

# Accelerating wheat innovation with AI-based field robotics

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**IN THE RACE TO DEVELOP** the climate-resilient wheat varieties Saskatchewan producers need to remain globally competitive, plant breeders are constantly looking for ways to accelerate crop research.

Dr. Keshav Singh, a research scientist at Agriculture and Agri-Food Canada (AAFC) Lethbridge, notes that breeding programs generate thousands of new crop lines that need to be evaluated each year using conventional methods that require considerable resources, limiting the number of new cultivars that can be assessed.

"They're going into the field and there's maybe a thousand or many thousands of plots they need to screen. That's very labour intensive, time consuming and subjective," said Singh, whose research involves using digital phenomics and remote sensing technologies to accelerate the development of cereal crops. "If we can speed up the variety selections using novel techniques then it will

indirectly help producers because there's always a bottleneck of new varieties being released to the market."

To help speed things along, Sask Wheat invested in a three-year project (2023 to 2026). This saw Singh's Remote Sensing and Phenomics Lab collaborate with the University of Saskatchewan to station unmanned ground vehicles (UGVs) at six geographically and environmentally distinct locations across Canada (Brandon, Lethbridge, Morden, Ottawa, Saskatoon and Swift Current).

Those UGVs, known as UFPS (University of Saskatchewan Field Phenotyping System) carts are automated mobile robots that were used to capture large-scale, standardized field data from 90 test plots planted with 30 historical spring wheat cultivars using LIDAR scans, RGB/NIR imagery and high-precision RTK GPS ground measurements.

"We decided to deploy the same phenotype scanning system at six locations so

that the data that has been generated is unbiased," Singh said. He noted that more than 46,000 plot-level observations were recorded across all locations and organized into a large, high-quality database before AI modelling was used to predict key agronomic traits. "We also merged weather data along with our sensor data to find complex phenotypic traits and to identify how these types of genotypes are doing in different environmental conditions."

The net result? A scalable, standardized system that acquires and processes high-quality, unbiased data, rapidly screens large breeding populations, accurately predicts in-season crop performance and incorporates other efficiencies that together promise to accelerate the development of climate-resilient wheat varieties.

While the initial focus was on supporting breeders, Singh sees potential for UFPS carts to become a standard phenomics tool that ultimately benefits diverse researchers, agronomists and growers. 🌱



A UFPS cart that includes UAV and GPS RTK base stations. | PHOTO CREDIT: DR. KESHAV SINGH

