# Using LiDAR to Track Soybean Canopy Development under Weed Competition

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## Introduction

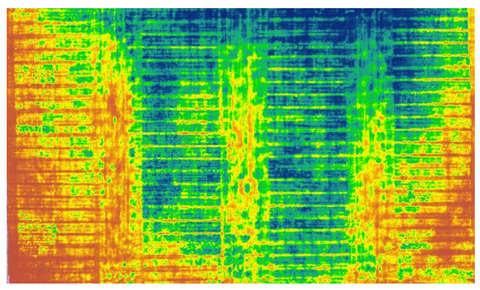
- Soybeans are a relatively uncompetitive crop due to their long vegetative growth cycle
- Weed pressure can reduce soybean yield up to 50% in prairie environments
- Adjusting management practices has the potential to reduce losses from weeds however, results are difficult to quantify
- Can we utilize remote sensing to track crop development under weed pressure?

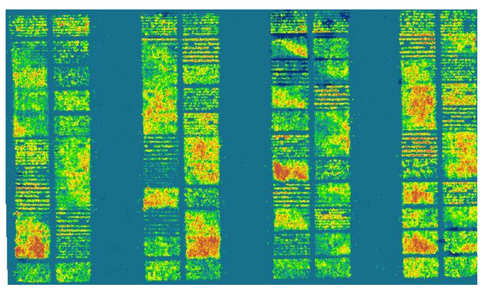
## Objective

**Determine how LiDAR can be used to evaluate the effect of best management practices on weed suppression in soybeans.**

## Methods

- Trial completed over the 2025 and 2026 growing seasons in Carman MB
- Three seeding rates (80, 160, 240k seeds/ac); three row spacings (7.5in, 15in, 22.5in) and two weed conditions (weedy vs weed free)
- LiDAR flights aligned with weekly biomass and height measurements taken on the ground.
- LiDAR metrics (90$^{th}$ percentile heights, canopy volume) extracted in CloudCompare and ArcGIS
- Analysis completed in R Studio using a mix of linear modelling, ANOVA, and marginal means comparison





## Results

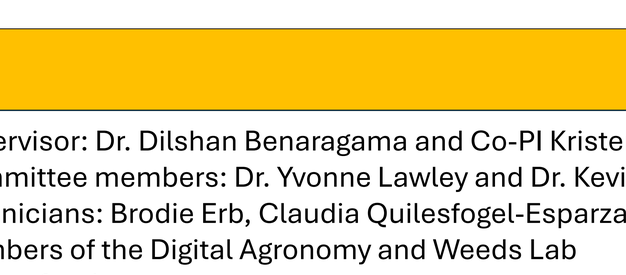



**Fig 1.** Regression of Week 7 crop height on Week 9 LiDAR height by weed condition.


**Fig 2.** LiDAR derived ground cover development between weeks 3-9 after seeding split by treatment combinations.

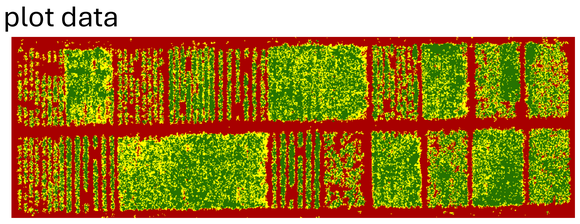

**Fig 3.** Yield loss per individual weeds in each treatment combination.

## Conclusions

- LiDAR tracked canopy height development over time and demonstrated the decline in crop height under weed conditions (Fig 1) indicating LiDAR effectively tracked the growth penalties under weedy conditions.
- LiDAR derived ground cover effectively separated treatment combinations and relative canopy closure (Fig 2)
- Yield loss under weed pressure was reduced more by increasing seeding rate than by narrowing row spacing, indicating seeding rate as the more effective management strategy in this study. (Fig. 3)
- **Overall, LiDAR provided sensitive, plot-level indicators of weed competition effects and management differences, supporting its use for in-season evaluation of soybean weed management strategies.**

## On-Going and Future Work

- Second Field season
- Object-based segmentation approaches are being utilized to isolate crop rows and improve relationships with weedy plot data



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