Jesusa C Beltran
School of Agricultural Resource Economics

Jessie obtained her Bachelor of Science in Business Administration and Master of Science in Agricultural Economics from two of the most prestigious universities in the Philippines. She has more than 10 years of research experience in the economic aspect of rice farming systems, but is new to the area of weed-related research. She became interested in the economics of weed problems in rice crops when she joined a collaborative project funded by ACIAR. Jessie’s PhD focuses on the economic analysis of weed management options in the rice production in the Philippines. Her research main contribution is a decision support program (DSS) that can help farmers make long-term decisions about the management of major weeds in their rice farms.
Economic analysis of weed management options in rice production in the Philippines

Jesusa C. Beltran

Supervisors:
W/Prof David Pannell
Res/Asst/Prof Graeme Doole
Prof Benedict White
Outline

- Background
  - Overview of RIMPhil model
  - RIMPhil standard results
  - Future research activities
Background

- Lack of labor availability
- Increased labor cost
- Shifts from transplanted to direct-seeded rice
- Development of herbicide resistance
- Weed shifts
- Environment and health impact

HERBICIDE USE

Increased labor cost leads to shifts in rice planting methods, leading to development of herbicide resistance and environmental impacts.
Background

- Implications on weed management

  - farmers are encouraged to use IWM strategies
  - IWM is a complex innovation
  - IWM strategy will be more likely to be used if it is profitable
  - economic analysis of IWM at the farm level is extremely complex
Background

- Economic analysis of weed management options
  - e.g. in WA model, $10^{119}$ treatment combinations
  - at one billion strategies per second, would require $10^{89}$ years to compare all strategies
    - earth is 14 billion years old
    - if we had started at the time of the big bang, we would be one billion, billion, billion, billion, billion, billion, billion, billion, billionth finished

Source: Pannell, 2007
Background

- Economic analysis of weed management options

- A bio-economic model is an effective tool to evaluate IWM strategies

- Bio-economic simulation models can help farmers develop long-term understanding about weed management

- RIMPhil is a DSS developed for major weeds in rice crops
RIMPhil: An overview

RIMPhil
Resistance and Integrated Management for Rice Farming in the Philippines
A model for testing the biological and economic performance of integrated weed management systems for herbicide-resistant weeds (annual barnyardgrass version)

Developed by Jesusa Beltran
Based on RIM by David Pannell, Vanessa Stewart, Anne Bennett, Marta Monjardino, Carmel Schmidt and Stephen Powles

The University of Western Australia
Faculty of Natural and Agricultural Sciences
School of Agricultural and Resource Economics

Philippine Rice Research Institute

version 2009a
RIMPhil: An overview

- Design and scope
  - framework is based on RIM
  - single field and enterprise: rice crop
  - major weed: annual barnyardgrass
  - crop establishment options: transplanted and direct-seeded rice
  - cropping season: wet and dry seasons
  - design for irrigated areas
  - 49 treatment options:
    - 27 herbicide options
    - 22 non-herbicide options
  - 5;10;15 and 20 years
RIMPhil: An overview

Select strategy

- Saved strategies
- Charts
- Biological results
- Economic results
- Crops & weeds
- Control costs
- Control%
- Prices & rates

Adapted from RIM 2004
(Pannell et al., 2004)
RIMPhil: An overview

- Major outputs of RIMPhil
  - average annual profit (Php/ha) for different periods (e.g. 1-5 years)
  - gross margin for each cropping season and year
  - total number of seeds in the soil (per m²)
  - density of weed plants (per m²)
  - total weed control costs (Php/ha)
  - herbicide resistance status of annual barnyardgrass

<table>
<thead>
<tr>
<th>Number of uses of herbicide groups remaining before weeds are mainly resistant</th>
<th>Shots left</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (fops)-high risk</td>
<td>12</td>
<td>Cyhalofop-butyl</td>
</tr>
<tr>
<td>Group B-high risk</td>
<td>12</td>
<td>Bispyribac Sodium</td>
</tr>
<tr>
<td>Group C2-high risk</td>
<td>12</td>
<td>Propanil</td>
</tr>
<tr>
<td>Group D-low risk</td>
<td>20</td>
<td>Paraquat</td>
</tr>
<tr>
<td>Group E-low risk</td>
<td>20</td>
<td>Oxadiazon</td>
</tr>
<tr>
<td>Group G-low risk</td>
<td>20</td>
<td>Glyphosate IPA</td>
</tr>
<tr>
<td>Group K1-moderate risk</td>
<td>16</td>
<td>Pendimethalin</td>
</tr>
<tr>
<td>Group K3-low risk</td>
<td>20</td>
<td>Butachlor</td>
</tr>
<tr>
<td>Group N-low risk</td>
<td>20</td>
<td>Thiobencarb</td>
</tr>
<tr>
<td>Group O-moderate risk</td>
<td>16</td>
<td>2,4-D</td>
</tr>
<tr>
<td>Other pre-emergence herbicide</td>
<td>0</td>
<td>User defined</td>
</tr>
<tr>
<td>Other early post-emergence herbicide</td>
<td>0</td>
<td>User defined</td>
</tr>
<tr>
<td>Other late post-emergence herbicide</td>
<td>0</td>
<td>User defined</td>
</tr>
</tbody>
</table>
RIMPhil: standard results

- Method of crop establishment sequence
  - transplanting–transplanting method (TT)
  - direct–direct-seeding method (DD)
  - transplanting–direct-seeding (TD)

- "Optimal" weed management strategy
  - manual weeding is a more profitable strategy than herbicides for low weed density
  - high dependence on herbicides as weed density and labour cost increases
RIMPhil: standard results

Reliance on herbicides on DD rotation, across weed threshold (WT) levels (plants/m²) and different labour costs over 20 years
RIMPhil: standard results

- Impacts of herbicide resistance
  - substantial economic losses
  - high weed treatment cost
  - altered weed management system

- Sensitivity analysis
  - 62 uncertain parameters (crop-related, weed-related, control efficacy and economics)
  - sensitive variables: yield, crop price, labour cost, weed germination, max weed seed production and crop competition factor
Future research activities

- Analysis of IWM and herbicide use

- Conservation vs exploitation

- Conduct of sensitivity analyses of model results
Acknowledgements:

- John Allwright Fellowship (JAF) funded by ACIAR

- Philippine Rice Research Institute (PhilRice)

- Supervisors: W/Prof David Pannell, Res/Asst/Prof Graeme Doole, Prof Benedict White
Future research activities

- Analysis of IWM and herbicide use
- Conservation vs exploitation
- Conduct of sensitivity analyses of model results