 seeds was promoted by prechilling, but prechilling seeds left in the berry inhibited germination. Averaged over all treatments, 'Josta-

berry' seeds began germinating in about half the time required by ORUS-6 seeds (23.9 versus 44.7 days, respectively).

Germination of prechilled seeds was swift and synchronous in both culti-

vars, with a median response time (days to 50% of final germination percentage) of 12.3 days (Fig. 1C). Germination in other treatments was poor and asynchronous, and median response times were very long (44, 49, and 53 days for fresh seeds, fresh berries, and prechilled berries, respectively). 'Jostaberry' seeds had a shorter median response time (32.8 days) than did ORUS-6 (46.7 days), when averaged over all treatments.

Discussion

The rate and extent of germination of hybrid *Ribes* seed was greatly increased by prechilling. In both genotypes tested, cleaned seed prechilled at 5°C for 12 weeks resulted in significantly improved germination. *Ribes* seed remaining in decomposing berries had significantly lower germination rates and percentages under the conditions of this study. Although some studies (9, 11) reported that scarification improved germination, allowing seed to remain in decomposing berries during prechilling was an ineffective treatment to promote germination of the two cultivars tested. Other research has indicated that the presence of germination-inhibiting chemicals in fruit pulp are common (6).

We suggest that the following conditions should be considered to germinate *Ribes* seed. Cleaned seeds should be used, and seed should be prechilled at 5°C for 12 weeks. Optimum temperature and duration of prechilling may be genotype dependent. Other studies (2, 5, 9) have stressed the effectiveness of widely fluctuating diurnal temperatures during germination. We used diurnal temperature fluctuations at 10/25°C for all germination treatments. The germination substrate should have a neutral pH (7). The duration of the germination test should be at least eight weeks with the first counts occurring at 14 days, judging from the mean response time of our prechilled treatments.

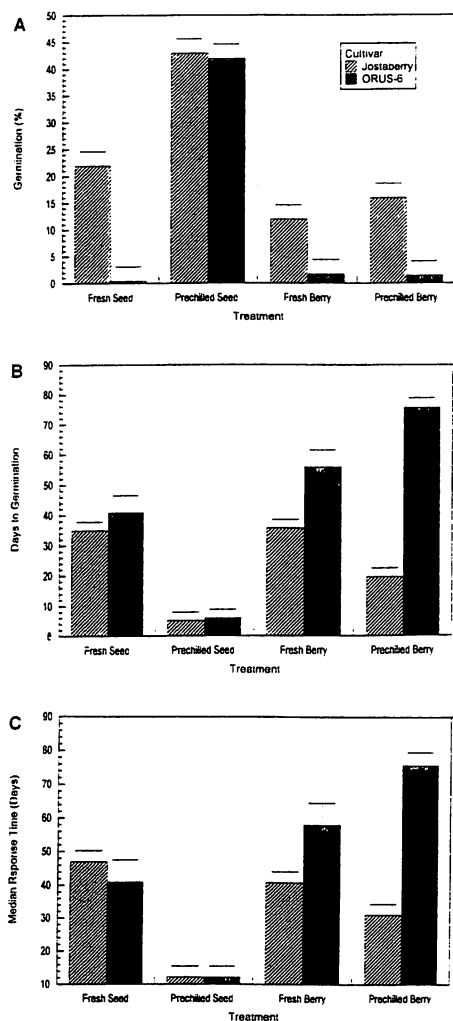


Figure 1. Percent germination (A), days to the start of germination (B), and median response time (C) plotted by pregermination treatment for two *Ribes* hybrids. Prechilling treatments consisted of 5°C for 12 weeks. Germination conditions were 10/25°C with seeds placed on sand. N = 4 for each cultivar within a treatment; N = 8 for each pooled treatment mean. Error bars equal 1 standard error.

The highest percent germination observed in this study was 43% produced by cleaned, prechilled, 'Jostaberry' seeds. This percentage is much lower than desirable and suggests that a combination of pregermination treatments, not tested in this study, may provide a more effective germination protocol for *Ribes* seeds.

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Apple Cultivar Trial Report Released

A report on the performance of new apple cultivars grown at 3 locations in Washington state during the 1991 season has just been completed. The publication contains detailed profiles of approximately 60 cultivars and selections, as well as bloom dates and data on yield and maturity (firmness, soluble solids, starch content, acidity, and sugar/acid ratio.)

The publication is available in two editions (most cultivars appear in both). The 69-page "eastside" edition contains 59 descriptions (profiles) of trees grown at Prosser, a warm summer/cold winter desert climate typical of the intermountain west, where stresses of heat and cold might be

expected. The 72-page "westside" edition contains 62 profiles of trees grown at Mount Vernon, a maritime climate with mild winters and cool summers.

Copies of either edition (please specify "Eastside" or "Westside") may be ordered from Washington State University, Mount Vernon Unit, 1468 Memorial Hwy., Mount Vernon, WA 98273, at a cost of \$10.00 (postage included) per edition, or both for \$17.00. Checks should be made payable to Washington State University.

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