Holos Software Tool – Hands-on Demo for Beef Production

United States Department of Agriculture

National Institute of Food and Agriculture

WESTERN SARE Sustainable Agriculture Research & Education

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While this demo won't include all Holos capabilities, we hope that it will give you a good basis from which to continue further explorations.

We are going to create a Canadian beef production system including cow-calf operation, backgrounding and finishing feedlots, and feed crop production system.

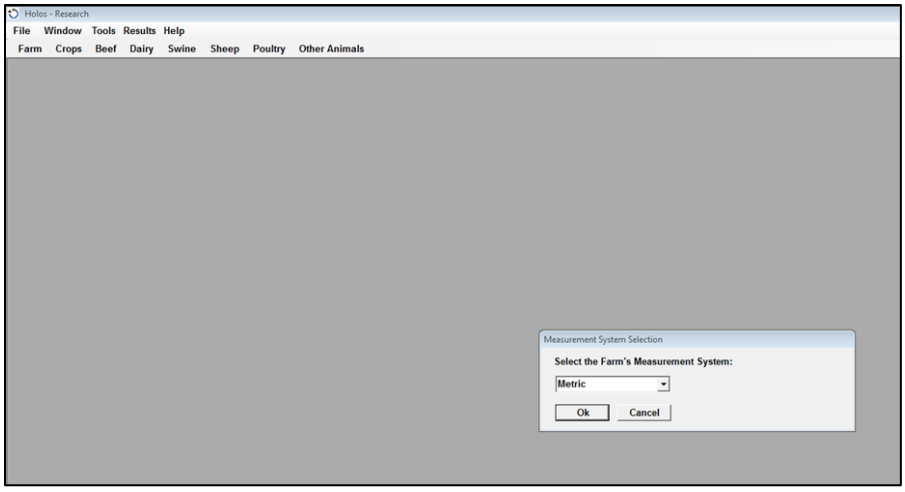
1. Launch Holos and New Farm

Launch Holos by double clicking on the Holos icon. The first window includes a choice of English or French and general information about Holos. Click "OK".

We'll be working in the "Holos Research" interface. Make that selection.

Holos navigation follows common Windows navigation. "File"→"New" begins a new farm.

Select the farm`s measurement system "Metric" Click "OK".



2. Naming and Locating the Farm

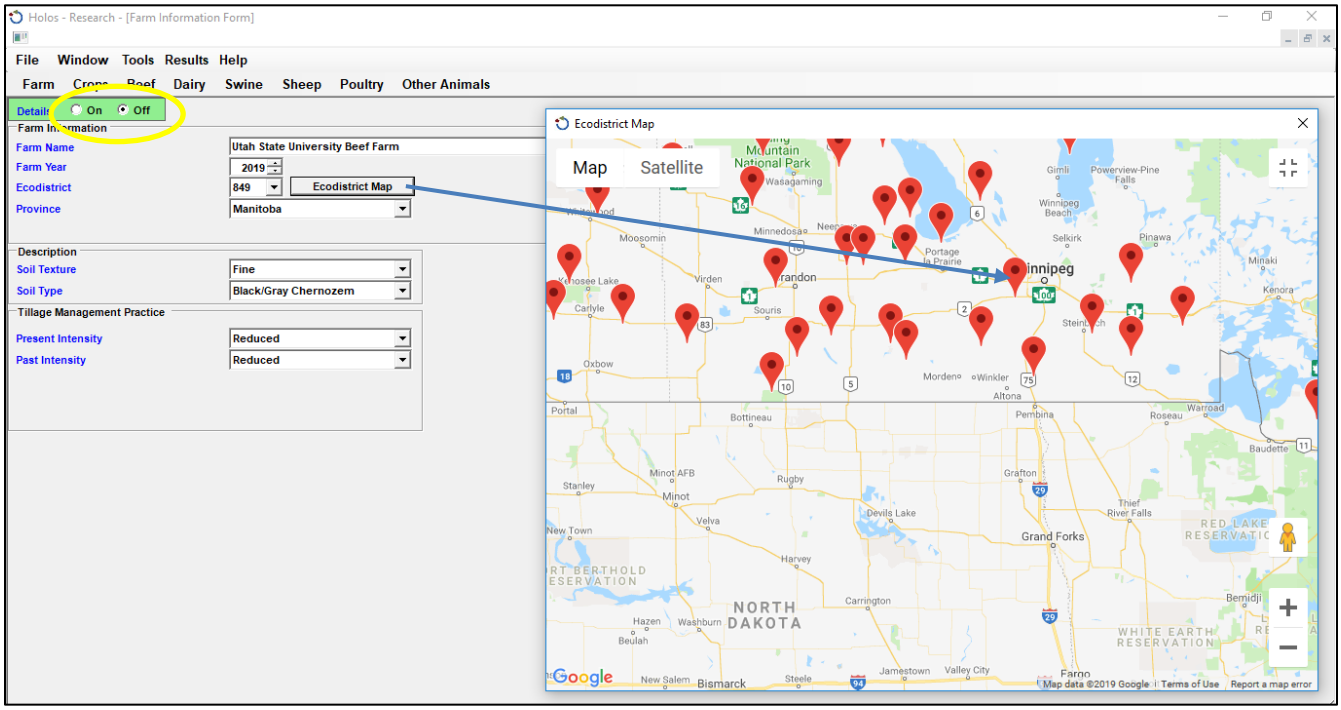
Users have the ability to create unique names for farms. We can call ours "Utah State University Beef Farm". You can also modify the year of your simulation. This is a good time to save your farm ("File"→"Save"). Holos will use your farm name and year as the name of your file. **Remember to save your farm as you move through your data input.**

The “Ecodistrict Map” button will bring up a map of Canada. This requires an internet connection. If none is available, the user may locate the farm by selecting the appropriate Ecodistrict. The map contains many point markers. Zoom in and select the marker nearest to Winnipeg, Manitoba (**Ecodistrict 849**). “OK” your selection to populate your location parameters and close the map window.

Tillage is input for the entire farm, both past and present in the “Tillage Management Practice” box. In this case, we’ll keep both “Present” and “Past Intensity” at the default of “**Reduced**”.

This interface has two levels of visible information. “Details on” in the upper left will ensure all information is visible and allows the user to override default values for many parameters. We’ll leave the default values as they are for now.

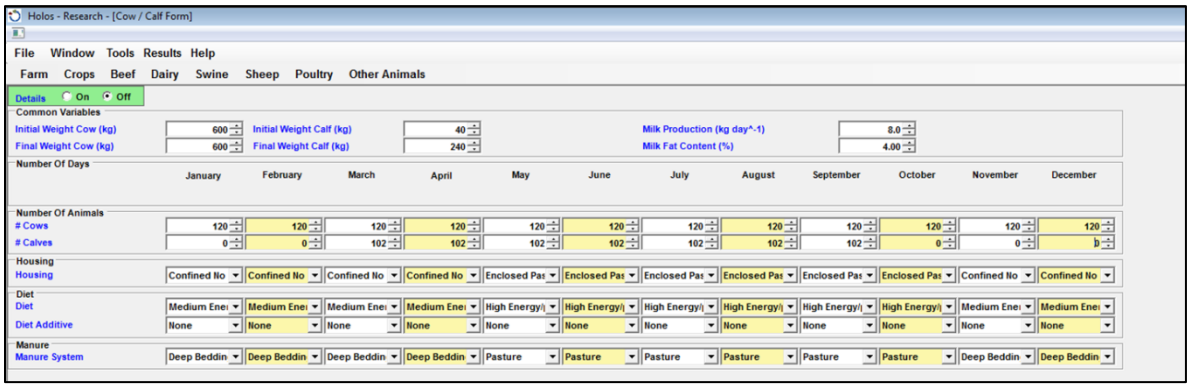
Farm components included in Holos are located in a series of drop-down menus on the top left. We’ll be working in the “Beef” and “Crops” component.



3. Entering the cow-calf operation

Launch the cow-calf input form ("Beef"→"Cow/Calves").

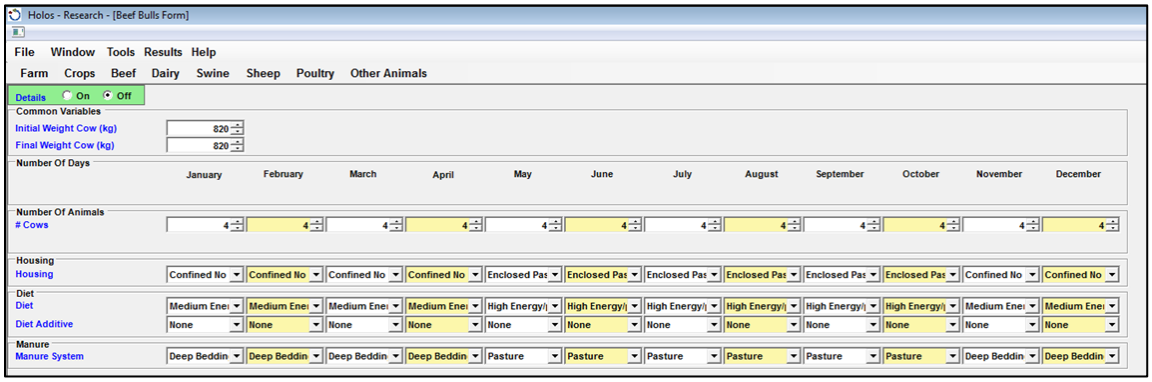
1. Enter 120 cows in each month.
2. Using a final weaning rate of 85%, we'll include 102 calves from March through September.
3. The cows and calves will be "housed" as "confined no barn" for January through April. From May through October, they will be moved to an "enclosed pasture". For November and December they will be moved back into "confined no barn".
4. Diet changes with the move from confinement to enclosed pasture. When confined, the diet is "Medium energy/protein". When moved to enclosed pasture, the diet changes to "High energy/protein".
5. All manure is handled as "deep bedding" during winter feeding (November to April) and as "pasture" during summer grazing.



Details can be turned on to view coefficients and details on manure handling and diet. Customization of these can occur by choosing "Custom" on the housing, diet, or manure drop down menus.

Launch the bull input form ("Beef"→"Bulls").

1. Enter 4 bulls in all months.
2. The bulls follow the housing, diet, and manure as above.



Close your farm when you are done entering inputs. Closing without saving does not lose your inputs but it's recommended to save your farm frequently.

4. Entering the backgrounding feedlot

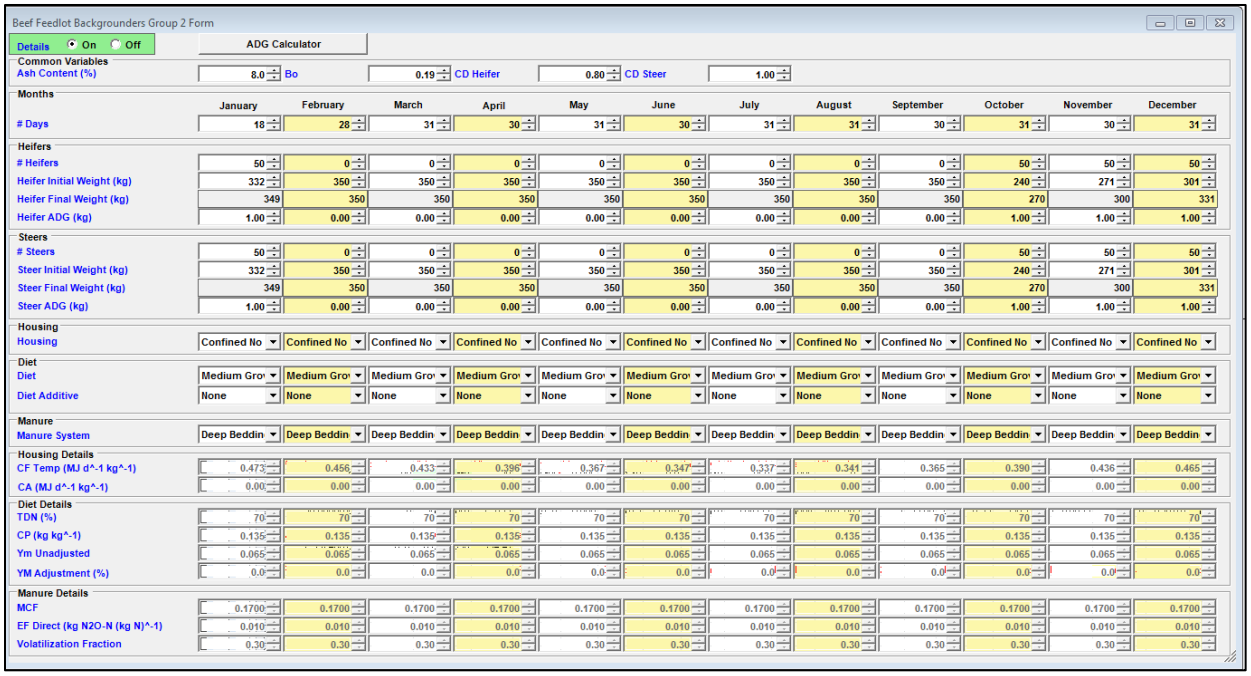
Launch the backgrounding feedlot input form ("Beef"→"Backgrounding Group 1").
(Holos provides the user the option to have more than one backgrounding feedlot.)

1. Our cow-calf operation has provided 102 calves. However, due to losses, we'll enter 100 animals into our backgrounding system. 50 of these animals should be heifers and 50 should be steers. The animals enter the backgrounding lot in October and continue through for 18 days in January (total = 110 days).
2. To specify 18 days in January, take a look at the form details ("Details"→"on"). In the number of days for January, override 31 with 18.

While, in reality, individual livestock are transferred into the next year, this is a representative farm and backgrounding livestock would be in this lot in January. Alternatively, and if conducting a multi-year cycle, a second "farm" or file could be set up.

3. Returning to October, enter in a heifer initial weight of 240 kg. Enter a heifer average daily gain (ADG) of 1 kg. The final monthly weight will transfer accordingly to the initial weight of the next month. However, the user must set the gain in subsequent months. Enter 1kg as the ADG for November, December, and January.
4. Because we have moved past year end in December, you must set the January initial weight appropriately. 331 kg is the final weight in December. Add your gain (1 kg) and use 332 kg as your initial weight in January.
   Note: Because of the cascading effect of feedlot weights in the software, you'll have to go back to October and reset your initial weight to 240 kg.
5. Repeat the same for steer backgrounders.
6. The animals will be "housed" as "confined no barn".
7. Choose "Medium growth" for the "Diet".
8. Choose "Deep Bedding" for the "Manure System".

With details turned on, coefficients and details on manure handling and diet can be viewed. Customization of these can occur by choosing "Custom" on the housing, diet, or manure drop down menus.

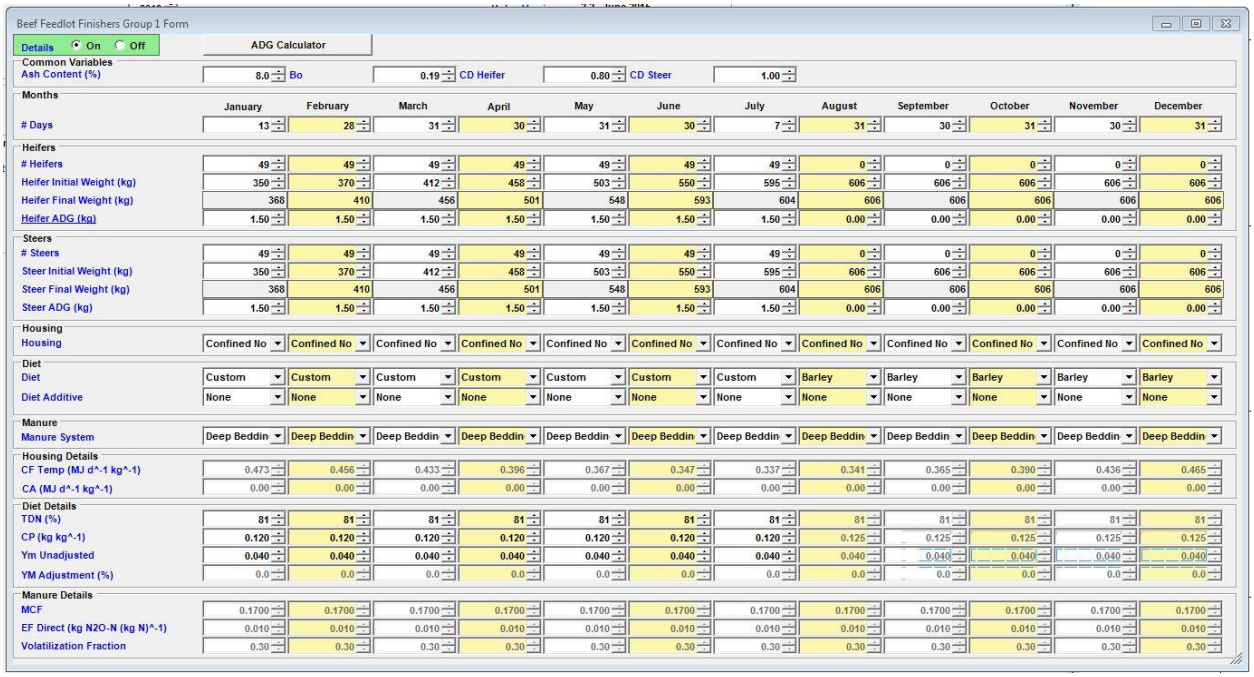


Close your farm when you are done entering inputs. Closing without saving does not lose your inputs but it's recommended to save your farm frequently.

5. Entering the finishing feedlot

Launch the finishing feedlot input form ("Beef"→"Finishing Group 1").
(Holos provides the user the option to have more than one finishing feedlot.)

1. Our backgrounding operation has provided 100 animals. However, due to losses, we'll enter 98 animals into our finishing system. 49 of these animals should be heifers and 49 should be steers. The animals enter the finishing lot in January 19 and continue through for 170 days leaving the feedlot after July 7.
2. Arriving in the feedlot on January 19 means we must specify the animals are in the lot for 13 days in January. To do this, take a look at the form details ("Details"→"on"). In the number of days for January, override 31 with 13.
3. To specify 7 days in July, in the number of days for July, override 31 with 7.
4. Returning to January, enter in a heifer initial weight of 349 kg. Enter a heifer average daily gain (ADG) of 1.5 kg. The final monthly weight will transfer accordingly to the initial weight of the next month. However, the user must set the gain in subsequent months. Enter 1.5 kg as the ADG for February through July.
5. Repeat the same for steer finishers.
6. The animals will be "housed" as "confined no barn".
7. We'll create a customized diet. Choose "Custom" for the "Diet".
8. In the "Diet details" area, ensure the Total Digestible Nutrients ("TDN") is 81%, the Crude Protein ("CP") is 0.12 kg kg^{-1} and the "Ym unadjusted" is 0.040.
9. Choose "Deep Bedding" for the "Manure System".



Close your farm when you are done entering inputs. Closing without saving does not lose your inputs but it's recommended to save your farm frequently.

6. Entering the annual cropping operation

Launch the annual crop input form ("Crops"→"Annuals").

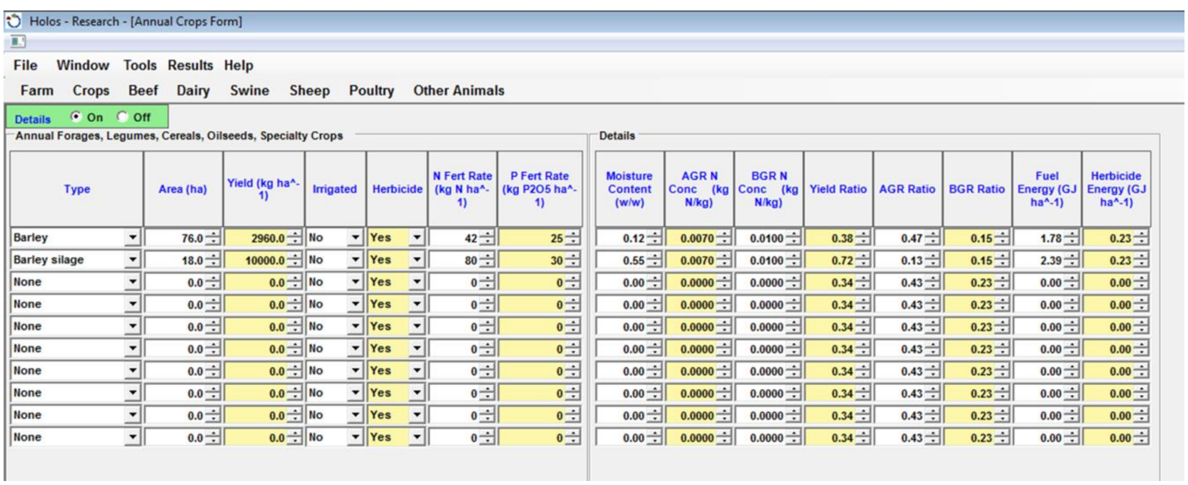
Tillage is input for the entire farm. This is found on the Farm Information Form. In this case, we'll keep it at the default of "reduced".

1. In order to provide our backgrounding and finishing feedlot with barley grain, we'll grow 76 ha of barley with a yield of 2960 kg per ha. The barley grain is not irrigated but herbicide is used. The crop nitrogen fertilizer rate ("N Fert Rate") is 42 kg N per ha and the phosphorus fertilizer rate ("P Fert Rate") is 25 kg P_2O_5 per ha.
2. Our feedlot animals are also fed barley silage. The area required for barley silage is 18 ha. Adjust the yield value to 10 000 kg per ha (from 2 000 kg/ha). The silage is not irrigated but herbicide is used. The crop nitrogen fertilizer rate ("N Fert Rate") is 80 kg N per ha and the phosphorus fertilizer rate ("P Fert Rate") is 30 kg P_2O_5 per ha.

F.Y.I. *Percentages of feed in diets*

	Barley grain	*Barley silage*
Backgrounding diet	*40%*	*60%*
Finishing diet	*90%*	*10%*

Calculating area required for feed crop requirements must be done outside of Holos utilizing dry matter intake, feeding, storage, and harvest losses, and yield of crops. Alternatively, real farm crop areas can be used for a real farm analysis of emissions.


Holos - Research - [Annual Crops Form]

File Window Tools Results Help

Farm Crops Beef Dairy Swine Sheep Poultry Other Animals

Details On Off

Annual Forages, Legumes, Cereals, Oilseeds, Specialty Crops

Type	Area (ha)	Yield (kg ha^-1)	Irrigated	Herbicide	N Fert Rate (kg N ha^-1)	P Fert Rate (kg P2O5 ha^-1)
Barley	76.0	2960.0	No	Yes	42	25
Barley silage	18.0	10000.0	No	Yes	80	30
None	0.0	0.0	No	Yes	0	0
None	0.0	0.0	No	Yes	0	0
None	0.0	0.0	No	Yes	0	0
None	0.0	0.0	No	Yes	0	0
None	0.0	0.0	No	Yes	0	0
None	0.0	0.0	No	Yes	0	0
None	0.0	0.0	No	Yes	0	0
None	0.0	0.0	No	Yes	0	0

Details

Type	Moisture Content (w/w)	AGR N Conc (kg N/kg)	BGR N Conc (kg N/kg)	Yield Ratio	AGR Ratio	BGR Ratio	Fuel Energy (GJ ha^-1)	Herbicide Energy (GJ ha^-1)
Barley	0.12	0.0070	0.0100	0.38	0.47	0.15	1.78	0.23
Barley silage	0.55	0.0070	0.0100	0.72	0.13	0.15	2.39	0.23
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00
None	0.00	0.0000	0.0000	0.34	0.43	0.23	0.00	0.00

Farms can also include fallow lands. Area of fallow and past fallow practices are included on the "Fallow Land Form" found under the "Crops" menu. If a farm has moved from fallowing to continuous cropping, this management change is entered in this form.

Close your form when you are done entering inputs. Closing without saving does not lose your inputs but it's recommended to save your farm frequently.

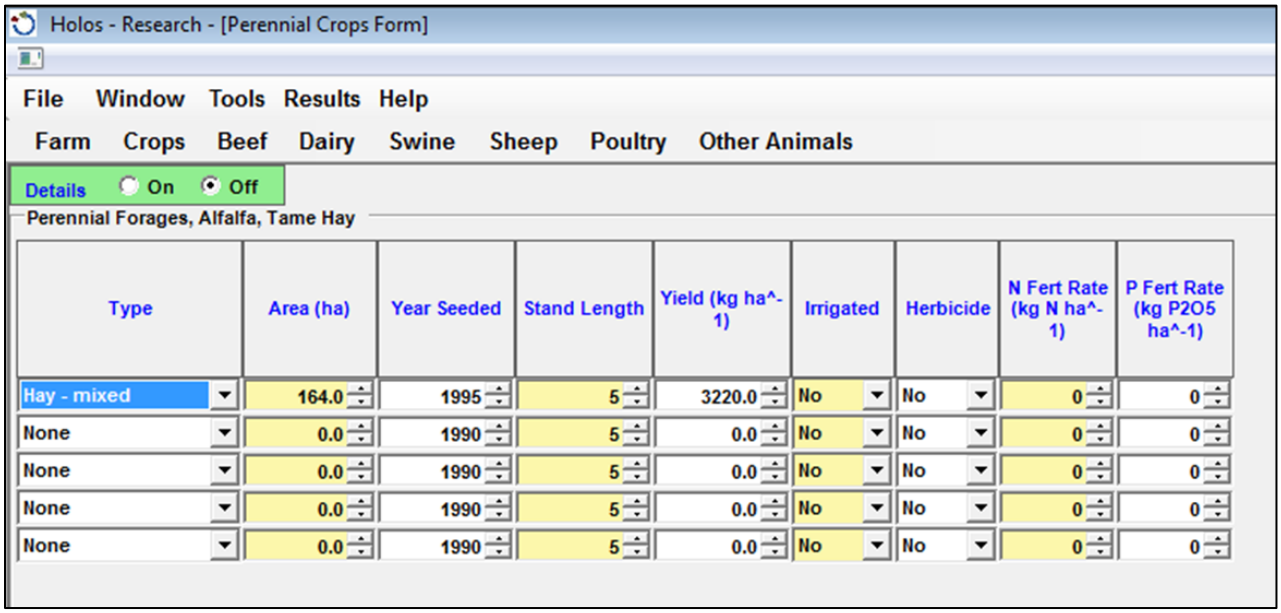
7. Entering the perennial cropping operation

Launch the perennial crop input form ("Crops"→"Perennials").

1. In order to provide our cow-calf operation with hay in the winter months, we'll grow 164 ha of mixed hay with a yield of 3220 kg per ha. The length of this stand of hay is 5 years. The hay is not irrigated nor is herbicide used. No nitrogen or phosphorus fertilizer is applied.
2. The perennial crop form also asks when this crop was seeded ("Year Seeded"). This is not the year of possible stand reseeding but the year this perennial crop was established and assumes a conversion from annual crop to perennial. We'll say this hay crop was established in 1995.

Calculating area required for feed crop requirements must be done outside of Holos utilizing dry matter intake, feeding, storage, and harvest losses, and yield of crops. Alternatively, real farm crop areas can be used for a real farm analysis of emissions.

With details turned on, coefficients and details on crops can be viewed and modified. To create a crop not included in Holos, choose "Other".



Close your farm when you are done entering inputs. Closing without saving does not lose your inputs but it's recommended to save your farm frequently.

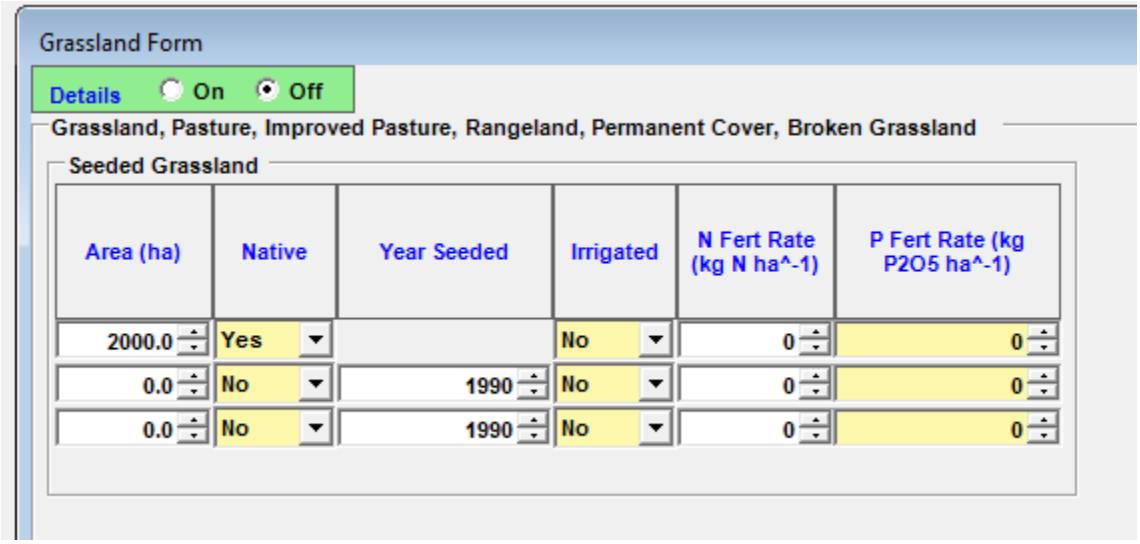
8. Entering the pasture/ grasslands

Launch the grasslands crop input form ("Crops"→"Grasslands").

1. The cow-calf operation relies on pasture for summer months. Enter 2000 ha of Native grassland. This grassland is not irrigated or fertilized.

Utilizing various methodologies, area of required pasture can be calculated.

With details turned on, details related to carbon storage calculations can be viewed and modified.



Close your form when you are done entering inputs. Closing without saving does not lose your inputs but it's recommended to save your farm frequently.

9. Discover results

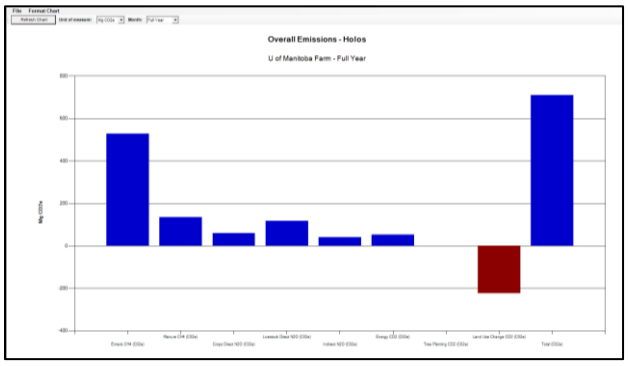
Results are available in a variety of reports and charts. The first chart is the “Simple Emissions” chart which should be apparent on your screen. Clicking “Refresh Chart” at any time updates your farm emission estimate with the latest inputs. You can choose your unit of measure as either Mg (tonnes) or kg of CO_2 equivalents (CO_2e).

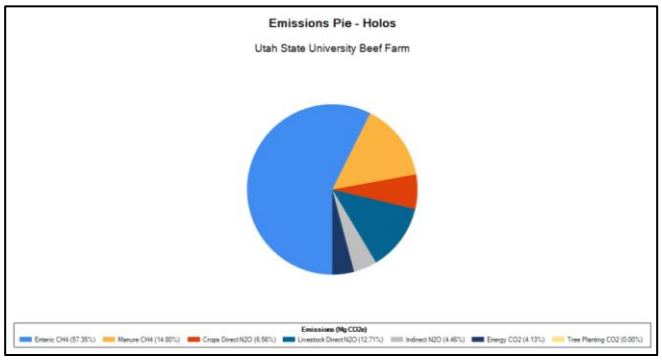
Other charts and reports are available under the “Results” menu. Reports contain more detail and can be cut and paste into a spreadsheet program. Note that results in Reports are available as a “Yearly Summation” or by month. Charts display emissions by farm component or by month. You can choose your unit of measure as either Mg (tonnes) or kg of CO_2 equivalents for both reports and charts. You can also choose to have results displayed as CO_2e or as unconverted greenhouse gas.

Some results are available on a yearly basis only (emissions associated with cropping and soils and tree plantings).

The Feed Estimate report provides an estimate of dry matter intake based on energy requirements of the animal and energy in the feed.

The Estimate of Production report provides total harvest yields, amount of land applied manure, and estimates of total gain and milk production for dairy scenarios.





Overall Emissions Chart demonstrating emissions from total farm inputs.

10. From net emissions to carbon footprint

Outside of Holos, net farm emissions can be divided by production (live weight) to become the carbon footprint of this input production system.

	Average farm
Net farm GHGs (kg CO2 eq)	709,292
Final live weight of finishers (kg)	604
Total number of finishers	98
Total live weight (kg)	59,192
Carcass weight (kg)	35,515
Emission Intensity/Carbon footprint (kg CO_2 eq/kg live weight)	**11.98**
Emission intensity/Carbon footprint (kg CO_2 eq/kg carcass weight)	**19.97**

Carcass weight is calculated assuming 60% of live weight.

While this was an annual example, for completeness you'll also need to consider emissions from replacement animals (or growth of breeding stock to maturity). This leads to analysis of a multi-year cycle. At this point, you'll also consider cull cows and bulls in your production.

11. Exploring changes in management

Save your initial farm. Now rename the farm adding "Exploration" to the name and "Save As" this new farm. This will ensure your original farm is maintained while you explore changes in management.

Once you have input your original farm, it becomes simple to explore the effects of management changes on net farm emissions.

1. Increase weaning rate in cow-calf operation. This increase in calves will cycle through the feedlots. More feed will be required.
2. Increase the total digestible nutrients of winter feed in the cow-calf diet.
3. Change the finishing backgrounding manure system to intensive compost (in all months).
4. Add 2% fat to livestock diets.
5. Increase nitrogen fertilization rate of barley grain crop and increase yield (decrease area as you will be producing more grain than your livestock require).
6. Plant trees.
7. Change native pasture to seeded pasture.
8. Utilize manure nitrogen on the system's crops reflected by reducing nitrogen fertilizer use.
9. Increase weight gain in finishing lot by increasing protein in diet. Time in the feedlot will decrease.

Some questions to consider:

What is the major source of emissions?
Do these changes impact feed intake and land requirements?
Do changes reduce the production time?
Do reductions in one gas or component result in increased emissions elsewhere?
What impact do these changes have on overall emissions?
What impact do these changes have on your system's carbon footprint?

Finally…

To download Holos, for more information, or to access a recent list of Holos related publications, visit: www.agr.gc.ca/Holos-ghg

To contact us, email:
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Whole-systems approach

An ecosystem consists of not only the organisms and the environment they live in but also the interactions within and between. A whole systems approach seeks to describe and understand the entire system as an integrated whole, rather than as individual components. This holistic approach can be very complex and describing the process can be difficult. One method to conceptualize a whole system is with a mathematical model. The whole-systems approach ensures the effects of management changes are transferred throughout the entire system to the resulting net farm emissions. In some cases, reducing one GHG will actually increase the emissions of another. The whole-systems approach avoids potentially ill-advised practices based on preoccupation with one individual GHG.

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