CropSyst model and model testing for use in Serbia

Technical Workshop on Crop Yield Forecast in SEE, Skopje, Macedonia
30 – 31 May 2013

CropSyst

- **CropSyst** (Cropping Systems Simulation Model) was developed by Washington State University experts – Biological Systems Engineering Dept.
- Model running in DOS (Pascal) and WINDOWS (C++)

http://www.bsyse.wsu.edu/CS_Suite/CropSyst
CropSyst

- Multi-year and multi-crop (corn, wheat, soybeans, barley, sunflower, sugar beet, potato) crop growth simulation model
- Daily time step
- Link to the GIS software and Weather generator

Use of CropSyst

- Model is used for simulation of growth of selected crop for selected soil
- Model enables estimation of potential crop development in specific climate and soil conditions

CropSyst simulate

- Soil water storage
- Water erosion
- Nitrogen soil reserves
- Use of pesticides
- Phenology and crop growth
- Crops yield and biomass
CropSyst input parameters and output products

<table>
<thead>
<tr>
<th>Data</th>
<th>Input</th>
<th>Output</th>
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</thead>
<tbody>
<tr>
<td>Climatic</td>
<td>Daily maximum and minimum air temperature, rainfall, air relative humidity (%), solar radiation and mean wind speed.</td>
<td>Products of statistical analysis of climatic parameters: mean, standard deviation, maximum and minimum value.</td>
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<tr>
<td>Crop</td>
<td>Planting date, thermal crop requests for specific growth level progress, morphological crop attributes (maximum index leaf area, root depth).</td>
<td>Date of growing stage, length of growing season, estimation yield depending on variability of climatic components, root depth</td>
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<tr>
<td>Soil</td>
<td>Hidropedological parameters of soil, soil texture.</td>
<td>Potential and actual evapotranspiration, soil moisture deficit.</td>
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<tr>
<td>Irrigation</td>
<td>Irrigation scheduling criteria</td>
<td>Estimated yield depending on the application of agrotechnical practices.</td>
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</tbody>
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Model testing in Serbia

- CROPSYST model tested on the maize crop and the region of Vojvodina
- Analysis of historical rainfall data (1961-2003) and selection of extreme climatic years (the driest – 2000 and the wettest – 2001);
- Estimation of crops growth parameters during vegetation season for an extremely dry and wet year.
- Comparison of actual and simulated yield of maize for period 1991-2008
- Estimation of extreme climatic effects on yield.
Model testing in Serbia
analysis of rainfall and parameters of crops development

Rainfall variability during maize growing season (April-September) for period 1961-2003.

Estimating the effects of climatic variability on the length of growing season, date of occurrence of the phase, root depth, canopy ground cover.

Model testing in Serbia
comparison of actual and yield obtained by CropSyst model

Yield, kg/ha

Obtained yield
Simulated yield

y = 0.9849x
R² = 0.766
Actual and simulated yield of maize for period 1999-2003 and forecasted values of maize yield for 2004

• Yield forecast - given on the first of July 2004 in the case of heavy (A-237mm) and light (B-34mm) rainfall in critical period (July and August)

• Actual yield in 2004 - about 6.5 t/ha (C), that is approximate to forecasted value in the case of heavy rainfall (A)

Preparing model for operative use

• Three weather scenarios (dry and hot, normal, cool and wet) - defined for the period from 1 July to 31 August, based on daily meteorological data (1990 – 2005)

• Average weather conditions - determined based on the average daily values of meteorological data for the period 1990 – 2005

• Dry and hot scenario - precipitation sum 30% from the average, positive air temperature anomaly of 3°C

• Cool and wet scenario - precipitation sum 50% greater than the average, negative air temperature anomaly of 2°C

• Cropsyst model in operative use in RHMSS since 2007
THANK YOU FOR YOUR ATTENTION!

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