Correlation between NDVI and canola yield: Usefulness of imagery tools to producers

Measurements of early crop vigor have been reported using various methods: biomass, vegetation indices (VI), visual observations, digital image analysis (Regan et al., 1992; Adamsen et al., 1999; Tesfamariam et al., 2010). Normalized difference vegetation index (NDVI) is the most widely used VI, as it used to monitor and assess canopy characteristics including biomass accumulation, stress and plant vigour (Moges et al. 2004; Freeman et al. 2007; Xue and Su 2017). NDVI can be measured quickly and with relatively inexpensive equipment like the GreenSeeker® (N Tech Industries Inc., Ukiah, CA, USA). The GreenSeeker is a ground active optical sensor that can provide fast and accurate field measurements. NDVI, along with biomass accumulation, has been used to calibrate the FAO AquaCrop model for predicting yield in canola (Zeleke et al., 2011). Others studies have reported strong correlations between NDVI and grain yield in different crops (Ma et al. 2001; Raun et al. 2002; Teal et al. 2006). Currently, producers are keen on utilizing modern technologies in order to make informed economic decisions on their farms, and technology such as the GreenSeeker® can be readily accessible to producers.

This demonstration was conducted at the AAFC Scott Research Farm in spring 2017 growing season. A randomized complete block design with four replications was used. There were six treatments (NDVI measurement timings) (Table 1). Fertilizer was applied at recommended rates according to soil test results. Pesticides were also applied as and when they were required. All the plots were straight-combined using a wintersteiger plot combine after desiccation with a registered desiccant at the recommended product rate. The grains were cleaned and corrected to the required moisture of 10%. The objective of this trial was to demonstrate to producers the optimal timing at which NDVI readings should be taken in canola (*Brassica napus* L.) to maximize the correlation with yield.

Table 1: Demonstration treatment list for 2016 and 2017 growing seasons

Treatment	NDVI measurement timings
1	2-3 leaf stage
2	4-6 leaf stage
3	Bolting stage
4	Before flowering
5	Full flowering (100 % bloom)
6	End of flowering (no visible petals present)

NDIV as a measurement of plant vigour was conducted at six developmental stages (2-3 leaf, 4-6 leaf, bolting, before flowering, full flowering and end of flowering). This study shows that the four to six leaf stage was the optimal timing to perform an NDVI measurement. At this stage, a strong positive correlation between NDVI and yield was observed (r >0.9) (Figure 1). This could be due to the active plant growth and canopy closure that occurs at the four to six leaf stage. A weak positive correlation was detected at the two to three leaf stage between NDVI and yield. This could be attributed to a smaller plant size at this developmental stage. After bolting and once the plants start transitioning to the reproductive stages the correlation between NDVI and yield becomes negative. This negative correlation is attributed to plant maturity. The results of the study concluded that the period from 10 to 30 July is the optimal time to relate spectral images to grain yield of spring-seeded crops that reach physiological maturity in August.

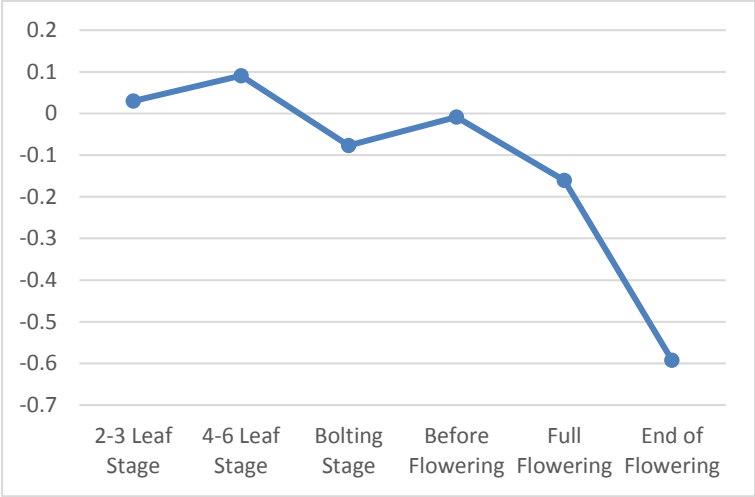

Figure 1: Correlation between NDVI and yield at six different crop stages throughout the growing year

The results from this trial provided some insights regarding the optimal developmental stage to measure NDVI to accurately predict yield. Based on the results, we concluded that the four to six leaf stage is the most accurate yield indicator in canola. We recommend continuing to monitor fields, as external factors such as insects and diseases, among others, can negatively affect final yield. NDVI should be used as a valuable tool to make management decisions rather than solely a yield predictor.

Full report at:

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