



ENGO 500 - Geomatics Engineering Project

Professor: Michael J. Collins

Crop Operations Cost Report

Project 7: GNSS relative accuracy improvements for agriculture

Advisor: Greg Roesler PEng., Novatel / Hexagon

Group Members

Name	UCID
Jan Erik Naess	30068695
Evan Prosser	30038396
Connor Johnson	30016802
Jonah Prevost	30068306

Introduction:

This brief report outlines the cost of underlap and overlap in broadacre farming. Canola was analyzed as the broadacre crop of choice because of its use and value here in Alberta. Initial calculations determined the operating costs at each stage as well as the market price of canola based on research and the current option trading of canola. In all the processes the cost of gas was ignored even though receivers could save on gas by optimizing passes. Gas prices were ignored for two reasons, price volatility and because they would be present at each step of the process and are independent of the use of precision agriculture products, gas is burned either way. The methodology section outlines where the prices came from and any additional calculations required to get the table values. The results section outlines price at each point as well as net price (market value - cost) and breaks down what it would cost for an acre of underlap and overlap at each stage.

Methodology:

Calculating the cost of each of the stages of broadacre farming starts with determining the seed cost, fertilizer cost, herbicide cost and the price of the grown crop on the market. Using the average regional spot price for canola in Alberta as a price/bushell and an average rate of 40 bushels per/ acre (2021 average for Alberta) the price of canola per acre and per square-meter can be calculated. Seed cost, fertilizer, and herbicide costs are all taken directly as price per acre and don't require additional analysis. Prices all come from the canola options trading market¹ or from the Alberta Crop Report for 2021². The regional costs for Canola were \$25.04 in Northern Alberta, \$24.71 in the Peace Region, and \$24.92 in Southern Alberta. All prices are price/ bushell. Average price is \$24.89/ bushel and with 40 bushels per acre average price per acre is \$995.60. Net cost is the sale price of canola subtracting the price of seed, fertilizer and herbicide. Herbicide and fertilizer application accounts for approximately 62% of crop yield in Canada so failing to apply both could result in 38% yields in a worst case scenario. A note on cost of fertilizer, today fertilizer costs are \$170-\$200/ acre depending on type and crop so the impact would be even more drastic of GNSS applications for saving underlap and overlap.

¹ <https://albertacanola.com/daily-canola-prices/>

² Alberta Crop Report: <https://open.alberta.ca/crop-report-2021-07-30.pdf>

Results:

Table 1: Cost of Crop, Seed, Herbicide and Fertilizer for Canola

Material	Operational Cost: (\$/m ²)	Operational Cost: (\$/acre)
Rape seed	0.016	66.19
Nitrogen Fertilizer	0.015	59.06
Herbicide	0.012	49.99
Harvestable Crop	0.246	995.60
Net Price	0.203	820.36

*Breaking the above values into the three processes that precision agriculture would be used for (seeding, fertilizer/herbicide application, and harvesting) the value of precision agriculture solutions becomes clear. In seeding, every acre of land not covered or missed (underlap) eventually translates to **\$820.36** of lost revenue once the sale cost of canola and the cost of materials is factored in. On the flip side each acre of overlap costs **\$66.19** extra in unnecessary costs. For fertilizer and herbicide application, using the worst case scenario where 62% of crops are lost without both, each acre of underlap would account for **\$508.62** in lost yield whereas each acre of overlap would cost you **\$109.05** on average. Harvesting is much simpler, overlap doesn't matter as much unless gas prices are factored in and each acre of crop left standing for whatever reason costs the same as a failure to seed an acre for canola, **\$820.36**.*

Conclusion:

Overlap and underlap caused by positional errors in broad acre applications are expensive to the producer. Underlap in seeding is the most expensive where the entire net profit of the crop is lost followed by underlap in fertilizing where up to 62% of yield can be lost depending on severity of weather conditions, or pest infestation. Overlap is almost twice as costly in the fertilization phase as in the seeding phase. Overall harvesting can be done by eye unlike seeding and fertilizing so a safe assumption is all available crop is harvested and the only operational cost is time. If current fertilizer costs of approximately \$170/acre were factored in Net price would be \$709.42/acre more than \$100 below the price calculated with 2021 fertilizer costs.