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WORLD BREWING CONGRESS 2016

Malting Conditions for Evaluation of Rye Cultivars

Yujuan Wang [A], Paul Schwarz [B], Ricard Horsley [B]

[A] NORTH DAKOTA STATE UNIVERSITY, DEPARTMENT OF CEREAL AND FOOD SCIENCE, [B] DEPARTMENT OF PLANT SCIENCES, FARGO, ND 58102 U.S.A.

World Brewing Congress
August 13-17, 2016
Sheraton Downtown Denver
Denver, CO 80202, U.S.A.

Introduction

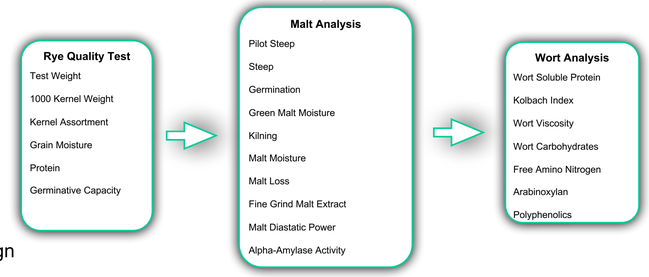
While, rye has been used by the baking and distilling industries for centuries, its use in brewing has traditionally been limited. However, rye has recently become more popular as its addition can contribute spicy or pumpernickel characteristics to beer flavor. The malting of rye and use of rye malts presents several challenges to maltsters and brewers. These include the lack of a hull, dense packing in steep, extreme shrinkage in the kiln and a high content of water soluble arabinoxylans. centrifuged prior to filtration. There is empirical evidence that rye genotypes differ in malting and brewing performance and flavor, but there is little published information on the malting of rye or the malt quality attributes of rye genotypes.

Objectives

The main objective of the current work was to evaluate laboratory micro-malting conditions that could be used in quality screening. Key objectives were achieving high extract, with minimal malt loss and lower wort viscosity/arabinoxylan content.

Experimental Approach

- Materials
  - Two rye genotypes: DR02 and one Unknown Iowa winter rye, all samples were grown during 2014 in two locations: Carrington, ND and IA
- Methods
  - Rye Quality Test
  - Malt Analysis
  - Wort Analysis



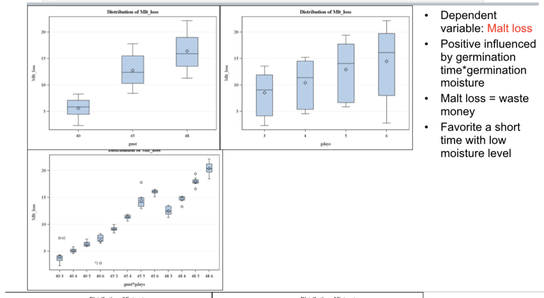
- Experimental Design
  - This study was designed according to a Randomized Complete Block Design (RCBD)
    - 96 observations including 2 replications
    - Two grain size: 5/64" fraction, plump fraction (>6/64")
    - Three steep moisture: 40, 45, and 48%
    - Four germination time: 3,4,5 and 6 days
  - Conditions: 16°C germination, 45-85°C kiln

Results and Discussion

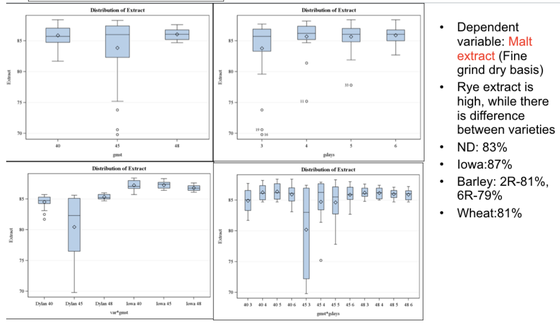
Table 1. Partial experimental results

	Malt Loss (%)		Extract (% db)		Viscosity (cp)		FAN(mg/L)	
Genotype								
Dylan	11.92	a	83.42	a	5.23	a	223.10	a
Iowa	11.25	b	87.08	b	4.47	b	221.75	b
Germination(H)								
72	8.55	a	83.76	a	5.37	a	217.13	a
96	10.41	b	85.70	b	4.98	b	223.50	ab
120	12.91	c	85.66	b	4.59	c	227.00	b
144	14.47	d	85.89	b	4.46	c	222.08	ab
Grain Size								
plump	11.52	a	85.46	a	4.83	a	230.63	a
medium	11.65	a	85.04	a	4.87	a	214.23	b
Malt Moisture								
40%	5.61	a	85.86	a	5.36	a	215.94	a
45%	12.74	b	83.84	b	4.76	b	211.00	a
48%	16.40	c	86.05	a	4.43	c	240.34	b

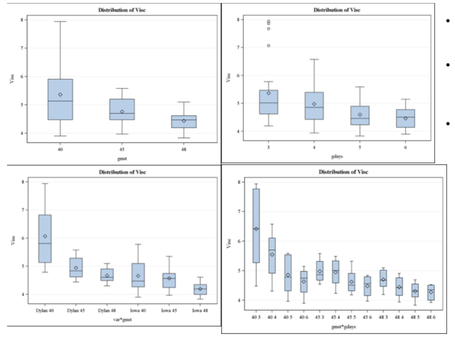
a means followed by the same letter are not significantly different (P<=0.05)
b Germination time



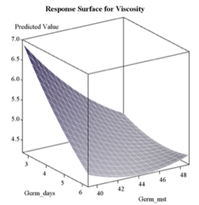
- Dependent variable: Malt loss
- Positive influenced by germination time*germination moisture
- Malt loss = waste money
- Favorite a short time with low moisture level

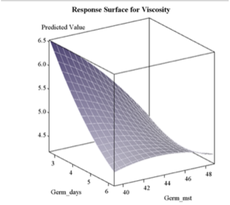


- Dependent variable: Malt extract (Fine grind dry basis)
- Rye extract is high, while there is difference between varieties
- ND: 83%
- Iowa:87%
- Barley: 2R-81%, 6R-79%
- Wheat:81%



- Dependent variable: Wort viscosity
- Viscosity is much higher than barley and wheat
- Favorite a high germination moisture level





Response surface for viscosity.
Left-plump kernel; right-meddle size kernel.

- Typically, **longer germination time** helps reduce viscosity at a relevant lower steeping moisture level

Sample was found to impact all parameters with the exception of FAN and arabinoxylan. Steep-out moisture did not influence extract or arabinoxylan level, but increasing moisture was found to increase the malt loss and decrease viscosity. Germination time increased extract values only up to 4 days, but longer times contributed to lower viscosity but greater malt loss. Significant interactions between some parameters confounded the interpretation of data, but in general high extract and lower viscosity were achieved by malting for at least 4 days at high moisture. Several commercial maltsters however, have indicated that the handling of germinating rye at high moisture levels is problematic. As such we recommend 6 days of germination at 45% moisture for future evaluation of rye cultivars.

Conclusion

Extract depends on the sample (genotype) and is higher than barley and wheat. The gmst*gdays interaction was statistically significant, but wasn't a "true" interactions (magnitude).

Viscosity was lowest (3.83 cP) after six days germination at 48% germination moisture. There were no significant difference between viscosity for samples germinated five and six days

Malt loss was largest (22.16%) after six day's germination at 48% moisture. Moisture had a greater effect than germination time

Thus, we recommend *6 days of germination at 45% moisture* for future evaluation of rye cultivars experiment

Reference

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