Seed Priming Effects on Longevity

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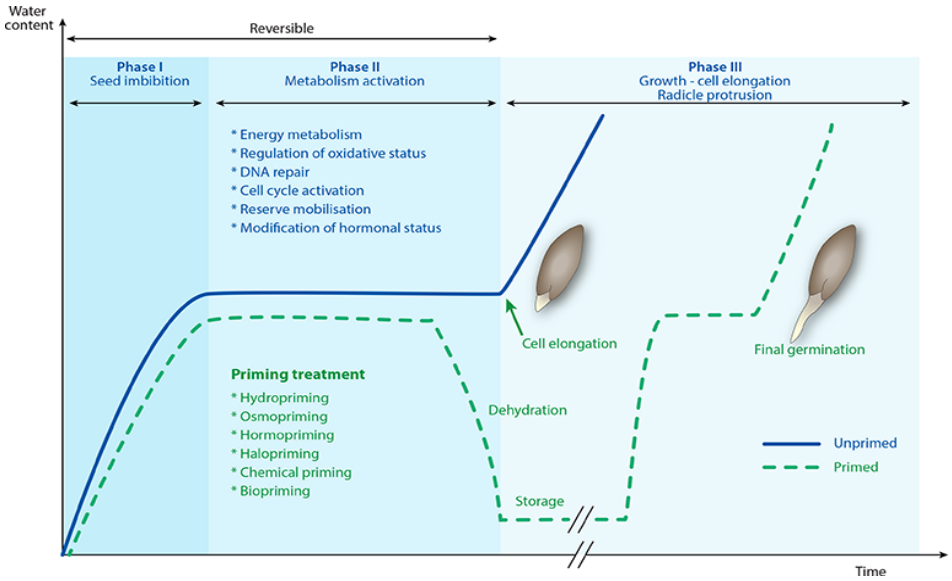
Overview

1. **Introduction**
   - Seed Priming
   - Seed Longevity
2. **Project Overview**
3. **Materials and Methods**
   - Seeds
   - Solid Matrix Priming
   - Q2 Analysis
4. **Results**

2

Seed Priming



Methods:

- Hydropriming
- Osmopriming
- Solid Matrix Priming
- etc.

Lutts, Stanley, et al. "Seed Priming: New Comprehensive Approaches for an Old Empirical Technique." (2016).

3

Seed Priming

Effects of priming:

- Increase germination rate and uniformity
- Develop seedling root systems rapidly
- Break dormancy, overcome some adverse conditions, e.g. high temperature

- Reduce seed longevity, especially at high moisture content

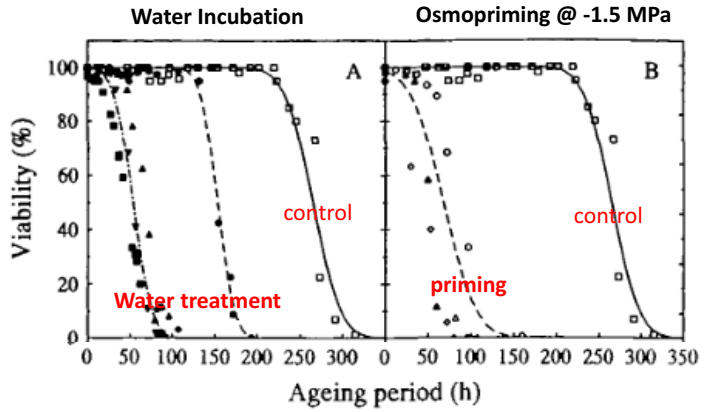
Factors affect priming:

- Temperature
- Water potential
- Priming duration

"Hydrothermal priming time" Model

Seed Longevity after priming

Lettuce Seeds
Controlled Deterioration @ 10% MC + 40C



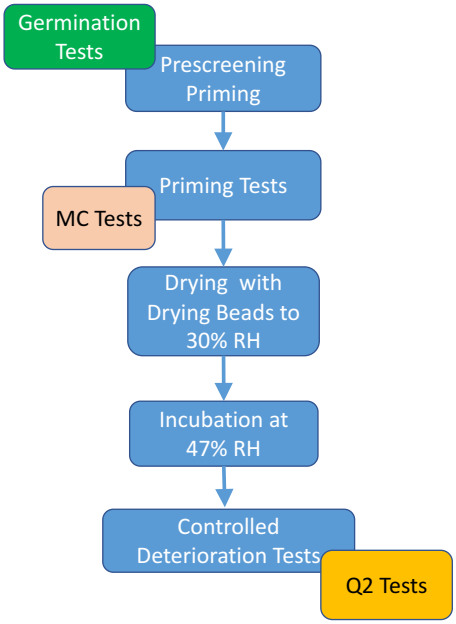
Water treatments and priming affect seed longevity.

Reduction of seed longevity in storage compared to non-primed seed

Tarquis, A.M. and Bradford, K.J. (1992) Prehydration and priming treatments that advance germination also increase the rate of deterioration of lettuce seeds. Journal of Experimental Botany

5

Project Design – Activities performed



Objective:

Develop and evaluate priming treatments on seed longevity

Materials and Methods

Seeds

Seeds were obtained from HM.Clause company, including:

- Two seed lots of tomato (cv. Pony Express E89224 (T1) and E57272 (T2))
- One seed lot of pepper (cv. Sequoia Pepper E65965)
- One seed lot of onion (cv. Mission Star E46851).

Materials and Methods

Solid Matrix Priming

Clay mixture material

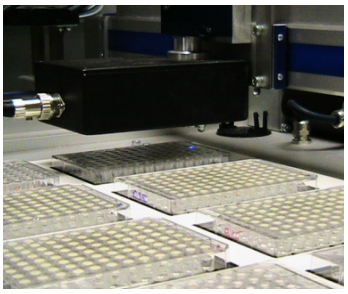
+ fixed amount of seeds and increasing amount of water to obtain threshold seed water content for priming.

Ratio seed : media : water range
1 : 2 : 1 - 2

A.G. Taylor, D.E. Klein and T.H. Whitlow (1988) SMP: Solid Matrix Priming of Seeds. Scientia Horticulturae, 37
Keith Kubick – HM-Clause

Q2 Oxygen Sensing Technology

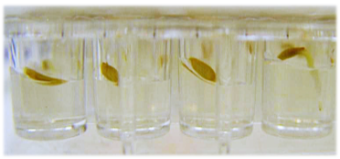
The Q2 equipment provides a quick and precise measurement of the oxygen consumption of each individual seed, so that it can give us respiration (oxygen depletion) time courses.

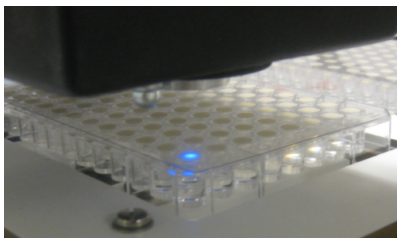


http://www.astec-global.com/q2-technology

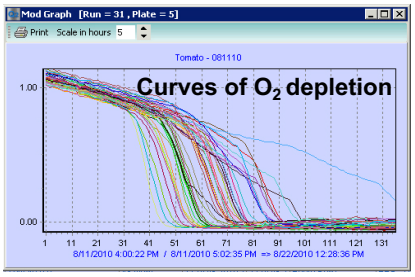
Q2 Analysis

Agar 0.4% + Fungicide

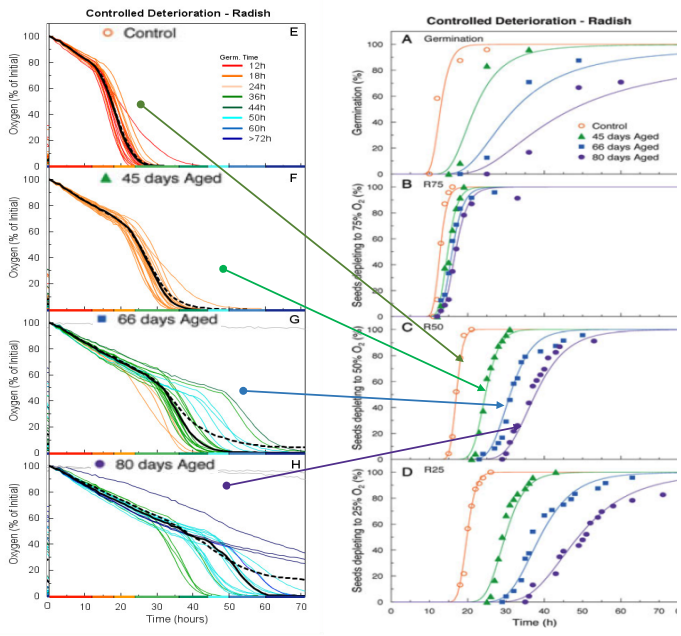




oxygen consumption measurements at 30-minute intervals



Materials and Methods



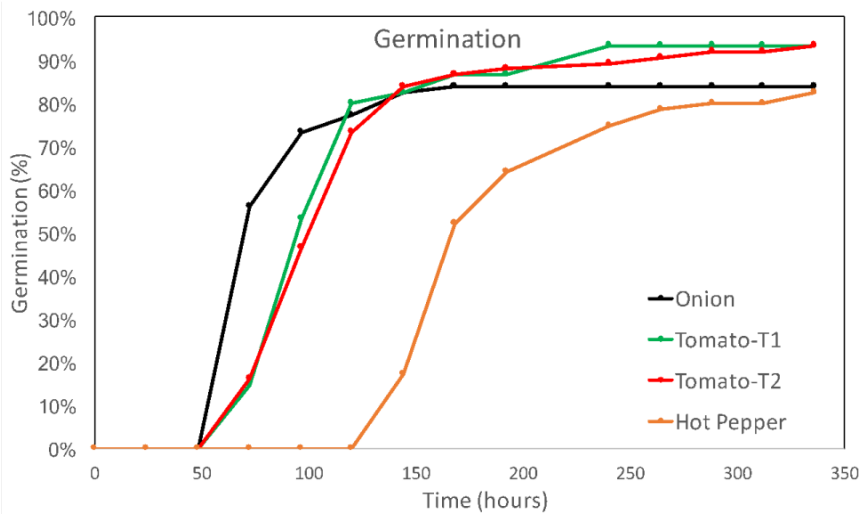
Population Oxygen Depletion (POD) Curves

- POD curves are visually similar to germination time courses .
- Seed oxygen consumption rates on an individual seed and population basis are highly correlated with germination timing.
- Potential maixumum longevity(Pmax) of seeds can be estimated aging-time model based on POD data.

Bello, P., and Bradford, K.J. (2016). Single-seed oxygen consumption measurements and population-based threshold models link respiration and germination rates under diverse conditions. Seed Science Research **26,** 199-221.

11

Results



Final Germination :

Onion 85%

Tomato-T1 94%

Tomato-T2 94%

Pepper 85%

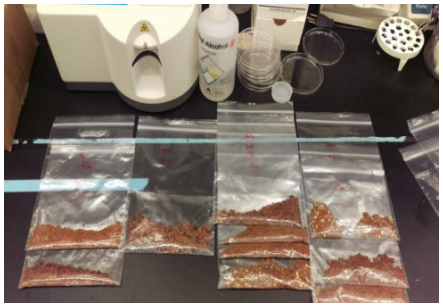
Initial seed germination at 25C.

12

Results - Prescreening of Priming

Days for germination

Water added (ml)	Pepper	Onion	Tomato-T1	Tomato-T2
2.5	None	None	None	None
2.75	None	None	None	None
3	None	None	None	None
3.25	Day 7	Day 6	Day 10 (few)	Day 6 (few)
3.5	Day 5	Day 6	Day 5	Day 5
3.75	Day 5	Day 3	Day 4	Day 4
4	Day 5	Day 2	Day 3	Day 2
4.25	Day 4	Day 2	Day 2	Day 2
4.5	Day 4	Day 2	Day 2	Day 2
4.75	Day 4	Day 2	Day 2	Day 2

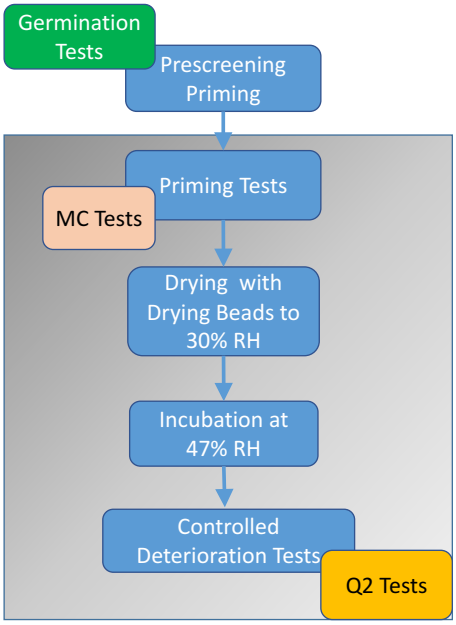


2.5g of seed + 5g of clay media + different amount of water.

Amount of days required to start of germination adding increasing amount of water on bags (2.5-4.75ml). 3ml chosen for priming on all species.

13

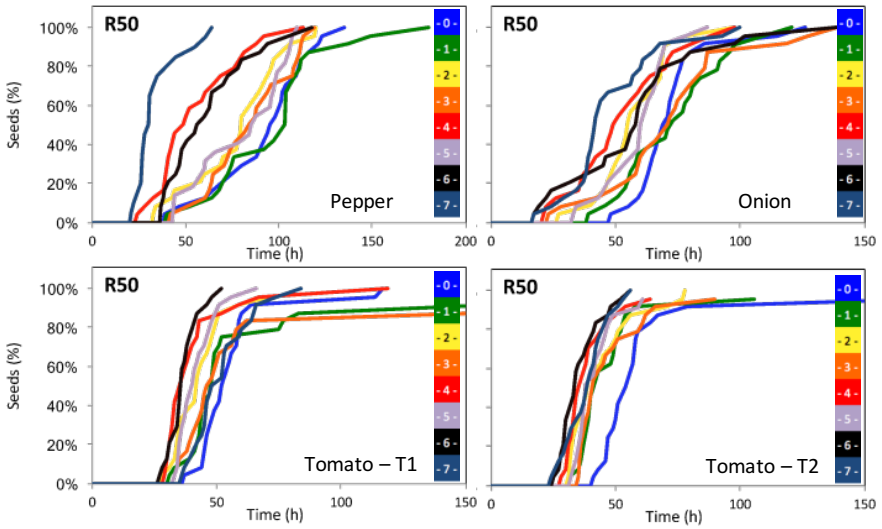
Project Design – Activities performed



Controlled Deterioration Test:
50°C with different aging durations, ranging from 10-40 Days

Q2 Test:
Population Oxygen Depletion (POD) Curves

Results – Priming Duration



Pepper – little change in rates for first 4 days of priming, increasing speed after that.

Onion – more gradual reduction in time with increasing priming duration.

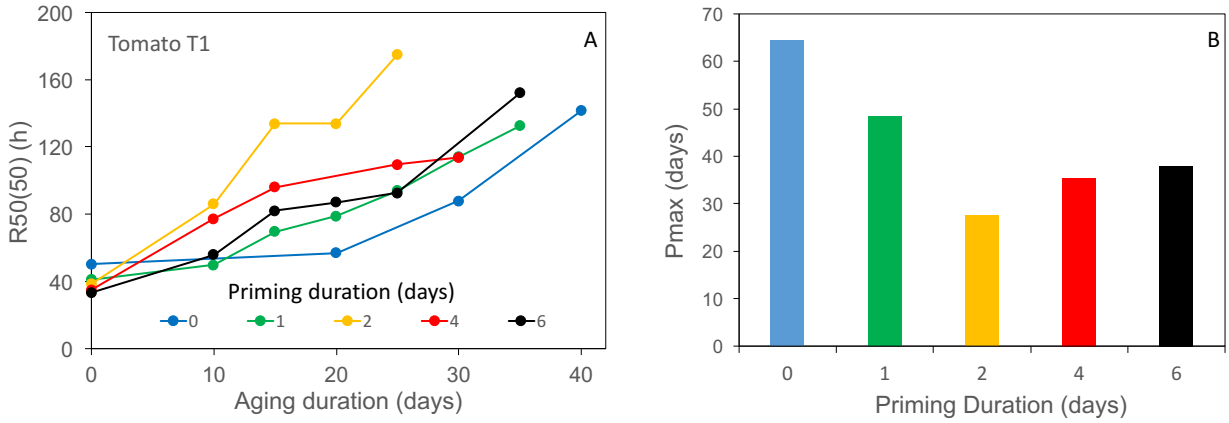
Tomato-T1 – Similar gradual response except with longest duration.

Tomato-T2 – 1 and 2 days duration response strong as longer priming duration.

Figure.Population Oxygen Depletion (POD) curves for pepper (A), onion (B), tomato-T1 (C) and tomato-T2 (D) with different days of priming (legends in each panel). The curves are plotted for R50 (the times at which each seed consumed half of the oxygen available in the Q2 vial).

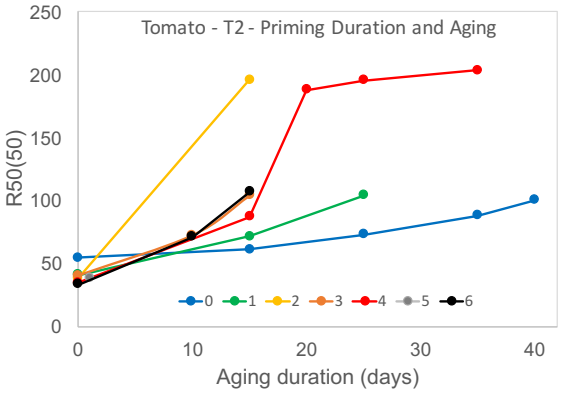
15

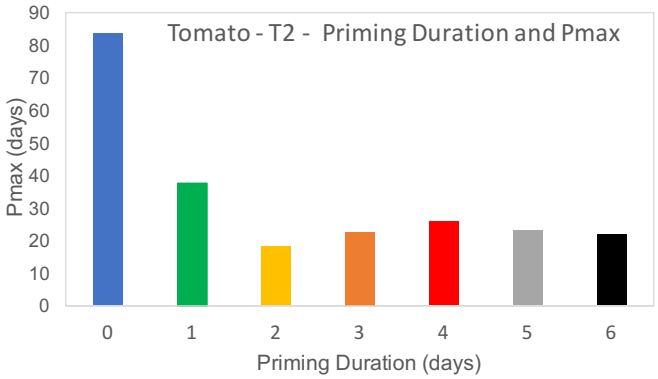
Results – Controlled Deterioration
Tomato - T1



Longevity declined sharply between 0 and 2 days of priming, then recovered somewhat at longer priming times.

Results – Controlled Deterioration
Tomato-T2





Similar pattern to T1, with the least potential longevity occurring after 2 days of priming

17

Take-home Messages

Performance enhanced by priming:

- Increase germination rate and uniformity
- Develop seedling root systems rapidly
- Break dormancy, overcome some adverse conditions

Disadvantage:

- **Reduce seed longevity**