# PREDICTION OF ROOT ZONE SOIL SALINITY AND ITS SIMULATED EFFECT ON PADDY CROP YIELD

**Abstract**

Sustained productivity from limited land resources is main concern where in the productive lands are getting degraded by different means. Especially in the canal irrigated command areas the land degradation due to root zone salinity and raised ground water table are posing main issues. Present study was conducted to predict the soil salinity and waterlogging using Saltmod and its combined effect on paddy yield using FAOs AquaCrop model for the Krishna Central Delta in Andhra Pradesh. It was found that waterlogging condition exists in the entire simulation period of 10 years and also soil salinity was found to increase from 2dS/m to 6.5dS/m. Using AquaCrop model the yield was predicted with 2m depth to water table and for the simulated soil salinity values of SALTMOD. By the end of the tenth year, the soil salinity reaches 6.5 dS/m which gives the dry yield reduced by 42.28% and the biomass yield reduced by 36.69%. Calibration and validation of models with field level data gives the more accurate results.

**Keywords:** SALTMOD, AquaCrop, Salinity and Waterlogging

**Authors**

**P. Indraja**
Department of Soil and Water Conservation Engineering
Dr. NTR College of Agricultural Engineering
Bapatla, Andhra Pradesh, India.

**Dr. K. Krupavathi**
Assistant Professor
Department of Irrigation and Drainage Engineering
Dr NTR CAE
Bapatla, Andhra Pradesh, India.

**Dr. H.V. Hema Kumar**
Associate Dean
CAE, Madakasira
Andhra Pradesh, India.

**Dr. A. Mani**
Dean of Agril
Engineering & Technology
ANGRAU
Andhra Pradesh, India.

**Dr. L. Edukondalu**
Professor & Head
Department of Food Processing and Technology
CFST, Pulivendula
Andhra Pradesh, India.

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## I. INTRODUCTION

A non-renewable resource, land is the foundation of primary production system. However, we are forced to look for new land resources due to the expanding human population and the rising demand for food. In an endeavour to provide the food and nutritional security of the expanding population, several resource degradation issues pose a further danger to the continued output from the few land resources. According to estimates, 4 billion people worldwide are affected by some types of land degradation, which affect 75% of the earth's usable area. About 80% of soil degradation is caused by wind and water erosion, which is followed by salinization/ alkalinization and water logging. The green revolution technologies overuse the natural resources in order to keep up with the expanding population. Planners and farmers are nonetheless concerned about declining soil fertility and the changes in the ground water table. As if these issues weren't enough, the difficulties of water logging and soil salinization that emerged in canal-irrigated command regions cast doubt on the viability of irrigated agriculture. However, typical estimates are near to 1 billion hectares, which represents around 7% of the earth's continental extent. Authors' statistics concerning salt-affected areas differ. In addition to the naturally salinized regions, roughly 77 Mha have undergone secondary salinization as a result of human activity, with 58% of those areas being irrigated. On average, salts have an impact on 20% of the world's irrigated areas [1]. In order to increase agricultural output in numerous semi-arid and dry regions of the nation, India has developed 80 Mha of potential irrigation, primarily through significant irrigation projects. A rise in soil salinity and waterlogging in 15-20% of irrigation commands, however, appear to pose a danger to the long-term viability of irrigation [2]. Nearly $7\times10^6$ hectares of farmed land in India has been negatively impacted by soil salinity and waterlogging as a result of the implementation of canal irrigation [3]. Peninsular India is blessed with a long coastline of about 7517 km on its both sides. Andhra Pradesh state is of no exception of it and has 974 km long coast of Bay of Bengal. Apart from a relatively small extent of irrigation induced salinity and waterlogging, majority of the agricultural land along this coastal belt needs to be specially focused to combat these twin problems persisting in certain localized strips.

The study area considered here is the Krishna Central Delta (KCD), in Andhra Pradesh, which is having the coastal belt and certain parts of this area were converted into aquaculture mainly because of salinity. Sea water intrusion or the secondary salinization caused the agricultural lands to get degraded which in turn into aquaculture. Many studies were conducted to simulate the soil salinity and its adverse effects on crop productivity using different simulation models. Of which, SALTMOD was mostly used for prediction of soil salinity and waterlogging under different scenarios and management options and thereby affects of these land degradation problems on crop yield was simulated using FAO's AquaCrop model. SALTMOD simulation model [4] was applied to an irrigated district, Tunisia, to predict the long term variations in soil salinity and for different seasons under varying drainage conditions. The study found that EC values were decreasing following the rains. In the dry season of 2013, an experimental study [5] was done at Bangladesh Agricultural Research Institute, Gazipur with a popular rice variety to test the suitability of AquaCrop model in simulation of rice yield under different salinity regimes. The results showed that the AquaCrop model, with most of its default parameters, could reasonably describe the fluctuation of rice production with salinity variation. The AquaCrop model was studied using the salinity module [6] to simulate yield and water productivity of different

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wheat varieties grown under various salinities was assessed at the Water Technology Centre (WTC) of the Indian Agricultural Research Institute (IARI) research farms, New Delhi. The model was calibrated and tested with field data and it was suggested that the AquaCrop model was better at predicting grain yield compared to biomass and water productivity for all varieties and salinities. Therefore, considering the suitability of the above said models, this study was conducted to predict salinity and waterlogging in the study area using SALTMOD and to simulate the effect of salinity on crop yield under hypothetical scenarios using AquaCrop.

## II. DESCRIPTION OF STUDY AREA

Krishna Central Delta lying between the latitudes 16º 37' 15" N and 15º 42' 15" N and longitudes 80º 34' 0" E and 81º 16' 0" E was developed agriculturally with profound canal network from the majors canals of Krishna Eastern Bank and Bandar Direct canal with a command area of about 2196.55 $km^2$ covering around 18 mandals in Andhra Pradesh. This canal network is from the left bank of the holy river Krishna at Prakasam Barrage, Vijayawada, and Andhra Pradesh. The boundary of Krishna central Delta is depicted in figure

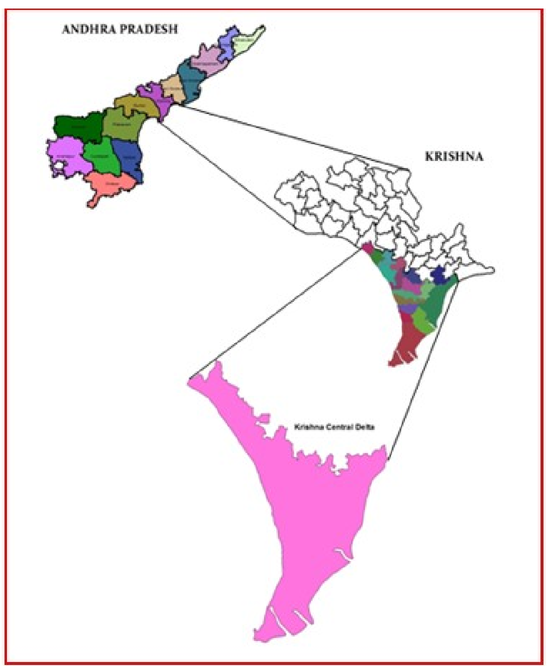


**Figure 1**: Location of Krishna Central Delta

KCD experiences extreme hot summer and cold winters. Months from April to June are the high temperature months with peak temperatures recorded in May. South West monsoon starts from mid of June to October. Temperature begins to rise from the middle of February till May that is about 38°C. With the onset of southwest monsoon in June, the temperature decreases to about 20°C and is more or less uniform during the monsoon period. Krishna Central Delta (KCD) receives around 900-960 mm rainfall of which about 60% falls in south- west monsoon. Rainfall in the months of September- November records about 40-45% of the annual rainfall. The major soil type that occurs in almost all mandals of KCD is calcareous soil that has highest percentage of calcium carbonate, it accounts for about 67.86% (i.e., 1478.16 $km^2$) of total area. Then the second major soil type is clay soil, it accounts for about 19.01% and covers about 414.19 $km^2$. Both calcareous and clay soils contribute the major portion of land under cultivation. Gravel, silt and sandy soils can be found, but in a small proportion. During the *kharif* season (July/August-November/December) paddy and sugarcane are the major crops grown and in the Rabi season (December- March) the predominant crops grown are paddy, groundnut, maize and some extent with pulses. Sugarcane is also grown as major crop in the northern region of the study area. Orchards are also grown specifically.

## III. SIMULATION OF SALINITY AND WATERLOGGING CONDITION IN KCD USING SALTMOD

1. **SALTMOD Model:** Oosterbaan and Pedrose de Lima developed the "SALTMOD" hydro-salinity model, which calculates the salt and water balance for the root zone, transition zone, and aquifer zone. It predicts soil salinity of soil moisture, groundwater and drainage water, the depth of water table, the drain discharge in irrigated agriculture lands, under various (geo) hydrologic conditions and water management options, including the usage of ground water for irrigation and different crop rotation schedules. SALTMOD is relatively simple to use and input data used are easily available or that can be computed with reasonable accuracy and relative ease. This can also be used to assess various management options. Further, SALTMOD gives the option of the reutilizing drainage and well water and it can account for farmer's response to water logging, water scarcity, soil salinity and over pumping from the aquifer.

2. **Working Principle of SALTMOD:** Salt and water balance of cultivated lands on seasonal basis is the main approach for SALTMOD. Among, wet, dry, hot, cold, irrigation or fallow seasons any four seasons can be distinguished. Seasonal time step (Ts) is considered on monthly basis ($0<Ts<12$) for each season. Seasonal water balance components resulted to surface and ground water hydrology are given as input. Depth to water table is the result of water balance computations. In SALTMOD, surface, root zone, transition zone, and deep ground water reservoirs are considered. Concentration of salts (dS/m) in the outgoing groundwater, either from one zone to the other are based on water balances computations and on the salt concentrations of the incoming water by varying leaching efficiencies. A few input data in SALTMOD (shown in Table 1 and 2) were calculated or considered from the literature, in which study area remained same and the other parameters were determined by the model.

**Table 1: Season Wise Input Parameters for SALTMOD**

| S. No. | Parameters | Season I | Season II | Season III |
|---|---|---|---|---|
| 1 | Duration | July to November (5 months) | December to February (3 months) | March to June (4 months) |
| 2 | Crops grown | Paddy | Pulses, Ground nut | Fallow |
| 3 | Source of water | Rainfall and | Less rainfall, No | Moderate rains, |

| | | canal waters | canal waters | No canal waters |
|---|---|---|---|---|
| 4 | Fraction of area occupied by irrigated crops | 1.0 | - | - |
| 6 | Fallow | - | - | 1.0 |
| 7 | Rainfall (m) | 1.214 | 0.074 | 0.23 |
| 8 | Ground water used for irrigation | Nil | Nil | Nil |
| 9 | PET of crops/ non-irrigated area (m) | 0.7 | 0.499 | 0.93 |
| 10 | Percolation from canal system (m) | 0.1 | - | - |

3. **Calibration of SALTMOD:** The input data was given considering the averages values for all the seasons i.e., irrigated season, non-irrigated season and fallow season. The model was regionalized to KCD area, under existing scenario of irrigation practices and crop cultivation practices, to predict water table changes and salinity in root zone which are closely related parameters for quantifying the waterlogging and salinity problems. Certain factors namely, Flr, the leaching efficiency of the root zone and Flx, leaching efficiency of transition zone could not be measured. Flr or Flx is the ratio of concentration of salts in the water percolating from the root zone/transition zone into the underground divided to the average salt concentration of the soil moisture in the root zone/transition zone [7]. Flr and Flx factors have to be estimated before running SALTMOD model application in KCD. Considering the Flr values arbitrary as 0.2, 0.4, 0.6, 0.8 and 1.0 in input file through the input menu, by renaming the other input parameters same, each time the values of Flr has been changed and the file was run. By inspecting the output, the optimum Flr value was selected that better suits the conditions of study area.

**Table 2: Other Input Parameters in SALTMOMD**

| S. No. | Parameters | Value |
|---|---|---|
| 1 | Storage efficiency | 0.75 |
| 2 | **Depth of (m)**<br>Root zone<br>Transition zone<br>Aquifer zone | <br>0.35<br>1.60<br>8.0 |
| 3 | **Effective porosity of**<br>Root zone<br>Transition zone<br>Aquifer zone | <br>0.050<br>0.050<br>0.055 |
| 4 | **Initial salt content of the soil moisture at field saturation in (dS/m)**<br>Root zone<br>Transition zone<br>Aquifer zone | 2<br>11.45<br>3.25 |
| 5 | **Total pore space of** | |

| | | |
|---|---|---|
| | Root zone<br>Transition zone<br>Aquifer zone | 0.50<br>0.50<br>0.55 |
| 6 | Salt concentration of canal water (dS/m) | 0.60 |
| 7 | Initial depth to water table from ground surface (m) | 1.0 |
| 8 | Critical depth of water table for capillary rise (m) | 1.50 |

4. **Simulation of Salinity and Waterlogging :** To address the salinization and waterlogging problems, detailed regional knowledge on its spatial extent, expansion patterns, and its level of severity is required. Various simulation models have been created to forecast both soil salinity and the depth to the water table. The SALTMOD model has been developed to predict the long-term consequences of various strategies in water management on desalinization in cultivated regions, including the depth of the water table.

Initially evapotranspiration data that is required for the input of SALTMOD are collected from the Aquacrop. The climate data that includes rainfall, maximum and minimum temperatures, wind speed, relative humidity and solar radiation from 2000 to 2014 was given as input to Aquacrop and ETo value was estimated. By exporting the climate output file, monthly averages and corresponding ETo was obtained from which season wise rainfall and potential evapotranspiration were calculated (Table. 3). From the table, the inputs of precipitation for season 1, 2 and 3 are 0.124, 0.074 and 0.234m/season respectively.

Average rainfall was found highest in season1 (*kharif*) because of the South West monsoon period and is next followed by season 3 and is found low in season 2. Reference evapotranspiration value is highest in season1, about 813.3 mm/day and next highest with a slight difference was found in season3, about 812.6 mm/day and it is found least during season 2, about 428.7 mm/day. And also a similar trend was observed in crop evapotranspiration values also. Highest ETc value for paddy was found in season1 and is about 715.69 mm/day and least was found in season3 and is about 182.6 mm/day. All these are given as inputs in SALTMOD and the root zone salinity and depth of water table, which are of direct indicators to the salinity and waterlogged areas are simulated for the next 10 years' subject to the condition that there was no sub surface drainage system for use in the problematic area and hence Kd is given as 'NO' in the input file that indicates absence of drainage system.

**Table 3: Season Wise Rainfall and ET Particulars**

| **Month** | **Rainfall (mm)** | **$ET_o$ (mm/day)** | **$ET_c = ET_o \times 0.8$ (mm/day)** | **For paddy $ET_c \times 1.1$ (mm/day)** |
|---|---|---|---|---|
| **Season- 1** | | | | |
| July | 229.9 | 186.7 | 149.36 | 164.29 |
| August | 312.1 | 172.4 | 137.92 | 151.71 |

| | | | | |
|---|---|---|---|---|
| September | 240.4 | 160.8 | 128.64 | 141.5 |
| October | 276.1 | 153.5 | 122.8 | 135.08 |
| November | 155.5 | 139.9 | 111.92 | 123.11 |
| **Total** | **1214** | **813.3** | **650.64** | **715.69** |
| **Season- 2** | | | | |
| December | 37 | 143.8 | 115.04 | 126.54 |
| January | 11.4 | 141 | 112.8 | 124.08 |
| February | 25.9 | 143.9 | 115.12 | 126.632 |
| **Total** | **74.3** | **428.7** | **342.96** | **377.252** |
| **Season-3** | | | | |
| March | 17.7 | 184.4 | 147.52 | 162.27 |
| April | 21.9 | 192.1 | 153.68 | 169.05 |
| May | 42.8 | 228.6 | 182.88 | 201.17 |
| June | 151.8 | 207.5 | 166 | 182.6 |
| **Total** | **234.2** | **812.6** | **650.08** | **715.09** |

Thus considering all the parameters, input file was run and the changes obtained in the root zone soil salinity, that is indicated as Cr4 and the depth of water table Dw are discussed in the following sub sections.

5. **Prediction of Salinity in the Root Zone:** After calibration, Saltmod was run under the condition of nonexistence of drainage system and simulated the salinity in root zone for the coming10 year's period. The changes in salinity of root zone (Cr4), transition zone (Cxf) and aquifer zone for the predicted 10 years is indicated in Figure 2. Salinity of the root zone was observed to decrease till the end of the first year prior to rising over the following 10 years, reaching a value of 6.5 dS/m. Salinity of soil moisture in the aquifer (Cqf) is seen to be constant over the entire ten-year period in comparison to both the salinities in root zone and the transition zone.

By the end of third season it was determined that the Cr4 peaked in the simulation starting period to 2 dS/m and then gradually ascended to 5.93, 6.45, and 6.5 dS/m in the fourth, sixth, and tenth years. From the graph, it was noticed that the salinity in root zone was found to increase up to 5 years at an increasing rate ranging from 2dS/m to 6.28 dS/m and then increase in root zone salinity was at a very low rate and is almost maintained nearly same up to tenth year. Peaks or highest root zone salinity, Cr4 was observed in season3 that is during fallow period, in which due to high evaporation all the salts are brought up. A similar trend was persisted consistently throughout the entire forecast period. During third season Cr4 also followed an increasing trend up to sixth year and there after it is almost one other the same up to tenth year of simulation. During first and second seasons Cr4 remained same in all the years.

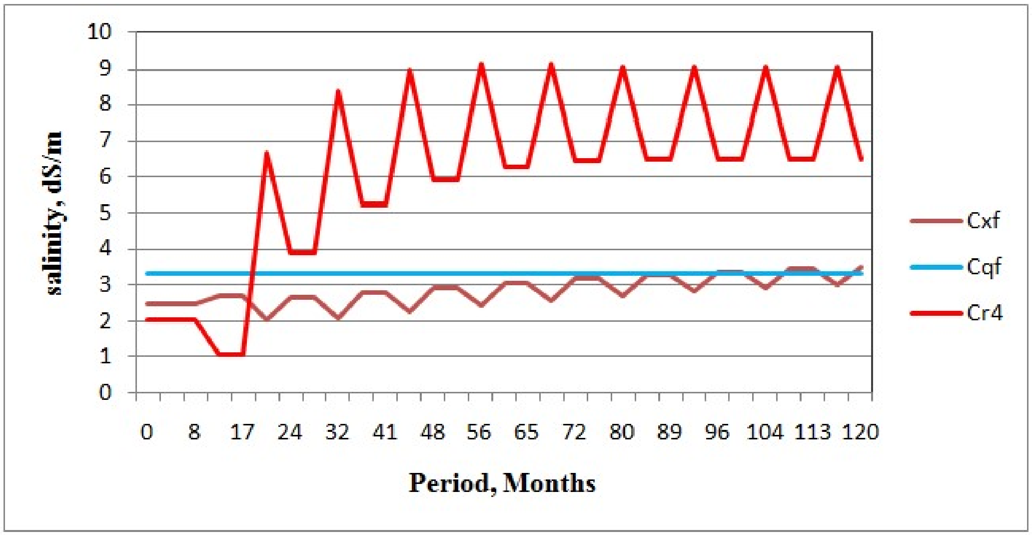


**Figure 2:** Salinities of Root Zone, Transition Zone and Aquifer Zone

6. **Prediction of Depth to Water Table:** Under identical conditions, in the absence of a drainage system, water table depth was projected for the next 10 years. During the first season (kharif season), the water table depth decreased significantly, approaching the surface, indicating the potential for increasingly critical waterlogging conditions in the upcoming years. Figure 3 displays the predicted water table depth data for the kharif season. The graph illustrates a trend of decreasing water table depth over time, starting at 1.5 meters at the beginning of the simulation and reaching 0.465 meters by the end of the tenth year. Notably, the rate of decline in water table depth accelerated from the onset of the simulation until the sixth year.

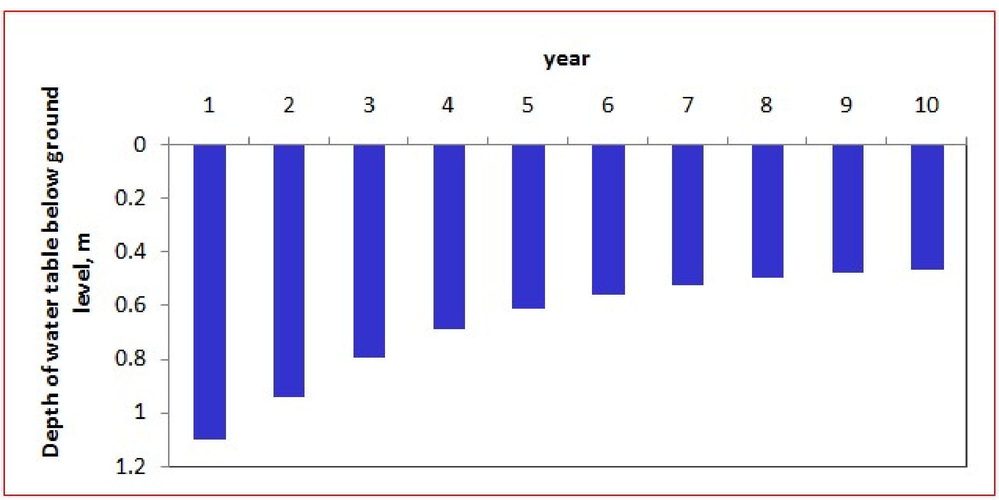


**Figure 3: Predicted Water Table Depth for A Period Of 10 Years**

The depth of water table in first year was around 1.2 m of the forecast period and decreased to approximately 0.56 m in the sixth year. Thereafter, there was not a significant change in the depth of the water table and it essentially stayed the same. It indicates that if the saline and waterlogged soils are left untreated or if no reclamation measures were adopted the depth of water table decreases and causes root zone saturation completely, or can be said as critically waterlogged. With these conditions the aeration will be reduced and plant growth gets reduced or sometimes the crop may not sustain if it is sensitive to waterlogging. Here only season 1 (*kharif*) data is considered because the crop yield simulation was planned for paddy crop, which is the most predominant crop in the KCD region that is cultivated during *kharif* season.

## IV. SIMULATION OF YIELD UNDER SALINE AND WATERLOGGING CONDITIONS USING AQUACROP

1. **AquaCrop model to KCD:** Simulated values of root zone salinity as obtained from the SALTMOD for over 10 years was used for yield simulation model using the Aquacrop model released by Food and Agriculture Organization (FAO) in 2009. Rice is the most staple food crop in India, and in Krishna Central Delta Rice is one of the predominant crops grown. Hence the objective here is to study the impact of salinity and waterlogged areas on the rice yield using salinity module present in Aquacrop. AquaCrop is a crop simulation model which describes the interactions between the plant and the soil (Figure 4)

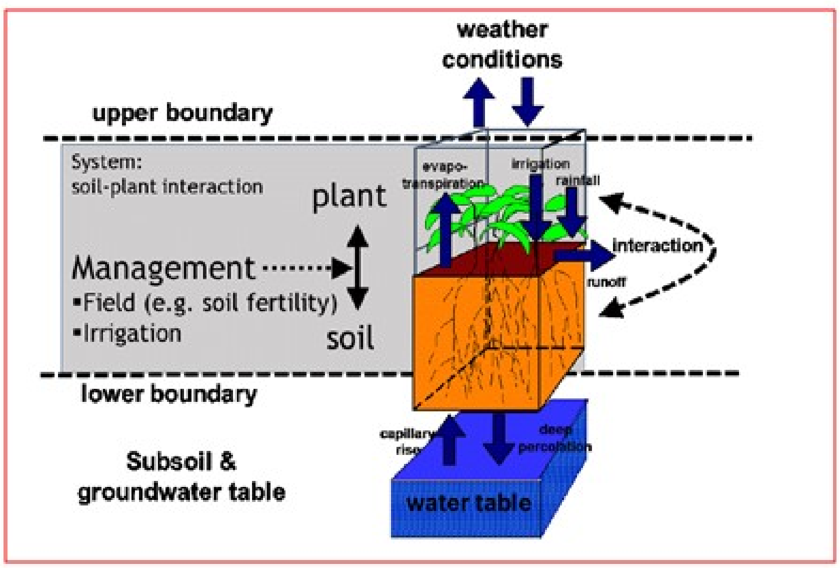


**Figure 4:** The part of reality that is described by Aquacrop

Plants acquire water and nutrients from their root zones, with both field management (such as soil fertility) and irrigation management being essential factors affecting soil-plant interactions. This integrated system maintains a connection with the atmosphere via its upper boundary, regulating evaporative demand (ETo) and providing essential $CO_2$ and energy for plant growth. Conversely, the lower boundary allows water to exit the system, either into the subsoil or the water table. In cases where the water table is close to the surface, water may ascend into the system through capillary rise. AquaCrop relies on a concise set of explicit parameters, with many input variables being defined using simple methods. However, the computational techniques employed are grounded in fundamental and often intricate biophysical processes, ensuring precise simulations of plant responses within plant-soil systems.

2. **Input data requirement of AquaCrop Model:** AquaCrop consists of six elements: climate, crop, soil, field, irrigation, and initial conditions (see Figure 5). AquaCrop's climate component requires daily weather variables such as maximum and minimum temperatures, precipitation, ETo, solar radiation, and wind speed. In this study, daily historical weather data were collected from his Globalweather.tamu.edu website and ETo was calculated by Aquacrop using the Penman-Monteith method described in FAO-56. Crop file is the key file which considers salinity module. Considering the full set parameters of crop (that involves all stresses), crop file was created for transplanted paddy, shallow rooted crop with 20×15 cm plant spacing for varieties grown in KCD region such as BPT 5204 and MTU 1061 having crop duration of 150 days. All the crop growth stages from the day of transplanting were given as input. AquaCrop calculates initial canopy coefficient from plant density [Figure 6]. From Agricultural Research Station, Ghantasala, details of all crop parameters are collected.

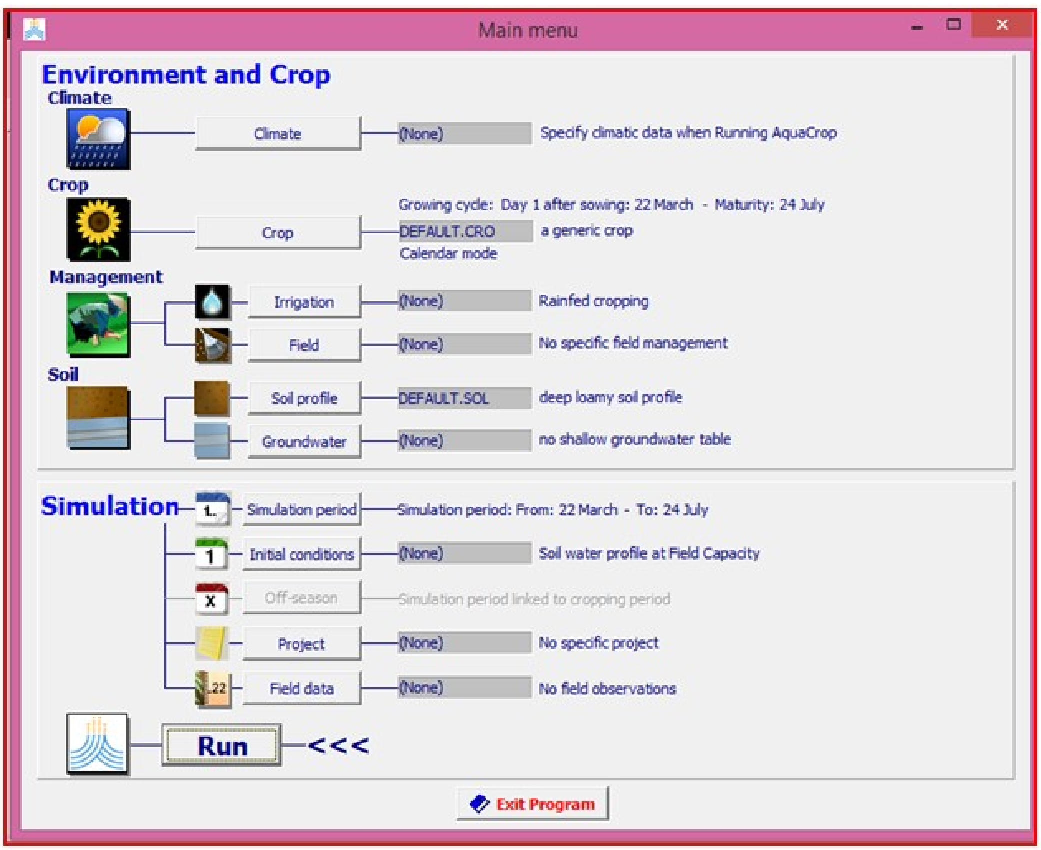


**Figure 5:** Main menu window showing the required input files of AquaCrop.

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AquaCrop considers distinct soil layers with in the root zone suitable to the local conditions. Soil parameters such as soil moisture content at saturation, field capacity and permanent wilting point were entered if observed values are varying from default values provided by AquaCrop. In this study, soil fertility level was non-limiting in experiment. Irrigation file was generated based on crop water requirements as per growth stages including the rainfall amount in the crop season. It was considered that initial soil condition was completely saturated and soil salinity was given as per the data generated from the analysis of ground truth samples.

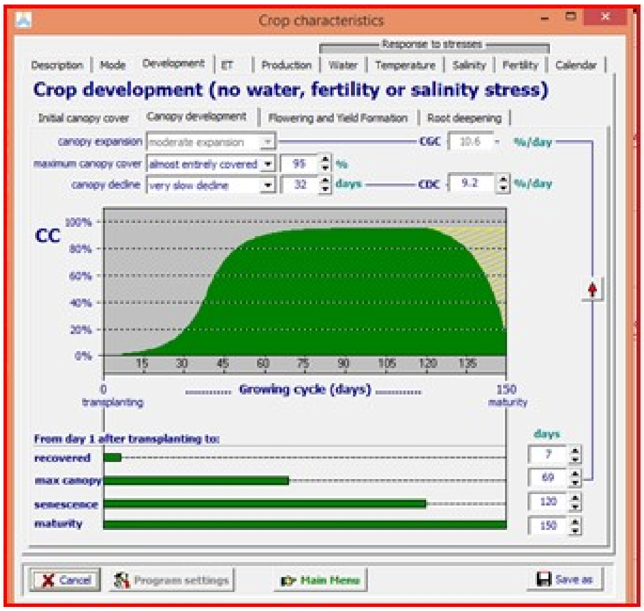


**Figure 6:** Canopy Development under No Stress Conditions

3. **Estimation of Crop Yield Using Aquacrop:** FAOs AquaCrop model [8] considers, the maximum yield (Yx) and actual yield (Y), the maximum evapotranspiration (ETx) and actual evapotranspiration (ETa), and a proportionality factor Ky between relative yield loss and relative reduction in evapotranspiration to estimate the yield response (1).

$$\frac{Y_x - Y}{Y_x} = K_y\left(\frac{ET_x - E\ \ a}{ET_x}\right) \qquad \text{------} \qquad (1)$$

AquaCrop considers separating the ET into E (evaporation from soil) and Tr (transpiration from crop) and the Y into biomass (B) and harvest index (HI).

4. **Simulation of Crop Response to Soil Salinity Stress:** Soluble salts are introduced into the soil profile either through the irrigation water or via capillary rise from a shallow groundwater table. The degree of salt accumulation within the soil is contingent upon several factors, including the quality and volume of the irrigation water penetrating the soil, the frequency of soil wetting, the effectiveness of leaching, the significance of evaporation and crop transpiration, the physical attributes of various soil layers, and the salt concentration as well as the depth of the groundwater table. The removal of salts from

the soil is facilitated through drainage water. To quantify the impact of soil salinity stress, a soil salinity stress coefficient (Kssalt) is employed, as illustrated in Figure 7. Specific thresholds for electrical conductivity of the soil extract (ECe) vary depending on the crop. Soil salinity stress leads to a reduction in canopy cover (CC) and closure of stomata.

- **Reduced Canopy Cover:** Reduced Canopy Cover: Soil salinity stress diminishes the crop's growth potential and the maximum attainable canopy cover (CCx) during mid-season. As a consequence of salinity stress within the soil, CC will progressively decline after reaching CCx at midseason.

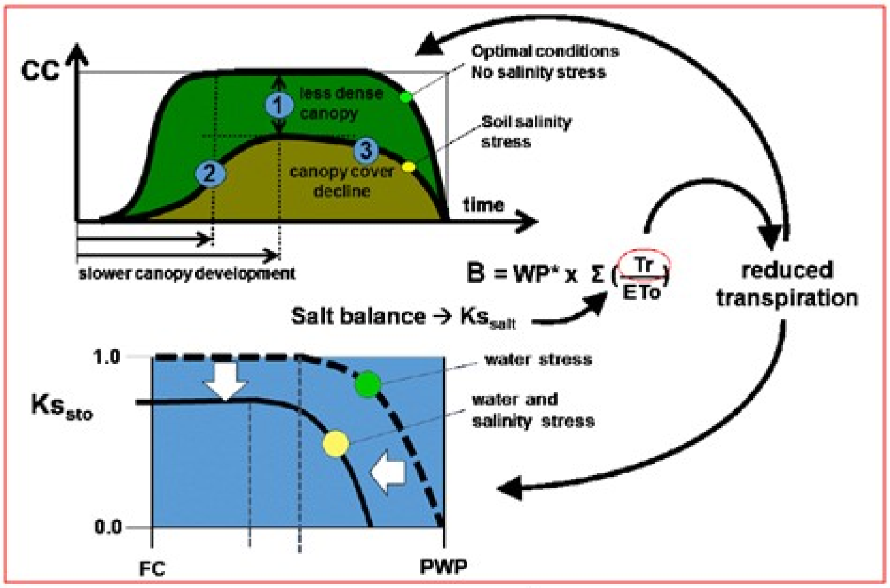


**Figure 7:** Simulation of Crop Response to Soil Salinity Stress

- **Stomatal Closure:** Osmotic forces, induced by the presence of salts in the root zone, reduce the availability of water to the crop by lowering soil water potential. Soil salinity leads to a reduction in the soil water stress coefficient responsible for stomatal closure (Kssto). Additionally, these osmotic forces are likely to modify the upper and lower thresholds governing root zone depletion, which in turn affects the soil water stress impact on stomatal closure (Kssto). This alteration has implications for crop transpiration.

  In instances of soil salinity stress, AquaCrop adjusts the values of stress coefficients, which influence both canopy development and stomatal closure. This adjustment aims to ensure that the simulated crop transpiration and the corresponding biomass (B) align with the required reduction specified by Kssalt.

5. **Calibration of AquaCrop under Salinity:** Considering the soil salinity stress, the effects of soil salinity on crop growth need to be calibrated. The parameters considered for calibration of soil salinity stress include the percentage of biomass production, maximum canopy cover and canopy decline in season with reference to a normal field. Considering

moderate biomass production, maximum canopy cover as close to reference and canopy decline in season as small, the model was calibrated. Fig.8 shows calibration of soil salinity stress window in AquaCrop.

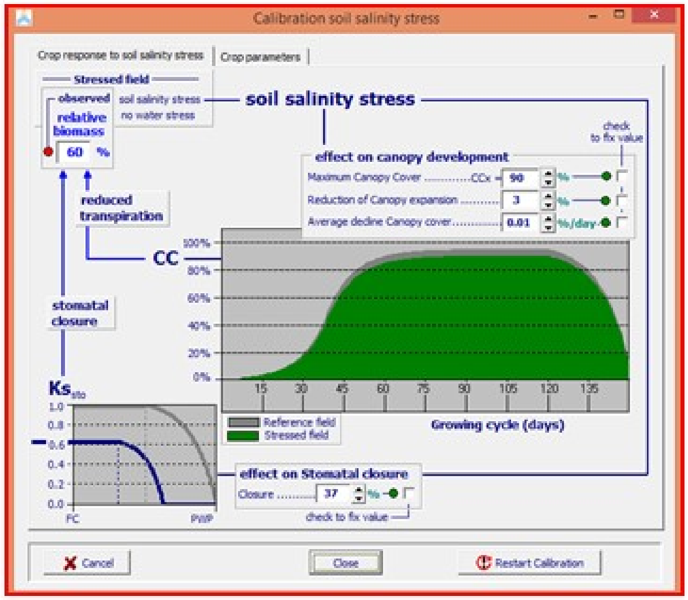


**Figure 8:** Calibration of Soil Salinity Stress in Aquacrop

6. **Simulation of Yield Under Saline and Waterlogging Conditions:** Considering the changes in salinity that was predicted by the SALTMOD under no drainage condition, it means if the twin problems of salinity and waterlogging are not addressed or under no reclamation measures, the land gets degraded. Corresponding to the predicted salinity for over 10 years and also considering that water table reaches root zone, the yield change was simulated using AquaCrop, version 5.0. The changes in the dry yield and biomass yield obtained by considering the EC values in first, fourth, sixth and tenth years of simulation for paddy crop were shown in Table. 4.

**Table 4: Dry and Biomass Yield under Varying Soil Salinities**

| S. No. | Year | Soil EC (dS/m) | Dry Yield (t/ha) | Biomass Yield (t/ha) |
|---|---|---|---|---|
| 1 | 1 | 2 | 4.252 | 7.731 |
| 2 | 4 | 5.93 | 3.611 | 6.565 |
| 3 | 6 | 6.45 | 3.404 | 6.189 |
| 4 | 10 | 6.5 | 3.3889 | 6.162 |

From the obtained data it was depicted that the increase in salinity results in the decrease of paddy grain yield and also the biomass yield. For a salinity of 2dS/m the dry yield obtained was 4.252 t/ha and the biomass yield was 7.731 t/ha, for a soil salinity of 5.93 dS/m (for fourth year) the dry yield obtained was 3.611 t/ha and biomass yield was

6.565 t/ha. When the soil salinity got increased to 6.45 dS/m the dry yield obtained was 3.404 t/ha and the biomass yield was 6.189 t/ha.

The Aquacrop was also run for the soil salinity of 0.5 dS/m and considering the depth of water table as 2 m. Under these conditions the root zone was free from waterlogging and the soil salinity at the minimum threshold of paddy crop. The dry yield obtained under these conditions was 5.87 t/ha and the biomass yield obtained was 9.734 t/ha.

**Table 5: Comparison of Paddy Yield under Varying Salinity Conditions**

| Year | Soil EC (dS/m) | % reduction in dry yield | % reduction in biomass yield |
|---|---|---|---|
| 1 | 2 | 27.58 | 20.58 |
| 4 | 5.93 | 38.5 | 32.55 |
| 6 | 6.45 | 42.03 | 36.42 |
| 10 | 6.5 | 42.28 | 36.69 |

Comparing the yield results obtained for the first, fourth and sixth years of simulation with the yield obtained under the reference conditions of EC 0.5 dS/m and depth of water table as 2 m, the percentage reduction was found and tabulated in Table 5. With increase of soil salinity from 0.5 dS/m to 2 dS/m there was about 27.58% reduction in the crop yield and 20.58% reduction in biomass yield. As soil salinity increases to 5.93 dS/m, paddy grain yield was reduced by 38.5% and the biomass yield was reduced to 32.55%. When soil salinity increased to 6.45 dS/m the paddy grain yield was reduced by 42.03% and the biomass yield was reduced by 36.42%. By the end of the tenth year, the soil salinity reaches 6.5 dS/m which gives the dry yield reduced by 42.28% and the biomass yield reduced by 36.69%

Better simulation of crop yields can be obtained when model calibration was performed with the actual field reference data by giving the exact crop growth cycle period for specific cultivars that are regionally adopted. However, the yield results obtained from the AquaCrop model were in accordance with the yields that are recorded from the salt affected farmer's fields during ground survey.

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