Solutions to Contested Agronomy: Should they be contested or resolved?

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Main point of this paper

- There are many ways to look at an agronomic problem and scientists working with farmers and other stakeholders should be thinking about resolving issues and evaluating the costs and benefits of a new intervention rather than disputing them. Finding ways to make them work.
Outline

• Challenges facing agricultural scientists
• The importance of soils
• The rice-wheat system of IGP – main issues
  • Late planting
  • Stemborer and weed issues
  • Equipment and how can resource poor farmers adopt?
  • Mind set of farmers and others
• Recent progress in India with Indian scientists
• When does no-till yield more?
Root proliferation
Movement of soil organisms
Aeration
Water retention
Water infiltration, filtration and transmission
Stability: erosion prevention

Physical

Nutrient content, retention & release
pH
Redox
Energy (C) storage
Toxicity mitigation

Chemical

Biological

Nutrient cycling
OM decomposition
N₂ fixation
Cause/suppress disease
Consume/release GH gases
Bioremediate contaminants
Genetic reservoir
Degraded soil → Healthy soil

- No addition of organic matter
- Only use chemical fertilizer
- Excessive tillage
- Use of toxic pesticides
- Mining of soil nutrients by unbalanced fertilizer use
- Erosion – wind or water

- Use of organic amendments
- Minimal soil disturbance
- Use of surface mulching
- Use IPM, IWM, IDM, ICM Rotations
- Nutrient balancing

Present farming practices??

Responsible, Intensive Land Management
Figure 3. Effect of planting dates and tillage options on productivity of wheat cultivar PBW 343.
Late planting reduces wheat yield.

- Late harvest of previous crop
- Farmers grow long duration varieties
- Some farmers grow a short duration crop after rice
- Excessive tillage
- Long turnaround from rice to wheat
- Excessive or too little soil moisture
- Thresh rice before plow for wheat
- Power constraints
Benefits of No-till in wheat after rice

• Better yields
• Less water
• Less costs
  • Less labor
  • Less diesel
  • Less wear and tear on equipment
  • Less weeds
• Improved soil health – physical, biological and chemical
• How much adoption?
Adding no-till to the rice phase
Improving water use efficiency

<table>
<thead>
<tr>
<th>Crop establishment &amp; irrigation methods</th>
<th>Grain yield (kg/ha)</th>
<th></th>
<th>Irrigation water use (M³/ha)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Without residues</td>
<td>With residues</td>
<td>Without residues</td>
<td>With residues</td>
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<tr>
<td>DSR-surface drip</td>
<td>5,010</td>
<td>4,620</td>
<td>5,590</td>
<td>5,570</td>
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<td>DSR-sub-surface drip</td>
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<td>DSR-flooded</td>
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<td>4,930</td>
<td>10,460</td>
<td>10,120</td>
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<td>TPR-flooded</td>
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<td>5,000</td>
<td>12,660</td>
<td>12,040</td>
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</table>
Use of new varieties of rice and wheat

• To allow earlier planting and intensify the system
  • Plant rice earlier with NT direct seeded rice
  • Earlier harvest so need wheat varieties that can be sown earlier
• Earlier wheat harvest, escape late season heat stress and allow planting of a NT legume like mung bean
Wheat germplasm for early planting
Addition of a mung crop
When does no-till yield more?

• Important to not equate no-till to conservation agriculture
• CA requires the retention of crop residues on the soil surface and
• Use of crop rotations
• Important to make the no-till work by using the correct equipment and way to do it.
Effect of residue and rotation in NT wheat and maize

### Effect of residue in ZT wheat by rotation

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<thead>
<tr>
<th>Residue</th>
<th>Monocrop</th>
<th>Rotation</th>
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<tbody>
<tr>
<td>Residue</td>
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<td>5591</td>
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<td>No Residue</td>
<td>4464</td>
<td>3518</td>
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### Effect of residue in ZT maize by rotation

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Residue</td>
<td>4628</td>
<td>4339</td>
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<tr>
<td>No Residue</td>
<td>2600</td>
<td>5285</td>
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</table>
Howard Buffet (2015) sums up the challenge of food security well by saying “Smallholder farmers will be required as part of the solution that embraces a Brown Revolution to rebuild soils. If we do not treat soils with more practical and sustainable approaches and base policies on serious commitments to address and overcome existing barriers, then we will fail”