Pakistan soil resources, issues, threats, ongoing activities and their sustainable management

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National Soil Resources of Pakistan

Total area 79.6 mha

Arid 41 mha

Deserts (climate hyper-arid) 11 mha

Semiarid 36.9%
Sub-humid 5.4%
Mixed 6.2%

Cultivated area 22 mha (27.6%)

Rangelands 45.2 mha (60.1%)

Forest area 3.5 mha

Canal irrigated 25%
Tube well irrigated =75%

Salt: affected area 6.69 mha
Importance of Pakistan in World of Agriculture

- Wheat (9th)
- Cotton (4th)
- Rice (8th)
- Sugarcane (4th)
- Mango (7th)
- Apricot (4th)
- Onion (5th)
- Date Palm (6th)
- Oranges (10th)

Pakistan ranks 20th worldwide in farm output.
## Growth Rates (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP</th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960s</td>
<td>6.8</td>
<td>5.1</td>
<td>9.9</td>
<td>6.7</td>
</tr>
<tr>
<td>1970s</td>
<td>4.8</td>
<td>2.4</td>
<td>5.5</td>
<td>6.3</td>
</tr>
<tr>
<td>1980s</td>
<td>6.5</td>
<td>5.4</td>
<td>8.2</td>
<td>6.7</td>
</tr>
<tr>
<td>1990s</td>
<td>4.6</td>
<td>4.4</td>
<td>4.8</td>
<td>4.6</td>
</tr>
<tr>
<td>2000s</td>
<td>4.8</td>
<td>3.2</td>
<td>7.0</td>
<td>5.3</td>
</tr>
<tr>
<td>2012-13</td>
<td>3.6</td>
<td>3.3</td>
<td>3.4</td>
<td>3.7</td>
</tr>
</tbody>
</table>
Challenge I: Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Population Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>188.1</td>
</tr>
<tr>
<td>2020</td>
<td>203.5</td>
</tr>
<tr>
<td>2025</td>
<td>218.1</td>
</tr>
<tr>
<td>2030</td>
<td>231.7</td>
</tr>
</tbody>
</table>
### Future crop production estimates

<table>
<thead>
<tr>
<th>Crop</th>
<th>Current</th>
<th>2015</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>21.7</td>
<td>25.4</td>
<td>33.0</td>
</tr>
<tr>
<td>Cotton</td>
<td>12.4</td>
<td>21.5</td>
<td>29.2</td>
</tr>
<tr>
<td>(m bales)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>5.5</td>
<td>7.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>44.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maize</td>
<td>3.1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Major threats and issue of Pakistan Agriculture

Threats

A) Soil Health
B) Farm Inputs
C) Climate Change
D) Agricultural Credit
E) Farm Mechanization
F) Agricultural Marketing
G) Extension Services
A) Soil Health

Threats

Salinity/Sodicity

Soil Erosion

Waterlogging

Intensive cropping system

Harsh climate

Poor OM content

Over Mechanization

Poor Quality water

Poor soil health is threat to Food Security
Proper use of inputs is a key to food security/
Sustainable soil management
1. SEED

Seed Production is the most ignored aspect

Quantity

Quality

Timely availability/Cost
Development of new varieties is pre-requisite for enhancing agricultural growth & food security

- Non-integration of conventional & modern techniques of breeding
- Narrow genetic base
- Long time duration required
- Lack of funding and government policies
- Professional dishonesty
- Complicated variety approval system
2. Fertilizers

- Imbalance Use
- Soil degradation
- Fertilizer Use efficiency
- Urea / phosphorus
- Excessive use of nitrogen
- Timely availability
3. Irrigation

- Less amount available
- Poor quality
- WUE

- Cropping pattern for WUE
- Water saving
- Tube-well water

- Water harvesting
- Recycling wastewater
- Lack of planing
4. Pesticide

- Quality issue
- Cost issue
- Environmental issue
- Bio-control
- Govt. policies
C) Effects of Climate Change on Soil

- Temperature
- Precipitation
- Drought
- Floods

Soil
- Loss of organic matter
- Erosion
- Increased soil wetness
- Loss of nutrient-rich topsoil
- Diffused pollution of surface water courses

Loss in yield
Climate change is inevitable and ever-continued. No single approach will be effective, only multi disciplinary integrated approach can work.

- Metrological Estimates
- GIS and Remote Sensing
- Conservative Agriculture
- Varieties sustainable to climate change
- Biotechnology
- Strategic Management
- Cropping pattern
- Immediate attention
- Better Policy Instruments

Integrated Approach is Required
D) Agricultural credit

Farmers Face Problems

Inadequate credit availability to small farmers

High rate of interest

Cumbersome procedures
E) Farm mechanization

- Absence of corporate service provider
- Over mechanization limited agricultural machinery
- Non-availability of standard & certification facilities

Farmer Face Problems
F) Agriculture marketing & forecasting

- Inefficient and corrupt market committees system
- Exploitative role of the middleman
- Volatility in prices of essential commodities
- Poor forecasting system
- No system for grading and quality premium
G) Farm Extension Services

Weakening of extension services after devolution

Staff shortages and female quota → Deficient monitoring of Extension Staff

Capacity building of extension agent → Severance of linkage with research
How Agricultural Productivity could be enhanced on sustainable basis to ensure food security for 200 million people without disturbing the ecosystem
BRIDGING THE YIELD GAP – THE CHALLENGE

The relevant gap that can be narrowed
Sustainable soil health management is key to food security

National Priorities for Sustainable Soil Management

- Soil rehabilitation
- Manage harsh climate
- Replenish soil OM & balance nutrients
- Proper mechanization-better aggregation
- Green manuring
Carbon Sequestration in Soil

Common organic soil amendments

Biomass carbon 100 %

Biomass carbon 100 %

Biomass carbon 0 %

After 100 years

Biochar

Biochar carbon 50 %

Biochar carbon >40 %

Pyrolysis

Energy

Potential to reduce current global carbon emissions by as much as 10% 

Woolf et al., 2010
On going activities for sustainable management and protection of soil resources

- Balanced Fertilizers
- Biofertilizers
- Organic fertilizers
- Mineral Fertilizers availability
- INM/IPM

- Nutrient indexing
- cyber network
- Govt. Policies Formulation Revision Implementation
- Tackle salinity/sodicity
- drought- and salt-tolerant crops.

- watercourse improvement
- Raised bed farming
- OM
- Drainage facilities
- Incentives to the Farmers
Bridging the yield gap between the potential and the present level of productivity through:

- Acceleration of seed production
- Timely supply of inputs
- Innovative products
- Time of application
- Method of application
- IPM/INM
- Best agronomic practices
- National Policies
- Farmers visits and training
Role of Research and development organizations in agriculture development

- Human resource development
- Research & agriculture development for sustainable soil management and food security
CONCLUDING REMARKS

- Better management of soil & water resources
- Increase OM in soil
- Reclamation of salt affected soil
- Novel management techniques / climate change requirements
- New varieties / Hybrid and GMOs
- Innovative and non-traditional agriculture
- Farmers friendly policies (input cost, output price, export, taxation and etc.)
- Capacity building
Thanks.....!