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Climate change impact chain for rice

The major climate stimuli such as temperature, precipitation (rainfall, flooding), salinization, tropical ozone and tropical storms show different biophysical and socio-economic impacts on key agricultural crops such as rice, maize, millet, sorghum, and coffee. In view of this, an **impact chain approach** analyses and highlights the consequences induced by the climate stimuli. In a second step, it shows the related implications on the considered crops, as well as ascertains the required adaptation measures to counteract the relevant stimuli.

Weather is a key factor in agricultural productivity, despite many technological advances. Climate change is leading to changes in global and regional climates which turn to have severe impacts on the growth of crops as well as on activities associated with agriculture and distribution of food. There is now an extensive and still a growing body of research which considers the impact of climate change and severe weather events on crops and agricultural systems and also applies modelling techniques to simulate their impacts on agriculture.

Based on state-of-the-art literature reviews, **climate stimuli charts** show which climate stimulus is most critical at which crop production stage. For **rice** erratic rainfall, flooding during ripening, salinization and tropical storms cause major biophysical impacts on rice.

<table>
<tr><th colspan="5">Rice sensitivity chart</th></tr>
<tr><td rowspan="2">Climatic stimuli</td><td colspan="4">Production phase</td></tr>
<tr><td>germination</td><td>growth/flowering/fruit setting</td><td>ripening</td><td>harvest</td></tr>
<tr><td>temperature</td><td colspan="4">some controversy</td></tr>
<tr><td>rainfall</td><td colspan="2">vulnerable to erratic rainfall</td><td></td><td></td></tr>
<tr><td>drought</td><td colspan="2">vulnerable</td><td></td><td></td></tr>
<tr><td>flooding</td><td colspan="4">vulnerable to prolonged flooding (except e.g. scuba rice)</td></tr>
<tr><td>trop. ozone</td><td colspan="4">harmful and leads to grain yield decrease</td></tr>
<tr><td>salinization</td><td>problem in dry season</td><td></td><td></td><td></td></tr>
<tr><td>CO_2 fertilization</td><td colspan="4">fairly strong positive effect</td></tr>
</table>

How to use the tables / impact chains:
The table lists, for each crop, a number of climatic stimuli and how they impact onto the crop in various development stadia (biophysical impacts) and socio-economic impacts.

- *Red high negative impact*
- *Yellow / Amber medium negative impact*
- *Green low or no negative impact (Dark green positive impact)*
- *Blue impact disputed*
- *[white] if no information present*

Apart from presenting an overview of the impacts of climate stimuli on rice, the **impacts chain approach** provides decision-makers with a first indication of where climate impacts may be felt earliest, and where interventions might be needed.

Rice impact chain			
Climatic stimuli	**Biophysical impacts**	**Socio-economic impacts**	**Adaptation measures**
Temperature	Requires hot and humid climate with prolonged sunshine. Too high temperatures (above 40°C) can lead to reduced growth.	Due to change of the climatic situation and favourable climate stimuli rice may be grown in areas previously excluded from rice production. Adverse climate stimuli may cause • lower production therefore food insecurity, • reduced income for farmers, • increased demand for rice causing higher prices at local markets	Use of heat tolerant cultivars (type of cultivar is region specific)
Rainfall	Highly vulnerable to erratic rainfall and drought periods especially during growth.		Additional irrigation during dry spells especially at growing stage.
Flooding	Tolerates waterlogged conditions during vegetative stage, however cannot withstand standing water during ripening stage (except for scuba rice).		Drainage during ripening stage
Salinization	Rice is sensitive to salinity, particularly during the seedling stage and in dry periods		• Use of irrigation water with low salinity, • Use of salt tolerant varieties (regions specific), • Soil improvement measures (before plantation, flooding of fields helps washing out salts), plantation of soil extracting plants (region specific) as alternative crops.
Tropical storms	Rice is most vulnerable to damage at the heading stage of its development		Introduction of early warning systems
Tropical Ozone (especially near urban centres)	Reduced yield due to high ozone concentration		No measures applicable

Get the full report with a detailed analysis on maize, coffee and millet at link.

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