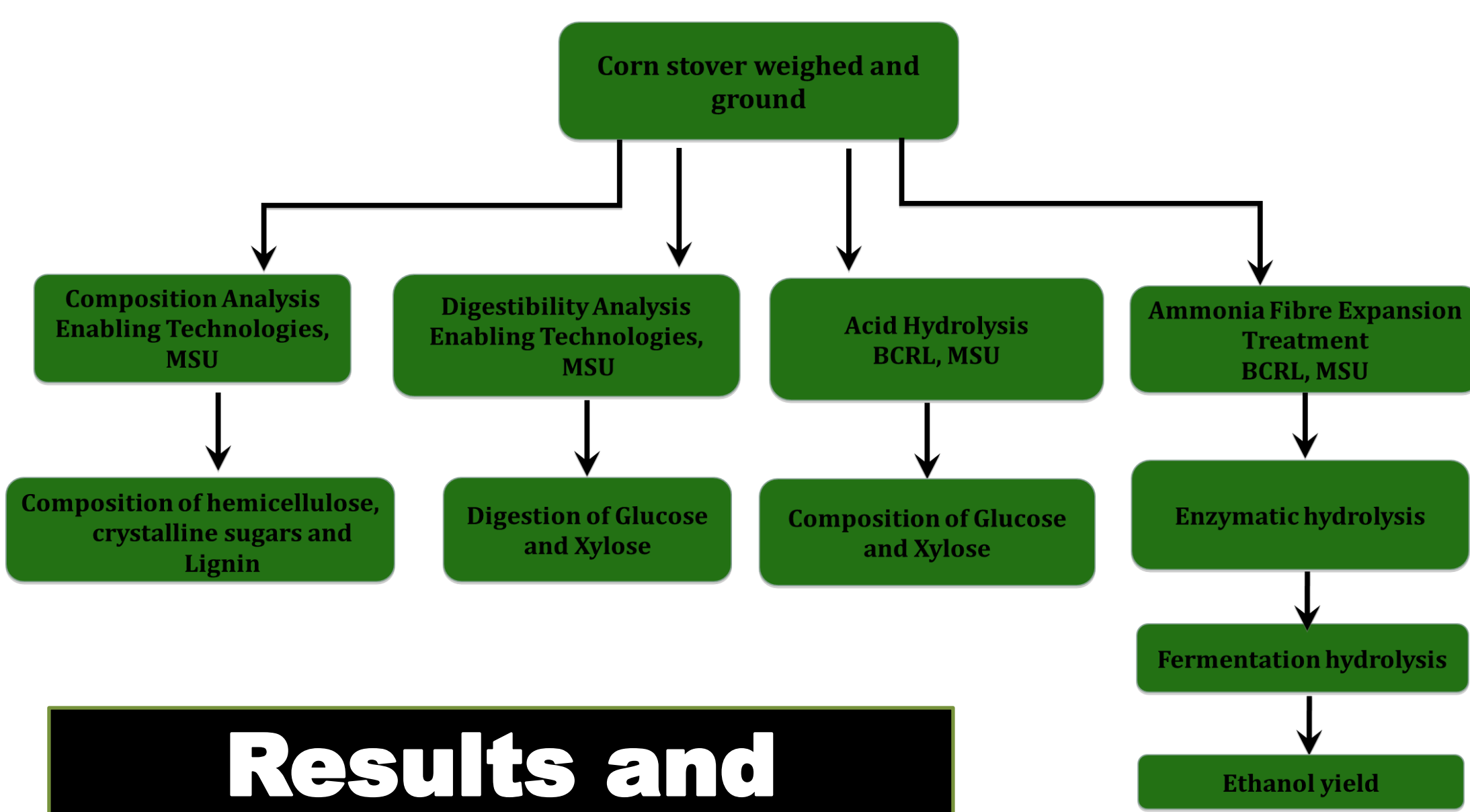


Abstract: A recent publication from Banerjee et al. 2010, reported differences in corn stover glucose release ranging from 95 to 64%. These significant differences in fermentable glucose levels would likely result in tremendous variability in bio-refinery ethanol yield from corn stover feedstock. Preliminary GLBRC analyses of corn stover (cultivar Pioneer 36H56) showed year to year (2008-2009) variability in ethanol precursors, glucose and free sugars, suggesting a significant environmental effect on stover quality. Additionally, work published by Saxena and Stotzky (2001) showed that the lignin content, an anti-quality agent for ethanol production, was significantly higher (33-97% higher) for Bt lines compared to their respective non-Bt isoline.

Objective: To evaluate the effect of the Bt trait, location and hybrid differences on corn stover and cob ethanol yield.

Materials & Methods: For the experimental design, 2 hybrid pairs (one Bt and one near-isoline relative) were analyzed giving a total of 4 hybrids. Each hybrid pair were grown at two latitudinal differing locations at the MSU Hybrid trials in four replicated plots at each location. One hybrid pair was grown in Saginaw and Mason Counties (Zones 2 & 3) and the second hybrid pair was grown in Mason and Menominee Counties (Zones 3 & 4). Total samples to process = 2 hybrids x 4 locations x 4 reps = 32 samples. At each location, the entire corn plants were harvested. Then the ears were removed from the plants and the grain was shelled from the cob. Wet and dry weights were recorded from all three fractions for each plot (stover, cob, and grain). This experiment was repeated in the years 2010 and 2011. Samples were ground and were submitted for AFEX pretreatment. Samples will be analyzed for glucose, sugar profile, cellulose, and IVTD. Samples will be fermented and analyzed for ethanol yield.

Flow chart from Corn stover to Ethanol

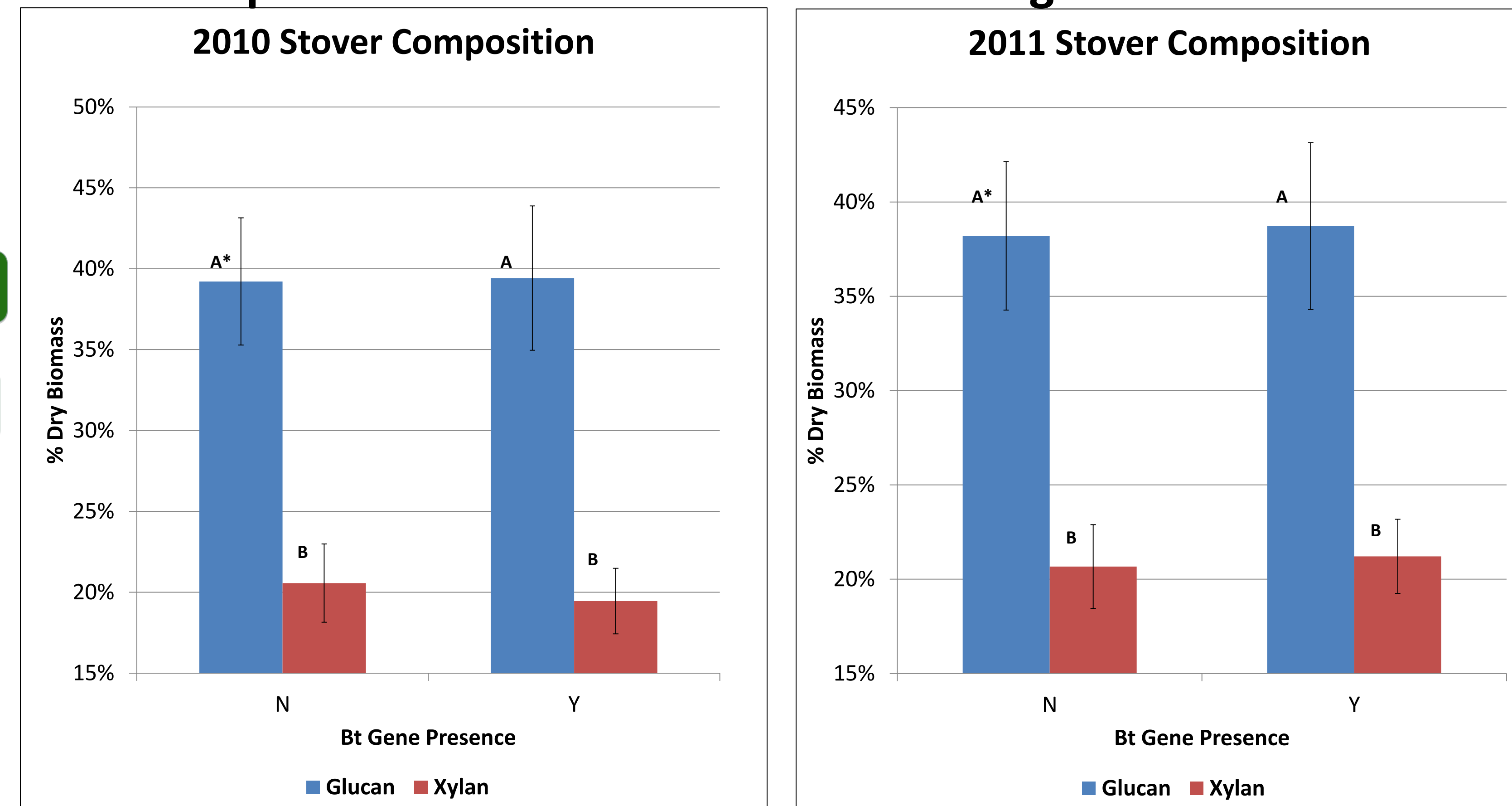


Results and Discussion

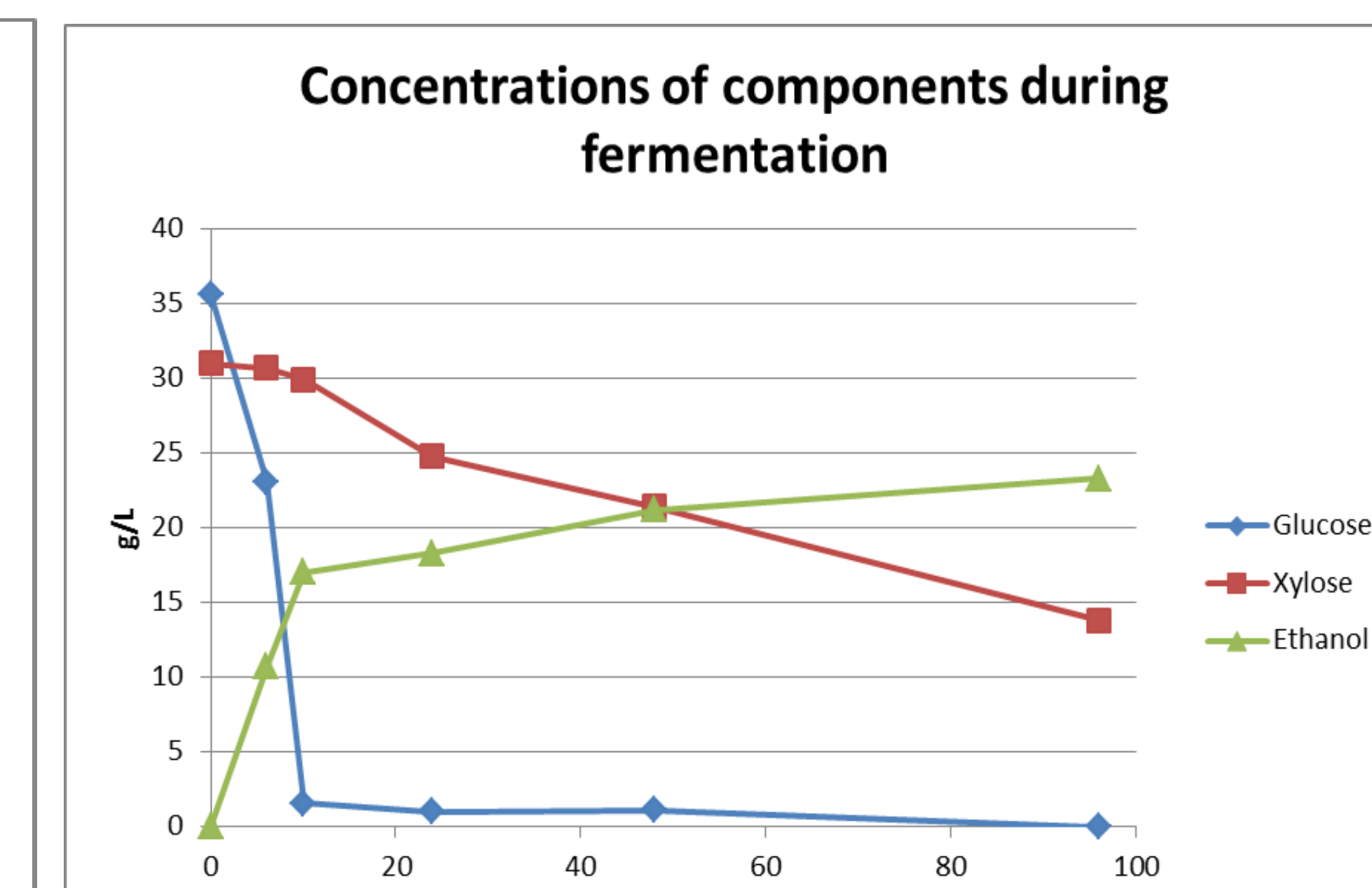
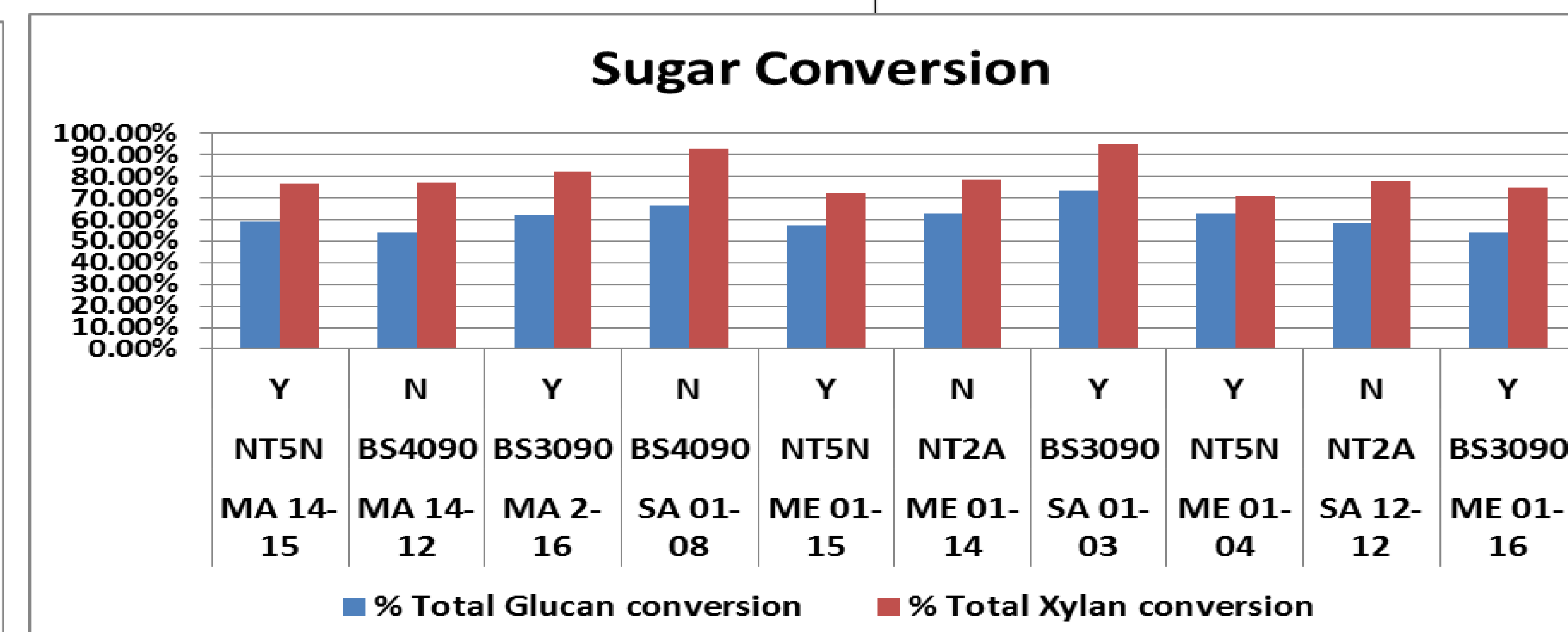
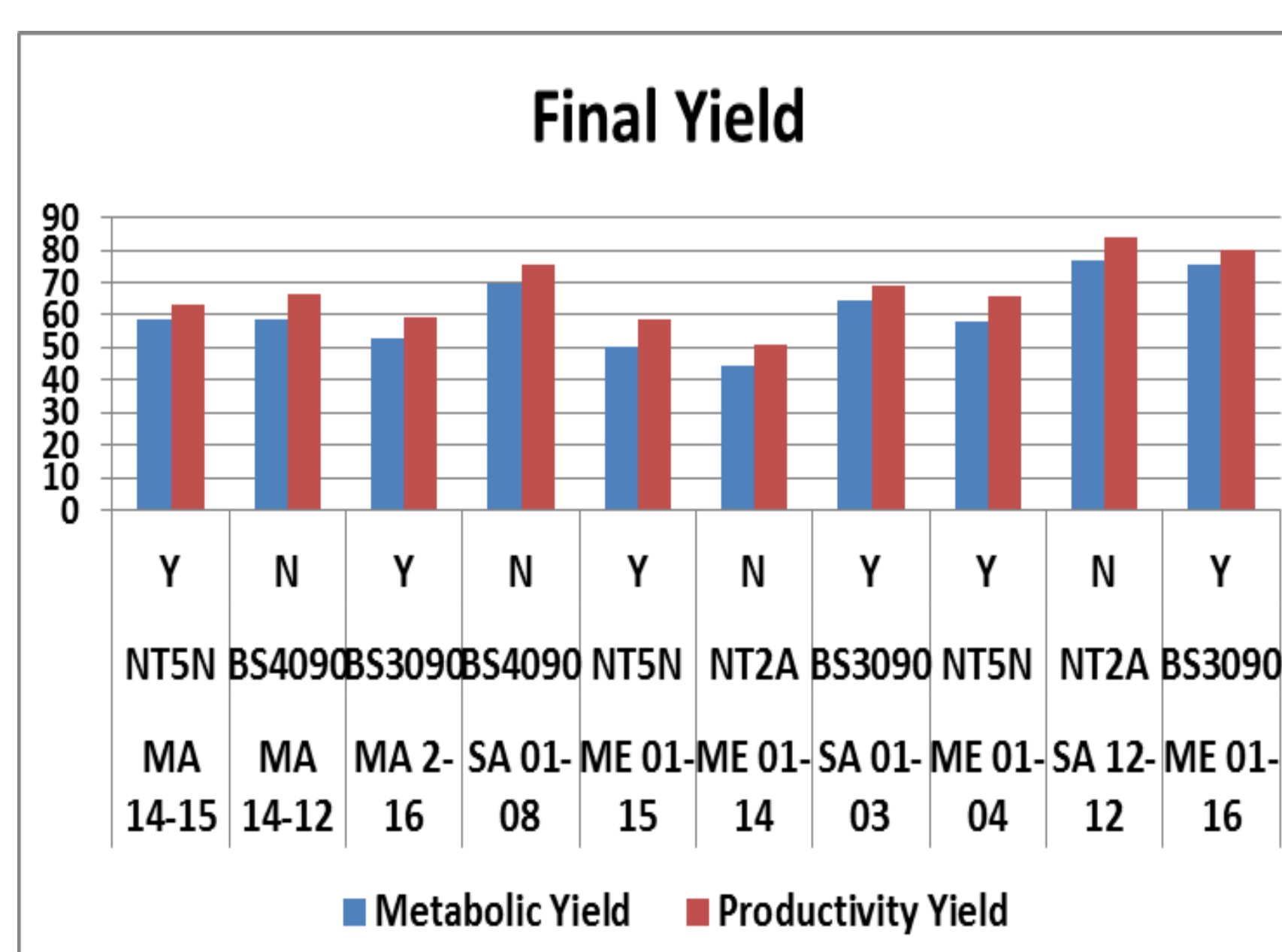
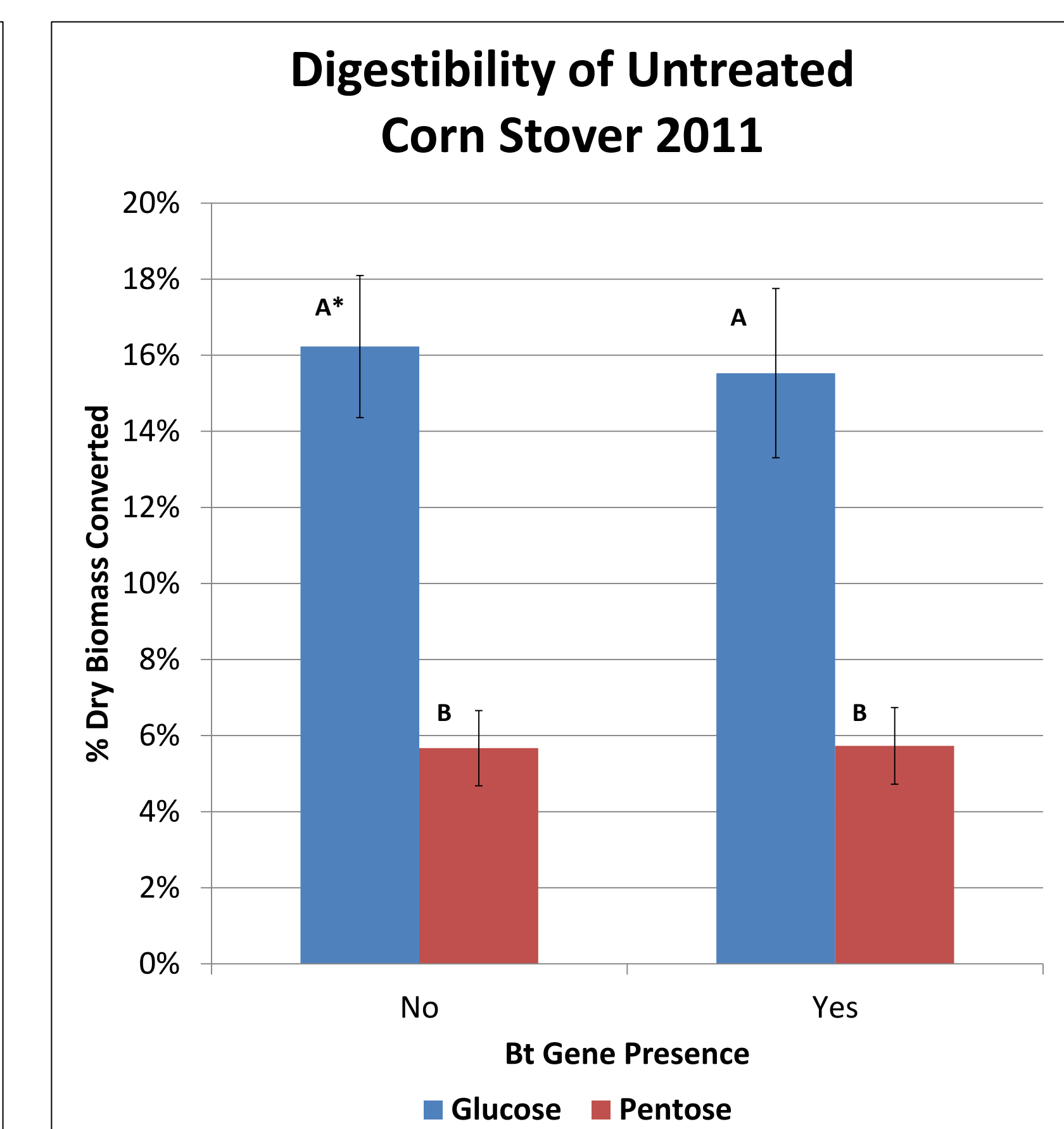
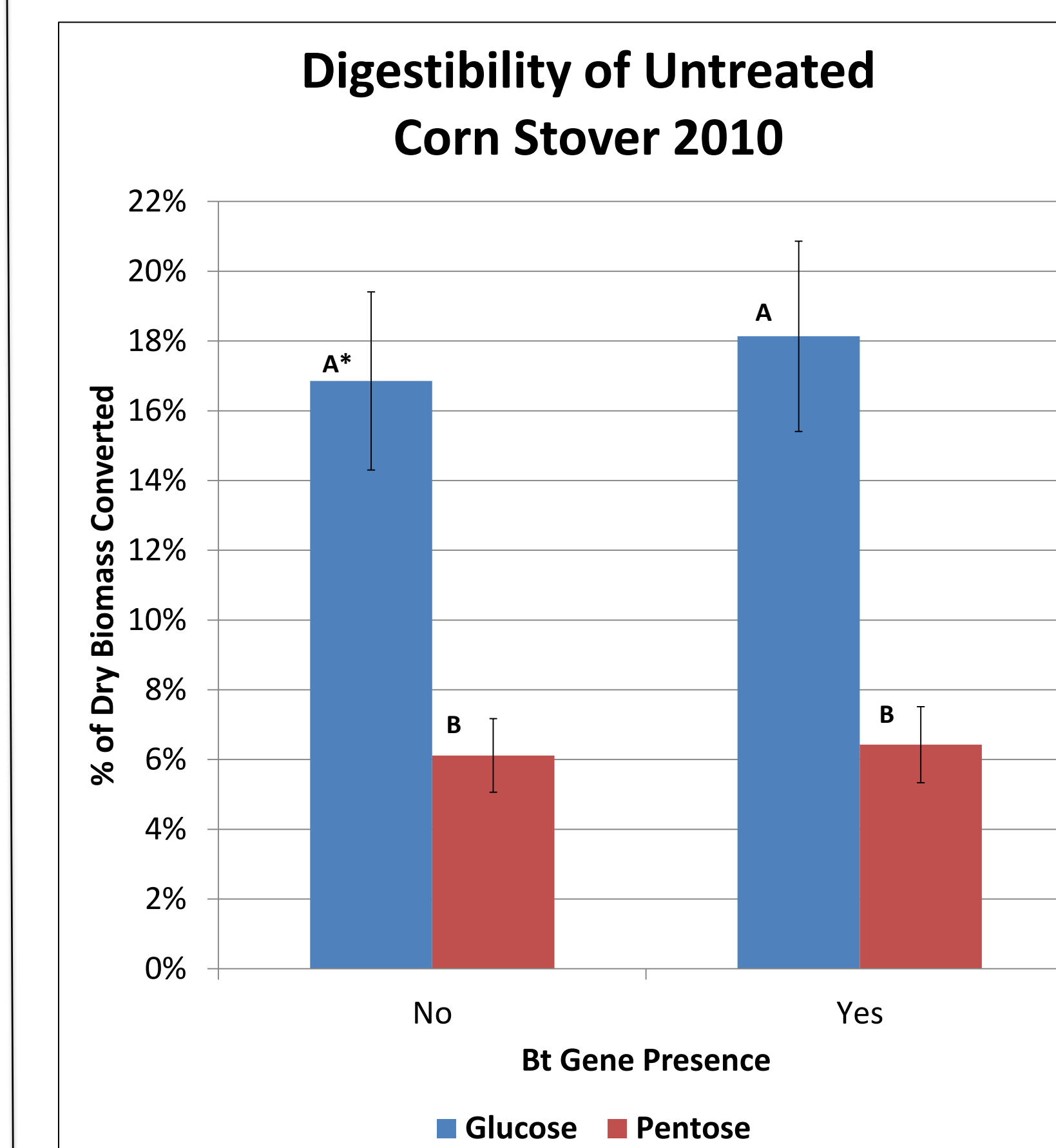
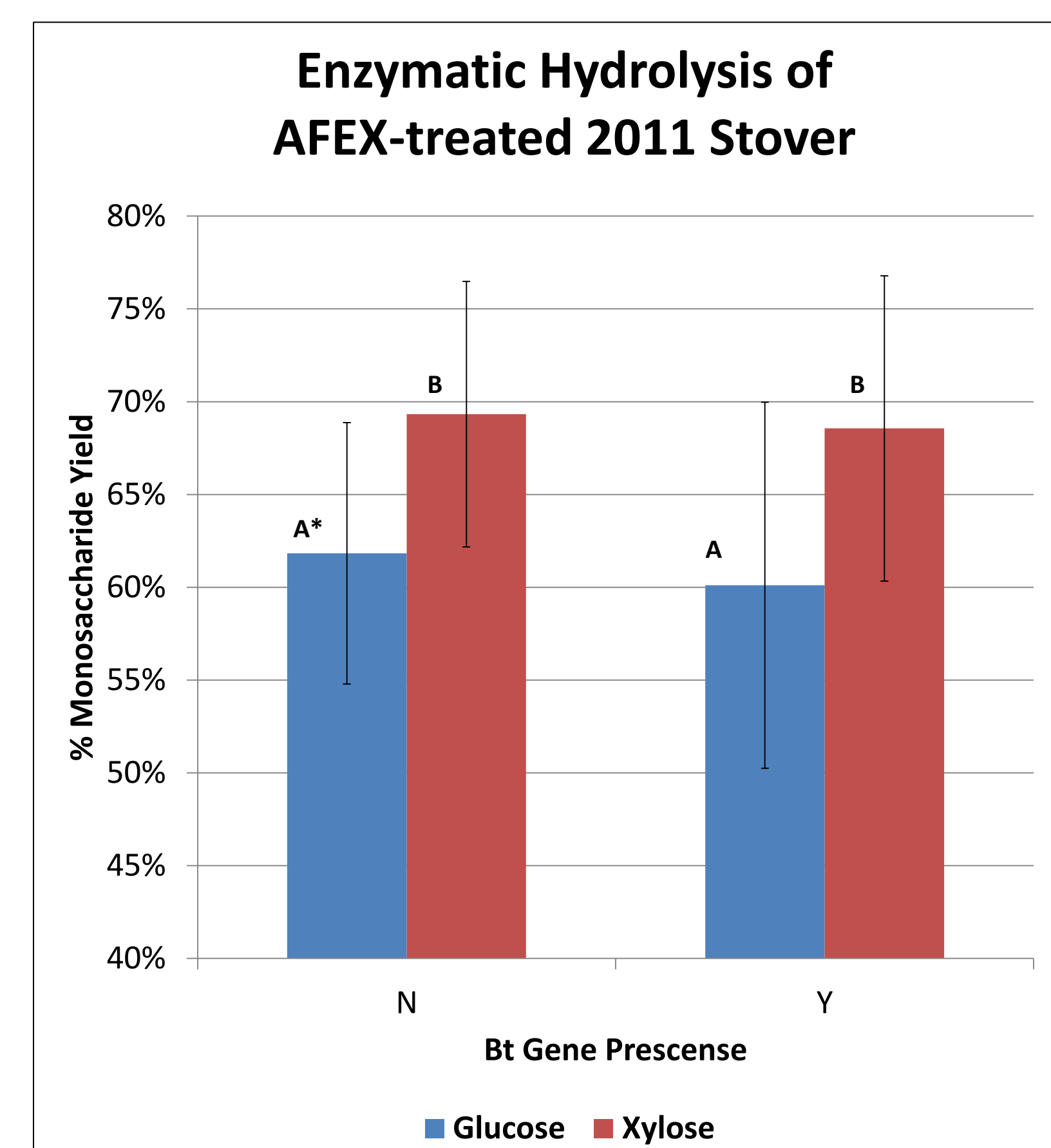
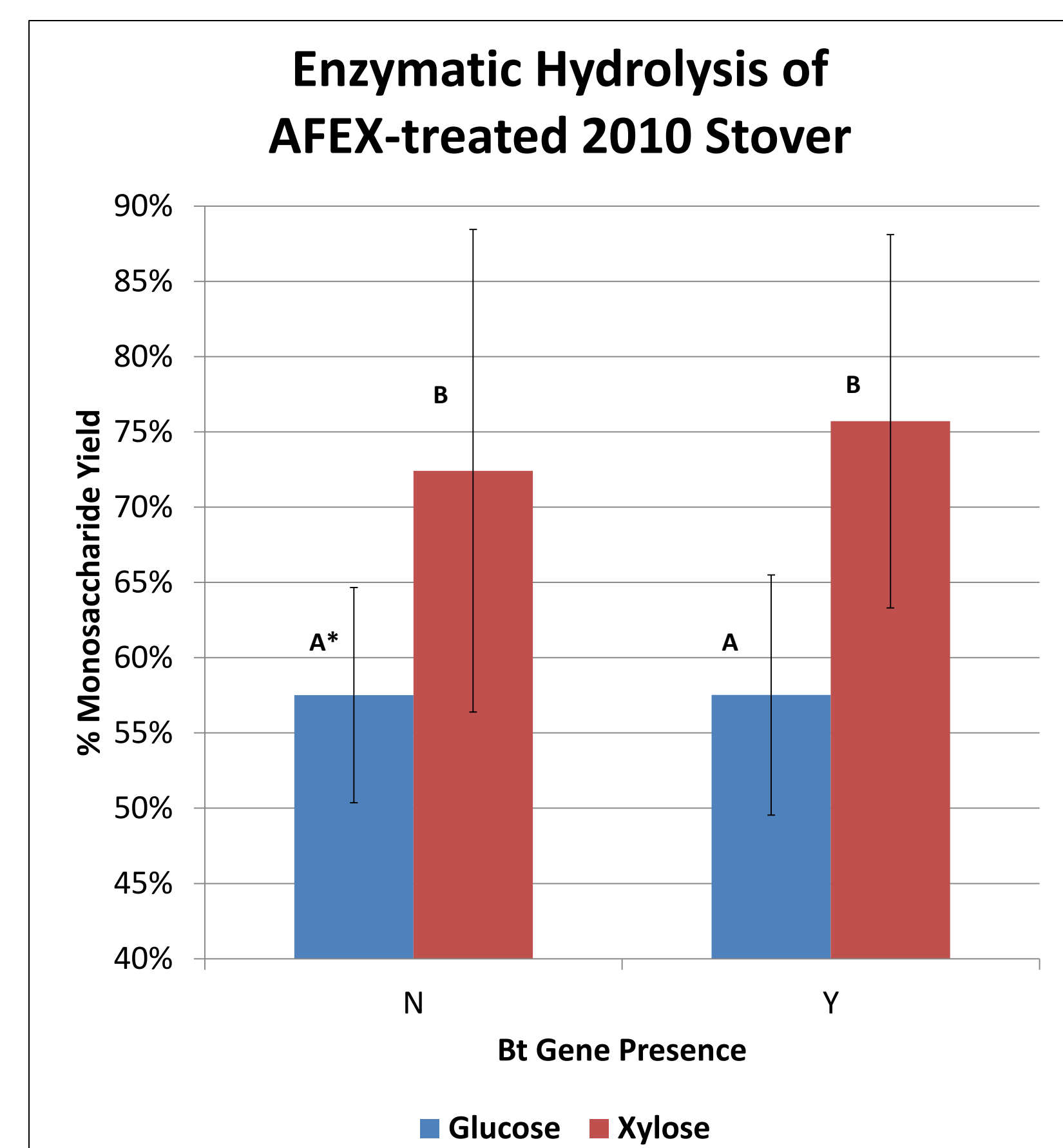
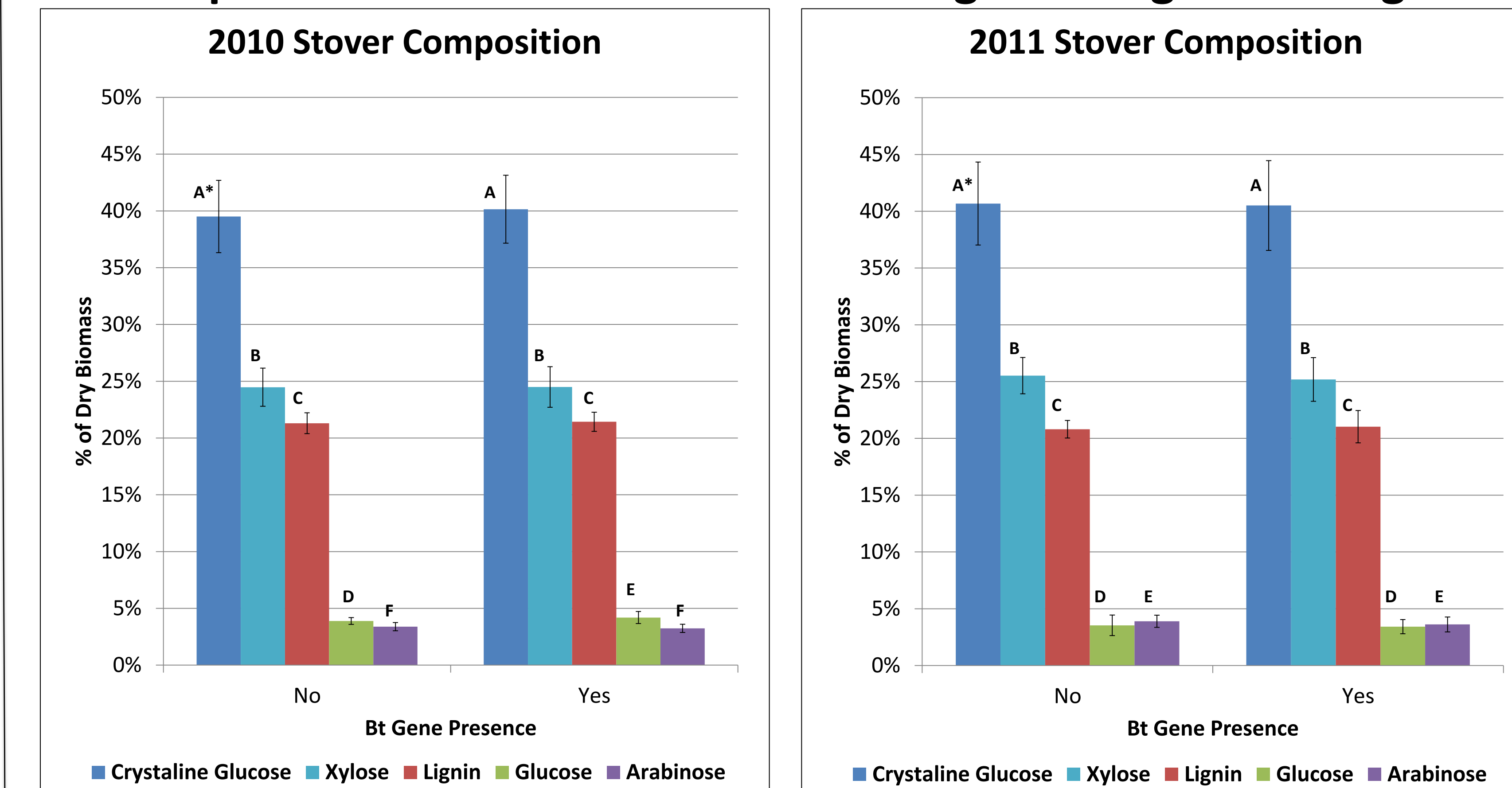
*Effects were considered significant at $P < 0.05$.

- All data were analyzed with the analysis of variance (ANOVA) using the PROC MIXED procedure in SAS.
- Bt trait and isoline pair were held as fixed variables and location and year (environment) was considered random.
- Mean separation between variables was obtained by LSD Test.
- The presence of the Bt Cry1AB & mCry3 transgene in corn stover did not affect the concentration of the important ethanol quality components glucose and xylose.
- Hybrid (isoline pair) had an effect on the corn stover compositional analyses of ethanol quality component glucose and anti-quality component lignin. However, component levels did not vary when stover was subjected to biorefinery simulated pretreatments of weak acid or AFEX followed by enzymatic hydrolysis.
- Environmental effects of location or year did interact with the hybrids studied and affected corn stover compositional levels of glucose and crystalline cellulose, thereby influencing theoretical ethanol yield. Additionally environment interacted with the hybrids studied and affected glucose and pentose levels in biorefinery simulated weak acid pretreatment but not the AFEX pretreatment.

Comparisons of Bt. vs. Non-Bt Corn Using BCRL Protocols



Comparison of Bt. vs. Non-Bt Corn Using Enabling Technologies



References: Banerjee, G., S. Car, J. S. Scott-Craig, M.S. Borrusch, N. Aslam, and J. D. Walton (2010) Synthetic enzyme mixtures for biomass deconstruction: production and optimization of a core set. *Biotechnol. Bioengineer.* 106:7 07-720.
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