Adaptive Sustainable Agricultural Practices: To Build Soil Resilience and Enhance Crop Productivity

Context:

- Adverse effects of the green revolution on agro-ecosystems are more visible now, exacerbated by changing climatic conditions (Rahman, 2015).
- Indiscriminate and inappropriate use of agrochemicals such as fertilizers and plant protection measures lead to deterioration of soil, water and other natural resources in the agro-ecosystems.
- With a growing population, degrading landscapes and an almost stabilized cropping area (GoI, 2016), implementation of land remediation measures to improve soil health and ensure sustainable food production is urgently required.
- It is important to enhance crop productivity by using eco-friendly measures and reduce the input costs invested on agrochemicals to help farmers double their income.

Key Recommendation:

Adaptive Sustainable Agriculture (ASA) along with sustainable land management practices help to conserve the natural resources, revive the degraded agricultural lands, enhance crop production, and achieve Land Degradation Neutrality (LDN) targets.

Objectives:

This study was conducted in 3 different agro-climatic regions of Maharashtra, in a total of 21 villages in Sakri, Bhokardan and Parner blocks of Dhule, Jalna and Ahmednagar districts respectively, with the following objectives:

- To assess the effects of ASA practices on farmers’ fields for different crops and in different agro climatic regions.
- To motivate farmers about the effectiveness of Organic and Integrated Nutrient Management techniques over regular farmers’ practices.

The Adaptive Sustainable Agriculture practices followed:

- Seed treatment & crop geometry: Appropriate crop spacing and use of inoculants – rhizobium, phosphate solubilizing bacteria, azotobacter, trichoderma viride etc.
- Soil testing and Integrated Nutrient Management (INM): compost, vermicompost, neem cake and green manure crops in combination with synthetic fertilizers.
- Integrated pest & disease management: Bio-pesticides like Amritpani, Dashparni ark, 5% NSKE, Neemastra, trap crops, pheromone traps and bird perches. Label claim pesticides are recommended only when pest population exceed the Economic Threshold Levels (ETL).
- In-situ moisture conservation & water management: Efficient water management methods facilitate better utilization of soil moisture and reduce the effect of drought and dry spell.

To make agriculture ‘Climate resilient’, ASA practices need to be supported with crop and locale specific agro-met advisories and protection with crop insurance that directly benefits farmers.
Research Results:

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Crop</th>
<th>Farmers' Practice (kg/ha)</th>
<th>Organic Practices (kg/ha)</th>
<th>Percent increase by Organic practices over Farmers' Practice</th>
<th>INM Practices (kg/ha)</th>
<th>Percent increase by INM Practices over Farmers' Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sakri</td>
<td>Paddy</td>
<td>3986</td>
<td>4300</td>
<td>7.88</td>
<td>4450</td>
<td>11.64</td>
</tr>
<tr>
<td></td>
<td>Chickpea</td>
<td>598</td>
<td>695</td>
<td>16.22</td>
<td>726</td>
<td>21.40</td>
</tr>
<tr>
<td>Bhokardan</td>
<td>Soybean</td>
<td>1572</td>
<td>2138</td>
<td>36.01</td>
<td>1953</td>
<td>24.24</td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
<td>2700</td>
<td>3383</td>
<td>25.30</td>
<td>3279</td>
<td>21.44</td>
</tr>
<tr>
<td>Parner</td>
<td>Green gram</td>
<td>607</td>
<td>734</td>
<td>20.92</td>
<td>715</td>
<td>17.79</td>
</tr>
<tr>
<td></td>
<td>Rabi Sorghum</td>
<td>733</td>
<td>874</td>
<td>19.24</td>
<td>850</td>
<td>15.96</td>
</tr>
</tbody>
</table>

The grain yield showed that organic and integrated nutrient management resulted in the increase in crop productivity compared to the farmers' practice. These practices also reduce the cost of cultivation by about 15.68% and 11.16%, respectively. Thus, the use of organic/integrated nutrient management based on soil health status, is a viable strategy to reduce production cost and obtain good crop productivity, without compromising on long term benefits.

Long term studies conducted by various researchers showed that organic and integrated nutrient management practices improve soil organic matter which enhances water holding capacity, improves soil structure, reduces erosion, holds soil nutrients and retards nutrient leaching losses which ultimately increase soil fertility and maintain soil health (Bronick and Lal, 2005; Jagadamma et al., 2009 and Timsina, 2018).

Policy Recommendations:

- Efforts should be directed towards sustainable land management practices that reduce erosion, which is essential for building resilience of agriculture and important for food security in India.
- Adaptive sustainable agricultural practices need to be included in all watershed development programs as these contribute to increase farm income, while maintaining soil fertility.
- Rather than expand agriculture land, managing the cultivable land with sustainable land and water management practices brings in sustainable returns (D’Souza et al, 2019).
- Promoting organic or integrated nutrient management practices will help to reduce the use of chemical fertilizers and the government’s subsidy amount spent on it, as well as farmers’ input costs.
- Providing farmers with crop and locale specific agro-met advisories and crop insurance will move towards Climate Resilient Agriculture (CRA).
- There is a possible role of soil organic carbon considered as a carbon sink for mitigating climate change and should be studied in detail as it has possibilities of inclusion in emission trading schemes.

References:


