Environmental Strategies
Natural Resources 431

Systems of Rice Intensification

Environmental Benefits and Economic Feasibility

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Sinon Bamidaaye
Nora Lovell
Grant MacIntyre
Paswell Marenya
Jong O Sun
Isaiah Sutton

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- Introduction
- Sustainable Agriculture
- Principles and Practices – Nuts and Bolts
- Economic Tools For Water Management in Irrigated Agriculture
- Conventional Rice Cultivation
- Soil Chemistry
- Labor Intensification
- Conclusive Recommendations and Solutions

Introduction

- Can Systems of Rice Intensification (SRI) translate into economic and ecological profits for farmers in developing nations?
  - Inputs
  - Water
  - Soil
  - Yields
  - Labor Obstacles

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Sustainable Agriculture

- The challenge today is to find ways of producing higher yields of crops and livestock while conserving the essential natural resources, like soils, water, forests and biodiversity that will be needed for the survival of future generations.

Sustainable Agriculture

- Development inevitably brings in its train the disruption and loss of natural ecosystems and of hundreds of thousands of species of plants and animals. (Murdoch,1980)

Sustainable Agriculture

- Penning et al (1995) defines sustainable agriculture as an ecotechnology-oriented approach, resembling an ‘integrated’ system of farm production akin to Western European agriculture, but one in which the emerging shortcomings are minimized.

Sustainable Agriculture

- Poor farmers in developing countries are assumed to abuse their own soil and water resources because they are living from hand to mouth, their discount on the future being too high. (Paarlberg, 1993)
- Lack of appropriate economic incentives stand in the way of investments in long term natural resource management and intensification.

Sustainable Agriculture

- Agroecology - involves the use of biotechnology and modern principles of ecology as the basis for launching what might be called a second generation technological revolution in agriculture that could be aimed at underdeveloped agricultural systems, ensuring sustainability.

Sustainable Agriculture

- At the heart of the agroecological strategy is the idea that an agroecosystem **should mimic the functioning of local ecosystems** thus exhibiting
  - nutrient cycling
  - complex structure
  - enhanced biodiversity

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Principles and Practices

System of technique, not technologies

Principles and Practices

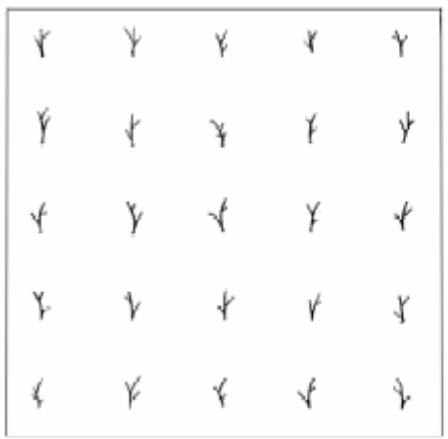
- Seed Selection
  - Separate bad and good seeds using saline solution, good seeds sink

Principles and Practices

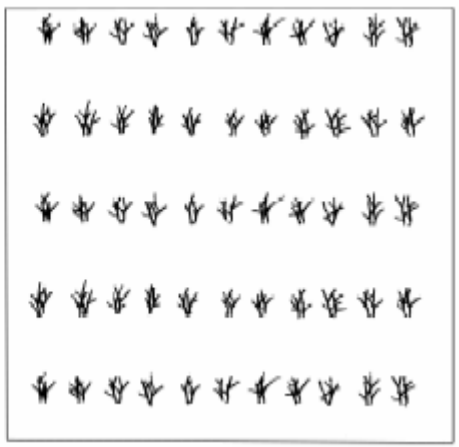
- Site Preparation
  - Wider spacing
  - Shift to organic compost

Principles and Practices

- Transplanting
  - Transplant at 8-10 days rather than traditional 20-30 days
  - Singular planting



SRI



Traditional

Principles and Practices

- Water Use
  - Optimally moist, well drained soil
  - Never flooded more than 4 days at a time
  - 25-30% water savings
  - Increased labor

Principles and Practices

- Harvest
  - Similar to traditional methods

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Economic Tools for Water Management in Irrigated Agriculture

- Problems of Excessive Water Use in Agriculture
  - Increased Salinity
  - Depletion of groundwater resources
  - Pollution of groundwater resources
  - Soil compaction

Economic Tools for Water Management in Irrigated Agriculture

- Salinity and Water Logging
  - Decreases water use efficiency
  - Improving efficiency can be accomplished through putting appropriate cost on water use

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Economic Tools for Water Management in Irrigated Agriculture

- Groundwater Depletion
  - Individual pump operators have no incentive to optimize long run extraction rates since water left in the ground can be captured by other users, other irrigators or potential future irrigators.
  - Some portions of China losing 1 meter of water per year
- Water Rights – A Chilean example
  - Tradable water rights permits
  - Possible solution for water management

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Conventional Rice Cultivation

- Five principle differences
  - Irrigation
  - Control of water supply
  - Land
  - Labor
  - Markets

Conventional Rice Cultivation

- Traditional cultivation involves submerged plants closely clumped together

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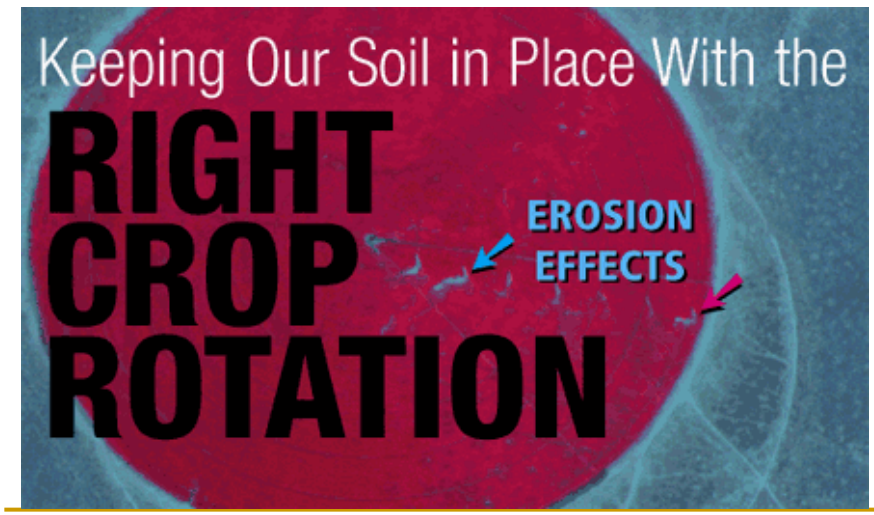
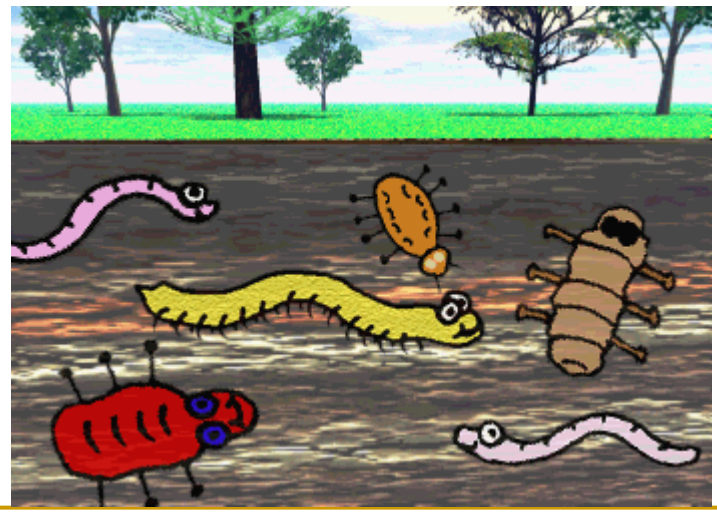
Soil Chemistry

- Maximum rice yield achieved through appropriate fertilizer use
  - However, fertilizer use has negative environmental effects
- Constant submersion leads to loss of nitrogen in soil

Soil Chemistry

- Crop rotation
  - Achieves higher (and more sustainable) nitrogen level in soil
  - Timing important in maximizing nitrogen retention
  - Can increase value of property





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Labor Intensification

- Land Preparation
  - 2/3 days more labor per hectare in first 2 years
  - Improves as farmers hone techniques
  - 25 percent more labor than traditional rice cultivation
- Transplanting
  - Significant time increase over traditional methods
  - Offset by fewer total plants over a wider area
- Weeding
  - Exposure to air creates more weeds, and more need for weeding
  - Pesticides are discouraged, creating need for manual labor

Labor Intensification

Labor Intensification

- Cost/Benefit
  - Several studies show that the increased rice harvest more than paid for the increased labor, lead to improved profit margins for farmers
  - However, many farmers cannot afford the initial labor investment

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Conclusive Recommendations and Solutions

- Microeconomic management – sustainable loans
- Income diversification
- Crop rotation – supplement rice income with other crops
- Education through governmental bureaucracies and NGOs
- Labor sharing between farmers

Questions ?