

**ABI Cardinal delivers competitive yield with an earlier harvest maturity time and a better disease resistance package compared to other major 2-row varieties. ABI Cardinal has superior malting and brewing performance compared to current midwestern 2-row barley. ABI Cardinal is still in internal approval. Plant scale malting and brewing has yielded favorable results with all testing completed. Internal review and approval is expected in December 2021.**

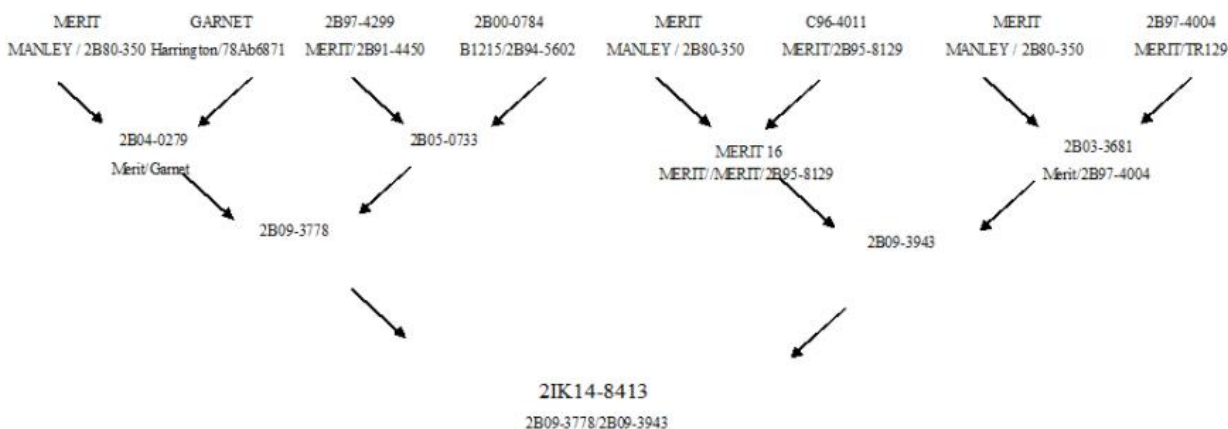
## ABI Cardinal Breeding History:

The line ABI Cardinal (2IK14-8413) was derived from the cross (C10-4655) made in spring of 2010 in Ft. Collins, CO between 2B09-3778 as female and 2B09-3943 used as male. The female parent is a BARI experimental breeding line with an extended pedigree of 2B04-0279/2B05-0733. The male parent is a BARI experimental breeding line with an extended pedigree of Merit 16/2B03-3681.

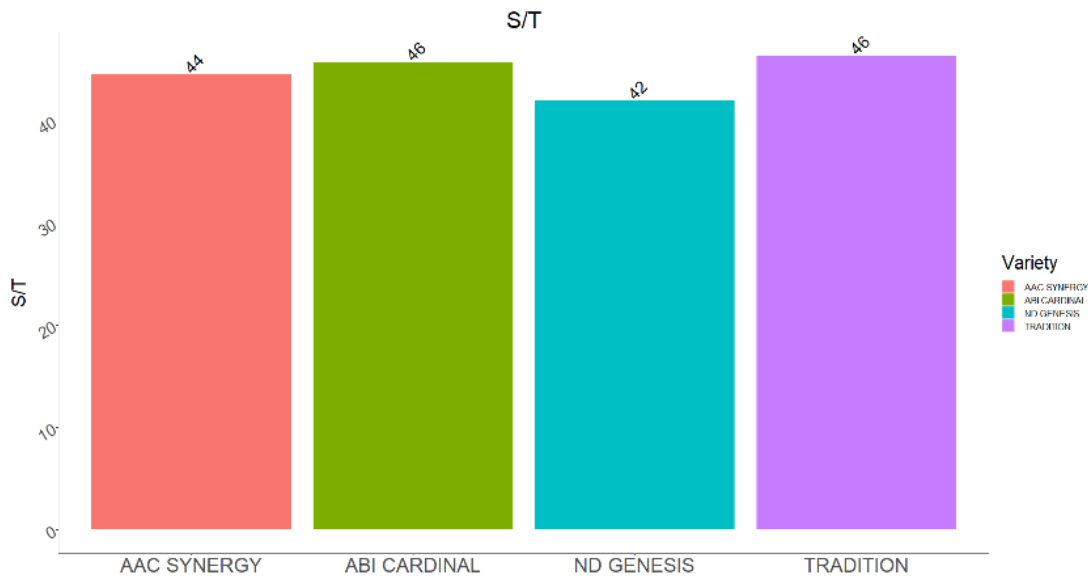
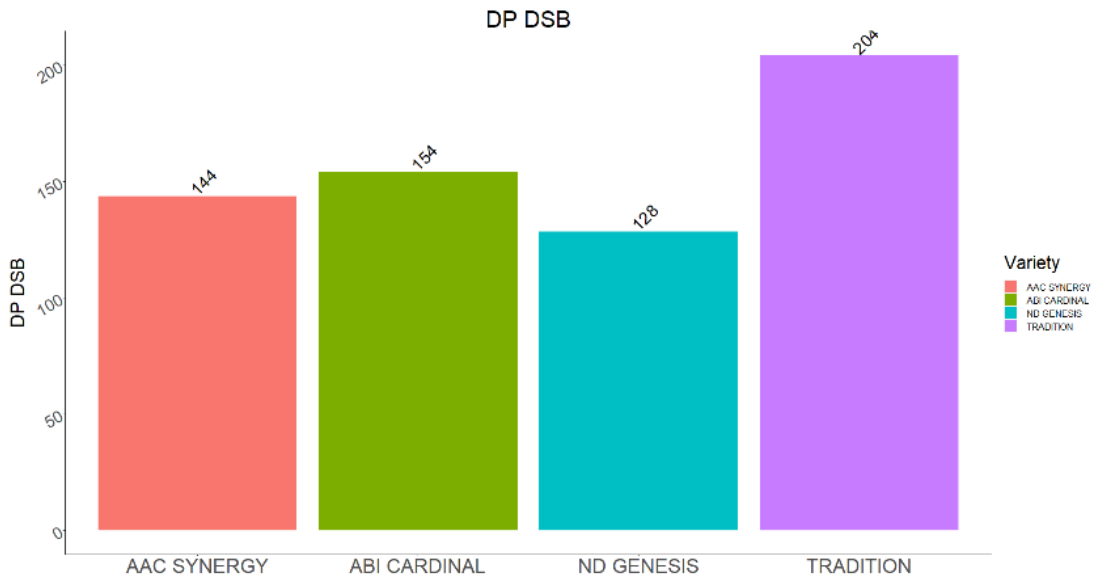
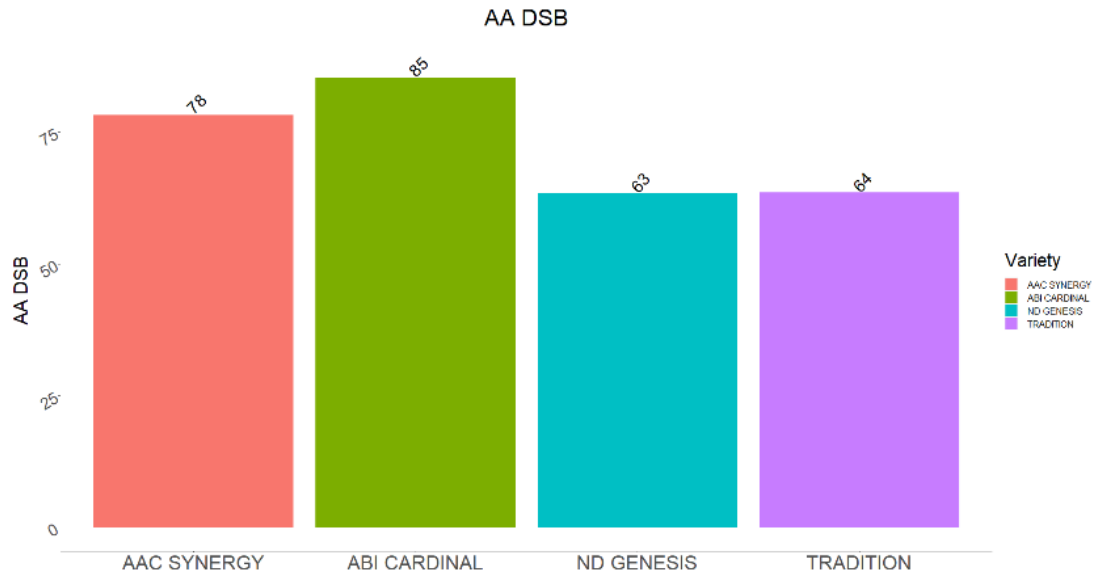
The F<sub>1</sub> of cross C10-4655 was increased in the greenhouse in Ft. Collins, CO during the fall of 2010, followed by an F<sub>2</sub> population in Fort Collins, CO in the spring of 2011. The F<sub>3</sub> population was then grown in Fairfield, MT in 2012. From this population 100 F<sub>3,4</sub> single plant selections were made. These selections were then grown as F<sub>3,5</sub> head rows in Sidney, MT in 2013 from which 12 were then selected. These 12 selects were then sent to Christchurch, NZ as F<sub>3,6</sub> single rows in the winter of 2013/2014. Of which six were selected for harvest and entered into replicated performance testing in the spring of 2014 as F<sub>3,7</sub> yield plots. One of which was assigned the Y1 experimental number 2IK14-8413. Seed from New Zealand was used for first year yield trials in 2014 in the United States. All subsequent generations of seed were harvested as bulk from this seed lot.

In 2016 head selections were made at Fort Collins, Colorado from a uniform and stable F10 population to initiate purification and multiplication. 200 Headrows were grown in Ft Collins 2017. 82 of the 200 headrows were selected, uniform and true to type. The 36 selected rows were submitted for genotyping using 35 highly polymorphic markers covering the 7 chromosomes. 13 of the 36 rows were genotypically identical for those markers. 13 headrows were threshed and bulked together to create the source of the Breeder Seed. A 0.2 acre Breeder Seed field was planted in Ft Collins in 2018 producing 665 pounds of breeder seed. ABI Cardinal (2IK14-8413) has been uniform and stable from F10 through F13. Less than .005% of the plants were rogued from fields in 2017. Approximately 95% of the rogued plants were 2 to 4 centimeters taller than ABI Cardinal (2IK14-8413). Less than .005% total variant plants may be encountered in subsequent generations. ABI Cardinal (2IK14-8413) Breeder Seed has been increase in Arizona during the winter of 2018/2019 (0.7 acre) and in Ft Collins 2019 (0.8 acres) and has shown to be stable, inform and true to type. ABI Cardinal was granted PVP Title V protection in 2020 and was listed by the OEDC in 2021.

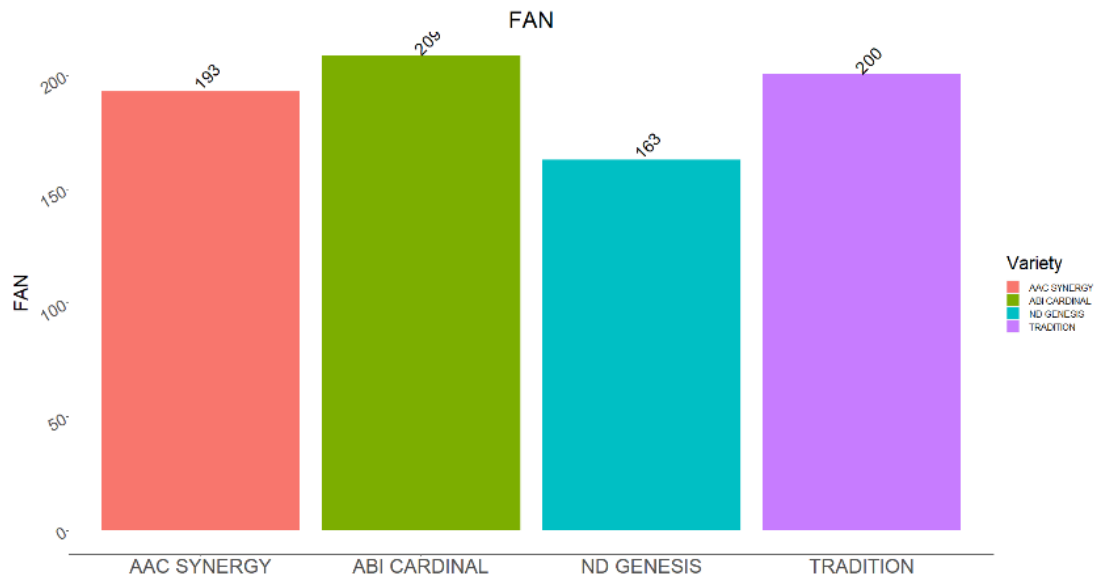
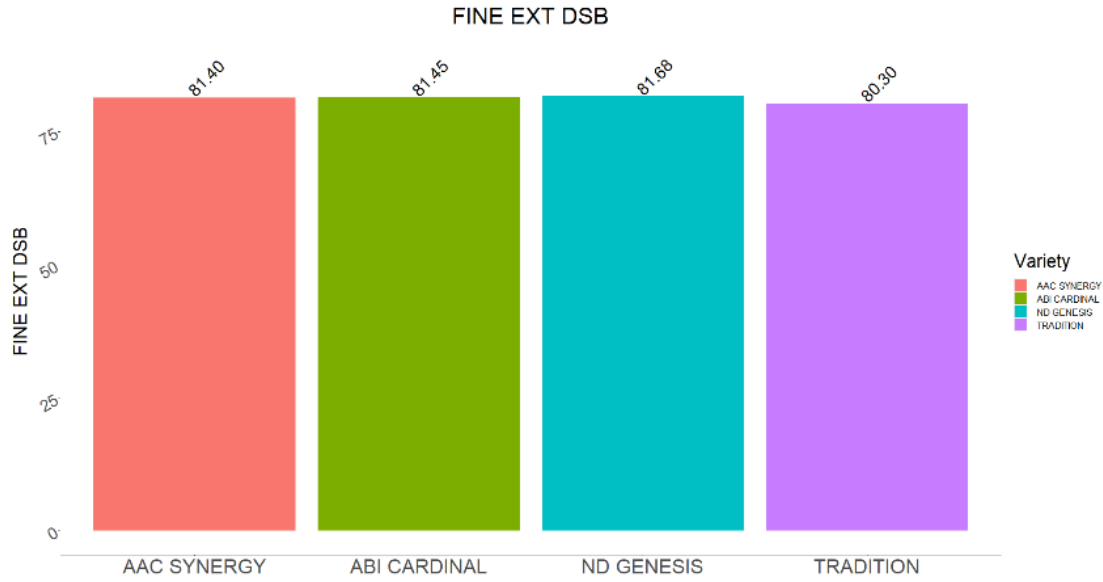
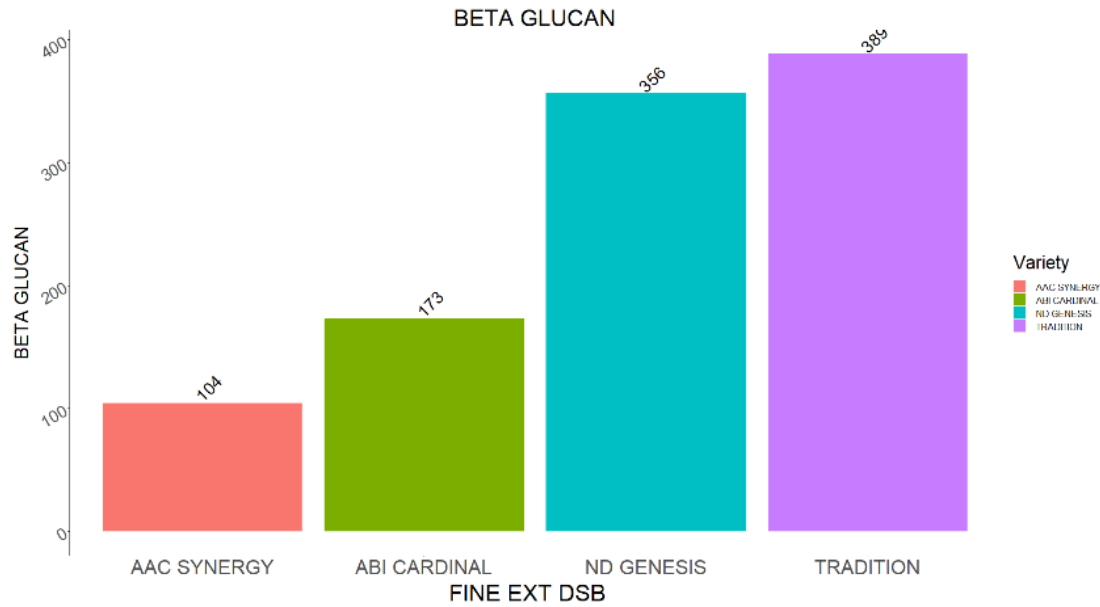
## ABI Cardinal Pedigree



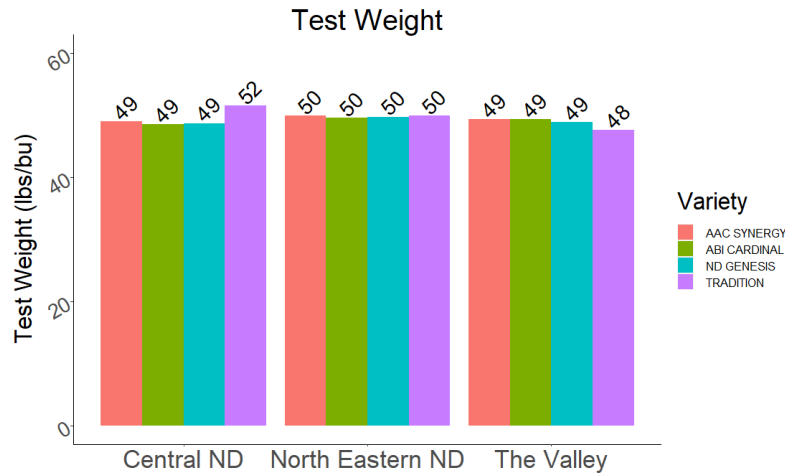
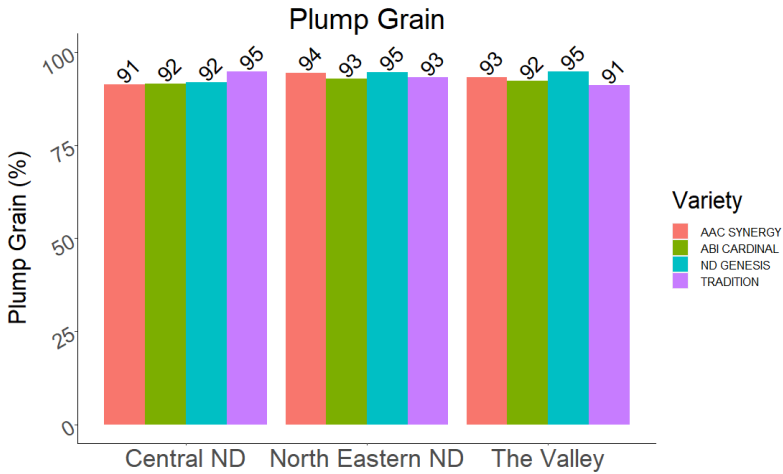
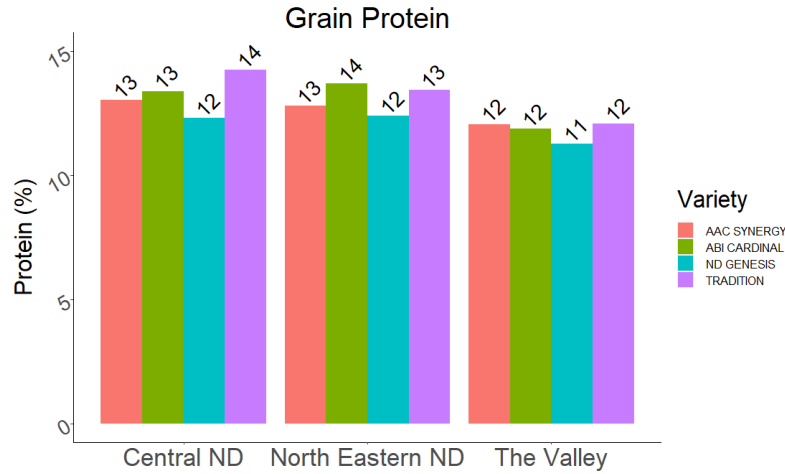
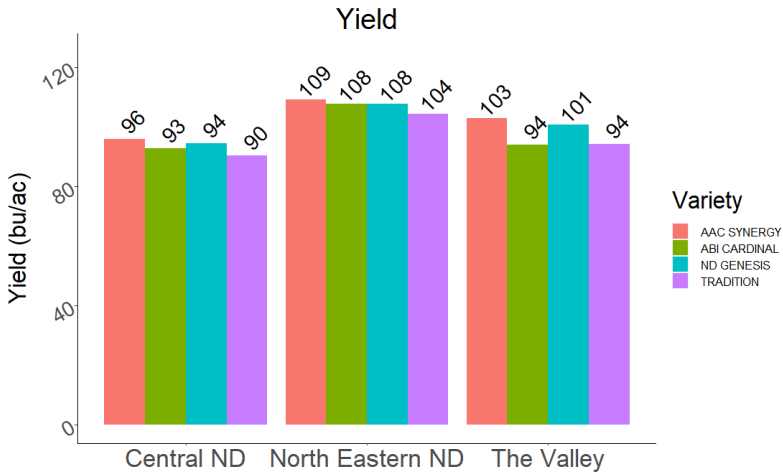
## ABI Cardinal Malting Performance:



## ABI Cardinal Malting Performance:



## ABI Cardinal Agronomic Performance:



## ABI Cardinal Disease Performance:

Disease	Resistance Rating
Spot blotch	Susceptible
Net blotch net form	Moderately Susceptible
Net blotch spot form	Moderately Susceptible
Fusarium head blight	Moderately resistant
Pre harvest sprout	Resistant

## ABI Cardinal Approval Status:

ABI Cardinal has performed equal to or better than control in all tests to date. Internal approval pending December 2021

Process	Status	Results	Date
Plant Scale Malting	Done		December 2020
Pilot Scale Brewing	Done		April 2021
Plant Scale Brewing	Done		August 2021
Plant Scale Brewing	Done		August 2021
Plant Scale Brewing	Done		August 2021
Internal Review	IP		December 2021