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شبكة المعلومات الجامعية

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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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بالرسالة صفحات
لم ترد بالأصل

COMPARISON BETWEEN MODERN IRRIGATION SYSTEM DESIGNS

by

Kamal Hossny Amer

A Thesis

Submitted to the Graduate Division of the Menoufiya University in Partial Fulfillment of the Requirements for the Degree

of

Ph. D. in Agriculture Sciences

(Agriculture Engineering)

January 2001

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ABSTRACT

Comparison between Modern Irrigation System Designs

Weather elements play an important role in plant life. They were measured to estimate evapotranspiration. The Penman model was used to determine potential ET in this research project due to the variety of field weather elements involved as well as recommendations made by many researchers. The average potential ET was considered to be as 3 and 2 mm of water per day for winter and 4 and 5.5 mm of water per day for summer in Kula, Maui, Hawaii and Shibin El-kom, Egypt, respectively.

The irrigation experiments were conducted in Kula, Maui, Hawaii and Shibin El Kom, Egypt. A drip irrigation system with ten different amounts of water treatments was designed and installed to disperse water throughout onion and cabbage fields. The amount of water use ranged from 0.2ET to 2.0ET. Water applied, ET_m, corresponding to the maximum yield, Y_m, was measured as the maximum amount of crop evapotranspiration, ET_c. These confirmed the crop ET. The results of irrigation experiments that were collected showed that the yield reduction occurred by both deficit and over-irrigation. This crop response was defined by model II. For the case when the yield was not changed by first portion over-irrigation (the top point was extended to a horizontal line for a while), the response curve can be considered as response model III. The shape of the crop response curve is a function of the given crop.

The uniformity coefficient as well as the coefficient of variation can be used for both sprinkler and drip irrigation systems. When the system is designed for high uniformity (UC $\geq$ 70%) the water distribution can be expressed as a normal distribution. Furthermore, it can be simplified to a straight line of water distribution

and the required evapotranspiration will show the deficit and over irrigation in the field by sprinkler and drip irrigation. The total yield production can be determined based on the crop response models that mathematically were developed. The deficit/over irrigation conditions can also be created in furrow irrigation by comparing the infiltrated water depth by irrigation and required ET. The yield under furrow irrigation can be evaluated based on the crop response with respect to deficit and over-irrigation. Optimum irrigation solutions based on maximum yield or maximum return can be found. Water-use-efficiency and application efficiency was also used to compare and evaluate irrigation systems.

The computer simulations for drip and sprinkler irrigation systems 0.1, 0.2, and 0.3 coefficient of variation were run for crop production and return. Production yield and total return for the crop response model II were compared to these by furrow irrigation. In general, linear relationship shows the correlation between the crop yield as well as return yield versus water use for either 100% deficit or 100% over-water applications. A quadratic relationship which describes underirrigation includes both deficit and over-water applications.

Comparison between sprinkler and drip irrigation systems represented in uniformity coefficient showed that drip system that designed over 90% uniformity coefficient while sprinkler over 70%. The best scheduling for saving water and giving high return yield was in the system with high uniformity. Comparison between drip and furrow irrigation systems showed that saving water and giving high return yield was under dripping than furrows because wasting water by runoff in furrow. Mathematical models for crop response II and III were developed for best scheduling and evaluating modern irrigation systems. Mathematical model for crop response II was applied for best scheduling and evaluating furrow irrigation by using modern techniques.

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