Characterization and Utility of Resistance Sources Against Resistance-Breaking Rhizomania in Sugar Beet

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Rhizomania, a severe disease caused by beet necrotic yellow vein virus (BNYVV), causes significant damage to sugar beet worldwide, not only physically harming the sugar beet root but also reducing the quality of extracted sugar. The most practical and common solution is the use of plants with resistance sources. Though the use of these resistance sources is widespread, resistance-breaking Rhizomania strains (RB-BNYVV) makes it difficult for the farmers to know which resistance source will work best. There is a need to know which resistance source, from one uncharacterized and five characterized sources, is the most effective, and to develop better methods to determine that. This study used field data (root scores), ELISA (composite root and individual) and qPCR to determine that Rz5 was the most effective resistance source, and that the uncharacterized resistance source is qualitative and so easily overcome by new virus strains. This study determined that despite the similarity in results, the composite root ELISA (most common measurement used) gave no indication of spread, which was an essential component of the individual ELISAs, and thus is not an informative measurement that should continue being used in the future to determine effectiveness of a resistance source. Finally, the effect of temperature on greenhouse studies was examined to determine if it acts as a confounding variable in supposedly controlled environments. As a part of this study, a temperature drop likely caused a reduction in virus titer for two treatments since Rhizomania's vector, Polymyxa betae, becomes dormant at low temperatures. Hence, effects of temperature need to be factored in when determining the right resistance source.

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