DISSERTATION

DEVELOPMENT AND CALIBRATION OF SURGE IRRIGATION PERFORMANCE EVALUATION MODEL

Submitted

by

SAJID MAHMOOD
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CENTER OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering and Technology
LAHORE 54890, PAKISTAN

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ABSTRACT

Surge irrigation has received much attention in the last two decades and normally it is considered a better alternative for its rapid water application with a high degree of uniformity, reducing both water and irrigation time. The performance of surge irrigation is mainly dependent on advance rate that is influenced by soil consolidation, prior surges wetting history, field slope, soil type, cycle time and cycle ratio. Many past studies revealed merits of surge irrigation on the basis of performance indicators for comparing it with continuous irrigation. But the literature still lacks in comparing surge and continuous advance rates graphically. Extensive field data collection during multiple surge advances is another difficulty involved to study the hydraulics of surge irrigation.

To fill the gap, a Surge Advance Prediction and Evaluation *'SAPE'* model was developed for comparing surge and continuous advance rates in furrows and estimating the distribution uniformity index for their evaluation. This was accomplished by introducing time-reduction factors for different surges in the power equation in the fact that surge advance time was reduced for subsequent surges from the first surge. The power equation so developed was used in simulating the advance rates for subsequent surges using only first surge advance-time data. This equation has been named, *'Modified Power Equation (MPE)'*. The *MPE* equation was further generalized for comparing surge and continuous advance rates graphically. This was done by re-defining the time-reduction factor, and introducing advance-adjustment factor on the basis of total number of surges applied during an irrigation event. This equation was used for graphical comparison of surge and continuous advance curves.

The results achieved for the graphical comparison of surge and continuous advance rates have shown a promising behavior. This simple empirical formulation would be a good addition to the present state of knowledge to overcome data collection during multiple surges that is time-consuming and tedious in studying the hydraulics of surge irrigation. Water distribution along the furrows and performance of surge irrigation were estimated by the model named, 'Surge Advance Prediction and Evaluation *'SAPE' model'*. The model was validated on the basis of advance-time data collected during different field experiments for various surge treatments. Distribution uniformity was estimated for both surge and continuous irrigated furrows based on the simulated water advances. The higher values of it for surge-irrigated furrows further proved the worth of the application of surge irrigation contrast to water application by the conventional method. The applicability of *'SAPE'* model has paramount importance and would encourage its adoptability at larger scale after further testing under different field conditions.