Delaware Soybean Board
Forage Soybean Report

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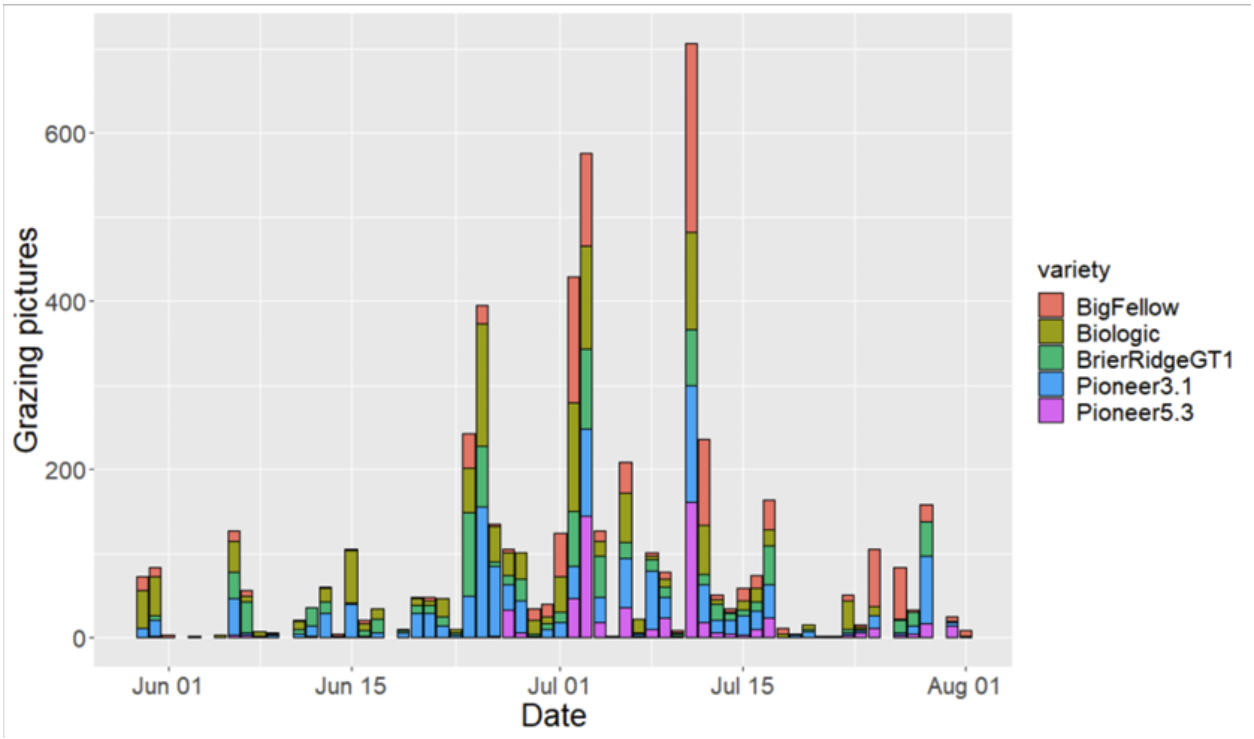
In 2023, we conducted our third year of research on forage soybeans to continue to determine their efficacy in reducing deer damage when used as buffers around crop fields. Although several formal analyses are forthcoming as we prepare a peer-reviewed article on our work, we have a number of results that inform this topic.

Deer activity

Using our current methods, we have not yet been able to identify clear deer preferences for varieties of soybeans, although they may certainly exist. Our data suggests that a deer's preference to graze near the cover of the treeline overwhelmed any preferences for varieties. We also found that deer grazing was highly variable, and correlated with periods approximately 2 days after rainfall. We hypothesize this may be due to new growth on plants and high water content in leaves.

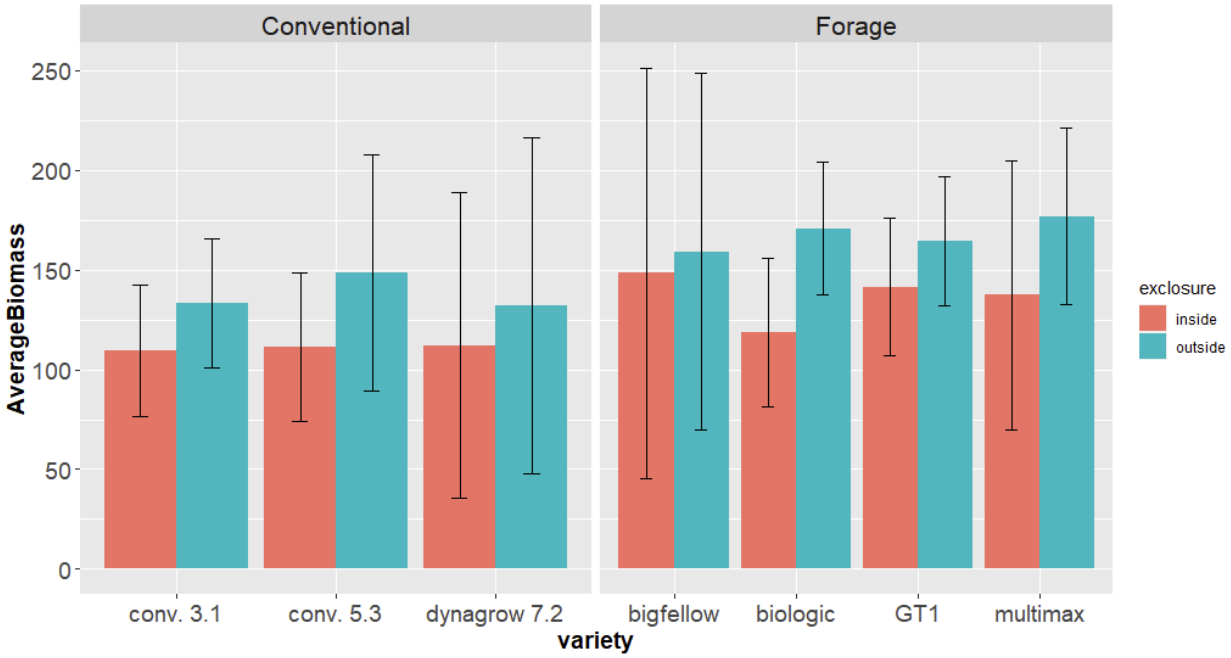


Biomass:

2021 Field season

Biomass differences between conventional and forage soybeans were noticeable, but not statistically significant. We unexpectedly found greater biomass in areas that were grazed with moderate deer pressure. This was likely due to branching effects that the grazing produced.

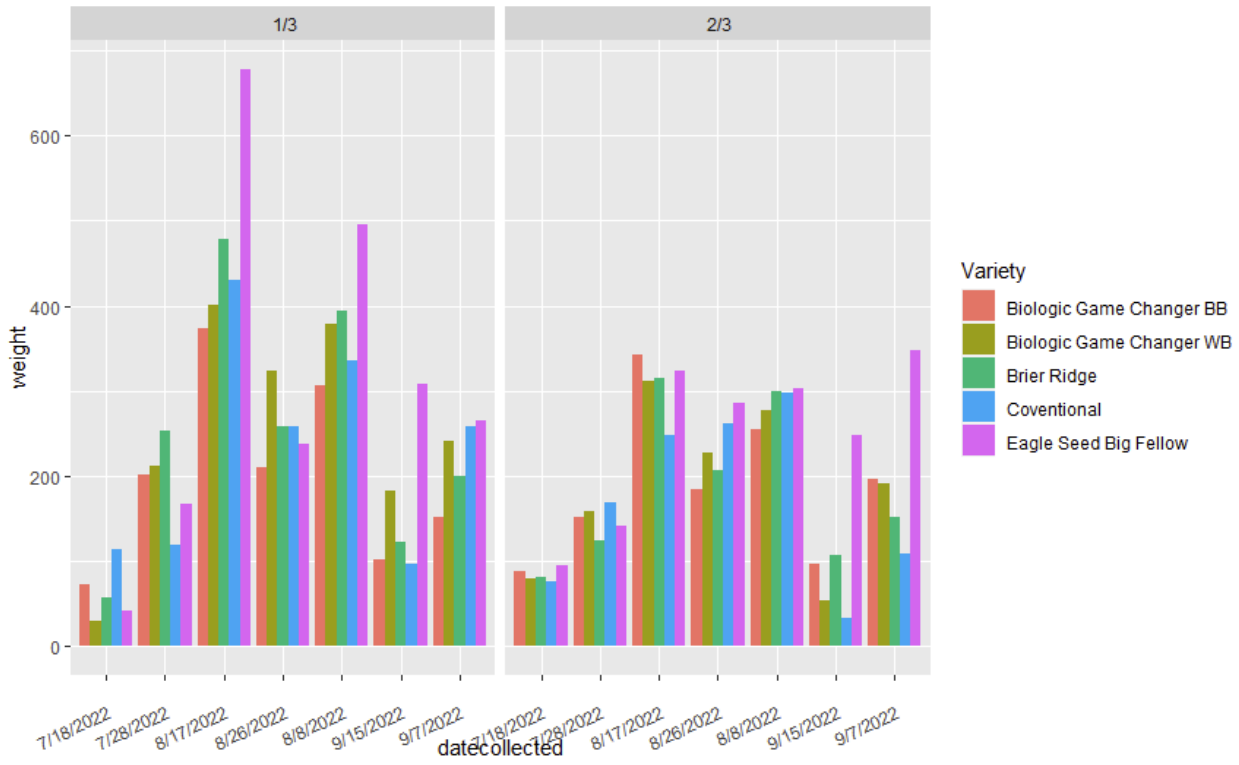
This aligns in some ways with findings from past research on deer grazing on soybeans, which suggested that deer grazing does not harm yields. In the case of moderate to light deer grazing, the soybean plants appear able to grow more vigorously, add additional branches, increase biomass, and potentially increase yield slightly.



2022 Field Season

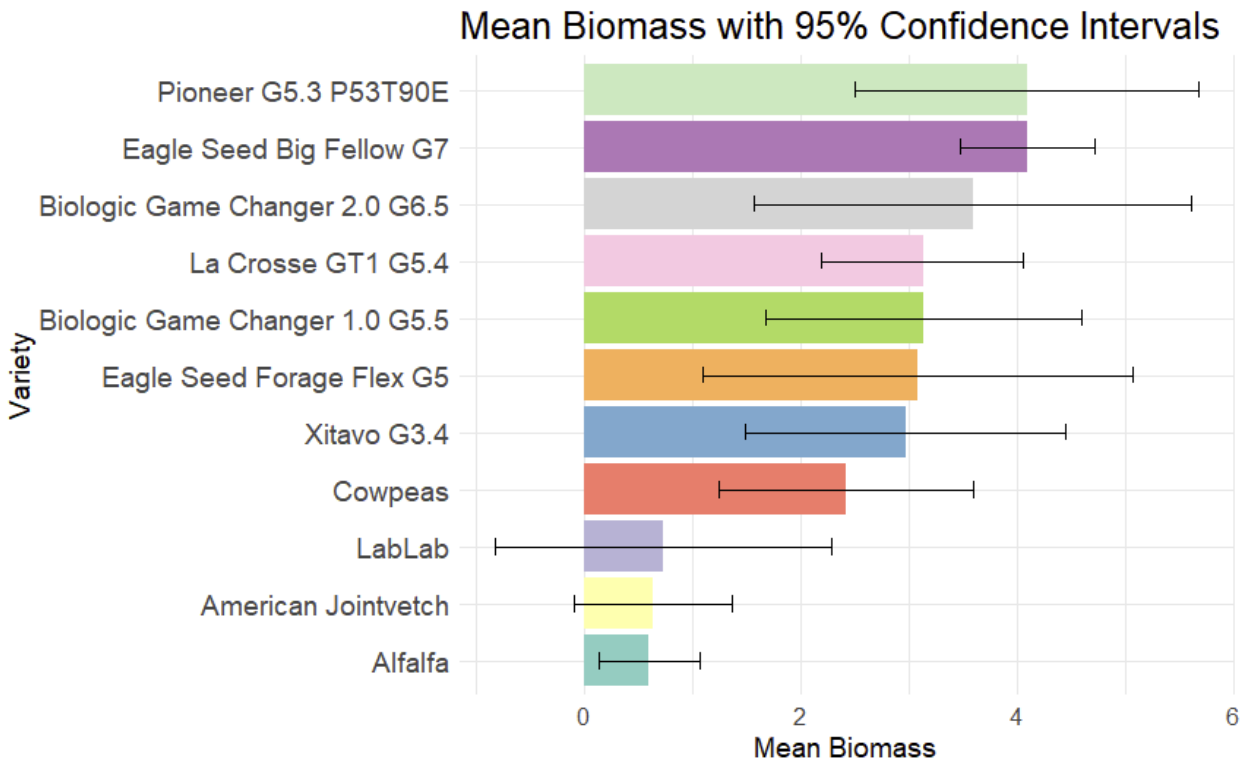
We simulated herbivory in 2022, and measured the biomass clipped off each variety. We clipped one section of approximately ⅓ of its leaves and another section ⅔ of its leaves on seven different occasions during the summer (figure below).

The first clipping on July 18, 2022, severely impacted the future potential of the soybeans for the rest of the season. By July 28, 2023, just 10 days after the clipping the soybeans that had only had ⅓ of their leaves clipped produced more biomass in just that ⅓ of their leaves, than the plots that were getting a a majority (⅔) of their leaves clipped. This suggests that soybeans if grazed lightly in the early season, can survive and even outgrow deer grazing later in the season.



2023 Field Season

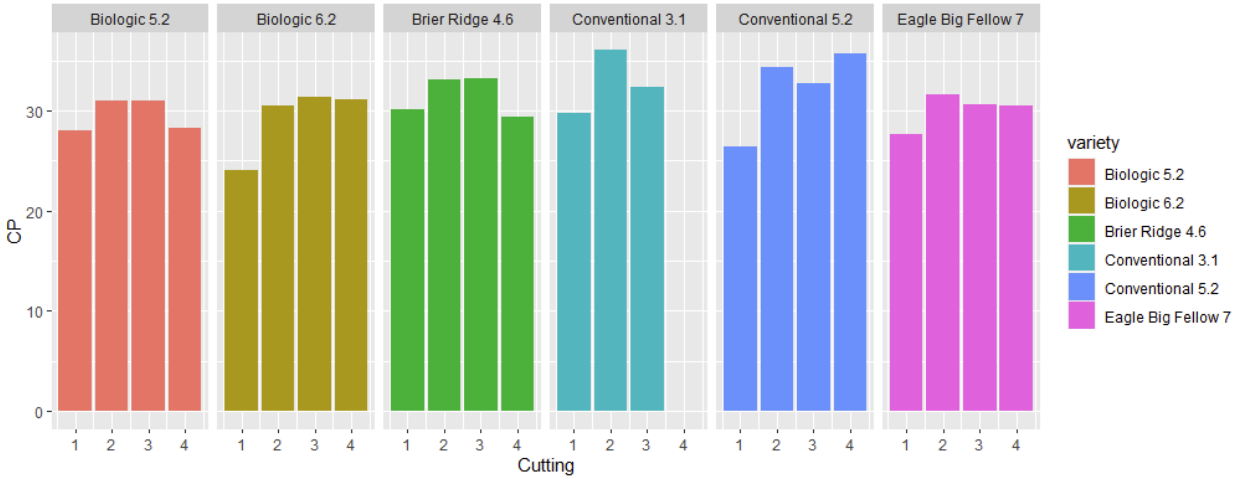
In 2023, we tried a new planting approach, and measured biomass in areas protected from grazing. We found that a conventional group 5 soybean from pioneer produced as much biomass on average as the Eagle Seed Big Fellow varieties, although with greater amounts of variation.



2022 Forage analysis:

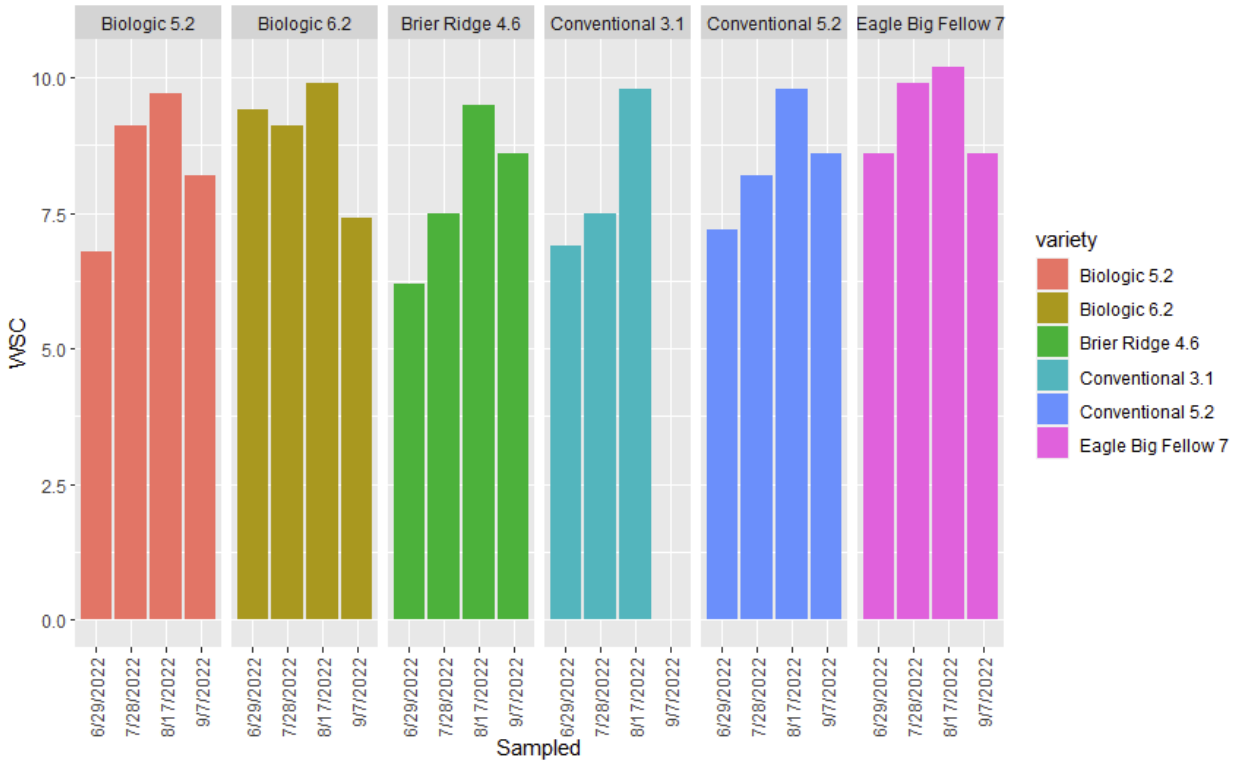
In 2022, we tested soybeans for a variety of forage analysis metrics to see whether they varied significantly between forage soybeans and conventional soybeans.

We did not find strong differences in crude protein:

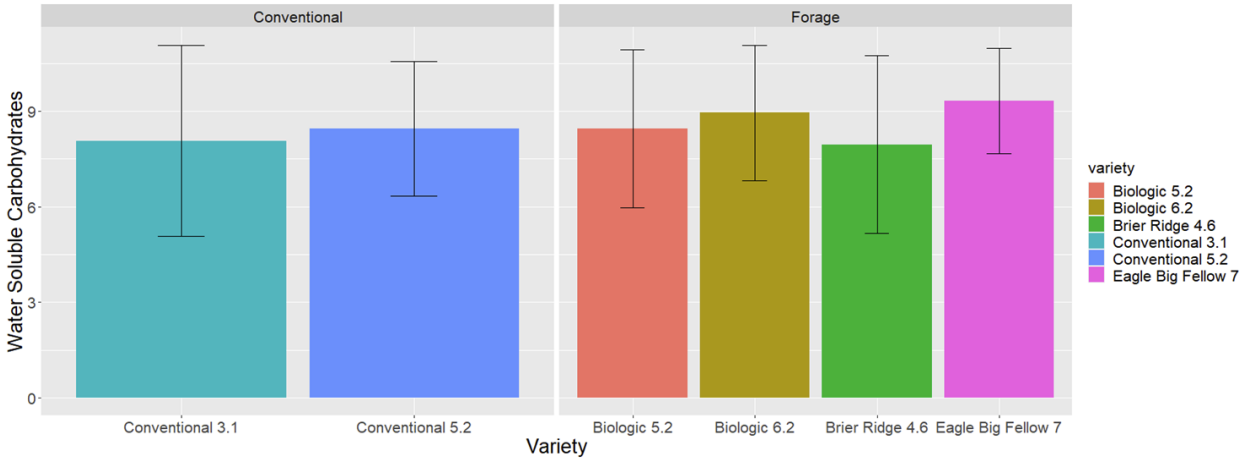


Sugars have been proposed as a mechanism by which deer might be preferring forage soybeans over conventional soybeans. Our results showed small increases in sugars –water

soluble carbohydrates– for the Eagle Seed Big Fellow variety and the Biologic Game Changer 2.0 (brown bag), especially in the early cuttings.



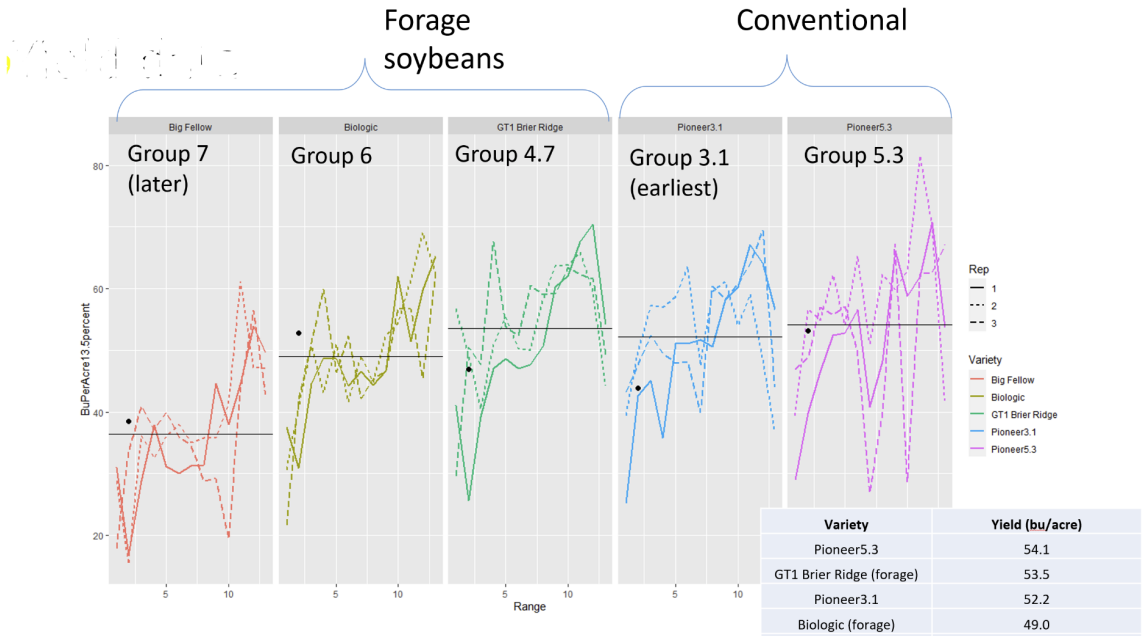
We averaged the sugar content and present them in the figure below to see how they compare across the entire summer (error bars are 95% confidence intervals):



Yield

2021 Yield

Our 2021 yield results revealed that the La Crosse GT! forage soybeans yielded comparably to conventional soybeans, while the Big Fellow variety yielded less than 40 bu/acre.



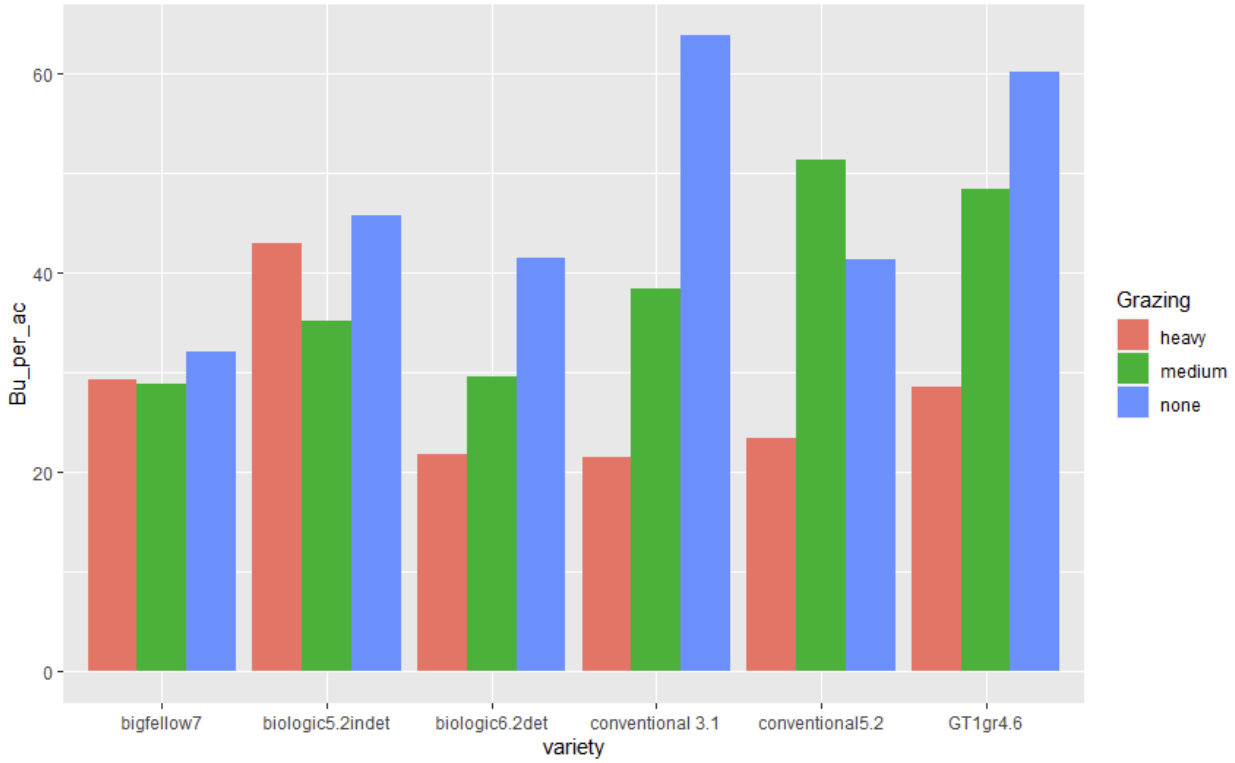
Variety	Yield (bu/acre)
Pioneer5.3	54.1
GT1 Brier Ridge (forage)	53.5
Pioneer3.1	52.2
Biologic (forage)	49.0
Big Fellow (forage)	36.4

2022 Yield & Simulated Herbivory:

We conducted simulated grazing in a controlled deer-proof fenced area to determine how different varieties might respond to grazing pressure. We clipped one section of approximately ⅓ of it's leaves and another section ⅔ of it's leaves on seven different occasions during the summer. A limitation to this result is that we did not replicate our grazing trial and field-level variation and possibly errors associated with accurately harvesting the plots may have affected some of the results.

Of the varieties we tested, we did see that two of the forage varieties were able to maintain yields even under high herbivory, the Big Fellow group 7 and the Biologic group 5. That said the yields for the Big Fellow hovered around 30 bushels/acre. The Biologic group 5.2 appeared to be able to maintain high yields in the face of extreme herbivory, but we recommend caution with this result because of the lack of replication and potential for measurement error to have

affected this result.



2023 Yield

Harvest has not occurred yet.

Demonstration seeds & farmer survey:

We provided demonstration seeds in 2022 and in 2023 and asked farmers if they would pay to purchase forage soybeans themselves in the future. On a scale of 0-10, farmers answered a 7 that it was helpful.

Would you pay to purchase these soybeans for yourself to reduce damage in the future? These wer... 6

Would you pay to purchase these soybeans for yourself to reduce damage in t... ↑	Average	Minimum	Maximum	Count
Biologic, Game Changer both maturity groups @ $80/bag	7.00	0.00	10.00	5
Eagle Seed, Big Fellow @ $77/bag	7.00	0.00	10.00	5
GT1 Brier Ridge: $50/bag	7.00	0.00	10.00	6

Discussion

In summarizing the multi-year forage soybean research supported by the Maryland Soybean Board, the effectiveness of forage soybeans as an effective buffer to deter deer damage remains tentative. Although methods are limited in our study to the use of trail cameras that may not accurately capture deer activity in different plots, clear preferences by deer for specific soybean varieties have not been established, suggesting that factors such as proximity to cover may play a more significant role in deer grazing habits.

Biomass measurements from different field seasons have provided insights into grazing and plant vigor. We found evidence to suggest that moderate deer grazing could potentially lead to compensatory growth in soybeans. We also found that protecting soybeans early in the growing season from heavy grazing can result in the growth of much more biomass in mid-summer, which can outgrow deer appetites. Interestingly, we found in 2023 that the biomass of a conventional Pioneer group 5.3 soybean matched that of Eagle Seed Big Fellow variety.

Forage analyses and yield results also offer a mixed picture. While there may be minor increases in sugar content and crude protein for certain forage soybean varieties, the differences seemed relatively minor and cast doubt on significant preferences that can be revealed through forage analyses. Yield data indicates that some forage varieties can maintain production under high grazing pressure; however, concerns about the replicability of these findings and the potential for measurement errors must temper any conclusions drawn.

Yield analyses from previous years indicate that while some forage soybean varieties can perform comparably to conventional ones under grazing pressure, variations in yield and the complex nature of deer grazing effects on soybeans highlight the need for further research.

Farmers had an overall positive perception of forage soybeans' utility ranking as a 7 on a scale of 0-10, which does provide some encouragement for their future application. Still, the survey results should be interpreted with caution due to the subjective nature of such assessments, low sample size, and confirmation bias.

One component of forage soybeans that may warrant further study or explain the efficacy that farmers see is the role of later maturity group soybeans to draw deer away from earlier maturing varieties even in the middle of summer. Our methods were limited in their ability to detect this behavior, but it could very well be occurring outside our ability to measure it using the methods available. A future study could place GPS collars on a large number of deer and then track with much greater precision where each deer is spending its time, which may reveal preferences we were not able to do using trail cameras.

A final note about the use of the term “forage soybean.” In most cases we found differences in the characteristics of forage soybeans to conventional soybeans. Usually, they are characterized by long viney growth patterns that often lodge in mid-summer. However, some

soybeans marketed as “forage soybeans” sometimes appear to simply be conventional soybeans marketed as forage soybeans.

Preliminary Conclusions and Recommendations

After 3 years of work on forage soybeans, I would recommend different approaches to using soybean buffers depending on a few factors, especially focused on herbicide traits, and timing of hunting programs:

Because deer did not appear to prefer any soybeans over another, my recommendation is to focus on high-biomass producing soybeans that will feed a greater number of deer. In 2023, we found that a conventional Pioneer group 5.3 soybean, was able to match Eagle Seed’s Big Fellow forage soybeans in biomass production

- If a farmer has weed issues that require herbicides beyond glyphosate, I would recommend a conventional group 5 soybean, which can produce high biomass, be resistant to additional herbicides, and produce a high yield.

- If a farmer is interested in using a soybean buffer as part of a lethal control or hunting program that includes a heavy focus on early hunting in September, I would recommend the latest maturity group variety available. In the soybeans we studied, Eagle Seed has a high biomass producing forage soybeans that will stay green partway into the second half of September which aligns with the early archery hunting season in many places, and may draw deer into the field for that. Note: other food plot species stay green later into the season, including cowpeas and lablab, but I am not aware of any commercially available varieties with herbicide resistant traits, limiting farmers to grass-selective herbicides for weed control.

- If farmers want to use an unharvested soybean buffer as a food-plot attractant for a lethal control or hunting program later in wintertime and are not interested in early season hunting, I would recommend a group 5 high-yielding and high-biomass-producing conventional soybean.

- If a farmer is interested in hunting in both early season and late season, and glyphosate tolerant varieties are sufficient, I would consider a mix of conventional and forage soybeans to achieve green forage in the early season, and a good yield of soybeans in winter.