

Weather-rice-nutrient integrated decision support system



Towards strategic crop management in rainfed rice areas

✓ Background

Rice is a staple food for half of the world's population, making it one of the most important crops for food security. Global rice demand is projected to increase by up to 555 metric tons by 2035, with Asia accounting for 67%. Demand from Africa and the Americas is also predicted to rise in the next decades. To meet future demand, grain yield should increase by an aggressive 0.6 tons per hectare per year over the next decade (IRRI 2015).

Irrigated rice areas account for 58% of the total rice area worldwide and contribute 75% to global rice production (GRiSP 2013 in IRRI 2015). Irrigation systems providing a favorable water supply are key to these figures. However, irrigated rice production is threatened by land conversion, competing water requirements of other sectors, and the high infrastructure costs of irrigation facilities. Enhancing production in rainfed lowland areas is imperative to achieve food security. Rainfed rice areas account for 33% of the global rice area, but only contribute 19% to global rice production, largely due to the low and unstable yields - as low as 2 tons per hectare compared to 5 tons per hectare average yield in irrigated areas (IRRI 2015).

✓ The Challenge

Rice farming is a major source of income in rainfed areas, the low and unstable yields contribute to high poverty incidence (Cantrell 2000).

- **Weather uncertainties** - Rainfed rice production relies on rainfall for its water supply. Critical crop production decisions including when to plant and apply fertilizer depend on water availability. Difficulties in determining the onset of rain, amount and distribution of rainfall, and flooding and drought occurrences during the upcoming cropping season are further aggravated by the impacts of climate change.
- **Drought** - More than half of the total rainfed rice areas are highly drought-prone and drought-prone because of their topographic characteristics and dominant soil texture (Garritty et al 1986 in IRRI 2015). Drought, especially during critical growth stages, can adversely affect plant growth and nutrient use resulting in significant yield reduction.
- **Small farm size** - In Indonesia, for example, the average farm size is 0.1–0.5 ha (USDA-FAS 2012 in IRRI 2015). Crop intensification, which aims to accommodate more than two crops during the rainy season, may overcome this physical constraint. However, it would entail increased water requirements, pest build-up, and changes in fertilizer dosage and application pattern, requiring more efficient soil and water management practices (Ladha et al 2000) in 2015.

▶ Potential Impact

- **Optimum sowing time:** Farmers would be able to determine the optimum sowing timing which is crucial to obtain higher yields (Basnayake et al 2006 in Hayashi et al 2018). With surpluses, farmers will have more incentives to produce and could graduate from subsistence farming.
- **Address labor shortages:** Farmers may not adopt a new technology if it is labor-intensive. In rice-producing countries such as Indonesia and the Philippines, a significant percentage of the labor force has shifted from the agriculture to the manufacturing and services sector. This resulted in labor shortages during critical periods such as land preparation, sowing, and fertilizer application. WeRise advisories could be useful in planning the production activities so farmers are able to allocate their resources (labor, money, time) more efficiently to help address these labor shortages.
- **Access to credit:** A majority of rice farmers (57%) have limited access to fair financing; many borrow from individuals and money lenders in Indonesia (Sudaryanto 2015). Using WeRise advisories can help decrease risks for farmers and unlock access to credit.

▶ Results

The following participatory approaches are complete with further experimental trials underway:

- **Technology development:** In collaboration with local partners in research and agricultural extension, on-farm validation experiments were conducted in Indonesia, Laos and the Philippines. Obtained results from on-farm field validation in Indonesia showed that the predicted grain yield was close to the actual grain yield that was obtained through optimum sowing timing given by the predictions. Optimum sowing timing from the seasonal climate prediction-based crop growth model improved Indonesia's rainfed rice yield (Hayashi, et al., 2018). Additional experiments in Indonesia and the Philippines are on-going.
- **Capacity development:** A total of 179 extension workers and researchers were trained on WeRise operation, maintenance, further development, and dissemination; data collection; crop modeling; plant sampling and processing; and research equipment use and maintenance.
- **Policy influence:** Stakeholder meetings/consultations with NARES in Indonesia and the Philippines were held to explore collaboration on integrating WeRise or making WeRise complementary to existing information systems.



✓ How does it work?

The Weather-rice-nutrient integrated decision support system (WeRise) is an ICT4D tool which was developed by the IRRI-Japan Collaborative Research Project (IJCRP) to improve rainfed rice productivity and consequently the livelihoods of small-scale rainfed rice farmers as they become increasingly vulnerable to climate change.

WeRise is a computer-based application that applies seasonal climate predictions in a crop growth model. It is based on the upcoming cropping season's weather characteristics, including the predicted onset, distribution and amount of rainfall, crop growth development, soil characteristics and farm management practices. WeRise provides advisories on the optimum sowing timing, fertilizer application schedule and the suitable variety for planting. Advisories are generated three months before the cropping season, giving farmers sufficient time to plan their resource utilization and crop production schedule more efficiently.

Timely access to the right information enables smallholder farmers to make informed decisions for better crop management. With proper resource utilization through strengthened capacity for climate change adaptation, WeRise can help transform rainfed rice areas into a more productive and sustainable production system ultimately contributing to food security (Johnson in Hayashi and Llorca, 2015).

How to generate WeRise advisories:

1. Go to: <http://werise.irri.org>
2. Register a WeRise account.
3. To generate weather advisories: Click the corresponding icon or tab in the menu of the landing page. > Select the location and forecast year under "Data Set." > Choose the weather data you want to generate under "Weather Data." The default parameter is Rainfall. You may also generate advisories for other parameters. > Click "Show Advisory." > Print or save the advisories.
4. To generate crop advisories: Click the corresponding icon or tab in the menu of the landing page. > Select the location and forecast year under "Data Set". > Select your preferred variety for the first crop and second crop. > Click "Show Advisory." > In case you have a sowing date in mind, after choosing the varieties, click the icon "More Options." > Choose your preferred sowing dates. > Click "Show Advisory." > Print or save the advisories.

✓ Lessons Learned and Recommendations

Implementing, scaling and sustaining ICT for development tools is challenging; studies show that a majority of ICT projects close within just four years (Caspary and O'Connor 2003 in Sundén, S., and Wicander, G. 2007). The failure rate is even higher in developing countries (Heeks 2002 in Sundén, S., and Wicander, G. 2007).

For IRRI and our partners, it is critical that technology "recipients" have the freedom to operate once the technology is transitioned. To ensure that this transition happens smoothly, it is important to take into account the enabling environment and external factors that will contribute to its continued success, such as the availability of local technological capacity (i.e., organizational commitment), post-implementation support, and adequate, accurate technical documentation of programs to facilitate maintenance (Sundén, S., and Wicander, G. 2007). These challenges will morph and change rapidly in such a dynamic sector.

▶ Next Steps

In the coming years, IRRI will continue implementation and dissemination activities while building both the capacity and ownership of key stakeholders in Indonesia and the Philippines. Our activities include:

- **Scientific validation:** Field validations to check predictive accuracy of WeRise.
- **Capacity building and training:** Capacity building of stakeholders identified for the maintenance, operation, and further localization of WeRise in the project sites. Training of Agricultural Extension Workers who will disseminate the WeRise advisories to the farmers with focus on effective communication
- **Long term sustainability planning and advocacy:** Finalize an action plan to integrate WeRise into Katam and develop WeRise in other rainfed areas of Indonesia. Facilitate policy advocacy to harmonize data sharing among local agencies for sustainability and institutionalize WeRise



The IRRI-Japan Collaborative Research Projects have been funded by the government of Japan through the Ministry of Agriculture, Forestry, and Fisheries (MAFF) since 1984. The IJCRP on Climate Change Adaptation through Development of a Decision-Support tool to guide Rainfed Rice production, which is the latest project, was launched in October 2015 and will end in September 2020.

For more information, visit <http://werise.irri.org>
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