



The Effects of Pesticide as Optimal Control of Agriculture Pest Growth Dynamical Model

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Abstract: Indonesia has tropical climate so that many crops can be harvested. One of agricultural problems is the agricultural pest (*Nilaparvata lugens*) in a rice field. This pest can be devastated by the natural predator spider (*Lycosa pseudoannulata*). To reduce the number of pests, we use pesticide as a control which is applied in the pest population. For the problem, we can construct the model as a predator-prey model with the pest as the prey and the spider as the natural predator. This paper discusses stability analysis and optimal control of the agricultural pest growth dynamical model by pesticide. In the agricultural pest dynamical model, there are populations of pests and spiders. From the mathematical model of agricultural pest growth, we obtain three equilibrium points. We will analyze the stability of each equilibrium point by using the eigenvalue. In this paper, for the original mathematical model of agricultural pest growth, we will introduce a control variable, i.e., pesticide. Then we will formulate an optimal control problem. The forward-backward sweep method is employed to solve the optimal control problem and to obtain the numerical solutions. According to simulation results, pesticide usage can minimize the number of pests achieving the minimum performance index.

Keywords: *optimal control; pesticide; pest growth dynamical model.*

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