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Bayer advances Tomato Virus defense with gene-stacked resistance strategy

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As the global tomato industry faces the challenge of the highly infectious Tomato brown rugose fruit virus (ToBRFV), Bayer is leading the charge in developing innovative, long-term solutions to protect crops and ensure profitability for growers. In an exclusive interview, Javier Quintero, Global Lead for Tomato R&D at Bayer's Crop Science division, shares insights into the company's groundbreaking work on multi-stacked resistance an advanced strategy designed to outsmart the virus's rapid mutation rate.Quintero discusses the limitations of first-generation resistant varieties and explains the science behind gene stacking. He also provides details on the results from recent high-pressure virus trials, showcasing how Bayer's latest hybrids combine durable disease resistance with superior fruit quality and yield. Furthermore, he highlights how these innovations are specifically tailored for high-tech glasshouse markets and hints at future applications of the resistance-stacking strategy in other major crops.With new product launches expected in 2025 and strong interest from growers worldwide, Bayer's advancements represent a significant progress in sustainable tomato production and potentially beyond.

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Could you share what motivated Bayer's focus on developing multi-stacked resistance in tomato varieties? Additionally, could you explain how this approach differs from the first-generation of ToBRFV-resistant tomatoes?

This is a very high impact virus, and we did intensive research on plant-virus interactions. The first generation of tomato brown rugose fruit virus (ToBRFV) resistant varieties has been useful for immediate solutions to an urgent problem. However, internal and external studies indicated that the virus is actively mutating, and we anticipated for the virus to overcome single gene resistances. For these reasons, several years ago we initiated a horizontal resistance breeding strategy where bringing several genes together provide a good level of resistance that is expected to hold up and be more durable against mutations in the virus. We now have commercial products available with multiple resistant genes, good agronomics, and very nice consumer quality.

Furthermore, could you elaborate on the mechanisms by which these multi-stacked resistance genes work to disrupt different stages of the plant-virus interaction?

Viruses use host plant replication mechanisms for their multiplication. We have investigated the host-virus interactions in our multiple resistant varieties, and we have found that virus multiplication is significantly slowed down in the new varieties as compared to susceptible varieties. It is our hypothesis that the resistant genes interfere with different steps in the replication process of the virus, and the trials have been supporting this hypothesis. We are also interested in learning more about the key findings from the recent high-pressure virus trials and how these findings validate the durability of these new hybrids.

We evaluated the resistance levels of selected candidate tomato varieties through standardized inoculated trials conducted in heated glasshouse conditions. In these trials, plants were inoculated with a Tomato brown rugose fruit virus (ToBRFV) suspension 40 days after sowing. Infection was confirmed two weeks later, and symptoms on leaves and fruits were assessed from 25 to 140 days after inoculation using a standardized rating scale. All trials took place in quarantined facilities with the capacity to test approximately 1,000 varieties annually.

In a separate study, we tested the performance of four new varieties against a resistance-breaking strain of ToBRFV. Plants were inoculated 15 days after sowing in two parallel trialsâ??one using the standard ToBRFV isolate (St-ToBRFV) and the other using the resistance-breaking mutant strain (RB-ToBRFV). Each trial was conducted in separate glasshouse compartments.

Symptom severity was rated at 14 and 21 days post-inoculation using the GonzÃ¡les-Concha (2023) scale, where a score of 1 indicates no visible symptoms and 9 indicates severe symptoms. The susceptible check variety, used as a control, exhibited strong symptoms in both trialsâ??scoring 9 in the St-ToBRFV trial and 5 in the RB-ToBRFV trialâ??confirming effective inoculation. These results are consistent with findings by Zisi et al. (2024). By contrast, the four Vegetable by Bayer hybrids recorded symptom scores between 1 and 3 across both trials, demonstrating strong and consistent resistance to both the original and mutated virus strains.

Could you provide some details on how these new hybrids perform in terms of yield, fruit quality, and shelf life when compared to traditional or earlier resistant varieties?

Whatâ??s impressive is Bayer products are behaving on par or even better as generations launched before ToBRFV resistance came in. This applies to products we converted ase well as new hybrids, exhibiting durable ToBRFV resistance combined with excellent agronomic features. In others words, no drags are observed linked to ToBRFV resistance within Bayer new launches. We were even able to deliver products with extra specifications and measures of performance that we did not have before. For example, extra resistance to the fungal plant pathogen Passalora fulva, which is absolutely exceptional! This is the type of innovation and benefits that growers appreciate and have been encouraging Bayer to continue developing.

With the anticipated launch in 2025, which regions or grower segments are likely to experience the most immediate benefits from these new varieties?

Most of the new launches are well adapted to high tech glasshouse growers worldwide. We are currently launching products in major glasshouse market segments (Large Truss, Medium Truss, Beef, Cherries) and are deploying product launches as fast as possible to each market in need of these newly developed solutions. The main challenge we are facing is to supply the high demand for seeds of these new launches, as we need to comply with local regulations. Similarly, we are expecting significant progress in our mid-tech greenhouse program, so stay tuned as additional launches may come soon. We encourage your grower audience to reach out to their local Bayer representatives for the latest information.

Finally, looking to the future, does Bayer have plans to apply similar resistance-stacking strategies to other crops that are currently facing threats from fast-mutating viruses?

Fast-mutating viruses are a concern across a number of crops, so weâ??ve established a multi-stack strategy to get and stay ahead of mutation. In tomato, we've already successfully deployed this strategy against TYLCV and TSWV, in addition to ToBRFV, and itâ??s in development across other solanum crops like peppers and in our cucurbit crops like cucumber, melon and watermelon, to name a few.

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