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DYNAMIC OPTIMIZATION MODEL TO CONTROL WEED INFESTATION: A MIXED-INTEGER NONLINEAR PROGRAMMING APPROACH

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Abstract. One of the main goals of weed control is to maintain the weed population density in a equilibrium level that is below economic damages. To achieve this goal, we propose a dynamic optimization model for weed infestation control using herbicides rotation strategy. The objective is to reduce the seed bank and the use of herbicide, maximizing the profit in a pre-determined period of time and minimizing the environmental impacts caused by excessive use of herbicides. The dynamic optimization model takes into

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account the decreased herbicide efficacy over time, which is due to an increase of weed resistance originated from selective pressure. The dynamic optimization problem involves integer and continuous variables modeled as a mixed-integer nonlinear programming problem (MINLP). The MINLP problem was solved by an implicit enumeration known as branch and bound method. Numerical simulations illustrated the solution of a case study for infestation control of the *Bidens subalternans* specie in a maize crop by interchanging between two classes of herbicides. The results demonstrate that our optimization model can improve the profit of farmers and has the potential to contribute for further decision-support tools in weed management that considers the resistance dynamics.