Near-real time rice production information system

• Generate information on:
  – Rice area and planting date
  – Pre-harvest (mid-season) and end of season rice crop yield
  – Drought and flood occurrence

• Policy and food security, e.g. production planning, rice import / export, market; crop insurance and commodity groups, e.g. crop input management

• Developed and applied by IRRI / partners in Asia & South-East Asia
  – Philippines (Dept Agriculture – PhilRice), Cambodia (Ministry of Agriculture, Forestry, and Fisheries), Vietnam (Ministry of Agriculture and Rural Development), several states in India (Odisha, Andra Pradesh, Tamil Nadu, m)
Rice area mapping

Andhra Pradesh, India

Assam, India

Andhra Pradesh, India (with validation points)

Validation > 90% accuracy in rice area detection (field scale), > 95% (village scale)

Rice baseline map of Odisha
Yield estimates

Mid season rice yield assessment, Andhra Pradesh, India, 2018

End season rice yield assessment, Andhra Pradesh, India, 2018

Multiscale yield estimates, Mekong Delta, Vietnam 2014-15

Yield modelling method

Yield estimate validation
Damage assessment: flood

Rice area affected by excessive rain and flooding. Odisha, India, Sept. 2018

Frequency of flood occurrence Central Luzon, Philippines, 2014-17

Flood inundation map of Assam, India, July 2019

Available SAR data (VV polarization): BEFORE & AFTER flood (close to cyclone event)

Rule based classification for flood damage assessment

Flood Map

Flooded area

< Flowering span R (p²) > 1.6

Crop Damaged

< Flowering span R (p²) < 1.6

Potentail Insultated Area (p<sub>ave</sub> = water threshold)

NO

Crop Survived

NO

Crop Survived

NO

Crop Damaged

NO
Rice fallow mapping & crop diversification suitability

Rice fallow suitability map, Mayurbhanja, Odisha, India

<table>
<thead>
<tr>
<th>S No</th>
<th>Classes</th>
<th>Area in Hectares</th>
<th>%</th>
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<tbody>
<tr>
<td>1</td>
<td>Suitable</td>
<td>86704.3</td>
<td>46.7</td>
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<tr>
<td>2</td>
<td>Mod Suitable</td>
<td>70828.5</td>
<td>38.1</td>
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<td>Marginal Suitable</td>
<td>17907.5</td>
<td>9.6</td>
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<tr>
<td>4</td>
<td>Not suitable</td>
<td>10301.5</td>
<td>5.5</td>
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<tr>
<td>Total</td>
<td></td>
<td>185741.7</td>
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</tr>
</tbody>
</table>

Climate, soil moisture dynamic, soil types, topography, crop duration
Digitizing the Agricultural Value Chain

**Planning**
- Help farmers plan what, when to plant
- Provide data for farmers to make business decisions on cash flow and maximizing profit

**Inputs**
- Reduce costs and risks for buyers
- Increase access to quality inputs
- Provide convenient and secure ways for farmers to purchase, save, and receive credit inputs

**On-Farm Production**
- Help extension services reach more farmers
- Use behavior change media to promote best practices among farmers

**Storage**
- Improve links between farmers, processors
- Inform harvest practices to reduce post harvest losses

**Post-Harvest Processing**
- Increase farmer negotiating power by providing market prices
- Track governance for supply chain optimization and grading

**Transport**
- Reduce costs of transport
- Increase choice of different types of transport for farmers

**Access to Markets**
- Increase market information available to farmers so that they have more choices
Digital & Knowledge Tools

**WeRise**
Towards strategic crop management in rainfed rice areas

**SeedCast**
A digital innovation to strengthen seed demand and supply information for rice

**ORYZA Crop Model**
Advancing rice science through crop modeling

**Rice Doctor**
App-based diagnostic tool that provides accurate and timely diagnosis and management recommendations

**Rice Knowledge Bank**
Showcasing rice production techniques, agricultural technologies, and best farming practices based on knowledge from research findings, learning and media resources, and in-country projects.

**EasyHarvest**
Smart Management of Machinery for Rice Postharvest and Mechanization

**Rice Crop Manager Advisory Service**
A web-based platform for field-specific information on crop and nutrient management to increase yields and income of the rice farmers in the Philippines

Contact: Carolyn Florey c.florey@irri.org
Initiatives and development

- Precision agriculture and drone
- Development of annual rice area layer for South-East Asia (MODIS-based, historic and annual map)
- Modelling rice crop stresses with EO (water, ET, nutrient, growth anomalies)
- Rice early warning system: couple yield prediction with short-term weather prediction
- Oryza: rice crop growth model and spatial simulation (e.g. CC)

- Rice straw management (India)
- Impact of sea level rise in rice-producing delta (Vietnam)
- EO for M&E, e.g. spatial uptake and effectiveness of flood resistant varieties (India, Bangladesh)
Pest Risk Identification and Management (PRIME)

- Rice farmers lose 37% of their crop annually due to pests (Oerke, 2006)
- Pests cause significant chronic losses and severe episodic problems
- Extreme weather events make pest issues worse
- Human health and environmental concerns on misuse of pesticides, additional costs

www.riceinfo.ph
Pest Risk Identification and Management

**General Objective:** To understand the risk factors for pest outbreaks and to identify appropriate management strategies and tactics to reduce crop losses.

**Specific Objectives**
1. Develop and improve current methods for generating rice crop parameters, including indicators for crop health, and management practices, from remotely sensed data,
2. Analyze risk factors for pest outbreaks,
3. Formulate efficient management strategies and tactics to reduce crop losses, and
4. Improve the capacity of project partners on remote sensing, and pest risk mapping and analysis.
Standard pest surveillance protocol

Site selection, frequency/time of monitoring, data to be collected, sampling points, monitoring of rodents
Updated database on rice pest occurrence

Electronic form | Number of submitted data*
---|---
Field profile | 4,399
Cultural practices | 3,541
Pest survey | 22,858
Pest management | 2,728
Nutrient management | 2,851
Yield | 2,196

* from 1 July 2018 to 24 September 2019

Monitoring is done in the first 2 weeks of each month.

PRIME Collect app as tool for data collection
Pre-semester / within season pest bulletins

Observation of disease and pest injuries, insect counts, crop stages for a set of fields per region
Risk factor analysis

Risk factors of bacterial leaf blight

- Cropping intensity (tns. of crops per year)
- Fallow period
- Planting synchrony

Crop growth
  - Crop establishment method
  - Crop growth stage
  - Rate of nitrogen fertilizer

Leaf wetness duration
- Effective resistance genes (variety)
- Dominant pathotype of the pathogen

Rainfall
- Relative humidity
- Temperature

Risk factors of rodents

**Positive factors**

- IMMIGRATION
  - Food supply
  - Competition

- BIRTH
  - Food supply

- Rodent population

**Negative factors**

- DEATH
  - Human rodent control
- EMIGRATION
  - Food supply

- Rat damage
  - % yield loss
  - % damaged tillers

Sites in bacterial leaf blight rice pathosystem are leaves. The disease usually produces only one lesion on a leaf. This pathosystem is also divided into four interacting subsystems or sites:
1. Healthy site = not infected
2. Latent site = infected by the pathogen but no bacteria are produced yet
3. Infectious site = where bacteria are produced
4. Removed site = previously infected but no longer infectious, considered “removed” from the system.
Risk factor experiments

Controlled conditions / field experiments, growth chamber

Management (AWD vs CF, DS vs transplanted), climate (T, solar radiation, extreme events) effects on occurrence, development and dissemination (pest and natural enemies)

Varieties resistance
Mapping of risk factors with remote sensing

- Rice ecosystems: Flooded vs rainfed
- Crop establishment: transplanted vs direct seeded
- Crop plantation synchrony: planting data, planting duration
- Fallow duration
- Cropping system: crop rotation, multiple rice crop, rice-other

National mapping based on PRISM rice area
Focus on Sentinel-1 SAR (VV, VH) and some optical (dry season)
Mapping of risk factors with remote sensing: peak of planting
Spatial and temporal risk index prediction – Brown Plant Hopper

Testing the model simulations with real field data. Comparison of field (black dots) and model (red - Monte-Carlo's average (mean); grey - minimum and maximum simulated values) abundances in one season.

Brown Plant H response to temperature and RH – a first step toward BPH outbreak predictions
<table>
<thead>
<tr>
<th>Title</th>
<th>Region</th>
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</thead>
<tbody>
<tr>
<td>Capacity Enhancement Workshop on Pest Risk Identification and Management (PRIME), Feb 13-15, 2019</td>
<td>X</td>
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<tr>
<td>Training on Pest Risk Identification and Management (PRIME) Crop Health Assessment, Mar 5-7, 2019</td>
<td>IX</td>
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<tr>
<td>Training on Pest Risk Identification and Management (PRIME) Crop Health Assessment, Mar 19-21, 2019</td>
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<td>Regional Training on Pest Risk Identification and Management, Apr 10-12, 2019</td>
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<td>Retooling on Crop Health Assessment for PRIME Data Collectors, Jun 10-12, 2019</td>
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<tr>
<td>PRIME Retooling, June 12-15, 2019</td>
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<td>IPM Training, June 25-28, 2019</td>
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<td>Crop Health Training for AEWs, August 12-16, 2019</td>
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<tr>
<td>Retooling on PRIME and IPM Training, September 17-20, 2019</td>
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Pest surveillance, species distribution modelling, remote sensing (GGE, drone, RF classification)