



GRO REPORT

2021 Performance Report on Yield
Forecast and Acreage Models



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About Gro

Gro Intelligence has organized, combined, and structured the world's climate and agricultural data into searchable and accessible insights.

Gro Intelligence has global expertise in developing effective and robust applications and analytics across a wide range of short-, medium-, and long-term use cases. Gro's forecast models cover a variety of subjects, geographies, and environmental conditions, examining and translating the intersectional effects of supply, demand, price, climate, and plant pests and disease each day. Our mission is for users to find meaningful, actionable insights and to enable better informed and faster decision-making.

Executive Summary

Gro Intelligence has over 2 million unique analytics that address a range of questions

across yield and production, supply and demand, growing conditions, and climate scenarios. In this paper, we focus on the performance of several of our yield and acreage models.

Gro's global models accurately predict yields and acreage far in advance of official government data.

- Gro's forecasts in the US are accurate 4-6 months ahead of official government estimates.
- In critical regions, such as Russia, Brazil, and China, Gro's forecasts are accurate up to 12-24 months in advance of official estimates.
- Gro's forecasts are available months ahead of official government estimates, and our forecasts are within 2%-5% of final government estimates.

Gro's yield models leverage pixel-level satellite data that capture every field in every county of a state, not just random fields as with traditional crop survey methods. Our forecasts are significantly more accurate because:

- **Research and data science** - Our team of experienced data scientists work closely with our research analysts to develop the best possible models. We use human intelligence which is then scaled through artificial intelligence.
- **Comprehensive global data sources and variables** - Our forecasts incorporate a combination of Gro's extensive suite of climate, environment, and crop condition data alongside and variables.
- **Geospatial expertise** - Gro's geospatial team creates proprietary crop masks for each yield model to enhance the explanatory power of climate variables.
- **Machine and human learning** - The machine-learning models constantly improve as additional ground truth data comes in, and Gro's domain experts examine this data to create new predictive features.

Accurate Forecasts Months Before Government Reports Are Released

Gro Intelligence's predictive models inform a customer's global view of grain and oilseed supply, demand, and revenue months ahead of government reports, in particular the US Department of Agriculture's reports.

Yield Models Within 2%-5% of Government Numbers - Gro's suite of machine-learning models currently cover 80% of global production for corn, soy, and wheat. Our forecast models provide in-season yield estimates at the district, province, and/or national levels on a daily basis.

Gro Yield Projections Are Available Months Before Final Government Estimates

Country	Crop	# of Months Gro Accurately Predicts in Advance of Final Government Estimate ¹
Argentina	Corn	5-6 ²
Argentina	Soybean	5-6
Brazil	Corn	6 ³
Brazil	Soybean	6
Canada	Spring Wheat	1-2 ⁴
China	Corn	3 ⁵
China	Winter Wheat	12-24 ⁶

Country	Crop	# of Months Gro Accurately Predicts in Advance of Final Government Estimate
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¹The number of months can vary year to year due to irregular reporting dates by a government source. Gro accuracy is 2%-6% on an average absolute basis across models.

² Ministry of Agriculture, Forestry, and Fisheries (MAGyP) generally reports final numbers in September-October.

³ Instituto Brasileiro de Geografia e Estatística (IBGE) generally reports final numbers in October.

⁴ Gro model stabilizes 1-2 months ahead of Statistics Canada's (StatCan) November report.

⁵ National Bureau of Statistics of China (NBS) releases final numbers in December.

⁶ National Bureau of Statistics of China (NBS) has not released winter wheat yield since 2018.

India	Wheat	5 ⁷
Russia	Winter Wheat	8 ⁸
Ukraine	Wheat	10 ⁹
US	Corn	4 ¹⁰
US	Soybean	4
US	HRW Wheat	6

Acreage Models

Our acreage models provide forecasts at the district level that can be used to provide a regional view.

- **Our Planting Intentions** Model projects how much land will be devoted to major crops in the coming year based on farmers’ planting economics.
- **Our Prevent Plant** Model estimates the number of acres that have been prevented from being planted at the county and national levels well in advance of the USDA’s report. These estimates allow our customers to measure the impact of lost acreage on product demand.

⁷ Department of Agriculture and Farmers Welfare publishes the final yield in September, and this number is adopted by the USDA.

⁸ Russia United Interdepartmental Information and Statistical System (EMISS) final report in March

⁹ State Statistics Service of Ukraine (Ukrstat) publishes final numbers in April.

¹⁰ USDA Annual Crop Production Summary in January publishes final numbers.

Gro Acreage Projections Are Available Far Ahead of Final Government Estimates

Model	Country	Crop	# of Months Gro Accurately Predicts in Advance of Final Government Estimate
Prevent Plant	US	Corn	6 ¹¹
Prevent Plant	US	Soybean	6
Planting Intentions	US	Corn	10 ¹²
Planting Intentions	US	Soybean	10
Planting Intentions	US	Wheat	10
Planting Intentions	US	Cotton	10

Yield Forecast Model Performance: Accurate Well Before Government Estimates

Gro’s Yield Forecast Models estimate in-season yields at the district, province, and/or national levels on a daily basis. The model uses spatially explicit environmental data, alongside ground truth data, to monitor crop conditions during the growing season and to continuously recalibrate final yield forecasts.

Available Models Include (Year Launched):

- **US:** Corn (2016), Soy (2018), Winter Wheat (2019)
- **Argentina:** Corn (2020), Soy (2020),
- **Australia:** Wheat (2021)
- **Brazil:** Corn (2020), Soy (2020)
- **Canada:** Wheat (2020)
- **China:** Corn (2019), Wheat (2021)
- **India:** Wheat (2018)
- **Russia:** Winter Wheat (2019)
- **Ukraine:** Wheat (2019)

¹¹ USDA Farm Service Agency (FSA) publishes final numbers in January

¹² USDA Annual Crop Production Summary in January publishes final numbers

The following tables compare the performance of Gro Yield Forecasts against official government reports for each respective crop/country combination. We show final, end-of-year yield forecasts for US and Brazil Corn, US and Brazil Soybeans, and US and Ukraine Wheat.

While we are only showing the final numbers, our Yield Forecast Models update daily and accuracy increases as the season progresses.

Gro Yield Forecast Performance | **US AND BRAZIL SOYBEAN**

Get certainty on US Soybean Yields four months before the final number is published in the USDA's January Annual Production Report.

Country	Crop	Harvest Year	Gro Forecast bu/acre	Final Number January WASDE
US	Soybean	2018	50.61	50.60
US	Soybean	2019	46.65	47.40
US	Soybean	2020	51.45	51.00
US	Soybean	2021	51.12	51.20

Get certainty on Brazil Soybean Yields six months ahead of the final number in the IBGE's October Report.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number IBGE
Brazil	Soybean	2020	3.23	3.28
Brazil	Soybean	2021	3.37	3.45

Gro Yield Forecast Performance | US AND BRAZIL CORN

Get certainty on US Corn Yields four months before the USDA releases its final number in its January Annual Production Report.

Country	Crop	Harvest Year	Gro Forecast bu/acre	Final Number January WASDE
US	Corn	2016	171.02	174.60
US	Corn	2017	176.86	176.60
US	Corn	2018	177.48	176.40
US	Corn	2019	170.02	167.50
US	Corn	2020	180.64	171.40
US	Corn	2021	177.36	177.00

Get certainty on Brazil Corn Yields six months before the IBGE December Report's final number is released.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number USDA PS&D
Brazil	Corn	2021	5.02	4.34

Gro Yield Forecast Performance | ARGENTINA CORN AND SOYBEAN

Get certainty on Argentina Soybean Yields five to six months before the Ministry of Agriculture's (MAGyP) final number is released.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number Ministry of Agriculture
Argentina	Soybean	2018	2.30	2.32
Argentina	Soybean	2019	3.21	3.33
Argentina	Soybean	2020	2.90	2.92
Argentina	Soybean	2021	2.88	2.81

Get certainty on Argentina Corn Yields five to six months ahead of MAGyP's final number.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number Ministry of Agriculture
Argentina	Corn	2021	7.02	7.43

Gro Yield Forecast Performance | CHINA CORN AND WHEAT

Get certainty on China Corn Yields three months before China’s NBS releases its final number.¹³

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number China NBS
China	Corn	2019	6.22	6.32
China	Corn	2020	6.29	6.32
China	Corn	2021	6.57	6.50

Get certainty on China Winter Wheat Yields one to two years before China’s NBS publishes its final number.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number China NBS
China	Winter Wheat	2020	5.67	N/A*
China	Winter Wheat	2021	5.99	N/A*

¹³ Note: China NBS has not updated final yield numbers since 2018.

Gro Yield Forecast Performance | US AND UKRAINE WHEAT

Get certainty on US Hard Red Wheat (HRW) Wheat Yields six months before the USDA publishes its final number in its January Annual Production Report.

Country	Crop	Harvest Year	Gro Forecast bu/acre	Final Number USDA ERS - Wheat Yearbook
US	Hard Red Winter Wheat	2019	44.24	48.18
US	Hard Red Winter Wheat	2020	42.83	42.22

Get certainty on Ukraine Wheat Yields 10 months in advance of UkrStat's final number.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number USDA PS&D
Ukraine	Wheat	2019	4.34	4.16
Ukraine	Wheat	2020	3.91	3.71

Gro Yield Forecast Performance | INDIA WHEAT

Get certainty on India Wheat Yields 5 months before the USDA PS&D releases its final number.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number USDA PS&D
India	Wheat	2018	3.10	3.37
India	Wheat	2019	3.22	3.53
India	Wheat	2020	3.23	3.44
India	Wheat	2021	3.57	3.46

Gro Yield Forecast Performance | RUSSIA AND CANADA WHEAT

Get certainty on Russia Winter Wheat Yields eight months in advance of the final number from EMISS (Russian Official Estimates).

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number USDA PS&D
Russia	Winter Wheat	2019	3.44	3.41
Russia	Winter Wheat	2020	3.76	3.77
Russia	Winter Wheat	2021	3.62	3.43

Get certainty on Canada Spring Wheat Yields up to two months before StatCan publishes its final number.

Country	Crop	Harvest Year	Gro Forecast t/ha	Final Number StatCan
Canada	Spring Wheat	2020	3.56	3.60

Acreage Models That Align to Government Forecasts, But Are Available Earlier

Gro’s Prevent Plant and Planting Intentions Models use a suite of machine-learning models to estimate planted area for the upcoming season. The planting intentions model considers a complex set of price relationships to predict farmer behavior, and our prevent plant model uses spatially explicit environmental data to predict the amount of acreage the farmers will be unable to plant.

Gro Prevent Plant Performance | CORN & SOYBEANS

Get an accurate forecast eight weeks before the USDA FSA’s initial report and six months before its final report.

Country	Crop	Harvest Year	Gro Forecast As of End June million acres	January Final Number USDA FSA million acres
US Corn Belt	Yellow Corn & Common Soybeans, non-irrigated	2019	10.30	11.13
US Corn Belt	Corn & Soybeans	2020	3.34	5.26
US Corn Belt	Corn & Soybeans	2021	0.54	0.38

(NOTE: US Corn Belt includes IA, IL, IN, OH, KS, NE, MO, MN, SD, ND, and WI)

Gro Planting Intentions Performance | **CORN, SOYBEANS, WHEAT, & COTTON**

Get an accurate forecast 10 months before the final NASS report.

Country	Crop	Harvest Year	Gro Forecast Million acres	USDA NASS March Prospective Plantings million acres	Final Acreage January USDA NASS million acres
US	Corn	2021	93.14	91.14	93.30
US	Soybeans	2021	88.56	87.60	87.24
US	Wheat	2021	44.33	46.36	46.70
US	Cotton	2021	15.11	12.04	11.19

Accessing Yield Model Forecasts and Acreage Models

Gro's yield and acreage models update daily in-season in a variety of formats.

- **API access** allows teams to incorporate all inputs of our yield and acreage models into their own analytics databases.
- **Yield Models** - Our yield model access varies by region:
 - Our US model is available in Starter.
 - Russia and the Ukraine models are available to Standard-level subscribers.
 - Brazil and China models are available only to Gro's Premium users.
- **Planting Intentions Model** - Our Planting Intentions Model is available at our Premium subscription level.
- **Prevent Plant Model** - Our Prevent Plant Model is available with a Standard-level subscription.

Conclusion

Gro's global models accurately predict yields and acreage far in advance of official data.

- Gro's forecasts in the US are accurate four to six months before official government estimates.
- In critical regions, such as Russia, Brazil and China, Gro's forecasts are accurate up to 12-24 months before official government estimates.
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Contact Gro to learn more about our models or to schedule a demonstration of our platform.

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