

Principal Field Crop Estimates and the Crop Reporting Cycle

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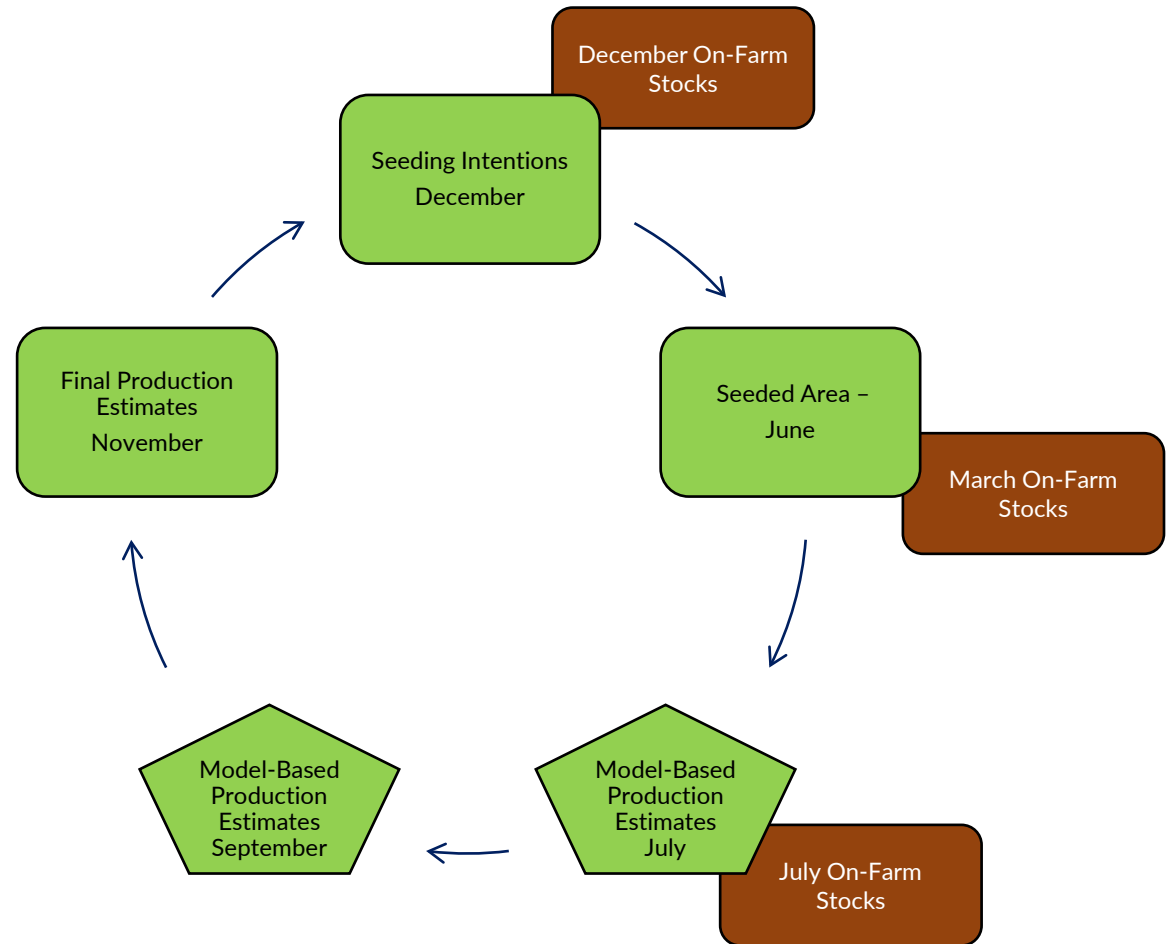
Introduction

- Overview of the Crop Reporting Cycle
- Comprised of two main components:
 - Production of Principal Field Crops
 - Stocks of Principal Field Crops
- Other Important Information:
 - AgZero is a modernization initiative that uses leading-edge methods and alternative data to reduce the response burden on farmers while providing more timely and comprehensive data to users. The alternative data are used to develop modelled estimates as a replacement for traditional survey-based data collection.
 - The AgZero initiative is important for the Economic Statistics Field because it demonstrates a concerted effort to greatly reduce burden on farmers.

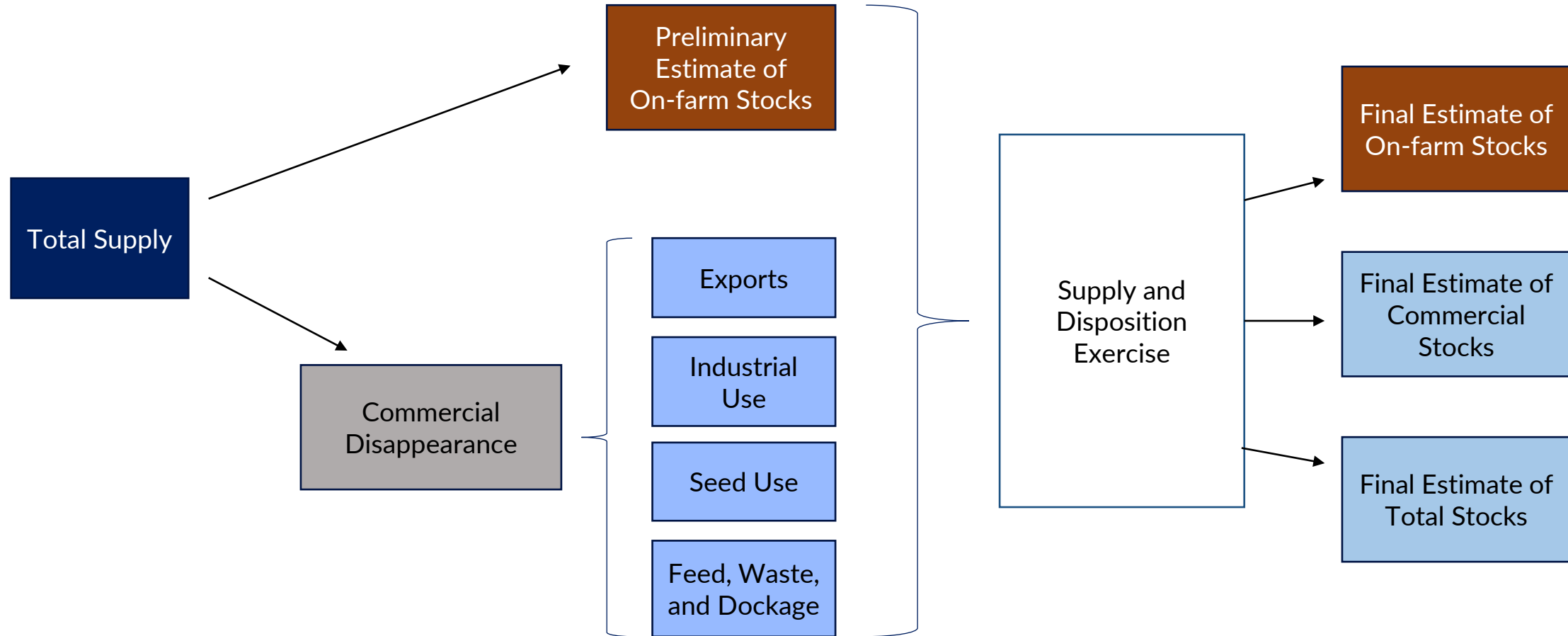


The Crop Reporting Cycle in brief

- More than a century
 - Data beginning in 1908
- Considered a major economic indicator at Statistics Canada
- Primary goal to measure crop area, yield and production throughout the year
- Also produces estimates of on-farm stocks of principal field crops

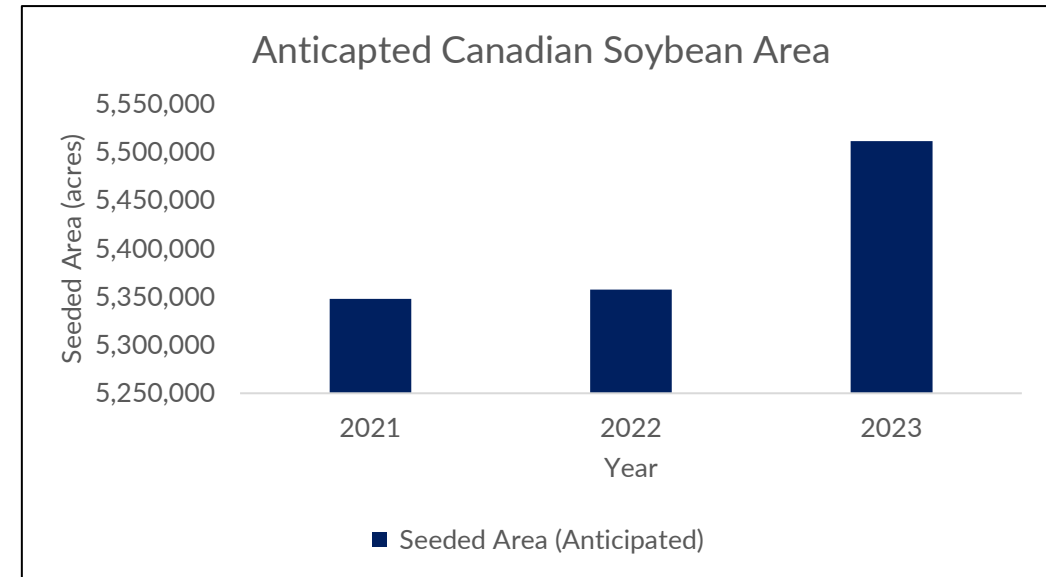


Stocks of Principal Field Crops – Supply and Disposition



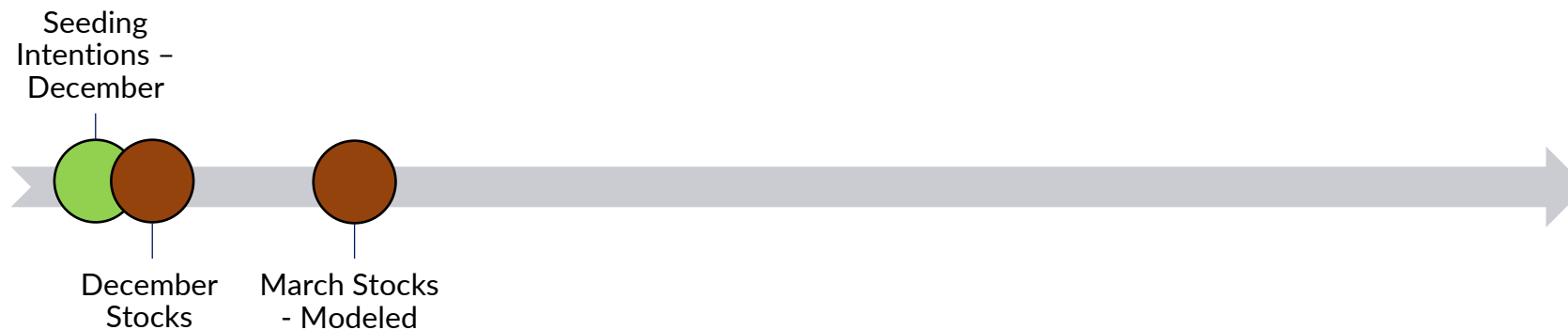
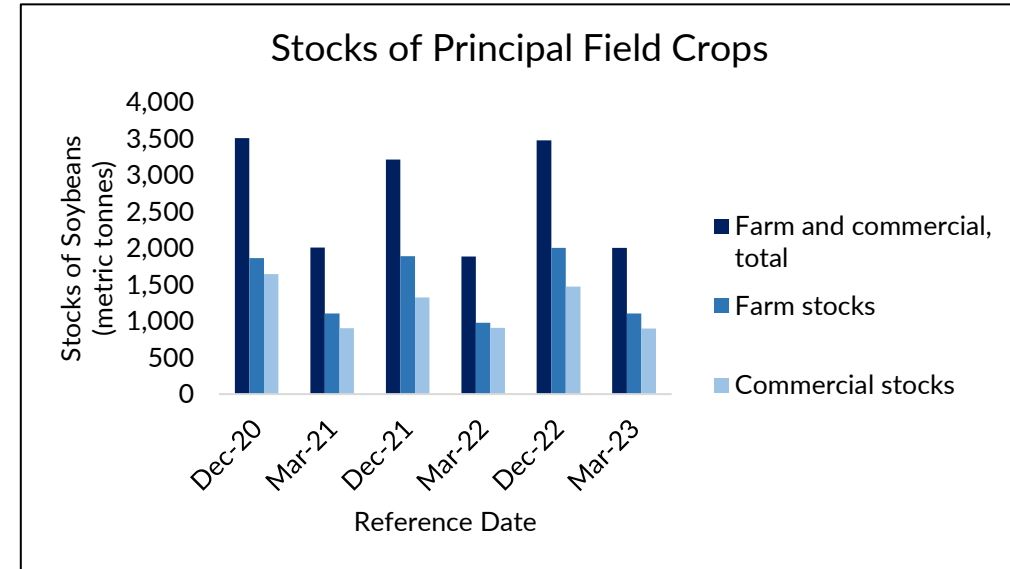
Seeding Intentions - December

- Collected in December/January starting in 2023
- Samples approximately 9,500 respondents
 - Collects for all crops
- Provides first estimate of seeded area
- Stocks of principal field crops



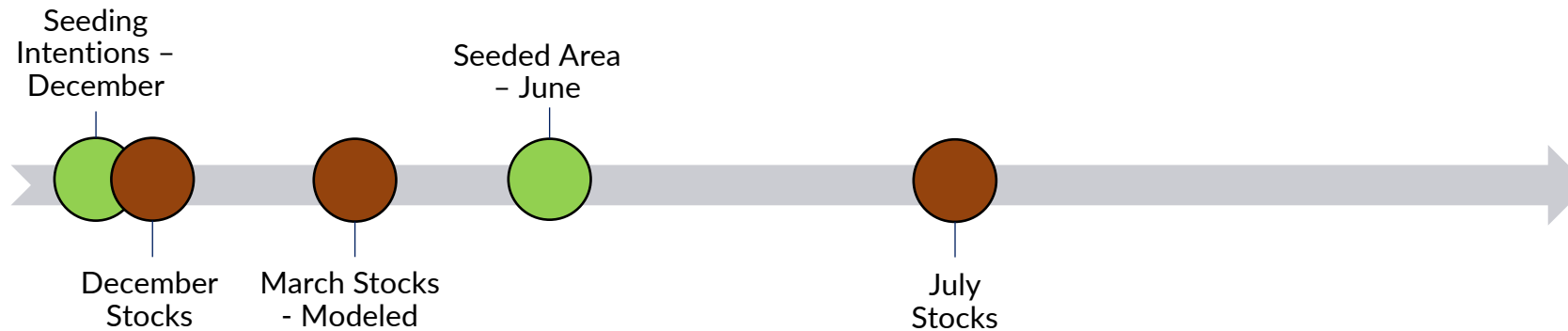
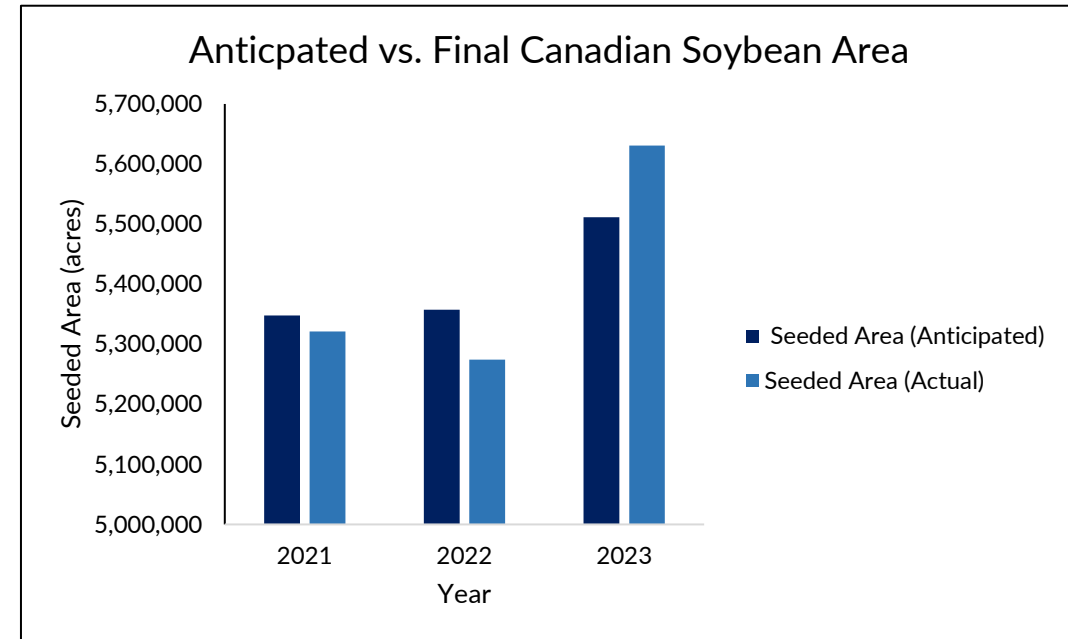
March Stocks

- March Stocks
 - Utilizes model-based approach
 - Uses historical relationships between the published estimates and various characteristics of the crops and grain industries.
 - Measure the degree of uncertainty in model estimates using of the confidence interval like the survey



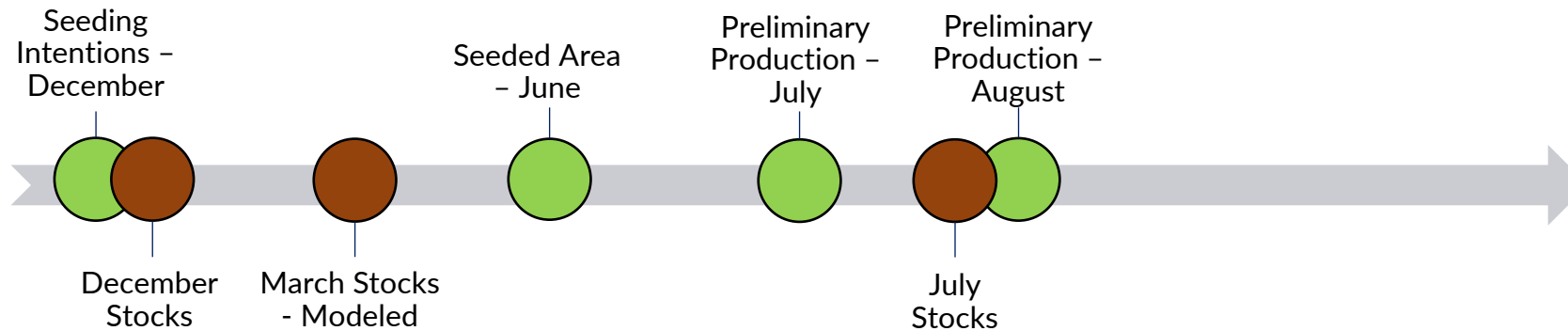
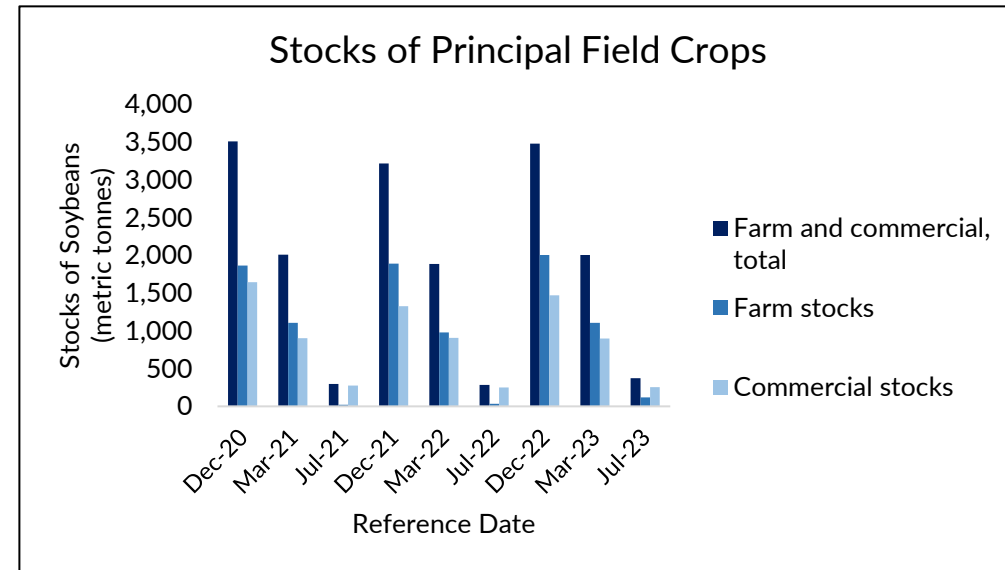
Seeded Area - June

- Collection take place during May/June
- Second largest survey
 - Samples approximately 25,000 respondents
 - Collects all crops
 - Surveys all 10 provinces
- Provides estimates of actual seeded area
- Collects Stocks of principal field crops as of July 31



Summer Estimates and July Stocks

- Final Stock estimates published in early September
- Summer production estimates replaced by model-based approach:
 - September replaced in 2016
 - July replaced in 2020



Crop Yield Model –for July and August

Motivation:

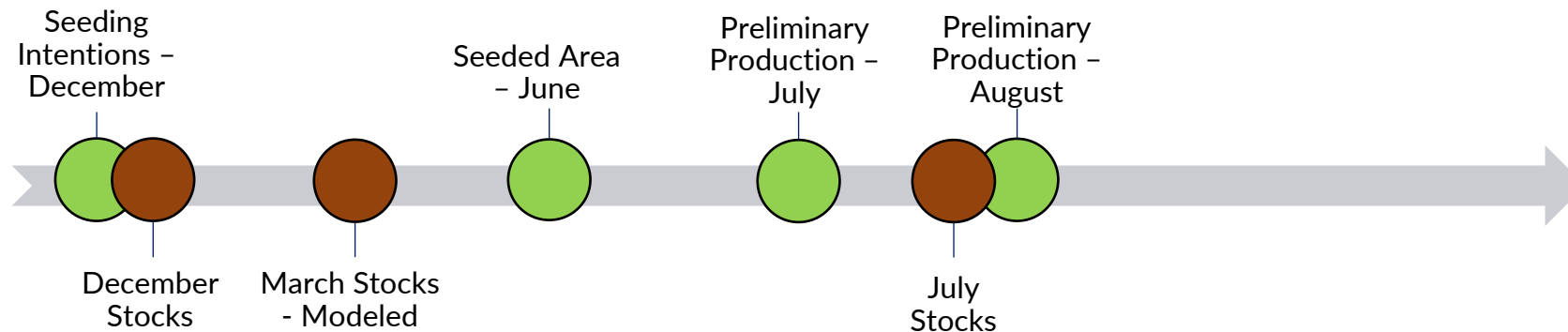
Statistics Canada

- under increasing pressure to reduce response burden and cost of the traditional surveys
- maintain relevance, accuracy, timeliness, accessibility, interpretability and coherence

Objective: *Develop a robust crop yield model for the principal field crops of Canada.*

Partnership: Statistics Canada and Agriculture and Agri-Food Canada (AAFC)

- 2014 - Material transfer agreement permitted the transfer of the AAFC yield model to StatCan
- 2015 - First modelled yields were released in parallel with the survey-based results
- 2016 - August estimates were replaced by the yield model estimates
- 2020 - July estimates were also replaced by the yield model estimates



Model Summary

Yield model input data:

- Coarse resolution satellite data (Normalized Difference Vegetation Index (NDVI))
- Agriclimatic data
- Historical yield data: StatCan November crop survey data and provincial crop insurance data

Yield model replaced the principal field crop surveys for:

- July (August release): modelled since 2020
- August (September release): modelled since 2016

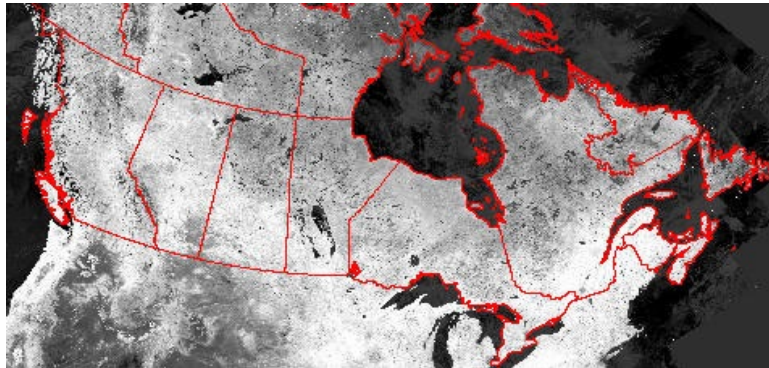
Benefits of using a model-based approach:

- Similar accuracy between the modelled and survey-based yield estimates
- July and Sept modelled estimates were released earlier than the traditional surveys
- Reduced response burden
- Cost reduction: survey-based collection no longer required for July and September



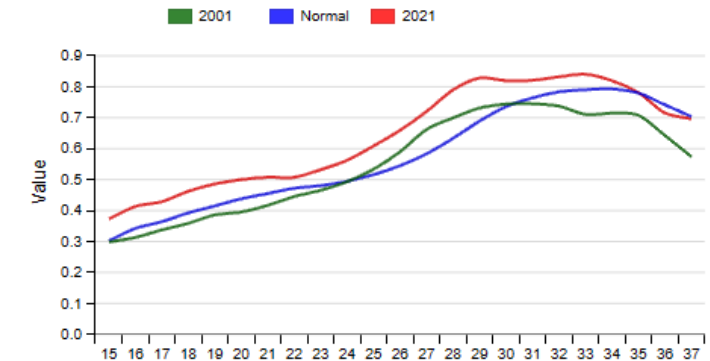
Yield Model – NDVI data

Normalized Difference Vegetation Index
Weekly satellite composites
mid-April to mid-Oct
1987 - present



Census Agriculture Region	Year	NDVI
3501	1987	0.786
3501	1988	0.655
3501	1989	0.699
3501	...	...
3501	Current year	0.776

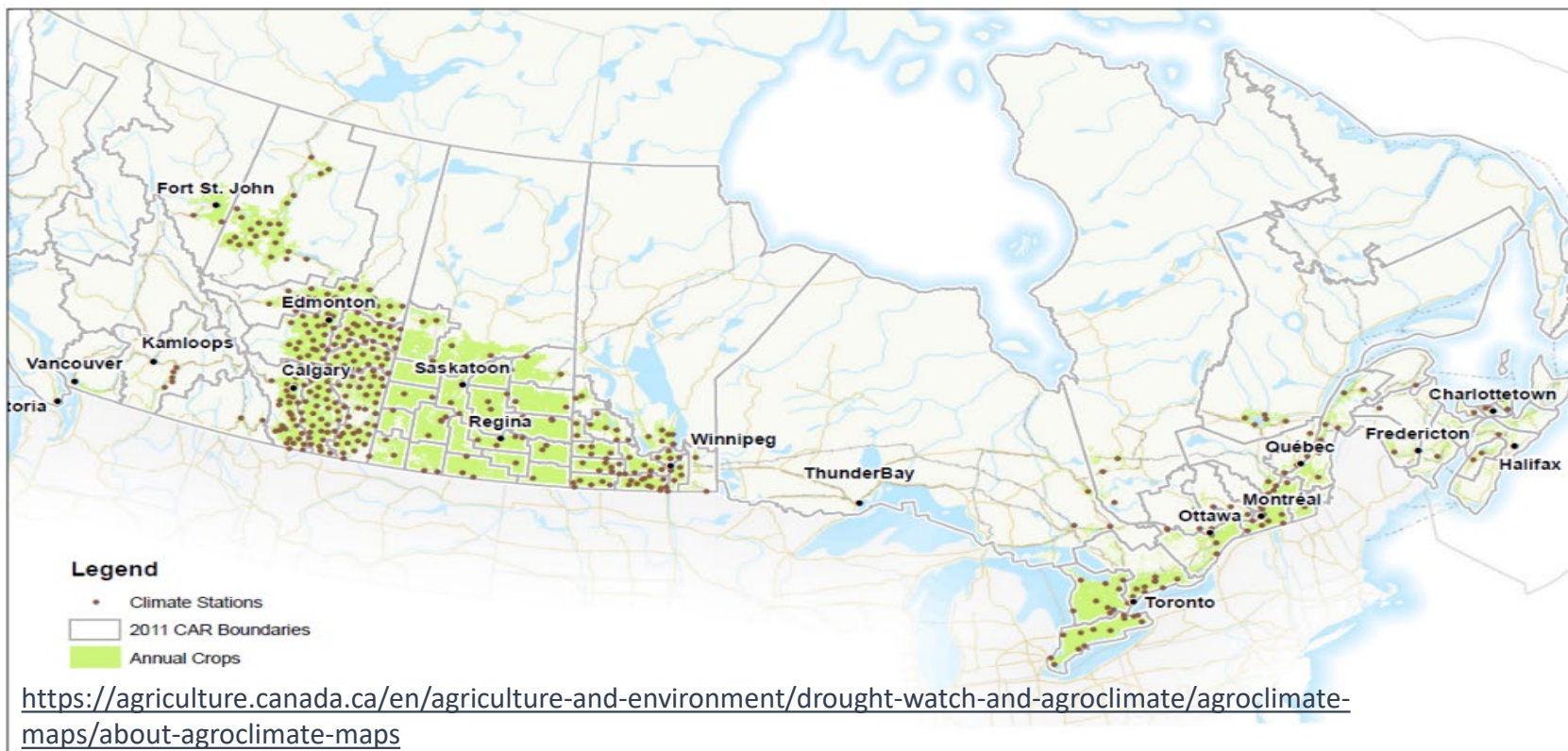
Crop and pasture NDVI. Graph result for: CD Region Essex (CD3537), Ontario



Soybean – Southern Ontario
Yield range

2021: 3.49 t/ha (51.9 bu/ac)
Normal: 2.78 t/ha (41.3 bu/ac)
2001: 1.40 t/ha (21.1 bu/ac)

Agriclimatic Data



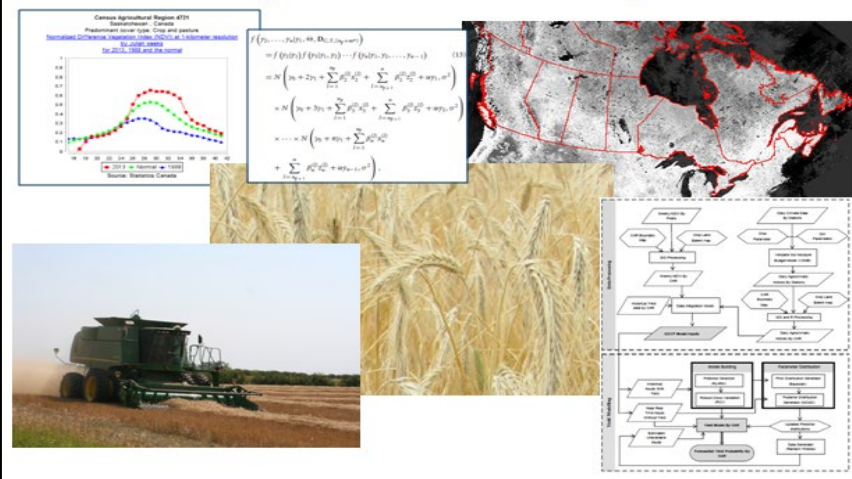
- The station-based daily temperature and precipitation data provided by Environment and Climate Change Canada and other partner institutions were re-analyzed by AAFC to generate the climate-based predictors which amongst others included crop moisture stress, cumulative precipitation and growing degree days.
- These data were provided to Statistics Canada by AAFC.

Newlands, N.K., Zamar, D., Kouadio, L., Zhang, Y., Chipanshi, A., Potgieter, A., Toure, S., Hill, H.S.J., 2014. *An integrated model for improved seasonal forecasting of agricultural crop yield under environmental uncertainty*. *Front. Environ. Sci.* 2, 17. Doi: <http://dx.doi.org/10.3389/fenvs.2014.00017>

Chipanshi, A., Zhang, Y., Kouadio, L., Newlands, N., Davidson, A., Hill, H., Warren, R., Qian, B., Daneshfar, B., Bedard, F. and Reichert, G., 2015. *Evaluation of the Integrated Canadian Crop Yield Forecaster (ICCYF) Model for In-season Prediction of Crop Yield across the Canadian Agricultural Landscape*. *Agricultural and Forest Meteorology*, vol. 206, pp 137-150. DOI: <http://dx.doi.org/10.1016/j.agrformet.2015.03.007>



Crop Yield Modelling



Historical yield data and other predictors

Yield estimates for the current year are based on current and historical:

- NDVI data
- Agriclimatic data
- Yields from statistical surveys and administrative data

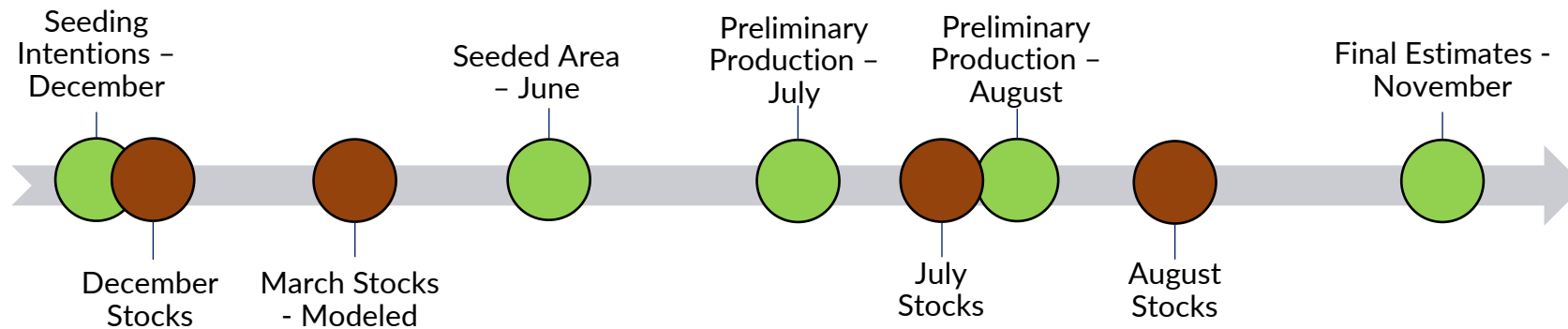
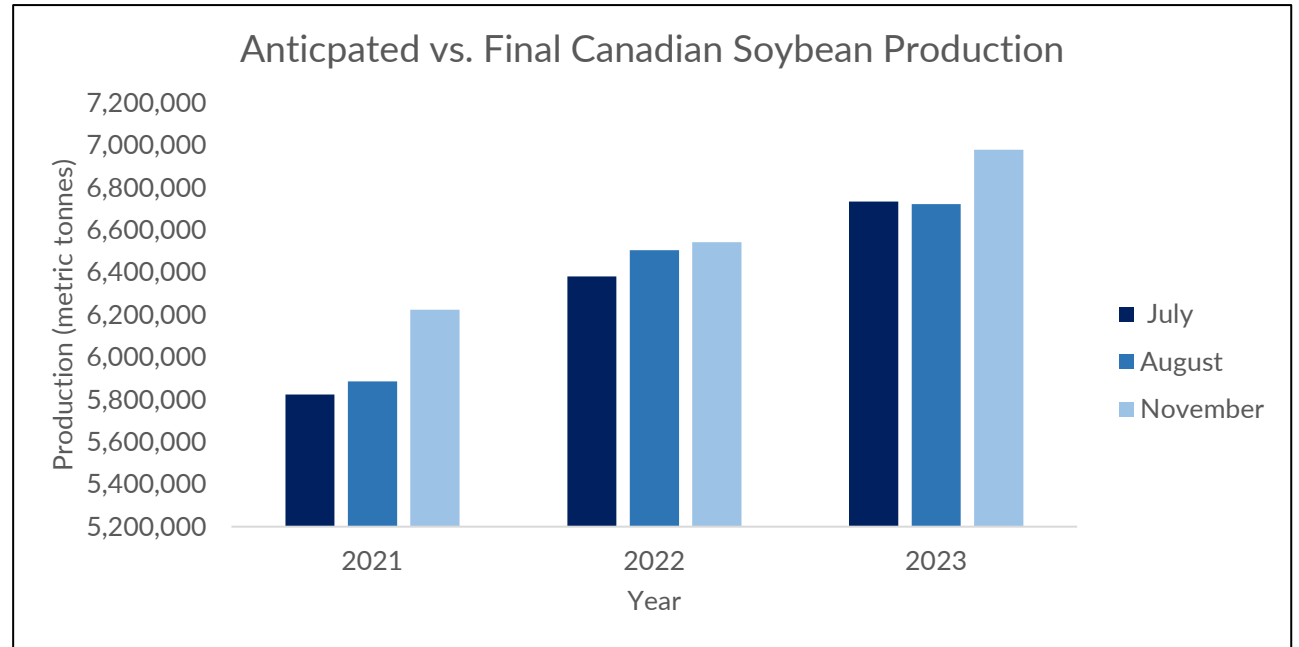
Example of top predictors used in the model

Crop yield can be influenced by a number of factors. Since yield can rarely be predicted by a single factor, a multivariable approach is more likely to provide more robust and accurate models.

Census Agricultural Region	Year	Survey Yield (bu/ac)	NDVI	Total Precip. (mm)	Total Growing Degree Days (GDD)	Average Water Stress Index (SI)	SD of Daily SI	SD of Daily GDD
3501	1987	34.2	0.786	340	1125	0.45	0.063	2.60
3501	1988	28.8	0.655	255	1087	0.56	0.101	2.78
3501	1989	30.6	0.699	312	1200	0.48	0.084	2.36
3501	...	...	...	...	...	...	...	...
3501	Current year	???	0.776	355	1211	0.34	0.079	2.49

Final Production Estimates - November

- Provides final estimates for area, yield and production
- Collection take place after most harvest is completed
- Surveys all 10 provinces
- Largest survey occasion
 - Surveys all 10 provinces
 - Samples approximately 27,200 respondents
- Subject to revision for up to two years



Conclusion

- The Crop Reporting Series continues to provide valuable crop information
- Essential to providing insight into Canadian crop production
- The Agriculture Divisions continues to modernize and improve our programs
- Statistics Canada remains dedicated to producing high quality statistics

Thank You



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For More Information

- [Agriculture and Food Statistics \(statcan.gc.ca\)](https://statcan.gc.ca)
- [Estimated areas, yield, production, average farm price and total farm value of principal field crops, in metric and imperial units \(statcan.gc.ca\)](https://statcan.gc.ca)
- [Stocks of grain and oilseeds at March 31, July 31 and December 31 \(statcan.gc.ca\)](https://statcan.gc.ca)
- [Supply and disposition of grains in Canada \(statcan.gc.ca\)](https://statcan.gc.ca)
- [Crop Condition Assessment Program \(CCAP\) \(statcan.gc.ca\)](https://statcan.gc.ca)
- [Estimated areas, yield and production of principal field crops by Small Area Data Regions, in metric and imperial units \(statcan.gc.ca\)](https://statcan.gc.ca)



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