Hail Damage Recovery in Soybeans

Comparing small-plot research results with in-field reality

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HAILSTORMS WERE SPORADIC and localized this season. While hail claims are still being processed at the time of writing this, roughly seven per cent of soybean acres were damaged by hail this growing season, above the usual average of five per cent. Soybean acres in the Central region were impacted the most, affecting 50,000 acres and damage recorded in Eastern, Interlake, and Southwest regions ranged from 14,000 to 15,000 acres.

SMALL-PLOT RESEARCH

The first comprehensive dataset evaluating the impact of simulated hail damage on soybean yield and maturity was developed for Manitoba. In this research, conducted by Kristen MacMillan, MPSG-UM Agronomist-in-Residence at the University of Manitoba, both defoliation and stem breakage were assessed in small-plot experiments at Portage and Minto from 2015 to 2018.

Results from this research, shown in Figure 1, indicate that short-season soybeans grown in Manitoba respond and recover differently than soybeans grown in regions farther south. Yield loss is both overestimated and underestimated at different growth stages and hail severities. The impact on maturity is also an important consideration, with severe amounts of stem breakage resulting in an 8-14 day maturity delay and severe amounts of defoliation causing a 3-4 day maturity delay.

Within each chart and soybean growth stage, bars followed by different levels are significantly different at $p<0.05$.

Full results from these comprehensive experiments may be found and explored in the annual reports available at **www.manitobapulse.ca/research/agronomist-in-residence/.**

Here, let's compare these results to a scenario we witnessed in the field this past growing season.

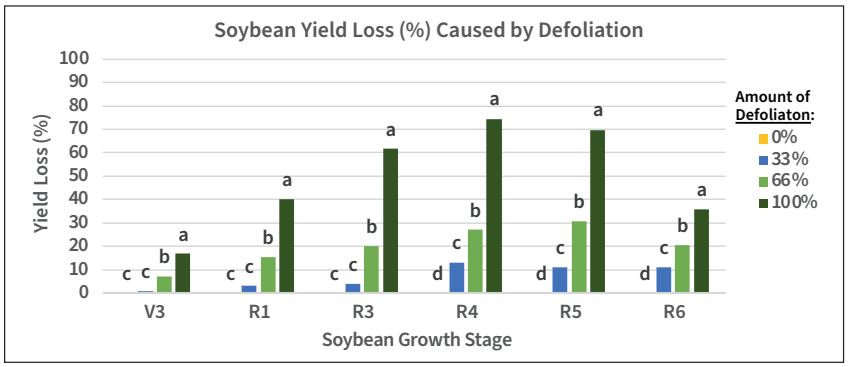
In The Field

Like many fields this summer, one of our On-Farm Network soybean trials was caught in the crosshairs of a hail and thunderstorm in late June. This trial received hail on June 28 and assessments of damage were made the following day.

These soybeans, which were flowering (R1-2) at the time, were left with one, two, or no trifoliate leaves remaining per plant, and one to two nodes were broken off at the top of the plant. Damage was fairly even throughout the field. Comparisons made to healthier plants near the shelterbelt estimated damage as 66 to 100 per cent defoliation and 20 to 40 per cent node removal/stem breakage on average. Luckily, very little plant stand loss was observed in the field, and plant stand remained at roughly 160,000 plants/ac.

What should we expect from this field moving through the rest of the growing season? To answer that question, we turned to the research.

On average, losing two-thirds of the leaves at R1 resulted in 16 per cent yield loss, while complete leaf loss caused 40 per



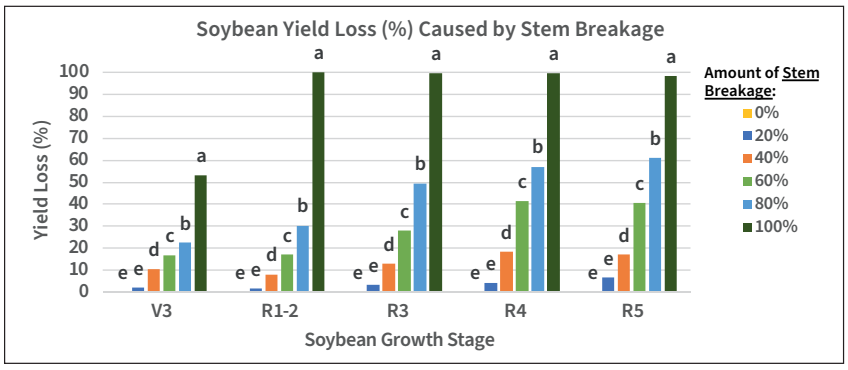


Figure 1. Average soybean yield loss (%) for varying defoliation (top graph) and stem breakage (bottom graph) severities at different soybean growth stages. (MacMillan, 2023).

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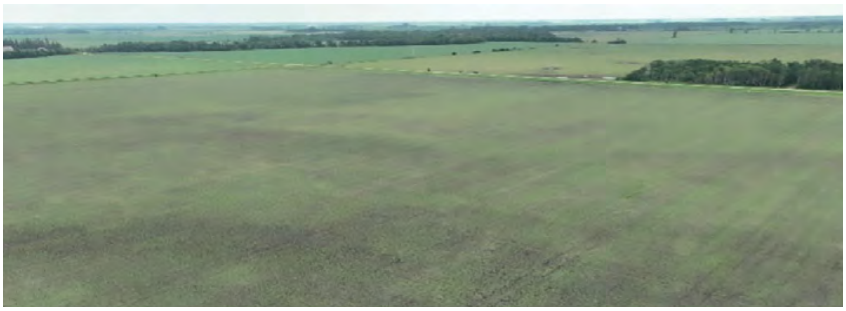

Soybeans the morning after a hailstorm on June 29 with few leaves remaining and broken stems. Photo credit: Laura Schmidt

cent yield loss in the small-plot research conducted at southern Manitoba sites. For stem breakage at R1-2, losing one node (20 per cent breakage) resulted in two per cent yield loss and eight per cent yield loss when two nodes were broken (40 per cent breakage). Add these numbers together, and we could anticipate yield losses of 18 per cent to 24 per cent for least damaged areas, and losses as high as 48 per cent for those beans hit the hardest.

The field was saturated following the storm, but there was no ponding water. Stems were partially shredded and there were concerns of diseases that might set in those open wounds. Another pass was made with the sprayer a few days following the storm to manage weeds like volunteer canola that had taken advantage of the extra room and sunlight to grow. With a wide-open crop canopy, the disease risk was ultimately deemed quite low.

Revisiting this field throughout the growing season showed the impressive capacity soybeans have to compensate in their growth through branching, number of pods per plant, and the number of seeds within those pods. On July 10, 13 days after the storm, soybeans in the field had reached R3 and regrowth was evident.

By mid-August, the crop canopy was thick with leaves, and plants were full of branches at R5-6. The only downsides were that these beans were about 12 to 14 inches tall and late-emerging weeds had taken advantage of those open spaces and the uncompetitive crop.

In terms of maturity, it looked like these hail-damaged soybeans were about 7 to 10 days behind other beans in the area. As the season progressed, that maturity delay became more apparent. Using the small-plot research results, based on the timing of hail and the severity of damage, roughly an 8 to 10 maturity delay would have been expected.

Come early September, plants were at R6.5 with 37 pods per plant and 2.7 seeds per pod, on average. Previous research by Kristen MacMillan has also outlined average yield components for Manitoba soybeans, finding 29 pods per plant and 2.3 seeds per pod on average. These hail-damaged soybeans compensated for the damage, in part, by increasing these two yield components.

A couple of weeks later and these soybeans needed some pre-harvest weed control. Heat and glyphosate were applied to manage the increased weed pressure. The field was harvested on October 19 at 15.5 per cent moisture, after some weather and equipment delays.

The million-dollar question, how did yields compare at the end of the season to yield-loss estimates?

The average soybean yield for the last five years in that region has been 34 bu/ac, according to MASC data. Estimating a whole-field average yield loss of 18 per cent to 24 per cent, we'd expect 26 bu/ac to 28 bu/ac out of this field. On the whole, the crop averaged roughly 42 bu/ac, with the on-farm trial area of the field pulling off an average 51 bu/ac. Oddly enough, that works out to 24 per cent above the area's yield average.

We wouldn't expect this scenario in every field or every year. Stars aligned for excellent soybean yield potential despite

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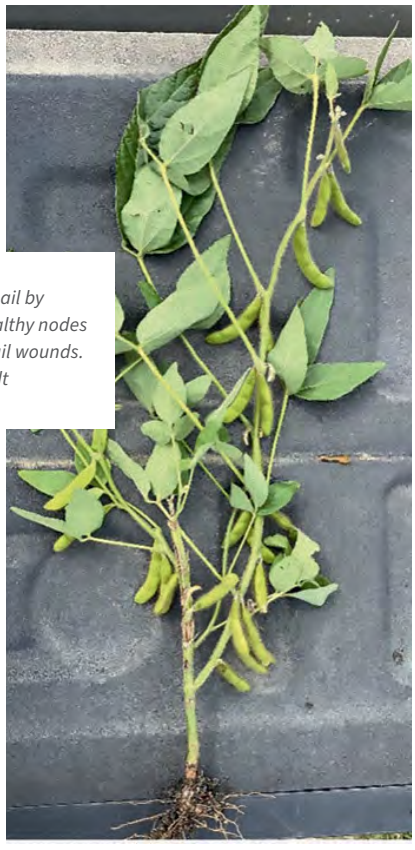
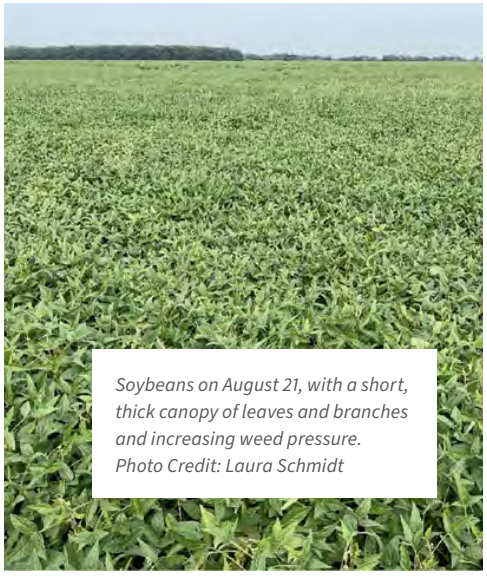
Soybean regrowth on July 10, two weeks after the storm. Photo Credit: Laura Schmidt



Soybeans recovered from hail by growing branches from healthy nodes and formed scabs under hail wounds. Photo Credit: Laura Schmidt



Soybeans on August 21, with a short, thick canopy of leaves and branches and increasing weed pressure. Photo Credit: Laura Schmidt

Hail-damaged soybeans on Sept. 8 had 37 pods per plant and 2.7 seeds per pod, on average. Photo Credit: Laura Schmidt

Weeds took advantage of the extra open space and sunlight in the field throughout the season. Photo Credit: Laura Schmidt

the hail damage. But this does showcase an impressive ability for soybeans to recover from damage at flowering.

Two other on-farm trials, near Elm Creek and St. Pierre, also received moderate to severe hail damage in early August when soybeans were at R5. We didn't follow those fields as closely throughout the season, but hail assessments were made. Near Elm Creek, 30 per cent defoliation was noted, along with some stem breakage. That trial averaged 40 bu/ac at harvest. And at St. Pierre, 75 per cent defoliation was noted, and the field averaged 19 bu/ac. At that site, moisture was a limiting factor for most of the season, impacting yield potential and plant recovery after hail.

MPSG's On-Farm Network strives to bridge the gap between applied small-plot research and the realities of what occurs at the field scale on farms across Manitoba. Hailstorms this season provided a unique opportunity for us to take a closer look at this research data on a broader scale. ■