

Comparison of Seed Coat Luster in a Recombinant Inbred Line of Shiny and Opaque Black beans

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Introduction

Dry Edible Bean Seed Colors Vary

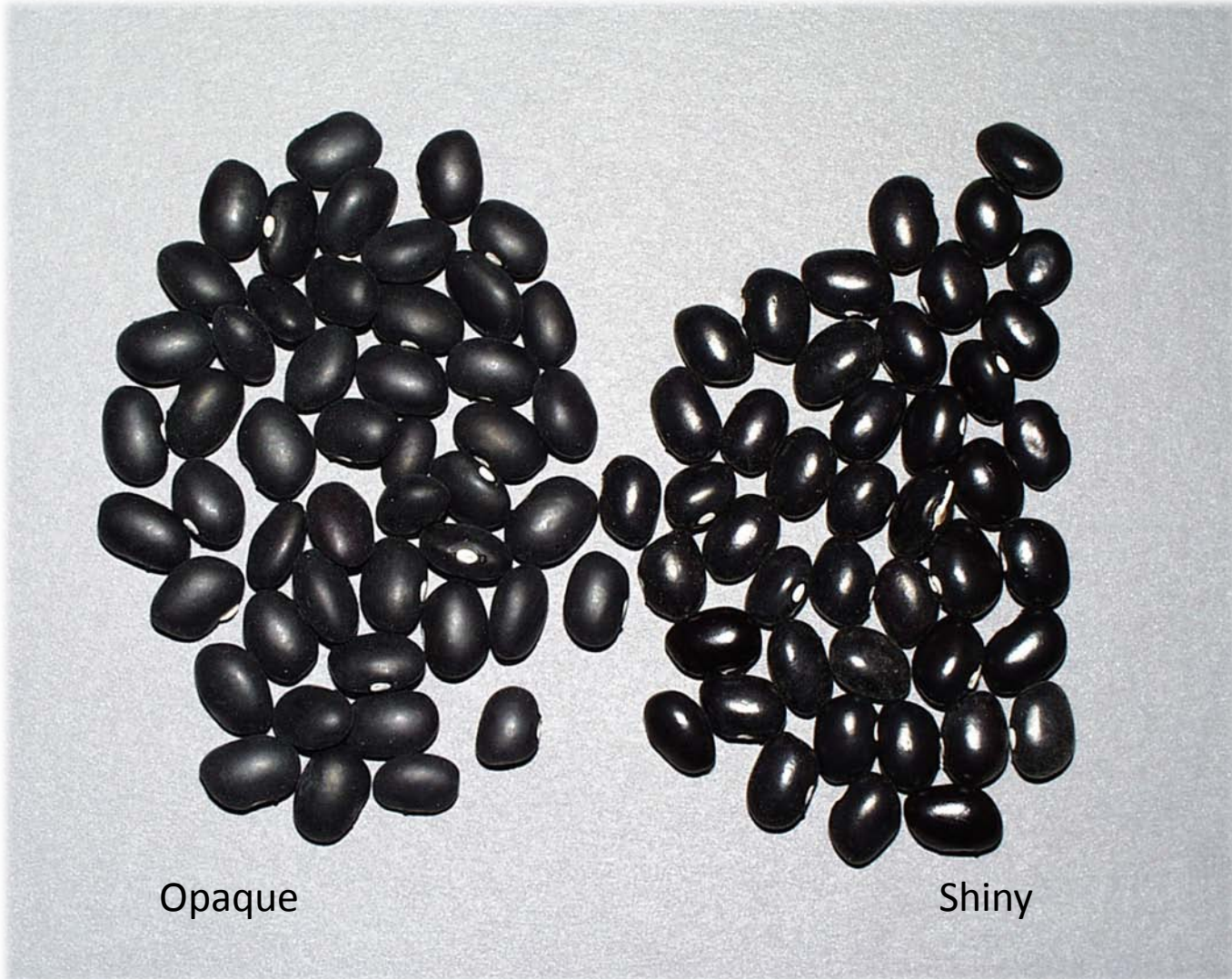


Dry bean market classes

Dry Bean Market Classes



Shiny and Opaque Black Bean Seed

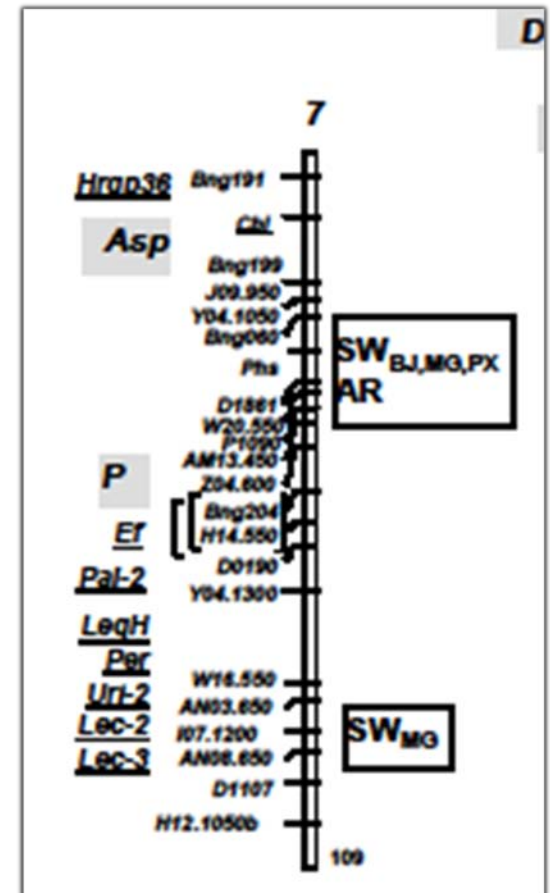


Genetic Control of Shiny Seed Coat Luster

- A single dominant gene controls seed luster:

Asper allele (Asp) (Lamprecht, 1940).

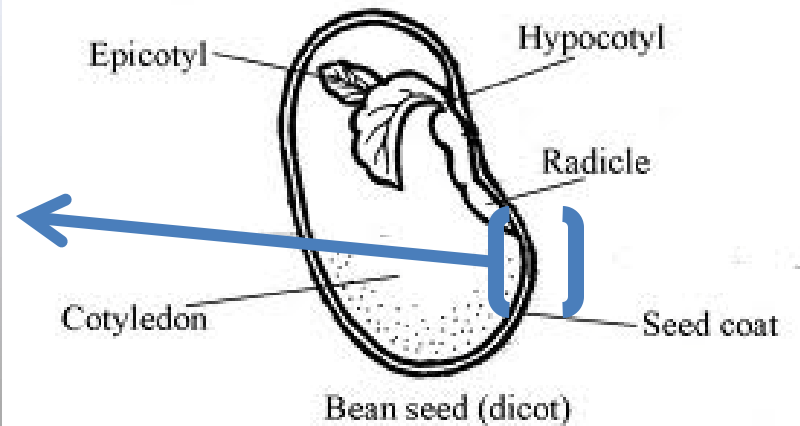
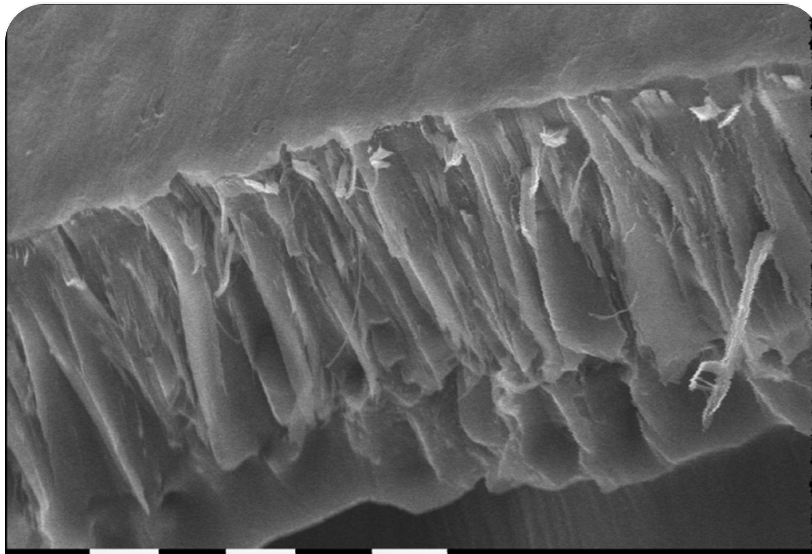
- Asp-allele influences pigment leaching, water uptake, and visual appearance of the canned product.



Commercial Importance of Seed Coat Luster in Black Beans

- **Seed coat luster determines canning properties**
 - **Shiny bean seed retains color better in the can.**
 - **Opaque bean seed has faster water uptake which influences canning and cooking properties.**
- **Shiny black beans are known to inhibit water uptake**
- **Therefore canners prefer opaque black beans**

Anatomical Features of Shiny and Opaque Black Bean Seed Testa



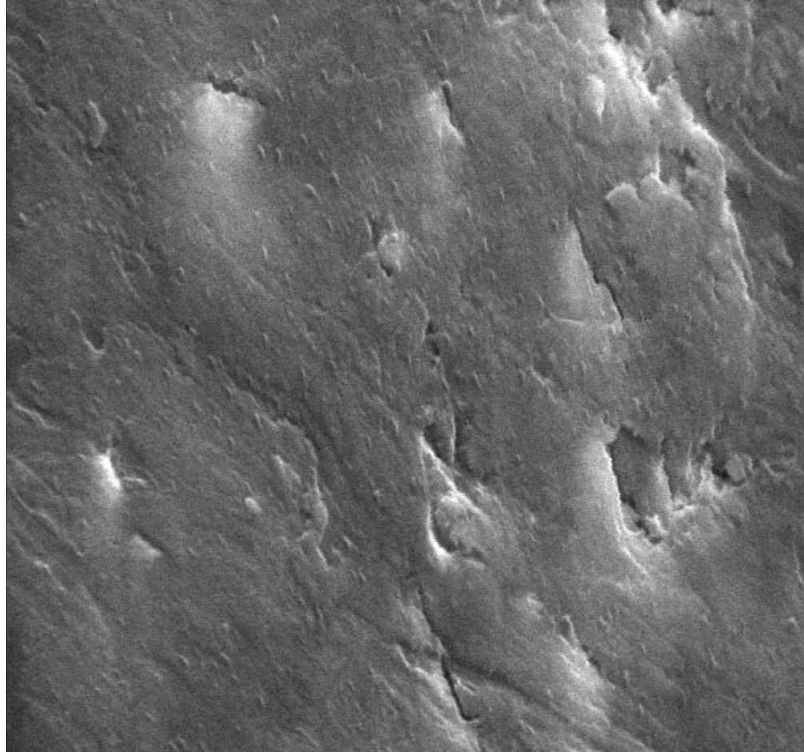
<http://www.google.com/imgres?q=seed>

Epicuticular waxy layer (EC)

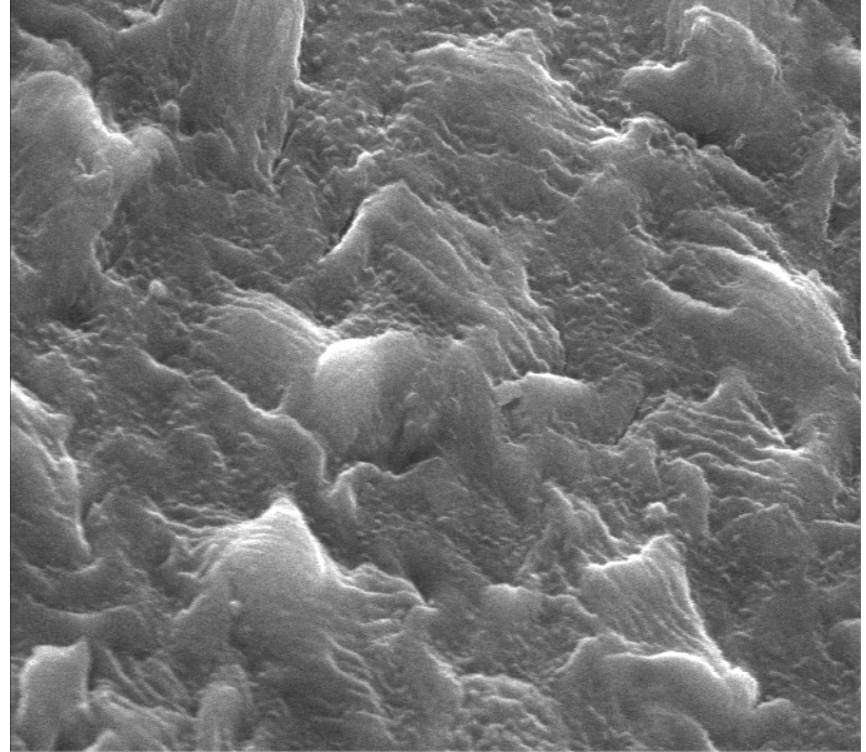
Palisade cell layer (P)

Hourglass cell layer formed beneath the palisade cell layer (H)

Shiny and Opaque Bean Seeds Differ in Surface Texture Of EC



Shiny 1250X
Scanning Electron
Micrograph



Opaque 1250X
Scanning Electron
Micrograph

OBJECTIVES

1. Compare water uptake of shiny and opaque recombinant inbred dry bean lines
2. Compare pigment leaching in soaking brine between shiny and opaque lines
3. Determine associations between shiny and opaque bean seeds and canning quality

MATERIALS AND METHODS



Plant Material



1. A recombinant Inbred Line Population (RIL) developed
2. Parent were Shiny Crow(Shiny) x Black Magic(Opaque)
3. 93 lines in the RIL population derived
4. Seed for this study was grown at East Lansing MI, Michigan State University.

Evaluation of Water Uptake

- Each line of the RIL population was evaluated for water uptake
- Dry beans were weighed before and after soaking in 50 mL distilled water for 16 hours.
- The change in weight prior and after soaking was considered water uptake.
- 25 seeds per replicate were measured for water uptake



Anthocyanin Concentration

- Anthocyanin concentration was calculated based on the AOAC Method 2005.02
- Method based on color of seed soaked solution using pH differential at two pH values (pH 1 vs 4.5)
- Read solution base on Spectrophotometer (absorbance)
- Anthocyanin pigment concentration calculated from a standard in cyanidin-3-glucoside equivalents (mg/L)



Consumer Acceptance of Black Bean Appearance

- Scale for appearance(overall canning quality) is 1 to 7
 - 7 is the best and 1 is the worst
- Reported mean of 14 people observing the *canned* black beans
 - Visual color (1 worst and 7 best).
- L value of canned beans that have been rinsed and drained.
 - The scale of this is 1 to 100 and the lower the number the more black the color.

RESULTS



Range in Water Uptake Among Entries

Entry Number	% Water Uptake
1340	134
1268	85

NS.

Mean Water Uptake Between Shiny and Opaque Lines

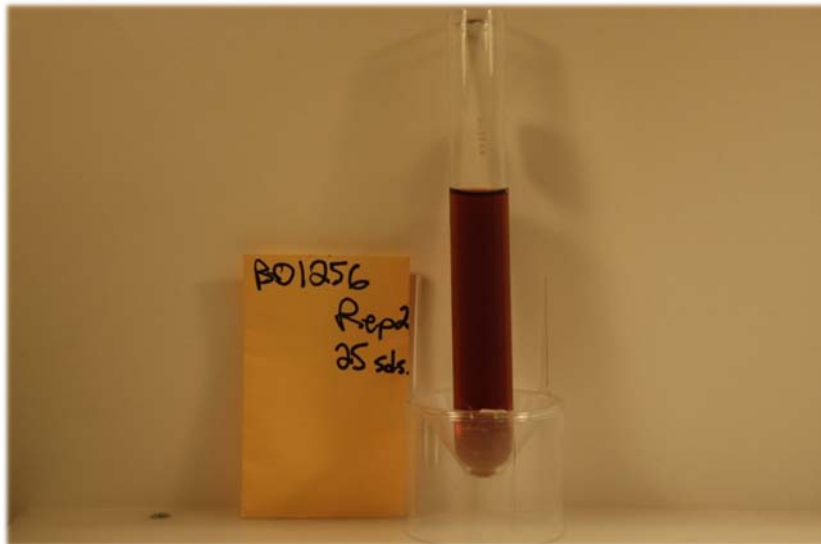
Luster	% Water Uptake
Opaque	113
Shiny	105

NS.

Range in Anthocyanin Content Among Entries

Entry	mg • L ⁻¹
1256	2303 a
1303	628 b

Significant



Mean Anthocyanin Content Among Shiny and Opaque Lines

Entry	mg • L ⁻¹
Opaque Luster	1231
Shiny Luster	1055

NS.

Correlation Between Water Uptake and Canning Properties

Visual Rating	Water Uptake	
Appearance	-0.001	NS
Color	-0.14	p=0.06
L-value	0.27	***

(***)—Significance of $p < 0.001$

Correlations Between Pigment Concentration and Visual Appearance

Visual Rating	mg • L ⁻¹	
Appearance	-0.012	NS
Color	-0.27	***
L-value	0.24	***

(***)—Significance of $p < 0.001$

Summary

- 1. Percent water uptake did not vary among entries or between seed coat luster
- 2. Anthocyanin concentration of soak brine varied among entries but not between opaque and shiny seed
- 3. Anthocyanin content was highly associated with both canned bean seed color and L-values

Conclusion

- 1. Water uptake is not a good predictor of canning quality in black beans
- 2. Pigment leaching is an excellent predictor of canned black bean quality
 - Cheap
 - Fast
 - Easy

Acknowledgment

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Thank You !