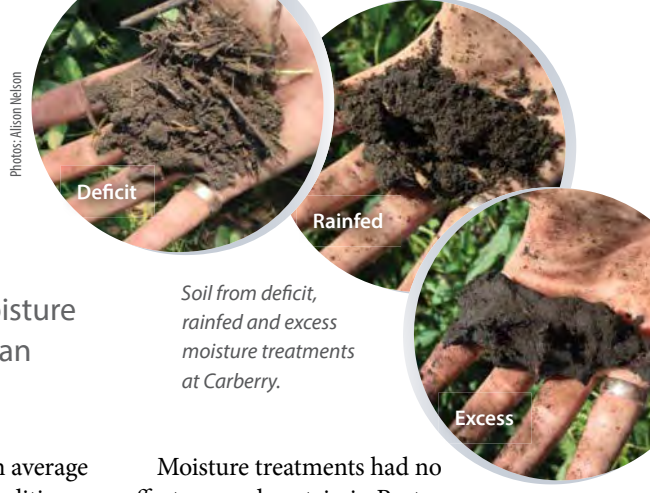
Soybean Performance Under Different Moisture Regimes

Established soybeans are relatively tolerant to excess moisture conditions, but late-season water deficits reduced soybean yields by 16–32%.



Soil from deficit, rainfed and excess moisture treatments at Carberry.

SOYBEANS, LIKE ALL crops grown in Manitoba, may be subject to moisture conditions ranging from deficit to excess. Moisture can vary not only among years, regions and fields, but also within a given year, growing region or field. While practices such as irrigation and drainage may be used to manage moisture extremes, it would be advantageous if simpler agronomic practices such as variety selection could be employed to reduce the effects of moisture extremes on crops.

On-farm experience in Manitoba suggests that soybeans are relatively tolerant of excess moisture compared to other commonly-grown crops, while research from the United States suggests that variability exists among soybean varieties in their response to moisture. The aim of this study was to determine if variability existed among soybean varieties with respect to disease, growth and yield, in response to moisture stress.

Established soybeans were relatively tolerant of excess moisture conditions. Soybeans grown under excess moisture consistently yielded the same as (in four of six site-years) or better than (in two of six site-years) rainfed conditions (Figure 1). This occurred even though excess moisture treatments had received substantially more water during July and August than rainfed treatments (108 to 450 mm more water at Portage, and 273 to 779 mm more water at Carberry, depending on the year) and had been irrigated to the point that chlorosis became evident in the soybean crop.

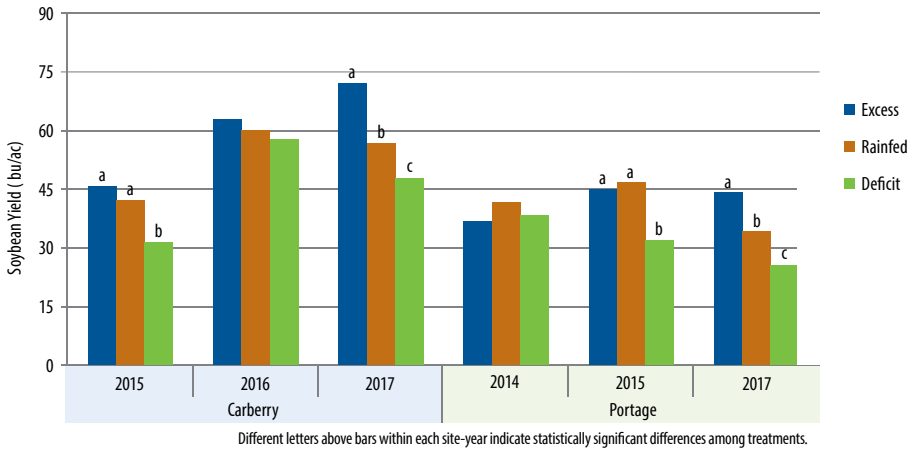
Soybeans were comparatively less tolerant of later-season moisture deficits. Withholding moisture later in the growing season (July through fall) reduced soybean yields in four of six site-years by an average of 16–32% compared to rainfed conditions (Figure 1). Those deficit treatments received between 24–45% of the rainfall in rainfed treatments.

While there appeared to be some evidence varieties differed in their yield responses under different moisture regimes, effects were not consistent among site-years. Therefore, among the varieties tested, no varieties emerged as superior in performance across contrasting moisture conditions. Plant stress in this study, whether in the form of moisture deficit or excess, was associated with increased soybean root rot. However, while there were cases in which lower soybean yields were associated with greater root rot severity, these effects were not consistent. This suggests that factors other than root rot contributed to the yield differences observed.

Moisture treatments had no effect on seed protein in Portage in any year. However, at Carberry in all years, seed protein concentration was highest in the excess moisture treatment. Excess moisture also resulted in lower oil content in five out of six site-years.

There exists the potential to explore this dataset further, to determine potential linkages between detailed soil temperature and moisture data collected over the course of the growing season, the incidence and severity of soybean root rot, and soybean yield and quality. This dataset is unique for Manitoba, as it includes a range of varieties with varying degrees of susceptibility to soybean root rot that were grown in the same field and under the same conditions, but exposed to different moisture stresses. Together, this information may contribute to a better understanding of factors driving root rot and yield under Manitoba conditions.

Figure 1. The effect of three moisture regimes on soybean yield in Carberry and Portage la Prairie from 2014–2017.



Different letters above bars within each site-year indicate statistically significant differences among treatments.

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MPSG INVESTMENT $94,789

CO-FUNDERS *Growing Forward 2* Growing Innovation: Agri-Food Research and Development Initiative

DURATION 4 years