

Management of Seed Crop Production for High Seed Quality

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Objective: High Seed Quality

"High seed quality is seed that is genetically uniform, highly viable and free from seed-borne pathogens"



Importance of High Seed Quality

"Recent advances in plug production have increased demand for high vigor seed that is high in viability and yields a high percentage of uniform seedlings. This creates an important challenge for vegetable and flower seed producers."



How to Produce the "Perfect" Seed

The "perfect" seed is produced on the plant. Thereafter, we are simply solving problems created during production.

How to Produce the "Perfect" Seed

- Seed production regimes where seed quality is compromised
 - Field/Greenhouse
 - Harvest
 - Drying
 - Conditioning
 - Storage

How to Produce the "Perfect" Seed

- Field/Greenhouse – Most critical



How to Produce the "Perfect" Seed

- Field/Greenhouse – Most critical
 - Principles
 - High quality plants produce high quality seeds
 - Know thy plant
 - Minimize yield, maximize quality
 - Multiple harvests
 - Understand flower and pollination
 - Understand the "DIW"

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - High quality plants produce high quality seeds
 - Find the ideal location for plant growth
 - The ideal location for greenhouse production is the tropical highlands
 - Weather conditions mild and even throughout the year



Costa Rica greenhouses, courtesy of F. Y. Kwong, Pan American Seed

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - High quality plants produce high quality seeds
 - Find the ideal location for plant growth
 - The ideal location for field production is an irrigated desert
 - Can control moisture and fertilization
 - Minimize disease
 - Must have a dry period for harvest



Sugar beet production, Salinas Valley, CA

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - High quality plants produce high quality seeds
 - Find the ideal location for plant growth
 - Irrigation
 - Creates turgor for growth
 - Solubilizes nutrients
 - Stages plant growth

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - High quality plants produce high quality seeds
 - Find the ideal location for plant growth
 - Irrigation
 - Fertilizer
 - Little information on seed yield and quality
 - Do soil and foliar analyses
 - Nitrogen important early, not late
 - Potassium essential for enzymatic activity
 - Phosphorous has little effect on quality

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - High quality plants produce high quality seeds
 - Find the ideal location for plant growth
 - Irrigation
 - Fertilizer
 - Monitor plant for pests
 - Use approved fungicides/insecticides/IPM
 - Do not apply at flowering
 - Damage stigma
 - Interferes with pollen tube development
 - Kills pollinating insects, lowers seed yield



How to Produce the "Perfect" Seed

- Field/Greenhouse
 - High quality plants produce high quality seeds
 - Find the ideal location for plant growth
 - Irrigation
 - Fertilizer
 - Monitor plant for pests
 - Eliminate weeds
 - Lowers seed yield
 - Complicates cleaning
 - Adds noxious weed seeds



How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Know thy plant
 - Identify discrete plant developmental stages



How to Produce the "Perfect" Seed

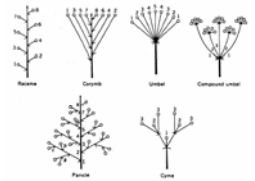
- Field/Greenhouse
 - Know thy plant
 - Identify discrete plant developmental stages
 - Identify markers for stress



Potassium deficiency in cabbage

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Know thy plant
 - Identify discrete plant developmental stages
 - Identify markers for stress
 - Understand inflorescence



How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Know thy plant
 - Identify discrete plant developmental stages
 - Identify markers for stress
 - Understand inflorescence
 - Identify markers for harvest
 - Physiological maturity
 - Fruit color/shape



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- Field/Greenhouse
 - Minimize yield, maximize quality
 - Seed is a sink for assimilates
 - Reduce inflorescence number (particularly late), maximize seed nutrient uptake
 - Seeds do not mature at the same time
 - Make multiple harvests

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Understand flower and pollination
 - Defines seed yield, determines genetic purity

How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Understand flower and pollination
 - Defines seed yield, determines genetic purity
 - Critical for hybrid production
 - Labor intensive, requires training
 - Flowers small
 - Damage to stigma results in poor seed set
 - Pollination timing important for optimal seed yield



How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Understand flower and pollination
 - Defines seed yield, determines genetic purity
 - Critical for hybrid production
 - Field production – know isolation distances (winds/bees)

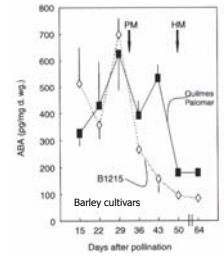


How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Understand the "DIW" (Dormancy Induction Window)
 - Need to eliminate dormancy and its variability

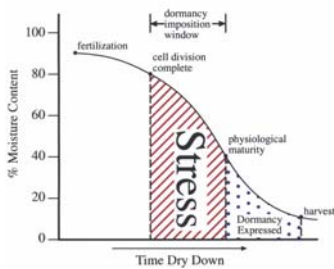
How to Produce the "Perfect" Seed

- Field/Greenhouse
 - Understand the "DIW"
 - Need to eliminate dormancy and its variability
 - Know dormancy induction window "DIW"
 - Dormancy imposed at 70 to 50% moisture content
 - Stress results in high dormancy
 - Understand inflorescence



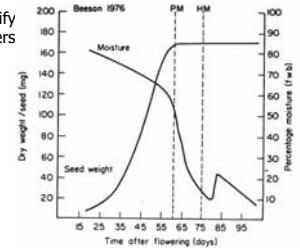
From Benesch-Arnold, 2004. *Handbook of Seed Physiology: Applications to Agriculture*. Pp.174.

How to Produce the "Perfect" Seed



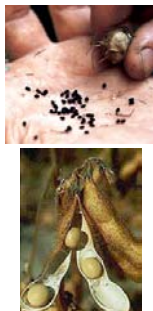
How to Produce the "Perfect" Seed

- Harvesting
 - Determine PM, identify morphological markers



How to Produce the "Perfect" Seed

- Harvesting
 - Hand harvest preferred
 - Minimize mechanical damage
 - Collection of undesired plant appendages
 - Selection of fruits at correct stage of maturity



How to Produce the "Perfect" Seed

- Harvesting
 - Single harvest undesirable
 - Immature seeds low in vigor
 - Old seeds deteriorated
 - Seeds at different "DIWs"

How to Produce the "Perfect" Seed

- Harvesting
 - Determine PM, identify morphological marker
 - Hand harvest preferred
 - Single harvest undesirable
 - Harvest middle of inflorescence for highest quality
 - Contains the majority of seeds
 - Early seeds old, late seeds immature



How to Produce the "Perfect" Seed

- Drying
 - Slow (3 days), natural drying preferred
 - Windrowing acceptable in absence of rains/dews
 - Keep seeds in pods/fruits



How to Produce the "Perfect" Seed

- Drying
 - Slow (3 days), natural drying preferred
 - Batch driers best for artificial drying
 - Slow dry (35C) until 20%, then fast dry (40C)



How to Produce the "Perfect" Seed

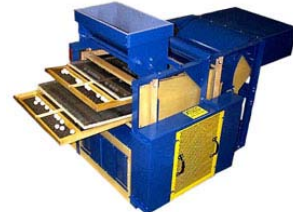
- Drying
 - Slow (3 days), natural drying preferred
 - Batch driers best for artificial drying
 - Minimize moisture fluctuations
 - Enhances membrane stabilization

How to Produce the "Perfect" Seed

- Drying
 - Slow (3 days), natural drying preferred
 - Batch driers best for artificial drying
 - Minimize moisture fluctuations
 - Seeds should enter storage at 8% MC

How to Produce the "Perfect" Seed

- Conditioning
 - Goal: Produce a clean crop





How to Produce the "Perfect" Seed

- Conditioning
 - Goal: Produce a clean crop
 - Objectives
 - Grade seeds into density/size classes
 - Remove undesired appendages
 - Scarification may be required for hard seeds
 - Seed treatments/coatings increasing



How to Produce the "Perfect" Seed

- Storage
 - Follow the "Rules of Thumb"
 - Each 5°C reduction in temperature, 2x life of seed
 - Each 1% reduction in SMC, 2x life of seed



How to Produce the "Perfect" Seed

- Storage
 - Follow the "Rules of Thumb"
 - Equation: $\%RH + \%F \leq 100$ satisfactory storage



How to Produce the "Perfect" Seed

- Storage
 - Follow the "Rules of Thumb"
 - Equation: $\%RH + \%F \leq 100$ satisfactory storage
 - Keep seed MC below 8%, use CaCl_2 (RH ~ 45%)



How to Produce the "Perfect" Seed

- Storage
 - Follow the "Rules of Thumb"
 - Equation: $\%RH + \%F \leq 100$ satisfactory storage
 - Keep seed MC below 8%, use CaCl_2 (RH ~ 45%)
 - Seed chemistry important: High oil seeds store poorly



How to Produce the "Perfect" Seed

- Conclusions
 - Emphasize production of high quality plants
 - Reduce competition among seeds for nutrients (eliminate other seeds)
 - Harvest the most uniform portion of the inflorescence
 - Identify morphological markers of plant/seed development
 - Determine the "DIW" to reduce dormancy

How to Produce the "Perfect" Seed

- Conclusions (continued)
 - Establish PM and harvest fruit at this stage followed by slow drying
 - Condition seed as little as possible to minimize mechanical damage
 - Grade seed according to density/size
 - Place seeds in storage at 8% and follow the "Rules of Thumb"

How to Produce the "Perfect" Seed

- More information:

McDonald, M. B. and L. O. Copeland. 1997. *Seed Production: Principles and Practices*. Kluwer Press. 749pp.

