Climate Information for Crop Risk Management in the SAT

AVR Kesava Rao
Sreenath Dixit
Anthony Whitbread
KPC Rao
Ram Kiran Dhulipala

Invited presentation at Annual Monsoon Workshop and Prof DR Sikka Memorial National Symposium on “Role of weather and climate observations and Forecasting on Increasing Agricultural Productivity and Risk management” at IITM Pune during 28-30 March 2019
Major risks for smallholder farmers

- Cost of inputs, pests and diseases, storage and market risks
- New challenges on integration of value chains; Liberalization and globalization effects
- Barriers to learn new farming techniques
- Adaptation to climate variability and change; Crop insurance issues
- Women farmers face lack of access to resources as their male counterparts

Climate Risks becoming more pronounced
## Coping with Climate Risk

<table>
<thead>
<tr>
<th>Tactical</th>
<th>Strategic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Timing of planting</td>
<td>Re-designing farming systems</td>
</tr>
<tr>
<td>• Selection of crop types and</td>
<td>• Historical and future climate analyses and</td>
</tr>
<tr>
<td>varieties</td>
<td>modelled scenario analysis</td>
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<tr>
<td>• In-season adjustment of inputs</td>
<td>• Co-design of the farm system(s) for resilience</td>
</tr>
<tr>
<td>• Crop insurance</td>
<td>and market opportunities</td>
</tr>
<tr>
<td>• Forward selling, contracts</td>
<td>• Infrastructure and institutions to enhance</td>
</tr>
<tr>
<td></td>
<td>adaptive capacity</td>
</tr>
</tbody>
</table>

More risks in Semi-Arid Tropics (SAT)
Semi-Arid Tropics

High levels of **poverty, malnutrition** and **environmental degradation**

Covers 6.5 million sq. km.
Across 55 countries
with 2 billion people
of which 644 million are the poorest of the poor
Specialization in crops suitable for the drylands

- Sorghum
- Pearl millet & Finger millet
- Groundnut
- Chickpea
- Pigeonpea

Good for you
Good for the planet
Good for smallholder farmers
Climate Smart Crop Cultivars: Super Early Chickpeas

Super early
ICC 96029, 75-80 days

Early maturing
KAK 2, 90-95 days

Extra-early
ICCV 2, 85-90 days

Effects of high temperatures on pod set in chickpea

Sensitive
Tolerant
Pigeonpea hybrids with high yield potential

On-farm demonstration of hybrid pigeonpea ICPH 2740

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>No. of Farmers</th>
<th>Mean yield (Kg/ha)</th>
<th>% Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ICPH 2740</td>
<td>Control</td>
</tr>
<tr>
<td>2009</td>
<td>Maharashtra</td>
<td>22</td>
<td>1791</td>
<td>1494</td>
</tr>
<tr>
<td>2010</td>
<td>Maharashtra</td>
<td>55</td>
<td>1380</td>
<td>1167</td>
</tr>
<tr>
<td>2011</td>
<td>Maharashtra</td>
<td>102</td>
<td>2144</td>
<td>1651</td>
</tr>
<tr>
<td>2009</td>
<td>Madhya Pradesh</td>
<td>13</td>
<td>1814</td>
<td>1217</td>
</tr>
<tr>
<td>2011</td>
<td>Andhra Pradesh</td>
<td>47</td>
<td>1999</td>
<td>1439</td>
</tr>
<tr>
<td>2011</td>
<td>Gujarat</td>
<td>40</td>
<td>1633</td>
<td>1209</td>
</tr>
<tr>
<td>Total/Mean</td>
<td></td>
<td>279</td>
<td>1794</td>
<td>1362</td>
</tr>
</tbody>
</table>

- **Extra Early Pigeonpea:**
  ICPL 88039: 110-130 days maturity

- **Super Early Determinate (DT) Pigeonpea:**
  ICPL 11255, ICPL 20338: 90-100 days maturity
Farmer-centric Watershed as an Entry Point for Sustainable Livelihood Improvement

- Integrated Genetic and Natural Resources Management
- Science-based consortium approach
- Profitability and sustainability
- Empowerment and knowledge sharing
- Social inclusion (equity, gender and youth)
Intelligent Agricultural Systems Advisory Tool (ISAT)

- Developed a pre-season decision tree to inform crop planning
- Developed a weekly decision tree integrating forecasts, crop and soil scenarios and systems information – messages sent via SMS
- Piloted with 700 farmers in Anantapur in 2017
Groundnut Crop Sowing Advisories

Devanakonda Mandal, Kurnool District Andhra Pradesh Kharif 2016

ICRISAT, Microsoft, Government, NGOs and Farmers
Sowing period variability at Devanakonda

Great year-to-year variability exists, making rainfed cultivation, a challenge

Water Balance approach (MAI) and simulation models along with 5-day rain forecasts helped in identifying successful sowing window
Groundnut yield simulations at Devanakonda

DSSAT Crop-growth simulations based on past 30 years’ climate data indicated optimum sowing window as the period between 20 June to 20 July.
Power BI dashboard for weather information

- Future weather prediction
- Rainfall

- Current weather conditions
- APSDPS

- Soil data
- PET, FC, ST

Azure ML Studio
MAI Prediction

SMS Service
Send Sow/Don’t Sow

Devanakonda Mandal Rainfall information

Average Actual Rainfall by District (in mm)

Actual Rainfall by Month (in mm)

Average Actual Rainfall by Mandal (in mm)

Next 5 Days Forecast Rainfall (in mm)
Weather-based sowing advisory for groundnut

Area sown (%)

- Devanakonda, Kurnool
- Sowing recommendation

<table>
<thead>
<tr>
<th>Date</th>
<th>Area sown</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-Jun-16</td>
<td>2</td>
</tr>
<tr>
<td>15-Jun-16</td>
<td>2</td>
</tr>
<tr>
<td>16-Jun-16</td>
<td>2</td>
</tr>
<tr>
<td>17-Jun-16</td>
<td>4</td>
</tr>
<tr>
<td>18-Jun-16</td>
<td>4</td>
</tr>
<tr>
<td>19-Jun-16</td>
<td>4</td>
</tr>
<tr>
<td>20-Jun-16</td>
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<tr>
<td>21-Jun-16</td>
<td>9</td>
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<tr>
<td>22-Jun-16</td>
<td>11</td>
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<tr>
<td>23-Jun-16</td>
<td>15</td>
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<tr>
<td>24-Jun-16</td>
<td>32</td>
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<tr>
<td>25-Jun-16</td>
<td>32</td>
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<tr>
<td>26-Jun-16</td>
<td>55</td>
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<tr>
<td>27-Jun-16</td>
<td>79</td>
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<tr>
<td>28-Jun-16</td>
<td>83</td>
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<td>29-Jun-16</td>
<td>86</td>
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<tr>
<td>30-Jun-16</td>
<td>90</td>
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<tr>
<td>01-Jul-16</td>
<td>92</td>
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<tr>
<td>02-Jul-16</td>
<td>92</td>
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<tr>
<td>03-Jul-16</td>
<td>98</td>
</tr>
<tr>
<td>04-Jul-16</td>
<td>100</td>
</tr>
</tbody>
</table>

Area sown for land preparation

- SMS for land preparation
Figures above blue bars indicate percentage increase in yield.
Interactive meetings at pilot villages in AP
AP’s ‘Rythu Kosam’ ropes in ICRI SAT

The effort by the ICRI SAT in association with Microsoft and elsewhere to reduce expenditure by farmers.

New App Promises to Tell Indian Farmers When to Sow Crops

Farmers in Andhra Pradesh can sign up for an app that shows them the weather and prime planting days.

By Vibhuti Agrawal
Jun 17, 2016 5:00 pm IST

Monsoon season in India has just begun, but farmers in Andhra Pradesh, a southeastern coastal state of India, won’t need to look to the skies to know when to sow their crops. A new mobile application launch earlier this month and developed by a local agricultural...
Weather advisories via SMS are nothing new

Integration to

• Delivery in real-time
• Context specific advice
• Based on ground reality and need
• Digital Strategy

*are the essential ingredients*
ICRISAT’s digital agriculture innovation platform

Agri-entrepreneurship can:
- Attract youth to agriculture
- Foster entrepreneurial spirit and accelerate increases in rural incomes
- Our Innovation - Incubation and research in Digital Agriculture

A creative platform for innovations that change the lives of farmers

ICRISAT ihub launched on February 13, 2017 to accelerate opportunities for Agri-entrepreneurs in India and beyond
Outreach and engagement

- Keynote address in CII regional events (2) and invited speakers/panelists at GFIA, ICPP, IRC, GDI (Univ of Manchester), GBC, ICT4D
- Knowledge partners (Ag track co-lead) of the annual ICT4D conference
- Nurtured strong partnerships with Microsoft, Cyient, Source Trace, aWhere, CRS, CGIAR BDP, CG centers, NABARD, State Governments
  - 3 training programs in 2018/19 on IOTs in agriculture for senior officers of NABARD
A few concerns of small holder farmers

- Rainfall forecasts are not specific to their locations
- Crop management recommendations are mostly generalized for all soils and seasons
- Several players offering advisories with conflicting content
- Contingency planning recommendations do not consider market information
Points for consideration

• Need to address the **Challenge of Scaling** – requirement for context specific information
• Capacity enhancement of stakeholders on probabilistic nature of weather forecasts
• Climate analysis results - integral part of decision support system for preparing advisories
• Knowledge of the farming systems
• Crop-growth simulation models for monitoring, yield prediction and fine tuning advisories
• Enhancing skill for seasonal forecasts to help make better decisions on crop acreage, availability of seeds and inputs
• Climate-Smart Agriculture Practices
Climate-Smart Agriculture

Conditions

1. Sustainably increase agricultural productivity and incomes in order to meet national food security and development goals

2. Build resilience and the capacity of agricultural and food systems to adapt to climate change

3. Seek opportunities to mitigate emissions of greenhouse gases and increase carbon sequestration

These three conditions (food security, adaptation and mitigation) are referred to as the “triple win” of climate-smart agriculture
Monsoon Mission Project 2018-21

Enhancing Groundnut Productivity in AP and Karnataka through Farmer Acceptable Climate Smart Strategies and Weather Based Crop Management Advisories
Generating crop genetic coefficients for up-coming new groundnut cultivars
Climate-Smart Village Approach

Brings together farmers, extension personnel, scientists, local NGOs and policy makers to work on a portfolio of practices to adapt agriculture to both climate variability and climate change.
Thank You

k.rao@cigar.org