A COMPARISON OF PRE-SOAKING AND PRE-WASHING AS METHODS OF INCREASING BEET (*BETA VULGARIS*) AND NEW ZEALAND SPINACH (*TETRAGONIA TETRAGONIOIDES)* SEED GERMINATION

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Chifundo Alberta Kalengamaliro

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ABSTRACT

Water soluble germination inhibitors located in the pericarp of *Beta vulgaris* fruits have historically been reported to be one of the causes of seed dormancy in fruit of this species. Dormancy can lead to low and non-uniform germination, which is a problem in the seed production system. Dormancy-breaking treatments that have been applied to *B. vulgaris* fruit include steeping, priming, rubbing the fruit coat or scarification, and washing and soaking the fruits prior to sowing as a way of leaching out the inhibitors. Anecdotal evidence suggests that soaking the fruits is as effective as the washing dormancy-breaking treatment recommended by the International Seed Testing Association (ISTA).

In this study, the presence or absence of dormancy in 18 *B. vulgaris* (11 vegetable beet, 4 fodder beet, and 3 sugar beet) seed lots was assessed by conducting germination tests on fruits in the absence of dormancy-breaking treatments. There was little or no dormancy in the seed lots tested. Six seed lots had over 90% germination, another six seed lots had more than 80% germination. Four seed lots had germination ranging from 76 to 79% while two seed lots had germination lower than 67%. These low germination percentages were due to empty fruits rather than dormancy. This suggests that dormancy may no longer be a problem in modern *B. vulgaris* cultivars.

Two *B. vulgaris* seed lots were identified as having some residual dormancy as indicated by a high percentage of ungerminated viable fruits. These were Flores sugar beet and an “unnamed” (Kings Seeds) sugar beet cultivar. These had 14% and 16% ungerminated viable fruits respectively. Two other seed lots identified had less than 90% germination, Brigadier and Kyros fodder beets, and had high percentages of ungerminated viable fruits (5%) compared with other seed lots in the same germination range. Dormancy-breaking treatments were conducted on the four seed lots. The dormancy-breaking treatments were i) fruits washed in running water at 25 ˚C for two hours, and ii) fruits soaked in 25 ˚C water for two hours, changing the water every 30 minutes. The aim of this experiment was to compare the effectiveness of the two treatments in removing residual dormancy by leaching inhibitors from the fruit coat. The effectiveness of these dormancy-breaking treatments was determined by measuring the germination percentage, time to 50% germination and the uniformity of germination. No significant differences were found between the germination of soaked or washed fruits compared with the control i.e. 84%, 89%, and 89% for Flores sugar beet, 77%,

80%, and 71% for the Kings Seeds sugar beet, 75%, 80%, and 73% for Brigadier fodder beet, and 93%, 91%, and 91% for Kyros fodder beet for control, soaking and washing treatments respectively. This suggested that water soluble germination inhibitors are absent from the fruit coats as the water treatments did not alleviate the residual dormancy. There were no significant differences in the time to 50% germination (T_{50}) of the seed lots following the treatments, except in Flores sugar beet where the soaking slowed down germination (49.9, 72.26, and 71.17 hours for the control, soaking, and washing treatments respectively).

Tetragonia tetragonioides was the only other species in the ISTA Rules for which the two hour washing treatment was recommended as a dormancy-breaking technique. The same dormancy-breaking treatments were applied to fruits of a *T. tetragonioides* seed lot. There were no significant differences in germination for the control, washing and soaking treatments (72%, 63%, and 70% respectively). The high percentages of ungerminated viable fruits of 26%, 32%, and 28% remaining for untreated, soaked, and washed fruits respectively indicated high levels of dormancy and inability of the dormancy-breaking treatments to alleviate this. A follow up experiment following an ISTA Rules change in 2011 that changed the two hour washing treatment to soaking the fruits for 24 hours was conducted to assess the effectiveness of the new 24 hour soaking recommendation in alleviating dormancy. The 24 hour soaking treatment gave a significantly lower germination (40%) and high percentage of ungerminated fruits (60%) compared with the control, two hour soaking, and two hour washing treatments. Cutting the endocarp of ungerminated fruits at the end of the 35 days germination period alleviated the dormancy in all remaining fresh viable fruits. The study also suggests that *T. tetragonioides* germination is inhibited by the presence of excess water past the early stages of imbibition, but further work is required to confirm this.

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