MODEL OF THE ONE-YEAR PLANT LIFE CYCLE

Mironchenko A.S., Nemertsalov V.V.

I.I. Mechnikov Odessa National University, Odessa, Ukraine

E-mail: smir@farlep.net, nemertsalov@pochta.ru

In our point of view, using of energetic model is biological efficient for the plant life cycle description. In fact, plant builds its own organism by photosynthesis (from the mineral substances with the energy of sunlight) (Тимирязев, 1904, Фотосинтез, 1987). This energy is distributed between plant organs as organic substances - products of photosynthesis. That is why we can consider the plant mass as the energy transformed by photosynthesis.

Process of photosynthesis is connected with the outside and inside conditions. The main conditions from the outside are characteristics of light, temperature, soil and air composition and humidity. The inside conditions are: plant's health, dimensions of plant organs, biorhythms, physiological status, work of the genetic apparatus.

On the basis of this conception we have built the model of the one-year monocarp plant life cycle. Our model is the system of differential equations. The outside conditions, that influence on photosynthesis, have been adopted as functional.

The functional general view was taken from the following sources (Rubin & Arcihovskaya, 1967, Larcher, 1976, Мусієнко, 2001) and was defined more exactly by the introduction of numerical coefficients.

All numerical parameters and coefficients were divided into two groups: experimental (empirical) and general (theoretical). We try to describe the life cycle by the methods of the theory of control. In the model plant can regulate the flows of energy and direct it. The main aim of this regulation bases on the principle of offspring maximization. In the one-year plant life cycle most of energy is used on the reproduction system work. And at last transformed into the seeds mass (quantity of seeds does not matter). But other organs of plants (roots and leaves) have to be formed before. That is why stages with preferred growth of roots, stems and leaves present in the plant life cycle. The model, as the problem of optimal control, lets to take real scheme of the plant development, without additional suppositions, which are necessary for the use of statistic methods.

The numerical decision of the optimal control task takes place in the MatLab packet. The coefficient computation and model approbation are still going on.

МОДЕЛЬ ЖИЗНЕННОГО ЦИКЛА ОДНОЛЕТНЕГО РАСТЕНИЯ

Мironченко А.С., Немерцалов В.В.

На основании теоретических представлений о фотосинтезе, дыхании, росте и размножении построена модель жизненного цикла однолетнего растения. Модель описывается системой дифференциальных уравнений и позволяет получить реалистичную схему развития растения. Численное решение задачи оптимального управления проводилось в пакете MatLab