ABSTRACT

Key words : - *mathematical model*

- *competition*

- *critical period*

This research represents a quantitative study on the weed management through biometrical approach. The basic purpose of the research is to develop a design and mathematical-testing model which can be used for analyzing, studying as well as predicting critical period of onion resulted from weed competition.

The research was conducted in two stages. The first stage constitutes a field research which was intended to explore empirical data through experiment of growth and experiment of Nieto method (Nieto *et al*, 1968). At the experiment of growth the treatment is dosage of N fertilizer which was repeated three times through randomized-complete design. At the experiment of Nieto method there conducted two main treatments on both weed-infected plant and non weed-infected plant in symetrical pair, and sub treatment of dosage of Nitrogen. Split-plot design was repeated three times in randomized-complete design. The individual treatment was experimented in three different elevation. Individually the experiments constitutes nested-experimental design in the sense that the treatment was essentially nested within a particular elevation.

At the second stage the model was tested by data resulted from the field experiment. The test covers both estimate of the parameter and the test of

validity. Estimate of the non linear parameter of the model uses least-square method through iteration tehnique of Newton Raphson while the linear model uses ordinary-least square. The model can only be used for analyzing and studying critical periode of the onion if it is valid (has $p < \alpha = 5\%$ and $R^2 > 95\%$) and interpretation to the parameter is supported by the concept of agronomy and the result of mathematical analysis. Interpretation method of agronomy on the critical period is reached through identification of the rate of yield change from low to high and vice versa. Besides, empirical-model design for estimating critical period is reached through the approach curve at the scatter diagram.

The result shows that the valid model and can be feasibly exercized for analyzing and studying critical period of onion resulted from weed competion is the logistic model, $W = \dfrac{b_1}{1 + e^{b_2 - b_3 t}}$. That is the empirical model found through data of the experiment of Nieto method at the treatment of non weed-infected plant.

Agronomic interpretation method for determining critical period of the onion resulted from weed competition can be exercized by identifying the early stage of critical period that is at the time of changing the yield rate from low to high while the end of critical period takes place in accordance with the changing the yield rate from high to low.

Development of empirical-model design finds that model

$\dfrac{b_2}{b_3} = 2.30 + 0.027\,N + 12.20\,E - 3.89\,E^2$ is valid and can be feasibly exercized

for critical period of onion caused by weed competition. (Notes : b_1, b_2, b_3 = parameters, W = biomass, t = time of non weed-infected plant, N = dosage of nitrogen, E = elevation)