AIP - Agronomy

Improving Cereal systems productivity through better agronomy

Imtiaz Hussain
Issues in wheat based systems

- Only 24% wheat in field before November 25
- Decreasing irrigation water availability
- Higher prices of input and diesel
- Residue in combine harvested fields
Agronomy Interventions

- Dissemination of CA based Techniques (365 sites)
- Agriculture based mechanization through new CA seeders (123 sites)
- Evaluation of CA techniques in wheat based cropping systems (5 institutes)
- Nutrient management (60 sites)
AIP – Agronomy: Activities & Partners

**National Partner (15) & 20 Districts**

- Barani Agriculture research Institute – Chakwal
- Maize and Wheat –NARC
- CCRI - Nowshera (KP)
- Adaptive Research Farms Punjab, Vehari
- Wheat research Institute, Sakrand – Sindh
- Agronomic Research Station – Bahawalpur
- Wheat Research Institute, Faisalabad
- Rice Research Institute, Kala Shah Kaku
- Engro Exim (Pvt) - Mureedkay
- Adaptive Research - Punjab (Sheikhupura & Gujranwala)
- Directorate of Agriculture Research, Usta Muhammad- Balochistan
- Agriculture Research Institute, DI Khan
- Arid Zone Research Institute, Bhakkar
- National Rural Support Program (NRSP)
- Greenland Engineering Private Limited, Daska
Ridge planting of wheat (73 sites)

Issue: water shortage during wheat season

Benefits:
- 30% Saving in water
- 10-15% better yield than conventional: (RS. 9000/ ha)

Partners:
- AZRI, Bhakkar; ARI, DI Khan and CCRI, Pirsaabak
- NRSP – In partnership with Farmer community organization (CO)

Area of focus:
- Bhakkar, Mianwali, Khushab in Punjab
- DI Khan and Nowshrea (KP)
Dissemination of fertilizer management

- Recommended fertilizer in rain fed wheat (80:58 N and P/ha) (54 sites):
  - 0.5 t/ha higher wheat yield
  - RS. 8000/ha

- LCC managed N in Basmati rice:
  - Rice yield (3.7 t/ha) at par with farmer practice
  - Saving of 30 - 40 Kg N/ha in LCC managed plots (90 Kg urea per ha)
Dissemination of Zero tillage in rice-wheat

- Jaffarabad – Balochistan (15 farms)
- DI Khan – KP (8 farms)

**Partners:** Balochistan Agriculture Research; ARI – DI Khan; DAR - Jaffarabad

**Jaffarabd - Balochistan:**

- **Issue:** Poorly drained soils and late wheat planting after rice
- **Benefits:**
  - 25 days earlier wheat planting and yield of 2.2 t/ha
  - Reduced cost of cultivation (RS. 7500/ha)
Zero tillage in legume - wheat cropping systems

- **Activity Area;**
  - Bhakkar and DI Khan districts (15 sites)
  - Mung bean –wheat and guar -wheat
- **Saving in cost of land preparation (Rs. 7500/ha)**
- 15% increase in grain yield
- 0.15 million ha area in this region

![Graph showing effect of planting techniques on wheat grain yield](image)

**Effect of planting techniques on wheat grain yield (Kg/ha) in mung - wheat & Guar - wheat system**

<table>
<thead>
<tr>
<th>Location</th>
<th>Farmer practice</th>
<th>Zero tillage</th>
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</thead>
<tbody>
<tr>
<td>Mung-DI Khan</td>
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<tr>
<td>Mung-Bhakkar</td>
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<tr>
<td>Guar-Bhakkar</td>
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</table>
Introduction of CA based planters (132 sites)

- Current situation of planting at farmer fields
  - Mechanized planting: 2.1 million farms
  - Non mechanize planting: 6.1 million farms

- Multi crop planters for beds and flat sowing
  - Inclined plate seeding system
  - Plant crops like (maize, wheat, mung cotton)
  - Fertilizer and seeding in one operation
Multi - crop Zero till planter (20 sites)

Evaluation of zero till in maize – wheat system in KP (n=7)

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Maize (t/ha)</th>
<th>Wheat (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero tillage</td>
<td>4.00</td>
<td>4.20</td>
</tr>
<tr>
<td>Farmer Practice</td>
<td>4.15</td>
<td>3.70</td>
</tr>
</tbody>
</table>

- Evaluation for direct seeded rice (DSR) - Punjab
  - No breakage of dry / soaked seed
  - (115 plants/m2 with 13 Kg seed / acre)
  - Local fabrication of inclined plates in process with Greenland Engineering
Evaluation of multi-crop bed planter (65 sites)

- **Farmer practice:**
  - Khyber Pakhtunkhwa: Hand planting on flat
  - Punjab: Hand planting on side of beds / ridges

- **Multicrop bed planter:**
  - Mechanized planting on center of beds / ridges
  - Fertilizer and seed in single operation
  - Plant population can be maintained

- **Issues:**
  - Low precision in plant to plant distance
  - Seed covering issue in poorly prepared fields

- **Moving forward:**
  - 2015 Kharife season: 30 sites with better plant population
  - Use of disc opener with press wheel for planting
  - Placing seed system on Pakistani bed planter
Pilot testing of Chinese push row planter (14 sites)

- Option for small maize growers
- Vertical seeding plate system
- Fertilizer and seeding in one operation
- Nowshera, Mardan and Peshawar district.

**Benefits:**
- Saving in time and labor
- Farmer practice: 48 man-hours / acre
- Hand planter: 8 man-hours / acre
- Plant population is same as in FP (12-13 plant /m length)
Burning of rice residue in Rice – Wheat area: Punjab

- Estimated amount of residue burnt:
  - Residue burning area: 70 - 80%
  - Basmati rice – wheat zone: 6 million tones

- Open burning results:
  - Smoke and health hazard
  - Increased greenhouse gases emission
  - Loss of nutrient: 5-8 Kg N; 1.6-2.7 Kg P$_2$O$_5$; 14-20 Kg K$_2$O / ton of rice straw

Ahmed et al., 2014
Zero till happy seeder: Planting in heavy residue

Farmer practice:
- Partial / complete burning
- Heavy tillage (5-6) for land preparation
- Broadcasting of seed and fertilizer

Zero tillage Happy seeder:
- Plant and fertilize in heavy residue in one operation

Area: Sheikhupura, Gujranwala, Sialkot & Faisalabad districts 33 sites.

Partnership for testing:
- Adaptive Research Punjab
- Engro Pakistan (Private sector)
- RRI - Kala Shah Kaku
- WRI – Faisalabad
Zero till happy seeder: planting in heavy residue (33 sites)

- 1.5 hours per acre drilling time
- Saving of 30 liter diesel and 5-6 operations per acre
- 70% saving in tillage cost (RS. 5000/acre)
- 20% or 0.65 t/ha higher grain yield
- Local fabrication of ZT HS
Evaluation of CA techniques in wheat based systems

- Rice-wheat: Heavy residue system in Punjab (RRI – KSK)

- Irrigated maize – wheat system (CCRI – Pirsabak)
Planting techniques in rain fed mung – wheat system: BARI - Chakwal

<table>
<thead>
<tr>
<th>Planting Technique</th>
<th>Spikes m⁻²</th>
<th>Wheat Grain Yield (kg ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero-Till Planting</td>
<td>208</td>
<td>2588</td>
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<tr>
<td>Conv.-Till Plating</td>
<td>188</td>
<td>2232</td>
</tr>
<tr>
<td>Beds Permanent-wide</td>
<td>169</td>
<td>1935</td>
</tr>
</tbody>
</table>

![Field Image]

![Crop Image]
## Evaluation of planting methods in cotton-wheat system: ARS - Bahawalpur

<table>
<thead>
<tr>
<th>Treatment No.</th>
<th>Cotton planting</th>
<th>Wheat planting</th>
<th>Seed cotton Yield (kg/ha)</th>
<th>Wheat Grain Yield (Kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-CBH-WB</td>
<td>Hand planting on wide beds</td>
<td>Planting after land preparation</td>
<td>2772</td>
<td>4089</td>
</tr>
<tr>
<td>FP-CBH-WR</td>
<td>Hand planting on wide beds</td>
<td>Relay planting with broad casting</td>
<td>2616</td>
<td>4729</td>
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<tr>
<td>FP-CFH-WB</td>
<td>Hand drill planting on flat</td>
<td>Planting after land preparation</td>
<td>2412</td>
<td>4203</td>
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<tr>
<td>FP-CFH-WB</td>
<td>Hand drill planting on flat</td>
<td>Relay planting with broad casting</td>
<td>2356</td>
<td>4658</td>
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<tr>
<td>FBC - FBW</td>
<td>Bed planting fresh</td>
<td>Bed planting fresh</td>
<td>2630</td>
<td>3650</td>
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<tr>
<td>PBC - PBW</td>
<td>Bed planting in residue</td>
<td>Bed planting in residue after sticks removed</td>
<td>1810</td>
<td>3544</td>
</tr>
<tr>
<td>PBC - PBW</td>
<td>Bed planting in residue</td>
<td>Relay planting with broad casting</td>
<td>1973</td>
<td>4838</td>
</tr>
</tbody>
</table>
Site Specific Nutrient Management (SSNM): Why?

- Imbalance use of nutrient
  - Wider N & P ratio in Pakistan (4:1)
  - Low use of K and micronutrients
  - Low use of fertilizer in rain fed area

- Nutrient requirement varies from field to field

- General recommendations not efficient
**Evaluation of NE in hybrid maize (n=8)**

- **Nutrient Expert (NE) for South Asia:**
  - DSS for maize & wheat site specific recommendation
  - Recommendations on the basis of farm yields & fertilizer application

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Nutrient Expert</th>
<th>Farmer Practice</th>
<th>NE - FP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer - N</td>
<td>Kg/ha</td>
<td>169</td>
<td>214</td>
<td>-45</td>
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<tr>
<td>Fertilizer - P₂O₅</td>
<td>Kg/ha</td>
<td>53</td>
<td>79</td>
<td>-26</td>
</tr>
<tr>
<td>Fertilizer - K₂O</td>
<td>Kg/ha</td>
<td>91</td>
<td>62</td>
<td>29</td>
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<tr>
<td>Grain Yield</td>
<td>Kg/ha</td>
<td>6242</td>
<td>5856</td>
<td>386</td>
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<tr>
<td>Fertilizer Cost</td>
<td>RS/ha</td>
<td>34730</td>
<td>37893</td>
<td>-3163</td>
</tr>
</tbody>
</table>

- **Farmer:** Apply K and P as basal - more Urea in 3-5 doses
- **NE:** P, 1/3rd Urea and 40% K as basal; Urea only at V6 (25-30 DAP) and Urea with 60% K at V10 (35-40 DAP).
- **Increase in grain yield and saving in fertilizer**
**Evaluation of NE for Wheat (n=28)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>NE</th>
<th>FP</th>
<th>NE - FP</th>
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<tr>
<td>Fertilizer - N</td>
<td>Kg/ha</td>
<td>132</td>
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<tr>
<td>Fertilizer - P₂O₅</td>
<td>Kg/ha</td>
<td>65</td>
<td>76</td>
<td>-11</td>
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<tr>
<td>Fertilizer - K₂O</td>
<td>Kg/ha</td>
<td>76</td>
<td>5</td>
<td>71</td>
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<tr>
<td>Grain Yield</td>
<td>Kg/ha</td>
<td>3689</td>
<td>3268</td>
<td>421</td>
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<tr>
<td>Fertilizer Cost</td>
<td>RS/ha</td>
<td>29125</td>
<td>22490</td>
<td>6635</td>
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</tbody>
</table>

- NE: All P and K at planting and N in three dose (planting, 1\textsuperscript{st} and 2\textsuperscript{nd} irrigation)
- Saving of RS. 6000/ha
Green seeker use for Nitrogen management in wheat

**Green Seeker (crop sensor)**
- Indicate plant health (crop stand & greenness)
- Estimate fertilizer application rates

**Partnership (05):**
- WRI – Faisalabad; RRI – Kala Shah Kaku; CCRI – Pirsabak; ARS – Bahawalpur and Wheat - NARC

- Evaluation at farmer field;
  - Rich N strip developed with 200 Kg N/ha
  - Sensing with Green seeker at 2\textsuperscript{nd} irrigation (Test plot & N rich strip)
  - Calculation of GS - N fertilizer dose by using India algorithm
Green seeker use for Nitrogen management in wheat (23 sites)

<table>
<thead>
<tr>
<th>District</th>
<th>Sites</th>
<th>Total N applied (Kg/ha)</th>
<th>NDVI readings</th>
<th>Grain Yield (Kg/ha)</th>
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<tbody>
<tr>
<td></td>
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<td>Green Seeker</td>
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<td>NDVI readings</td>
<td>Grain Yield (Kg/ha)</td>
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<td>Farmer practice</td>
<td>Rich N strip</td>
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<td>Farmer practice</td>
<td>Farmer practice</td>
<td>Grain Yield (Kg/ha)</td>
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<td>Rich N strip</td>
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<td>Farmer practice</td>
<td>Farmer practice</td>
<td>Grain Yield (Kg/ha)</td>
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<td>Farmer practice</td>
<td>Rich N strip</td>
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<td>Faisalabad</td>
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<td>156</td>
<td>108</td>
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<td>Nowshera</td>
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<td>3124</td>
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- First application 28-31 DAS
- 2\textsuperscript{nd} dose applied around 52 – 82 DAS with green seeker
- GS dose ranged from 2-14 Kg Urea per acre at 2\textsuperscript{nd} irrigation
- Saving of 50 Kg N / ha (44 Kg of Urea / acre) with same yield
AIP-Agronomy: Capacity building

71
Trained NARS

329
Farmers / support staff training

2885
Farmers participation
AIP - Agronomy Meeting: May 26-27, 2015
A glimpse of AIPs’ activities

Thank you for your interest!