Variety Evaluation for Pasta Making and Sensory Quality

Lisa Kissing Kucek[1], June Russell[2], Elizabeth Dyck[3], Liz Clark[4], David Benscher[1], Mark E. Sorrells[1], Julie Dawson[5]

[1]Cornell University; [2]Greenmarket, Grow NYC; [3]Organic Growers Research and Information-Sharing Network; [4]Gimme! Coffee; [5]University of Wisconsin-Madison

We thank Gramercy Tavern and The Natural Gourmet Institute for hosting the pasta making and sensory evaluations, respectively
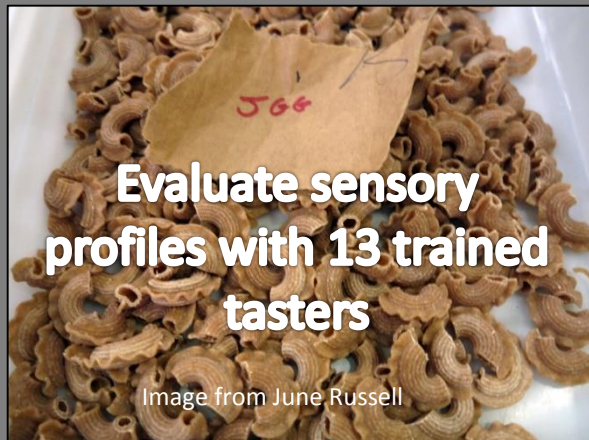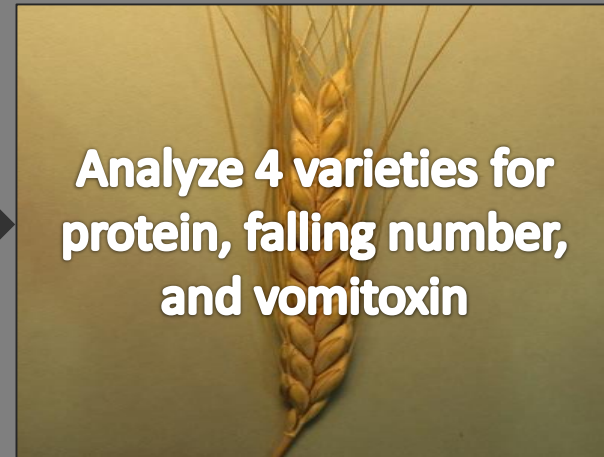
Preliminary Data – 30 March 2015

Evaluation Process:

Emmer varieties were screened for use in local organic food systems

Evaluate 66 varieties of emmer under organic management in 4 locations

Image from June Russell

Analyze 4 varieties for protein, falling number, and vomitoxin

Assess 4 varieties for pasta making quality

Image from June Russell

Evaluate sensory profiles with 13 trained tasters

Image from June Russell

Overview of Results

| Variety	Yield	Test Weight	Protein	Pasta Preference	Pasta Shininess	Pasta Roughness	Pasta Graininess	Pasta Firmness	Ability to Dissolve	Grain Preference	Grain Texture
Name	Rank¥	Rank¥	%	Probability	10=shiny	10=rough	10=grainy	10=chewy	seconds	Probability	10=chewy
Lucille	1	6	14.1	0.42*	5.24	4.58	3.88	4.46*	11.12	0.19	5.42*
ND Common	2	2	13.5	0.19*	5.88*	3.46*	3.61	3.63*	10.12	0.42*	6.27*
Red Vernal	4	4	15.0	0.27	4.84*	5.04	5.65*	6.21*	13.50*	0.15	6.19

■ higher scoring, ■ lower scoring, *significantly lower or higher than other varieties at p<0.05

Sensory evaluations were conducted on material blended 45% from 2012 and 55% 2014 harvested emmer from one site in Freeville, NY
¥ Rank is out of 14 total entries at three sites (Pennsylvania; Freeville, NY; Willsboro, NY) and three years (2012-2014)

Pasta Sensory Evaluation

13 tasters evaluated 3 varieties over 2 replicates

- **Lucille:** high preference, shininess and roughness; low graininess, cohesion, and firmness
- **Red Vernal:** high preference, roughness, graininess, cohesion, firmness, and earthy flavor; low shininess
- **ND Common:** low preference, roughness, graininess, cohesion, and firmness; high shininess
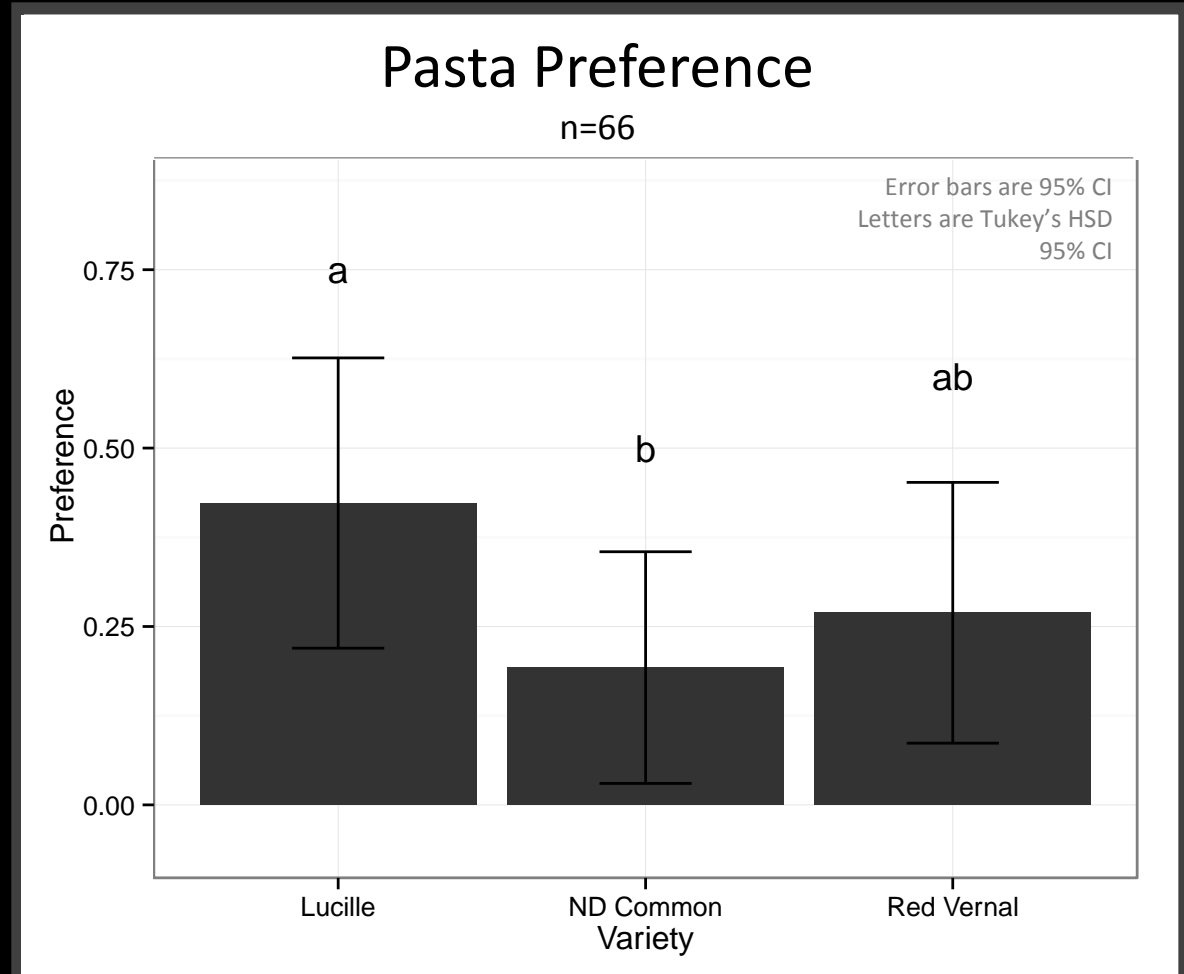
Type 3 ANOVA
H_0: $\beta_1 = 0$; $\alpha \leq 0.10$
$Y_{ijk} = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3}$

Y_{ij}: log odds of a flavor used for sample
B_0: intercept log odds
β_1: partial slope associated with variety
x_{i1}: fixed variable of variety i
B_2: partial slope associated with rep
x_{i2}: fixed variable of rep i
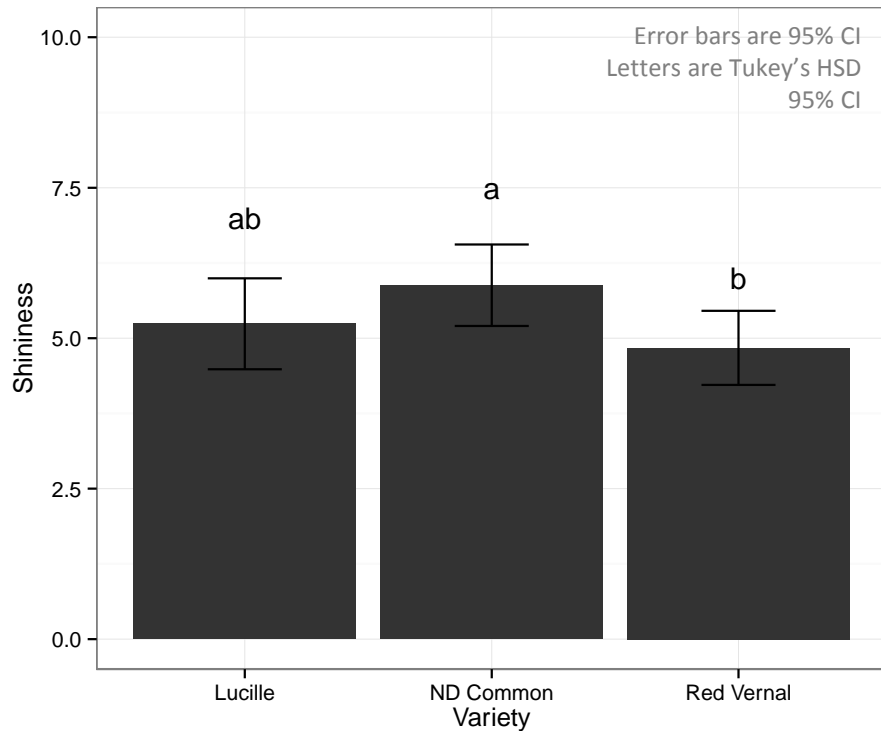β_3: partial slope associated with taster
x_{i3}: random variable of taster I

Pasta Preference
n=66

Error bars are 95% CI
Letters are Tukey's HSD
95% CI

There were significant differences in preference among varieties at p=0.032

Pasta Sensory Evaluation

Shininess
(1 = matte, 10 = slightly glossy)
N=75

Error bars are 95% CI
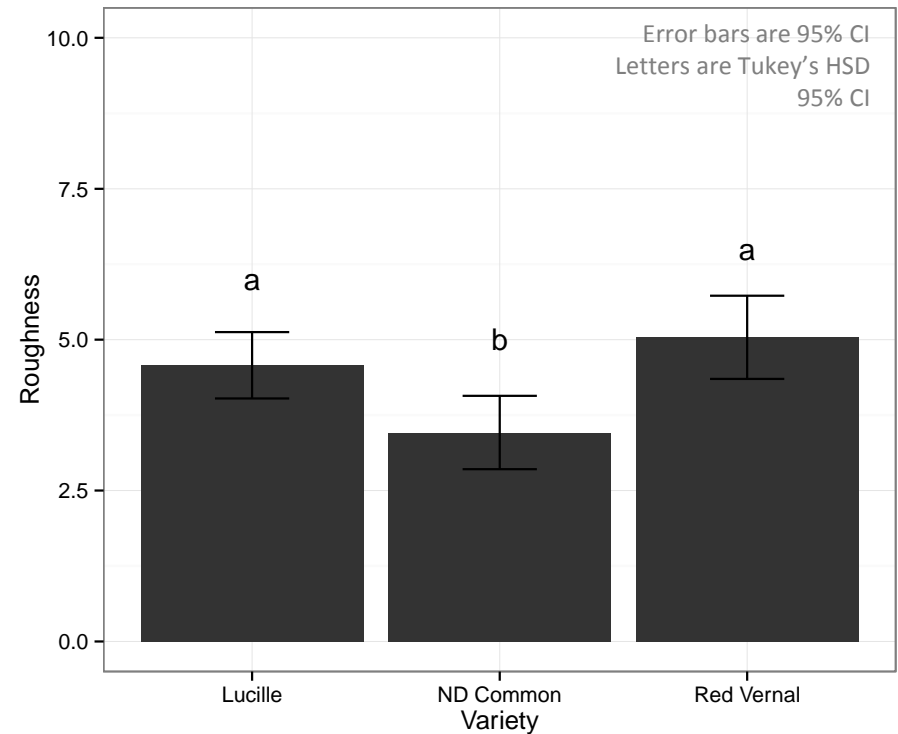Letters are Tukey's HSD
95% CI

There were significant differences among varieties at p=0.035.
Subject accounted for 31.76% of variance.

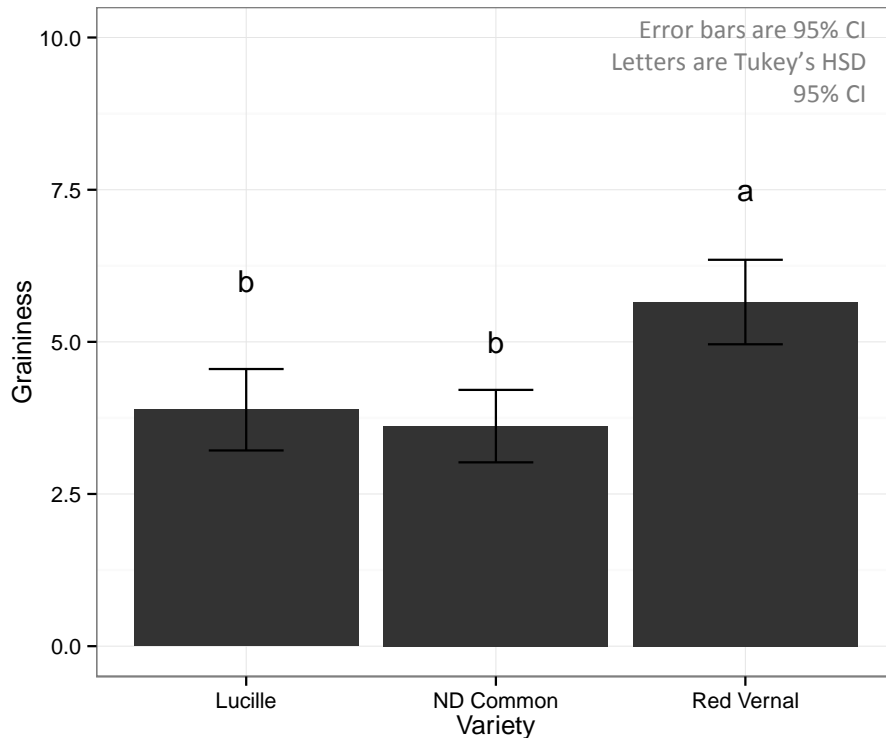## Surface Roughness
(1 = smooth, 10 = rough and coarse)
N=78

Error bars are 95% CI
Letters are Tukey's HSD
95% CI

There were significant differences among varieties at p=0.005.
Subject accounted for 15.97% of variance.

Pasta Sensory Evaluation

There were significant differences among varieties at p<0.0001. Subject accounted for 17.74% of variance.
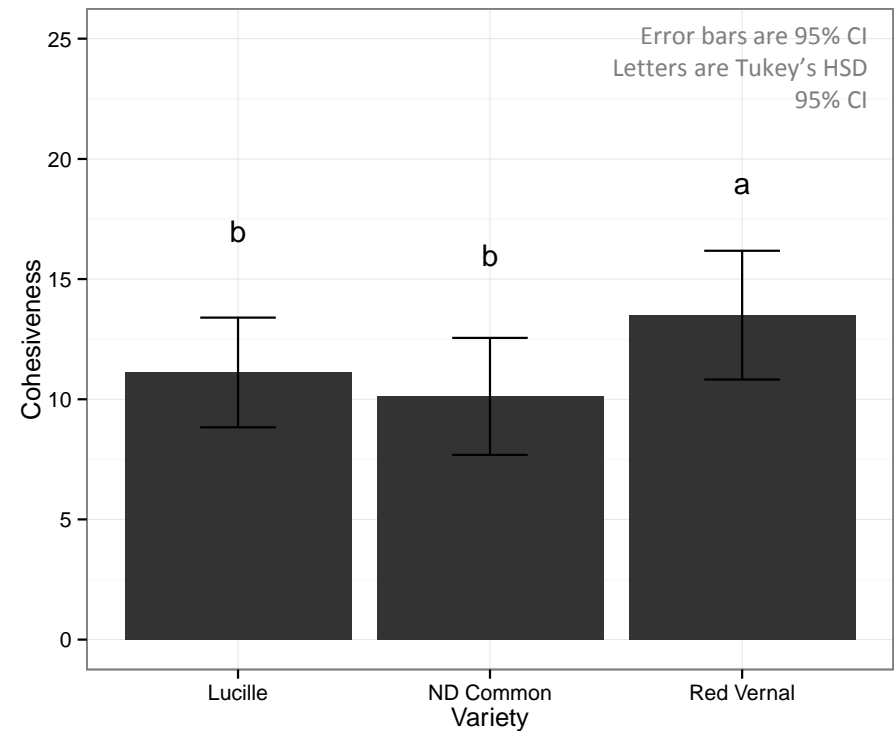
There were significant differences among varieties at p<0.0001. Subject accounted for 88.26% of variance.

Pasta Sensory Evaluation
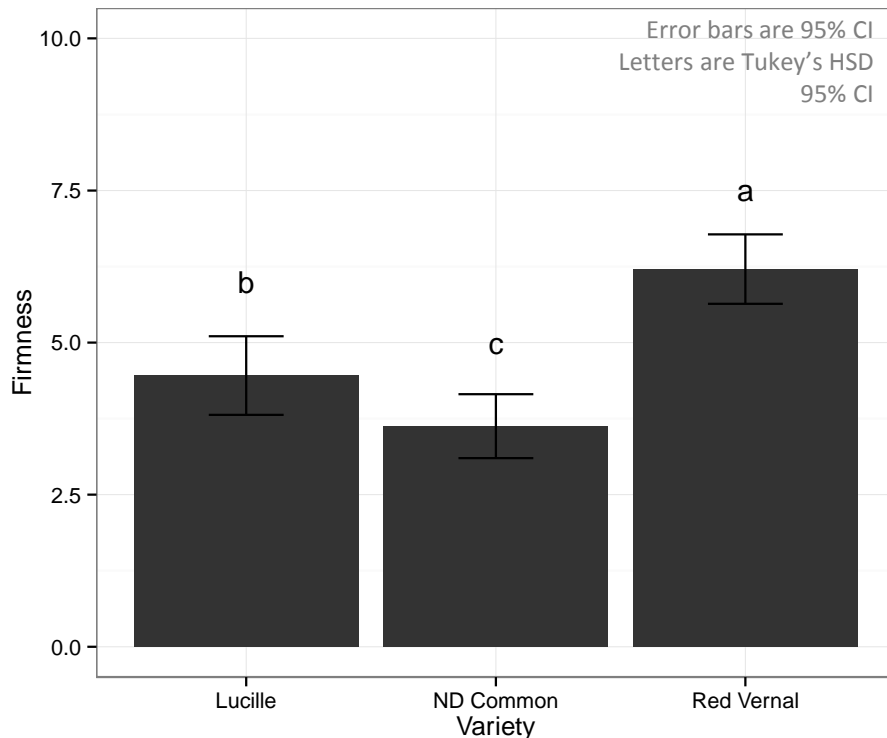
Firmness
(1 = falls apart, 10 = very chewy)
N=72

Error bars are 95% CI
Letters are Tukey's HSD
95% CI

Firmness — y-axis: 0.0, 2.5, 5.0, 7.5, 10.0

Bars: Lucille (b), ND Common (c), Red Vernal (a)

Variety

There were significant differences among varieties at p<0.0001.
Subject accounted for 44.89% of variance.

Surface stickiness (p=0.759) and starch texture (p=0.300) not significantly different among varieties

Type III ANOVA with Sattherwaite approximation
H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7$; $\alpha \leq 0.05$

$Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + \varepsilon_{ijk}$
y_{ij}: response for variety i, rep j, order k, and subject l
μ: overall mean response
α_i: fixed effect of variety i
B_j: fixed effect of rep j
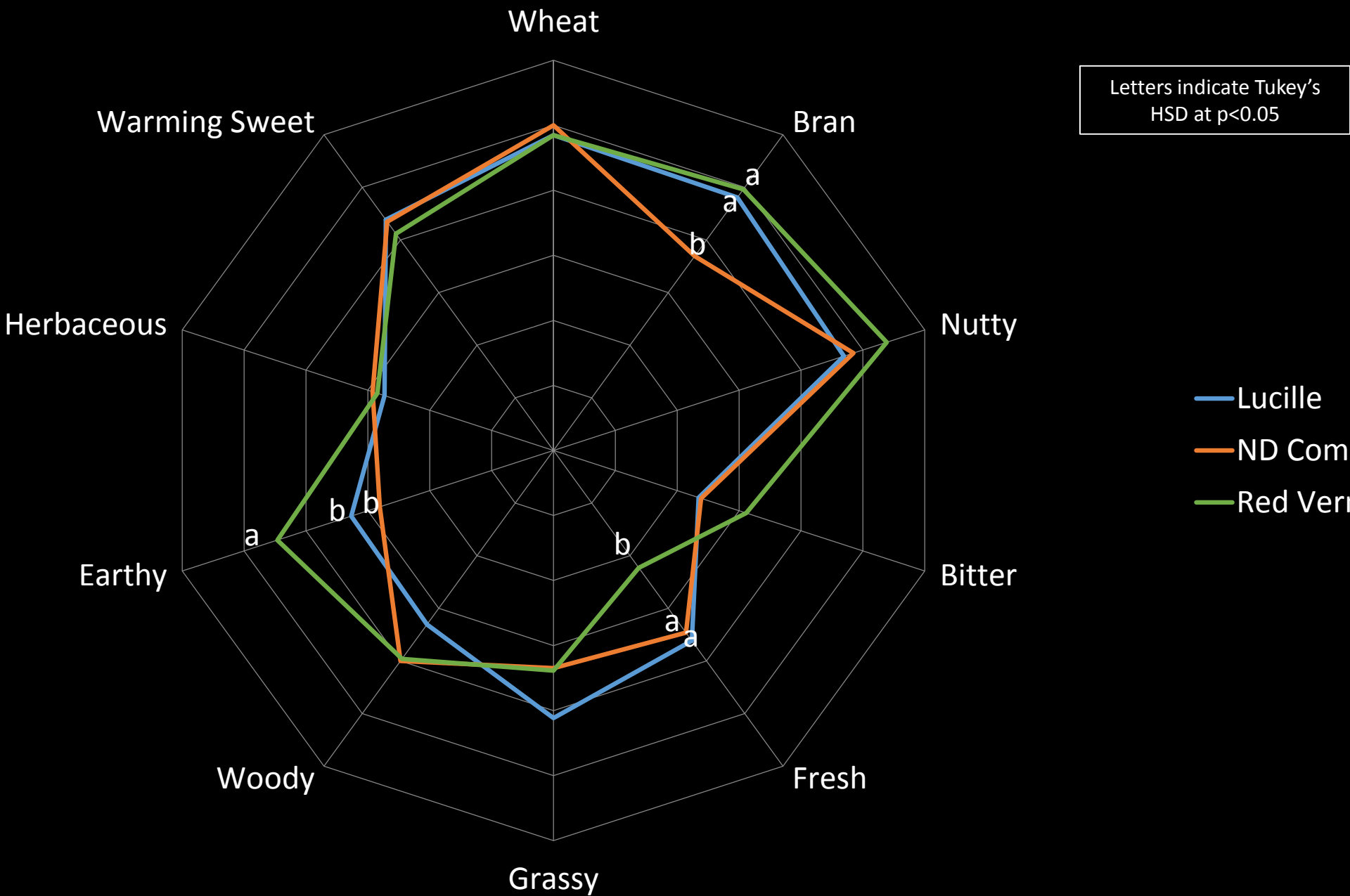γ_k: random effect of subject k
ε_{ijk}: experimental error associated with response I,j,k

Pasta Intensity of Various Flavors

Cooked Whole Grain Sensory Evaluation

13 tasters evaluated 3 varieties over two replicates

- **ND Common:** highest preference and most chewy texture, dominated by bran, woody, wheat, and nutty flavors
- **Lucille:** low test preference, least chewy, dominated by nutty, wheat, and grassy flavors
- **Red Vernal:** low preference, dominated by earthy, bitter, and wheat flavors
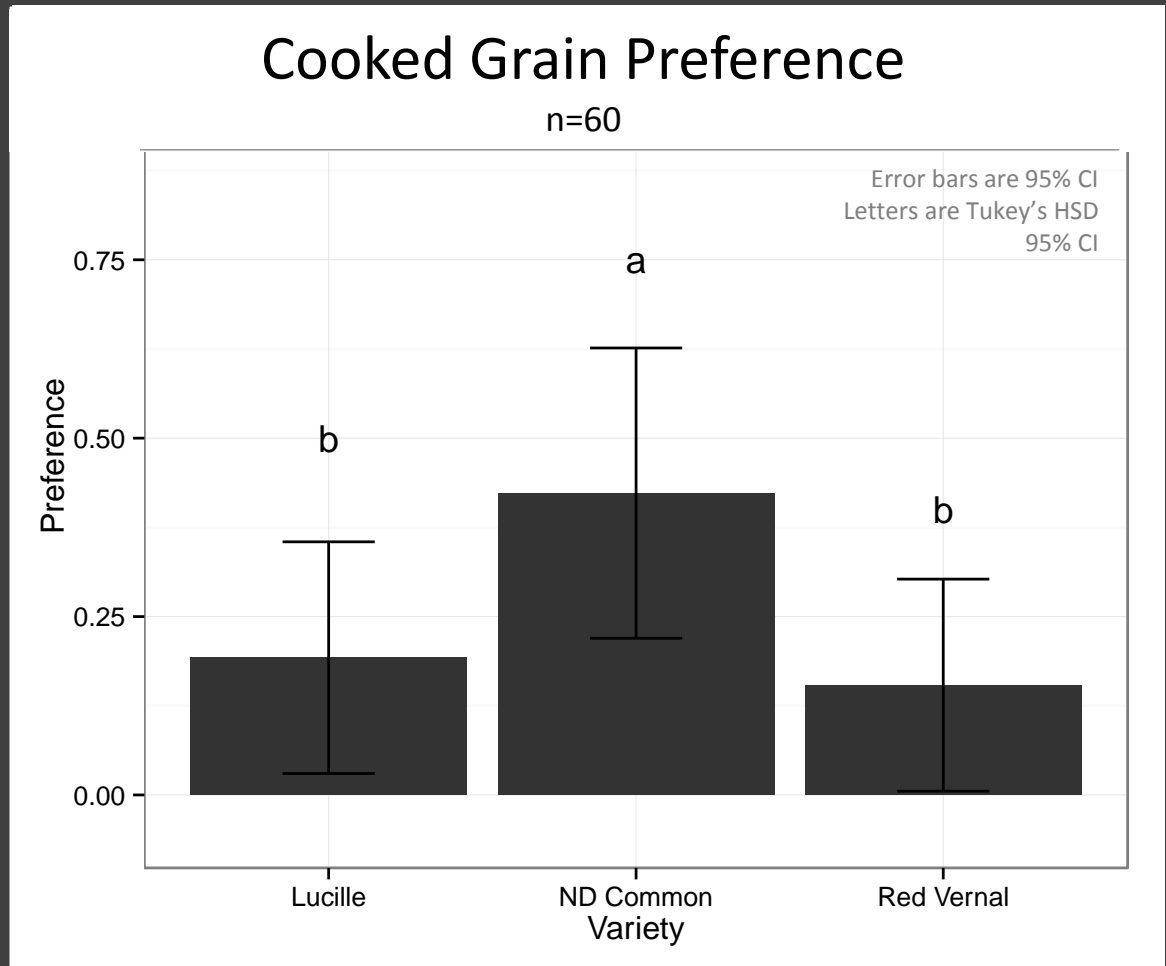
Type 3 ANOVA
H_0: $\beta_1 = 0$; $\alpha \leq 0.10$
$Y_{ijk} = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3}$

Y_{ij}: log odds of a flavor used for sample
B_0: intercept log odds
β_1: partial slope associated with variety
x_{i1}: fixed variable of variety i
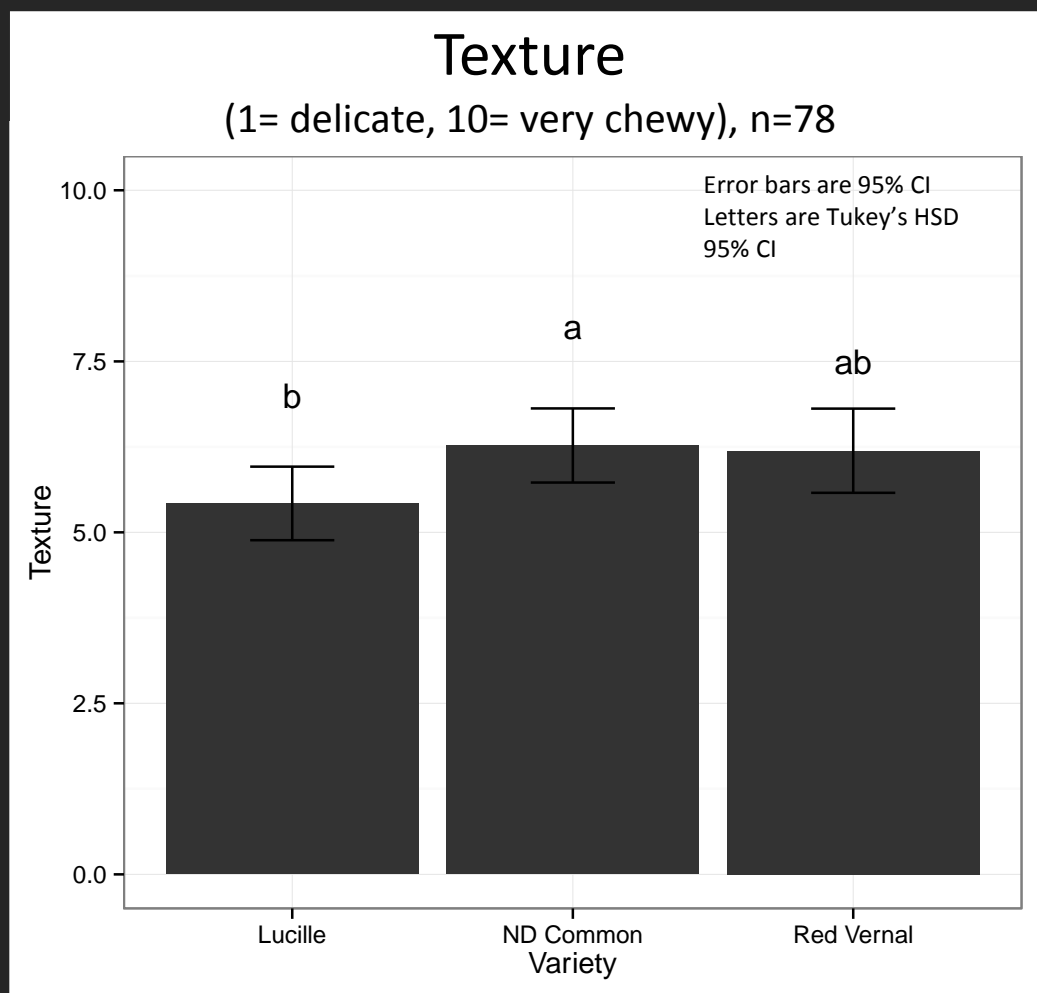B_2: partial slope associated with rep
x_{i2}: fixed variable of rep i
β_3: partial slope associated with taster
x_{i3}: random variable of taster I

Cooked Grain Preference — n=60. Error bars are 95% CI. Letters are Tukey's HSD 95% CI. Preference by Variety: Lucille (b), ND Common (a), Red Vernal (b).

There were significant differences in preference among varieties at p=0.038

Cooked Whole Grain Sensory Evaluation

Texture

(1= delicate, 10= very chewy), n=78

Error bars are 95% CI
Letters are Tukey's HSD 95% CI

a
ab
b

10.0
7.5
5.0
2.5
0.0

Texture

Lucille | ND Common | Red Vernal
Variety

There were significant differences among varieties at p=0.033. Subject accounted for 21.96% of variance.

Whole grain taste intensity (p=0.326) and dryness (p=0.539) were not significantly different by variety.

Type III ANOVA with Sattherwaite approximation
H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = \mu_7$; $\alpha \leq 0.05$

$Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + \varepsilon_{ijk}$
y_{ij}: response for variety i, rep j, order k, and subject l
μ: overall mean response
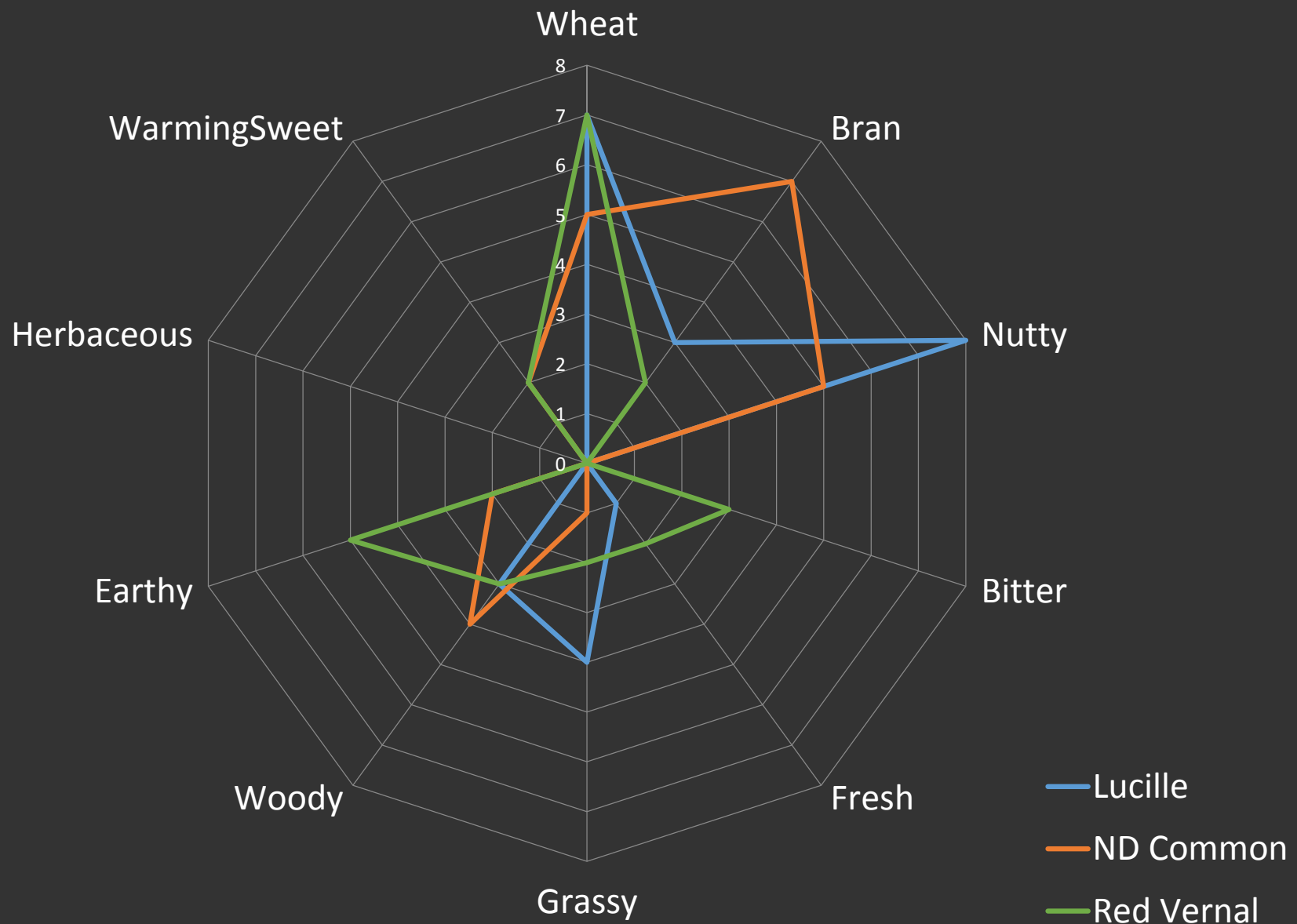α_i: fixed effect of variety i
B_j: fixed effect of rep j
γ_k: random effect of subject k
ε_{ijk}: experimental error associated with response I,j,k

Cooked Whole Grain Most Prominent Flavor

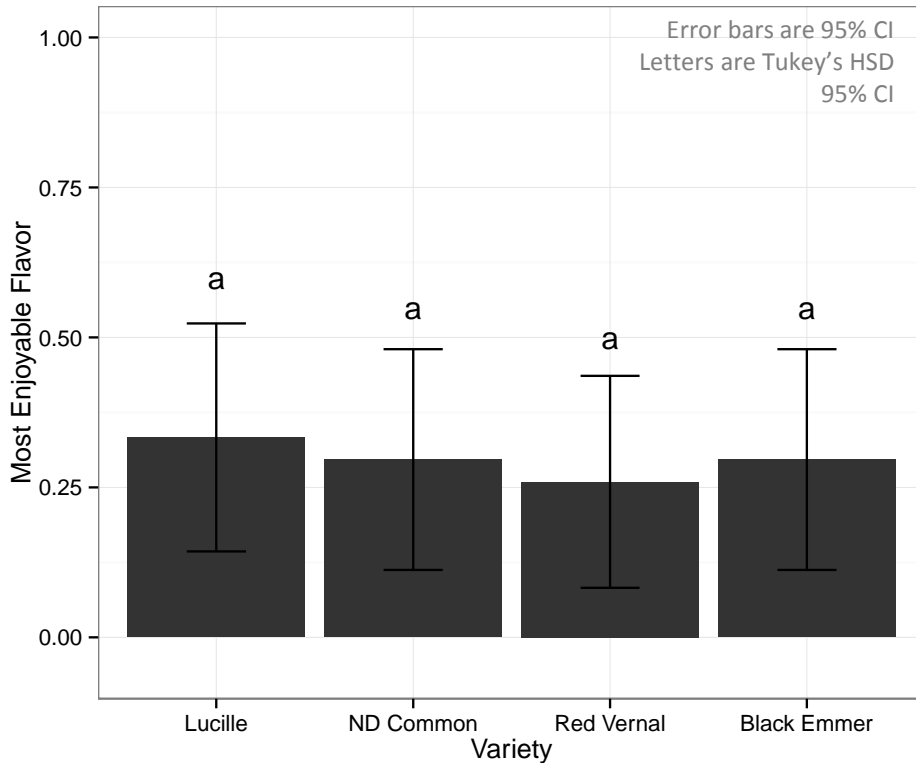# Cooked Whole Grain Public Preference Tasting

26 tasters evaluated 4 varieties in one replicate
Varieties were grown at a different site than the materials used for the sensory evaluation
Black Emmer was grown as a winter at a different site than the spring-grown Lucille, ND Common, and Red Vernal
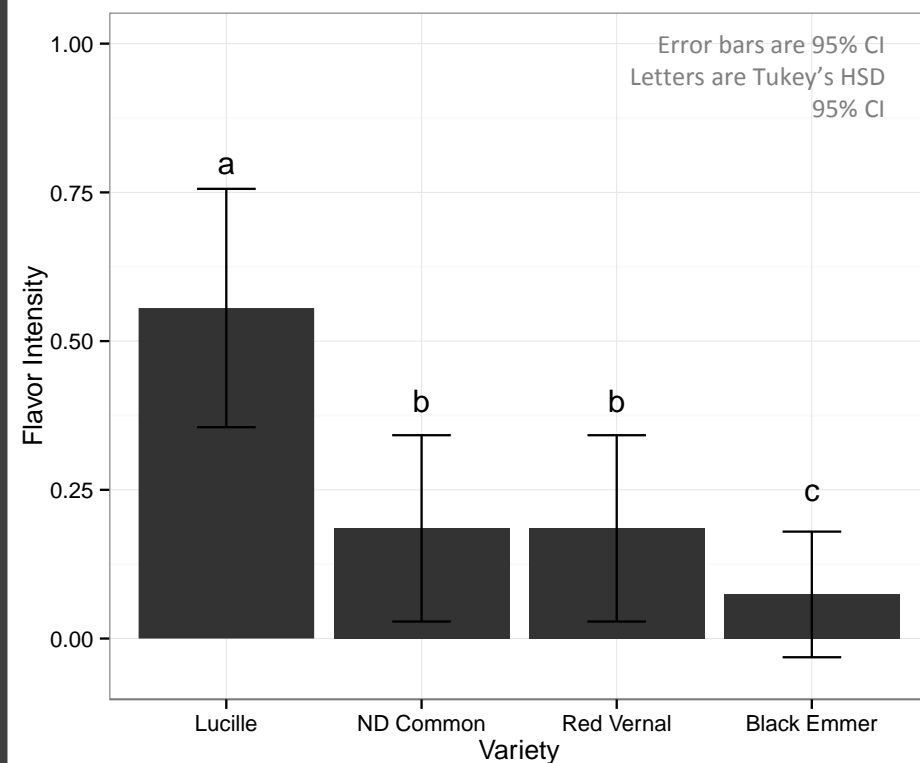

Most Enjoyable Flavor
N=108

Most Intense Taste
N=108

There were no significant differences in probability of being rating as most enjoyable flavor among varieties at p=0.55

There were significant differences in probability of highest taste intensity among varieties at p<0.0001

Type 3 ANOVA
H_0: β_1=0; $\alpha \le 0.10$
$Y_{ijk} = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2}$

Y_{ij}: log odds of a flavor used for sample;
B_0: intercept log odds; β_1: partial slope associated with variety ; β_2: partial slope associated with taster
x_{i3}: random variable of taster I; x_{i1}: fixed variable of variety j