

BLACK BEAN MATURITY AT HARVESTING
STAGE AFFECTS GERMINATION
DIFFERENTLY IN NORMAL AND SHINY
SEED COAT BLACK BEAN

DEPARTMENT OF PLANT SCIENCE

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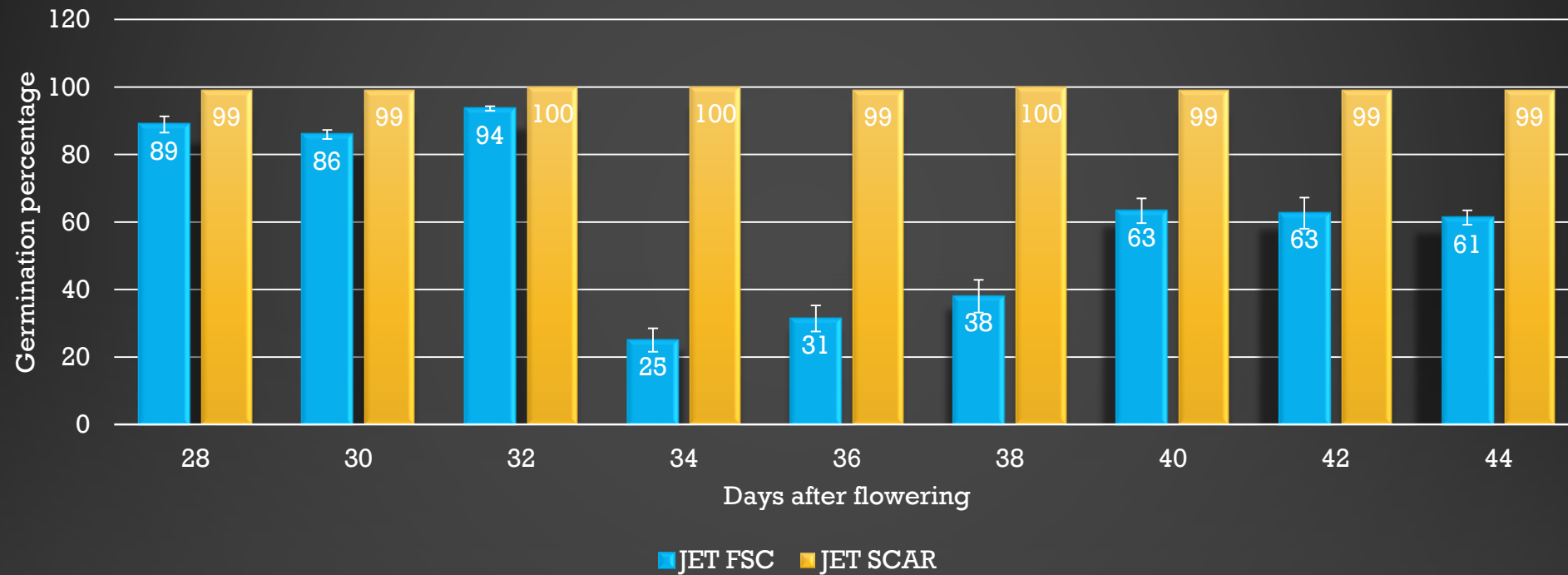
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MATERIAL AND METHODS

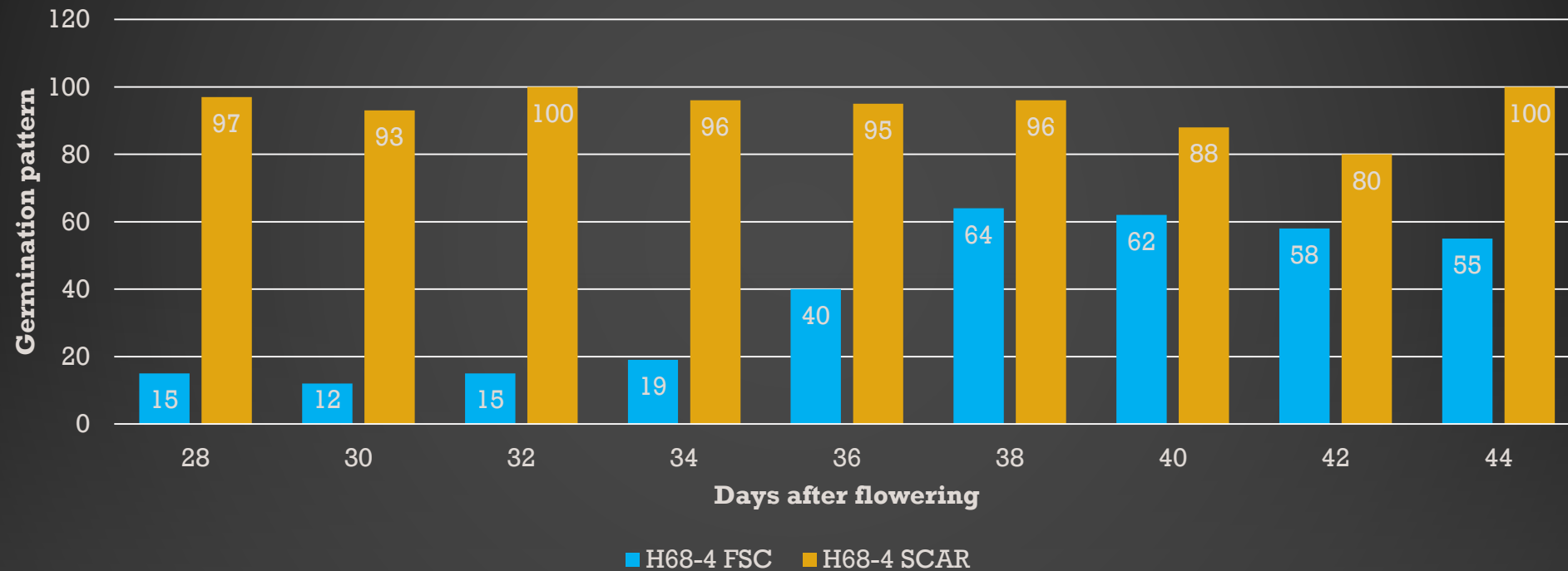
- **Two varieties of black beans**
 - Normal seed coat and shiny seed coat
- **Nine harvests based on days after flowering**
 - 28, 30, 32, 34, 36, 38, 40, 42, 44 days
 - Each plant, first flowering date would be marked as day 1
- **Harvested plants were dried, Seeds were threshed, cleaned, and sterilized**
 - 2.5% household bleach Clorex for 1 minute followed by 5 mins rinses with distilled water
- **Seeds were incubated for germination**
 - 25 °C, 95% humidity, no light
 - Four days



GERMINATION PATTERN OF NORMAL SEED COAT



GERMINATION PATTERN OF SHINY SEED COAT



SEED DORMANCY

- A living seed could not germinate even given the appropriate environmental conditions
- A dormant seed has its embryo in a state of quiescence
 - No stored nutrients are catalyzed and mobilized
 - No cells are divided and elongated
 - Germination-regulating genes are not expressed
- Seed dormancy is a type of plant adaptive trait
 - Optimize the time of germination
 - Increase the plants survivability in the nature

TYPES OF SEED DORMANCY

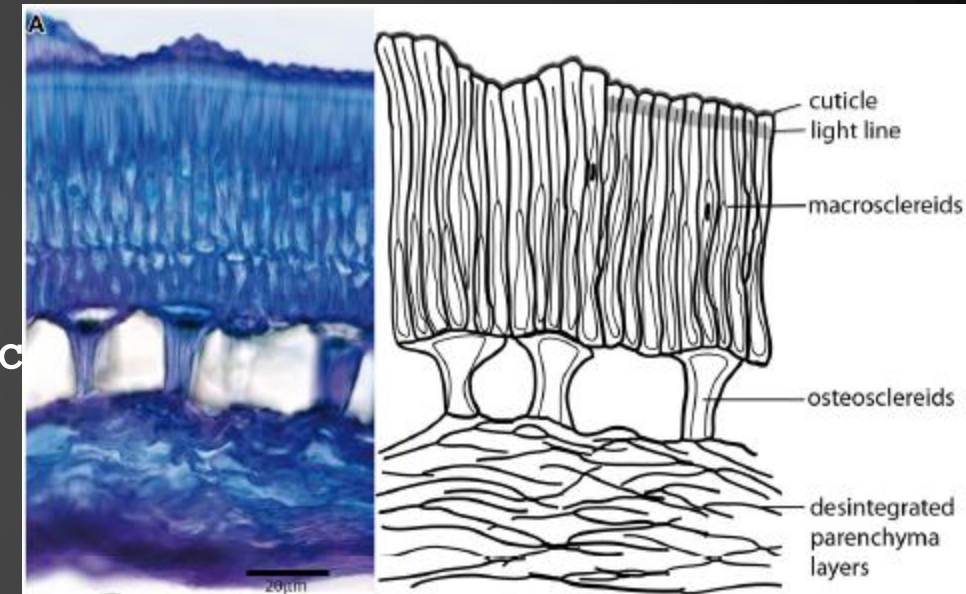
- **Physiological dormancy**
 - More prevalent
 - Determined by complicated physiological and biochemical pathways
 - Endogenous hormone mediation (ABA and GAs)
- **Morphological dormancy**
 - Undeveloped embryos
 - Longer time to grow
- **Physical Dormancy**
 - Not widely occurred (Common in Legumes)
 - Limited understanding

PHYSICAL DORMANCY

- Hardseededness
- Water-impermeable seed coat
- Developed during maturation drying of seeds in pod

PHYSICAL DORMANCY OF BLACK BEAN

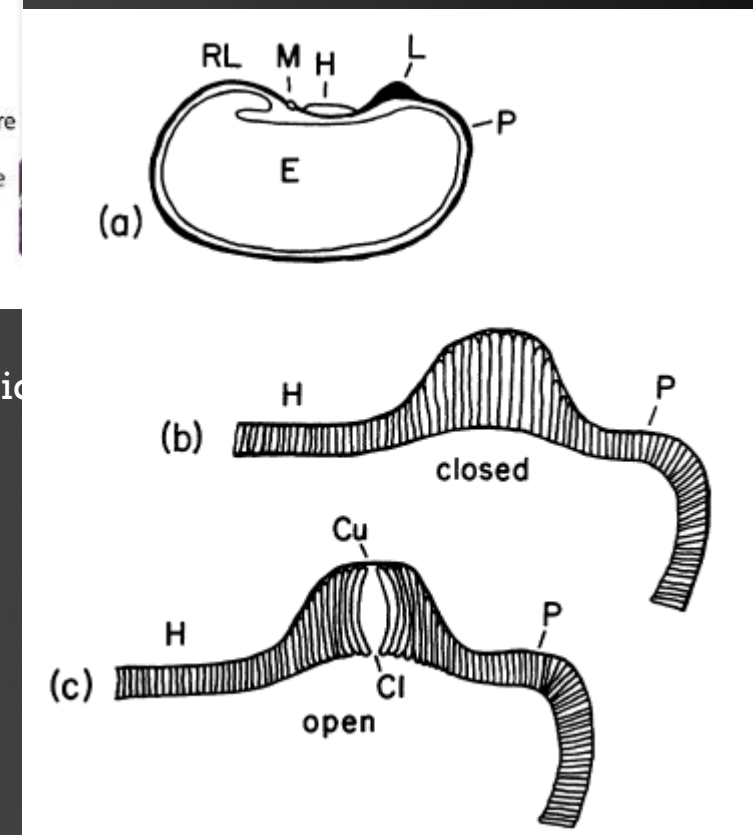
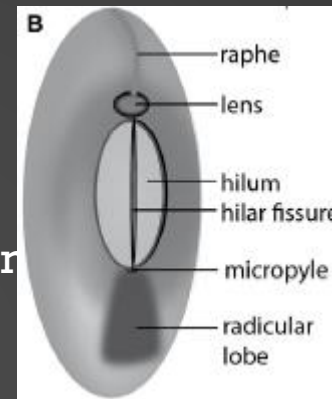
- Closed hilum and micropyle
- Cuticle and waxy deposition
 - Rich in suberin-cutin matrix
- Single layer of tightly packed palisade cells (Macrosclereids)
 - Radially elongated palisade cells
 - Heavily lignified cell walls (Rich in callose)
 - Light line in the outer ends of the palisade cells
 - Light line composed of hydrophobic substances callose
 - Continuous water-proof barrier around the seed
 - Cell vacuoles are filled with water-resistant hydrophobic chemicals (Phenolics)



Smykal et al. *Frontiers In Plant Science* (2014) 5: 1-19.

BREEDING OF PHYSICAL DORMANCY

- Water gap complexes
 - Specialized areas or structures
 - Environmental signal detectors for seed germination
 - Can differ in location, anatomy, morphology
- In legumes, water-gap is the lens
 - Modified elongated palisade cells (Longer narrower macrosclereids)
 - Lens is disrupted (Some environmental factors)
 - Lens split, narrow linear opening
- Once opened, it cannot be closed
 - No secondary physical dormancy



TREATMENT TO BREAK PHYSICAL DORMANCY

- Disruption of water gaps
- Make the impermeable covering layers permeable to water
- In nature
 - High temperature, widely fluctuating temperature (fire)
 - Alternating freezing/thawing
 - Pass through animals digestive tracts

TREATMENT TO BREAK PHYSICAL DORMANCY

- In the field
- Wet and/or dry heat treatment
 - Hot water bath
 - Oven or incubator
 - Bunsen burner flame
- Chemicals
 - Hydrogen peroxide, acids
- Physical damage
- Seed mortality

ANSWERS

- Different harvesting stages affect germination through influence of physical dormancy
- Different varieties of black beans may have their lens sense environmental clues differently

CONCLUSION

- Agricultural production requires seed to germinate as soon as they are planted and imbibed
- The occurrence of seed dormancy poses obstacles in growing and marketing black beans
- Harvesting times have effect on black bean germination
 - However cultivar specific
 - Normal seed coat, best time to harvest the seed is between 28-32 days after flowering
 - Shiny seed coat, best time to harvest the seed is after 38 days after flowering
- However, thanks to subject of genetics, we do have varieties that is resistant to physical dormancy, no more scarification needed.

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THANK YOU

TO:

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FIELD CREWS FROM CROP DEVELOPMENT CENTRE