Comparing aerial imagery resolution from different sources to identify in-crop variability in HRS wheat La Riviere, 2018

Background
This Hard Red Spring wheat field was seeded May 7 with the cultivar AAC Brandon at a rate of 146 lbs per acre aiming for a plant population of 32 plants/ft². A 90 lbs/a base rate of nitrogen was applied at seeding as a side band from the seed row, 60 lbs/a nitrogen was top dressed as a dribble band using liquid formulation at stem elongation stage and 30 lbs/a was applied as a post anthesis treatment. A field scale trial was setup to evaluate the effectiveness of applying a fungicide at different timing to control Fusarium Head Blight. The treatments were replicated and applied using the operator’s equipment. Untreated check were compared to early anthesis (standard) timing and another delayed by 3 days.

Imagery capture
Aerial imagery was captured by satellite, plane and fixed wing drone providing different resolutions while using different light spectrums (Red, Red Edge) with the hope of visualizing the treatments applied as the crop progressed to maturity. Having different resolutions provides a visual comparison to evaluate what level of resolution is sufficient to identify in-season variability within the field.

Figures 1. And 5. Show RGB and NDVI imagery of 50 cm/pixel resolution using a plane. The fungicide treatments applied are shown by the strip outlines. Figures 2.3.4 and 5 show NDVI images for July 13, 20, 28 and August 9 at resolution of 4 cm, 3 m., 3m., and 50 cm respectively. All show similar patterns and zones where green is active vegetative plant biomass, yellow having less and red the least. Figure 4 NDVI from the Dove constellation shows similar zones and patterns but not as extensive as capture using the Red Edge light spectrum

Interpreting the imagery
The middle and southern parts of the field reflect green indicating greater biomass and later maturity from improved moisture conditions in those lower landscape positions. The North-East corner of the field is an elevated landscape position relative to the field showing moisture deficit stress resulting in lower biomass, earlier crop maturity and likely reduced crop yield.

The south western edge of the field is also yellow indicating earlier maturity. This also appears to be caused by landscape position in the field and reduced moisture availability.

Considering the variability of the field and the location of some of the zones seen on the imagery collected during the 2018 growing season, highlights the need to determine the type of limitation and their location in order to apply inputs and/or set up field scale trials. Treated strips that intersect the NE corner will have a tendency to be moisture limited in dryer years and have lower yield. The opposite effect would also be expected in wetter years where lower landscape positions of the field would tend to suffer from excess moisture and yield less.

Unfortunately a yield map of the harvested crop is not available to compare to the in-season imagery captured. Probable yield map from historical yield data could not be prepared for comparison having insufficient years of yield data available.

Fungicide treatments did not show up in any aerial imagery. The treatments applied in N-S strips across the field were weighed at harvest to compare yield. The analysis showed that there was no significant yield differences between the untreated check, treatment at anthesis and delayed by 3 days (See table and graph). 2018 being a dryer and warmer than normal season, disease pressure was low and did not appear to be a yield determining factor.

Discussion
The imagery resolution from the drone, plane and satellite varied from approximately 4 cm, to 50 cm, to 3 m per pixel respectively. All three resolution levels provided satisfactory level of detail of the variability within the field. The lower resolution satellite imagery was available on a more than weekly basis and most useful by providing information on how the crop was doing during the season. The plane and drone images were higher resolution but one time snapshots taken in the early maturing stage.

Satellite imagery captured during the peak growing stage (drone image) of the crop (post anthesis) showed no differences between the different zones that developed as the crop matured. According to the image at the time, it appeared that the crop was doing equally well across the field and management decisions considered in season would have led one to treat the field uniformly across.

Determining productivity zones within a field will be influenced by a variety of factors including soil type, field topography and grower experience as major factors. Aerial imagery can be used to help determine productivity zones but need to be adjusted using other sources of information to better reflect their potential and be useful decision making tools.