

Smart Agriculture Research

2022 AFSC Hail Survey: Classification of Hail Damaged Areas within Annual Crops & Using Drone Imagery of Hail Damaged Fields within Central Alberta

INTRODUCTION

Agriculture Financial Services Corporation (AFSC) is Alberta's leading service provider of hail insurance to farmers. In 2021, AFSC and Olds College completed a proof of concept project to see if drones could classify hail damaged areas within a barley crop – which had promising initial results.

In 2022, AFSC and Olds College conducted another project to determine the feasibility of using drone imagery to classify hail damage within a field. The project methodology transitioned to using imagery of annual crops that were naturally damaged by moderate to severe hailstorms.

OBJECTIVES

- Develop an imagery database of hail damage crops for multiple methods of imagery analysis.
- Determine if various forms of imagery captured after a hail event can be used to classify damaged crop from undamaged crop.
- Identify if additional combinations of imagery exist that could more accurately represent annual crop damage from hail.

STUDY DETAILS

- Imagery of 6 hail damaged fields (wheat, barley & canola) were collected during summer of 2022.
- Equipment - DJI Matrice 300 RTK Drone was used with the following imaging equipment:
 - *Phoenix LiDAR Systems - RECON-A (Multi-pattern acquisition with 24 MP RGB camera integration)*
 - *Zenmuse XT2 Thermal Camera (FLIR Tau 2 thermal sensor paired with 4K visual camera)*
 - *MicaSense Red Edge-MX Dual Multispectral Sensor (2x 5-band cameras Red Edge-MX/Red Edge-MX Blue)*
- Imagery analysis types:
 - *Manual assessment & digitization of crop situations & damaged areas*
 - *DSM-DEM elevation subtraction analysis*
 - *Slope analysis*
 - *Unsupervised classification*
 - *Supervised classifications (RGB, Red Edge, Thermal)*
 - *Satellite image NDVI index change detection*

RESULTS

- The red edge band of the multispectral imagery seems to clearly distinguish all damaged areas of a field whether the damage is due to a hail storm or other situations (e.g.: seeding equipment malfunction or water damage).
- Combining classified red edge imagery with classified thermal imagery enabled a better classification of crop damaged areas. Outlier areas of temperature highs and lows that indicate poor/no crop present were removed from the analysis.
- Using multispectral imagery from Sentinel 2 satellites, change detection analysis was completed with pre and post storm images which showed positive preliminary results. The addition of a field baseline taken prior to the hail event was very useful in determining areas of the field affected by the hail storm. This methodology could also serve to eliminate some issues inherent in the other methodologies attempted. Further investigation is needed in order to prove its efficacy.
- GIS tools are quickly able to calculate the area of the damage within a field once the classification is completed regardless of the method used to classify the damage.

FUTURE RESEARCH

Continued imagery collection of fields damaged by hail storms in Central Alberta will take place in 2023, with the addition of high-density field scouting to validate damage forms observed.



Hail damage appearance in RGB imagery in a barley crop.
Learn more at oldscollege.ca/SmartFarm.