Conferring Higher Prebiotic Fiber Content to Kansas Wheat Lines

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Background

- Wheat contains low levels (1% of dry mass) of the heart-healthy prebiotic fiber β-glucan, while other cereal grains such as barley contain more significant levels (7% of dry mass).
- Using a whole-arm Robertsonian translocation (RobT) this trait can be transferred from barley to wheat. Higher β-glucan content has been achieved in wheat using this method.
- To make the trait usable for breeders, it must first be integrated into elite Kansas wheat lines though a series of backcrosses.

Hypothesis

- Since the parent translocation lines are homozygous for the barley arm, the first cross will be heterozygous. This heterozygous line will be used to introduce the barley arm to the elite wheat lines in the first backcross.
- **BC_1 Hypothesis:** The progeny of BC_1 will segregate at a 1:1 ratio. Half will carry the translocated arm and the other half will not.
- **GISH Hypothesis:** All parent lines will be homozygous for the 7H translocation.

Methodology

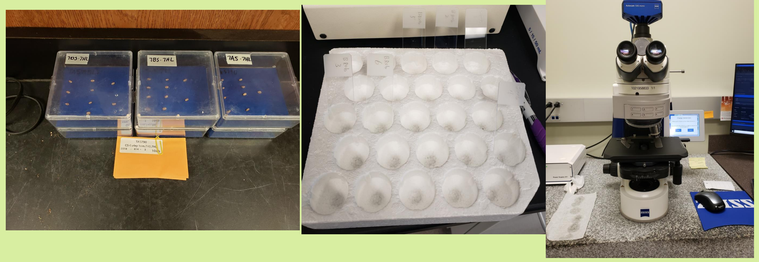
1. Heterozygous translocation line is crossed with Kansas Elite Wheat.

2. Seed is collected and saved for future backcrosses. Plants are genotyped and plants carrying the translocation will be selected.

3. Each successive backcross will contain more of the elite genome and less of the Chinese Spring background from the initial translocation line.

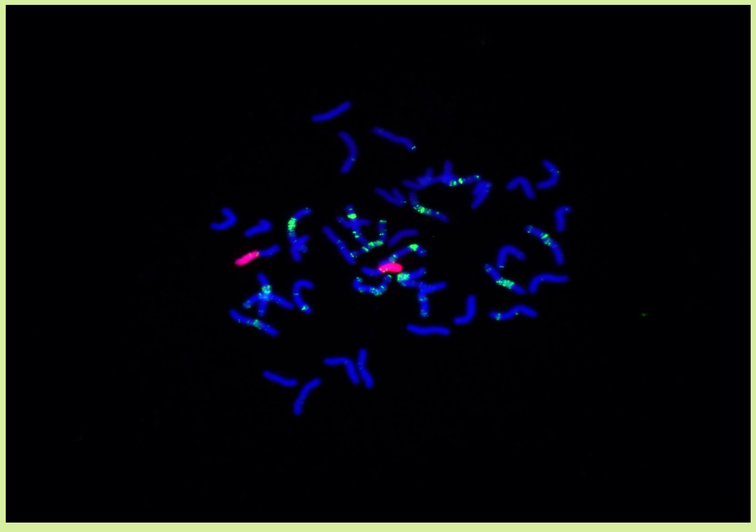
Emasculation of heterozygous BC_1 prior to BC_2

GISH (genomic *in-situ* hybridization) was used to verify the homozygous condition of the parent lines.



GISH Procedure

1. Seeds are germinated and root tips are collected.
2. Root tips are prepared using an enzyme mixture that breaks down cellulose, enabling the chromosomes to spread.
3. Chromosome preparations are mounted and counterstained with (DAPI). Probe DNA is labeled with GAA repeat (green) and barley genomic DNA (red). Images are captured with a Zeiss Axiocam microscope camera.

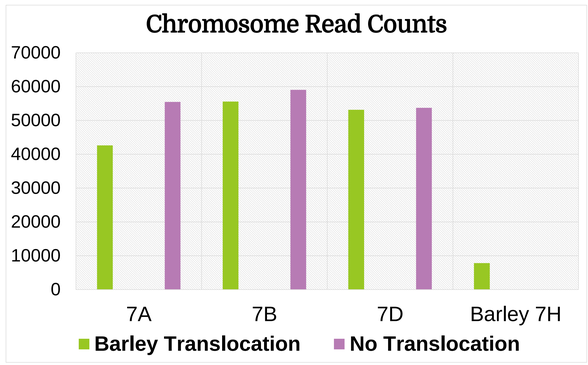


Chromosome image from Zeiss Axiocam. Barley genomic DNA is stained in pink. Green is GAA repeat marker.

Results

Genotyped backcross lines segregated 210:208 (210 trans, 208 no-trans). The expectation was that they would segregate 1:1. The ratio would likely have been closer if not for some die-off in the greenhouse. Seed will be gathered from the second backcross and planted in the fall for a third backcross.

GISH revealed that all the parent lines were, as expected, homozygous for the translocated barley arm.



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