Abstract

Plant disease monitoring metadata is a rich source of information for predicting pesticide use and costs on individual fields, farms, or regionally. Pesticide use patterns for management of hop powdery mildew (Podosphaera macularis) in Oregon were summarized by frequency of use of active ingredients and Fungicide Resistance Action Committee (FRAC) code. There was extensive variation in the frequency of use of specific active ingredients and FRAC codes among growers, ranging from a mean of 0 to 2.41 applications per yard. All growers used fungicides with FRAC codes 7/11 and 13; all but one grower used fungicide FRAC codes M02, NC, 3, and 11. Among fungicides with a moderate to high risk of developing resistance (FRAC codes 3, 5, 7, 7/11 pre-mix, 11, or 13), the mean number of applications was â€1.35 per yard across all growers and never exceeded four applications within a given yard. Hierarchical cluster analysis identified that the diverse use patterns could be categorized into three groups, which we define as pesticide programs. We fitted a random forest regression model and used Shapley values to quantify the importance of fungicide program in predicting the number of active ingredients applied and their costs relative to other known factors that influence these outcomes in individual yards. Pesticide program was the third most important variable predicting annual costs and the fifth most important predictor for the number of active ingredients applied. We also found hints that growers may switch between one of the three pesticide programs depending on the incidence of powdery mildew. mixtures. }