Terms of Reference for
Building Climate Resilient Cotton Production System under changing climate scenarios using Modelling Techniques

Project Name:
E-Smart Farming solutions for Cotton Value chain

Project Background:
Agriculture is increasingly becoming more knowledge-intensive. Having access to timely, accurate information that is tailored to specific locations and conditions is critical in helping farmers make the most of their resources in often changing circumstances.

Over the past 15 years the information and communication technology (ICT) revolution has driven global development in an unprecedented way. Today ICTs are a transformative force for good in socio-economic development.

It has been amply demonstrated that enhancing the ability of farming communities to connect with knowledge banks, networks and institutions via information and communication technologies (ICTs) has improved their productivity, profitability, food security and employment opportunities substantially.

The agriculture sector faces many challenges posed by climate change, loss of biodiversity, drought, desertification, increase in food prices and inefficient supply chains. The sector is increasingly becoming knowledge-intensive, and the availability of the right information, at the right time, in the right format, and through the right medium, influences and affects the livelihoods of many stakeholders involved in agriculture and related fields.

Impact of digitization is now evident in each sphere of life; it has increased the speed and breadth of knowledge turnover with the society and economy. Digitization is also fascinating the second largest sector of Pakistan economy, agriculture. Young generation of farming communities have been spellbound by smartphones, watching videos, sharing information, pictures etc. Now it is imperative to devise e-farming tools that will help farmers as well as field personnel for information collecting, analyses and reporting. Proposed initiative is small step towards development and testing of digitization in farming system.

Climate change is the most serious threat facing the agriculture, farmers, environment and the economy. Pakistan is among the list of top ten countries, vulnerable to climate change. Agriculture need to be address the dual challenges of reducing farming emissions as well as adapting to impacts of climate change. Farmers and crops are dependent on vagaries of weather that can be an opportunity as well as threat. Climate change is something that already happened and agriculture is feeling its force in the form of erratic rains, heat waves, insect pest pressure, loss of soil fertility, water resources and disturbing livelihoods.
**Objective of the Task:**

Sustainable Agriculture & Food Programme (SAFP) of WWF-Pakistan under its “E-Smart Farming” project intends to calibrate a cotton crop model. The mandate of the task is to:

a) Calibrate a cotton crop model based on climate and crop production data to narrow down the cotton yield gaps

b) Developing an adaptation package for cotton crop in the wake of climate change

**Scope of Work:**

The proposed model will integrate the factors like weather, soil, crop and management practices for analysis in cotton crop model and future recommendations will be drawn in the wake of changing climate.

**Specific Tasks:**

- Consultant/s will develop the cotton crop model for Khanewal & Bahawalpur districts of Punjab, Pakistan
- The consultant will define the methodology to carry out ‘cotton crop modeling’ in the wake of climate change scenario based on historic crop data and weather information.
- Consultant will be responsible to collect, compile and interpret the required information from relevant research institutions, academia and commodity markets etc. for modelling purpose, if required.
- Consultant (s) will develop formats and data sheets for field data collection and compilation.
- He/ She will be responsible to collect the metrological data of the target districts to be used in cotton crop modeling.
- The consultant will be responsible to visit cotton field areas in Khanewal & Bahawalpur to collect ground level information/data, required for modeling of cotton crop.
- Calibration of model through using advanced modeling tools like DSSAT.
- Consultant(s) will assess the present levels of crop inputs being used in cotton crop production, in Khanewal and Bahawalpur districts.
- Consultant(s) will study the impact of climate change on cotton productivity and propose a climate change adaptation package for cotton crop till 2050.
- Identify problems/gaps if any, in present nitrogen and water use practices of cotton crop and suggest possible remedies/suggestions to improve these.
- The consultant(s) will draft report based on information gathered from the field and will provide possible suggestions by using crop model. The consultant(s) will also present his findings to project team in ppt. file format.
• The consultant(s) will share all relevant data, including hard & soft formats, data sheets, historic weather data, audio/ video recording and pictures acquired for consultancy. The consultant will share methodology with project team prior to start of consultancy.
• WWF-Pakistan will bear boarding, lodging, travelling and accommodation expenses of the consultant and his team during field visits. Remuneration will be provided to consultant(s) as per agreement.
• No additional or accidental cost will be borne by WWF-Pakistan.

Specifications of the calibrated cotton model:

The model will strengthen the decision support system of farmers in targeted districts (Khanewal & Bahawalpur) in the wake of future climate change scenario;

Cotton varieties; Model will support in selection of cotton varieties according to the source, based on future weather scenarios, soil conditions and historic performance of variety in a particular district

Optimization of sowing dates; Cotton crop sowing date will be optimized based on historic weather conditions and future weather to establish effective crop protection and obtaining better yield.

Plant population assessment; Model will assess the plant population per acre keeping in view the varietal characters, sowing date, weather and prevalence of pests and diseases.

Tillage; The model will calibrate tillage practices in accordance with soil characteristics to ensure minimum tillage leading to emissions’ reduction and conservation of soil health.

Irrigation scheduling; The Model will calibrate, quantity of irrigation water based on varietal characteristics, weather conditions and critical growth stages of crop.

Nutrient Stewardship; The calibrated cotton model will predict the future scenario of nitrogenous fertilizer application based on 4R model i.e. the right source, right amount, right time and right place.

Deliverables:

• Detailed report entitled “Building climate resilient cotton production system under changing climate scenarios using modelling techniques”.
• Calibrated and evaluated cotton crop model
• Climate change adaptation package for cotton crop
• One research paper to be published in collaboration with WWF-Pakistan’s Sustainable Agriculture and Food Programme (SAFP) team and the consultant
- Survey data
- Presentation on calibrated crop model to WWF-Pakistan (SAFP) team

**Duration:**

<table>
<thead>
<tr>
<th>Sr. #</th>
<th>Description of the task</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Methodology and field visit plan</td>
<td>April, 2020</td>
</tr>
<tr>
<td>2</td>
<td>Field visits</td>
<td>May-June, 2020</td>
</tr>
<tr>
<td>3</td>
<td>Final draft of report</td>
<td>30 July, 2020</td>
</tr>
</tbody>
</table>

**Required Qualifications/Skills**

- PhD Degree in Agriculture, having expertise in crop modeling
- Minimum 10 years of experience in research/field studies related to crop modeling and climate change impact assessment.
- Experience of conducting field studies/consultancies in agriculture sector