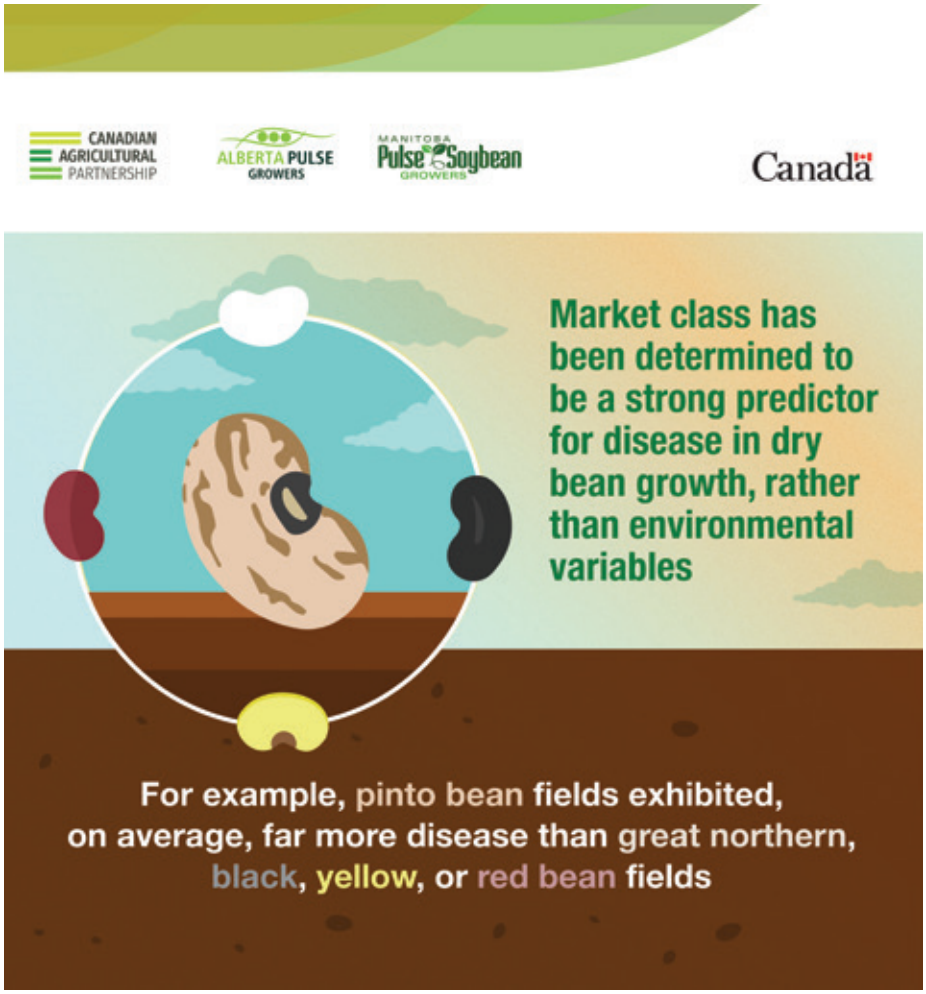
UNVEILING THE MYSTERIES OF MOULD IN DRY BEANS

It is every pulse grower's dream—a crystal ball that accurately predicts the risk of a disease outbreak during an upcoming growing season and recommends how to manage crops with the least amount of fungicide.

Research scientists have the power to unveil the mysteries of how airborne diseases behave under complex conditions. Agriculture and Agri-Food Canada (AAFC) researchers like Lethbridge's Dr. Syama Chatterton, whose recent study into the causes of white mould and bacterial blights in dry bean crops, is already delivering insights growers can apply to their operations today.

Chatterton's project aims to develop accurate white mould forecasting based on airborne spore and weather data. White mould is a major yield limiting disease that affects many Canadian field crops including dry bean, soybean, canola, and sunflower.

The most significant results of Chatterton's study focus on *Sclerotinia sclerotiorum*, the fungus that causes white mould and other diseases across Canada.



"The factors driving extreme white mould epidemics still are not clearly understood," Chatterton said. What researchers do know is that white mould is spread mainly through airborne spores that infect dead flower petals, then attack the bean pods and stems, resulting in yield loss. The fungicides used to prevent or treat white mould eat into profits.

To gain a better understanding of how these spores spread, Chatterton and her team surveyed irrigated fields in Alberta and unirrigated fields in Manitoba and Ontario over four growing seasons.

They monitored the air for spores across a significantly larger area and time span than similar research projects in the past. They used machine learning statistical methods

to analyze the results and reveal any telling connections between the environment, spores, and disease prevalence— information from which to build a forecasting model.

What they found surprised them. "None of the environmental variables we examined including temperature, relative humidity, soil temperature and moisture, and more were strong predictors of airborne spores or white mould in a field. Instead, a greater predictor was the market class of the dry bean," Chatterton explained.

Pinto bean fields exhibited, on average, far more disease than great northern, black, yellow, or red bean fields.

That said, pinto bean fields exhibited a huge range of disease levels, from 0–100% of plants infected—a range also seen in great northern bean fields. That means cultivar management practices may be important determining factors of diseases in all bean market classes.

Because of the unique life cycle of *S. sclerotiorum*, researchers also expected to find no early spores in the early part of the season, a sudden peak of spores at the flowering stage, and then no spores at the end of the season. "Instead, we found relatively high levels of spores throughout the season in almost all fields we surveyed," Chatterton noted.

That trend has important management implications for growers. If *S. sclerotiorum* spores are almost always in the environment, Chatterton said adopting the following strategies can help mitigate disease:

- Grow cultivars that are resistant to white mould, whether the resistance comes from structural features of the plant (i.e., more upright cultivars tend to trap less moisture, which helps prevent disease development) or from genetic resistance at the molecular level.
- For irrigated dry bean fields, reduce the irrigation frequency but apply more water at a time during the flowering period when the plants are most susceptible to infection.
- Apply fungicide strategically. Studies show that for fields with low infection levels, fungicides provide little if any benefit. Fungicide use is not typically economical below disease incidence levels of 20– 25%.

"Of course, deciding not to apply fungicides requires a certain amount of risk tolerance, since we cannot perfectly predict what the final disease levels in a field will be," Chatterton added.

While the ability to predict white mould epidemics with the clarity of a crystal ball remains elusive, Chatterton hopes future research will ease the burden of risk tolerance and help growers make better choices about fungicide applications based on airborne spore levels.

"Each grower is the expert in their own operation," she said. "It is up to each to assess the relative risks of these factors and to make management decisions accordingly."

If a grower decides that fungicide is the best management approach, Chatterton encouraged them to leave a check strip to compare the impact.

"This would also allow us researchers to decipher the effect of fungicide use on the risk prediction models we develop in the future."

There will always be guesswork in farming, but Chatterton's research moves the needle on reducing fungicide costs and managing mould in dry beans ever closer to mathematical certainty.

The Pulse Research Cluster includes Alberta Pulse Growers, Manitoba Pulse and Soybean Growers, Ontario Bean Growers, Saskatchewan Pulse Growers and Pulse Canada and is supported by the Agriculture and Agri-Food Canada AgriScience Clusters Program under the Canadian Agricultural Partnership.

Project
Optimizing disease management strategies for white mould and bacterial blights of dry bean

Industry Funders
Alberta Pulse Growers, Manitoba Pulse and Soybean Growers

Cost
$616,904

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