Potato Leafhopper Threshold Revised for Alfalfa Host Resistance and Alfalfa-Grass Mixtures

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Potato leafhopper, *Empoasca fabae* Harris (Hemiptera: Cicadellidae) is historically known to cause significant economic loss to alfalfa production, with loss estimates ranging from $32-66/ha. Assuming a cost to apply insecticide is about $37/ha per application and that at least one application is needed per year on half the alfalfa acreage in the affected region, then the cost of insecticide treatment for potato leafhopper across the region is $91 million. There are also economic and environmental costs when insecticide is applied but not needed. Research has demonstrated disruption of nitrogen fixation by feeding injury of potato leafhopper late in the growth cycle, when insecticides are typically not applied. There is evidence that climate change is associated with earlier appearance of the leafhopper by migration and severity of potato leafhopper induced losses increase with rising temperatures. The current economic threshold for potato leafhopper on alfalfa has been robust enough to be continued to be used for decades; however, a recent study questions whether those thresholds should be adjusted downward based on increased market value of alfalfa. The release of new leafhopper-resistant germplasm in the late 1990's has not been widely adopted by growers, although previous work has demonstrated their value in significantly reducing the damage caused by this pest. Research has also shown the value of including grasses in alfalfa mixtures as a means to increase crop tolerance to leafhoppers. Although the mechanism for disruption of nitrogen fixation by feeding injury of potato leafhopper late in the growth cycle is established, no evidence has been reported to date to relate late injury to rates of nitrogen fixation. Management of leafhopper populations through insecticides during the period of late injury is not common, thus resistant cultivars and perhaps alfalfa-grass mixtures may be the only means to reduce damage to nitrogen fixation. Here, we propose research to revise the economic threshold for potato leafhopper in alfalfa in light of changes in cultivars (i.e. host resistance), and the potential tolerance by grass-alfalfa mixtures across three states and multiple years. We will also relate leafhopper injury to rates of nitrogen fixation, providing a test of whether resistant cultivars and alfalfa-grass mixtures are an effective means to reduce damage to nitrogen fixation. This is important because an insecticide application late in the growth cycle is not practical nor would it be perceived as necessary by producers since it would have limited to no effect on yield of the current growth cycle. In addition to providing new guidelines to forage producers and consultants, we will document and demonstrate the value of leafhopper resistant alfalfa and grass-alfalfa mixtures, which we believe will increase adoption of those practices, leading to more sustainable approaches to protect alfalfa from this key pest.