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Integrated Crop Management in Rice

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Introduction

Rice is indispensable because it contributes about as staple food of 3 billion people in Asia. Rice is the staple food for more than half of the world's population and for more than 65% of the China's population. Increasing world rice production in a sustainable manner is vital for ensuring global food security. Global crop production can be increased by expanding the area of croplands, increasing crop yield, and increasing multiple cropping index. Cropland expansion is not feasible because of urbanization and environmental concerns such as biodiversity loss and greenhouse gas emission. It is essential to maintain the increase of rice yield at an annual rate of 1.5% and at the same time to increase the harvest frequency of existing croplands4 in order to keep pace with the food demand of the growing human population. Integrated Crop Management: the concept: "ICM is an approach to farming which aims to balance production with economic and environmental considerations by means of a combination of measures including: crop rotation, cultivations, appropriate crop varieties and careful use of inputs".

Principles

- ❖ Sustainability with regard to ecological and economic aspects.
- ❖ Optimization of local resources and minimization of external inputs.

- ❖ Environmental and human health as a central focus.
- ❖ Integrating agro ecological, economic and human resource aspects, including local and science-based knowledge.
- ❖ Emphasizing interrelatedness of various components, i.e. management practices in relation to crop conditions.
- ❖ Requiring empowerment and collectively at the farmer level relating to crop management needs assessment, decision-making and implementation.

Components and objectives:

Components Objectives	Components Objectives
Minimum tillage and soil conservation techniques Low-cost maintenance of soil structure and fertility	Low-cost maintenance of soil structure and fertility
Use of nitrogen-fixing plants, green manures and agro-forestry techniques Improvement in soil fertility	Improvement in soil fertility
Biological methods of pest and disease control Cheap and sustainable plant protection	Cheap and sustainable plant protection
Crop rotations	Prevent build-up of insect-pests, diseases and weeds
Productive use and disposal of plant and animal residues	Prevent damage to soil, water, human, plant and animal health
Maintenance and improvement of ecological diversity	Avoid loss of biodiversity and damage to habitat
Minimum use of purchased inputs and nonrenewable fuel resources	Reduce production costs and environmental damage

Advantages of ICM:

- ❖ Seed requirement is less than conventional practice.
- ❖ Saving on water due to intermittent irrigation.
- ❖ Cost of external inputs gets reduced as organic manures and fertilizers are used in integration.
- ❖ It is easy to handle 15-20 days old seedling compared to 8-12 days.
- ❖ Incidence of pest and diseases is low as the soil is allowed to dry intermittently.
- ❖ Higher yield due to increased tillering, panicle length and grain weight.

Yield enhancing ICM Practices:

- ❖ Plant high yielding variety adapted to region. λ Use high quality seed.
- ❖ Transplant strong, whole seedlings produced in a modified mat nursery.
- ❖ Transplant one seedling per hill at 20 cm distance from each other.
- ❖ Stir soil with hand-pushed mechanical weeder at 15 and 25 days after transplanting (DAT) and, if necessary, at 35 DAT.
- ❖ Apply fertilizer when needed.

Differences among various rice cultures:

Parameters	SRI	ICM	Conventional
Seed rate (kg/ha)	5-6	15-20	40-50
Nursery	Field nursery	Mat nursery	Conventional
Seedling age (d)	8-12	18-20	25-30
Seedlings/hill	1	2	3-4
Plant spacing	25 cm X 25 cm	20 cm X 20 cm	20 cm X 15 cm
Nutrient management	Organic + inorganic 20:15:10 (NPK) kg/ha +FYM 10 t/ha	Organic + inorganic 40:30:20 (NPK)kg/ha + FYM 5 t/ha	Only inorganic 120:60:40 (NPK)kg/ha

Weed management	Weeds turn down into the field by a weeder	Manual and mechanical weeding	Manually/ herbicides
Water management	Only moist condition	Intermittent irrigation	Continuous flooding

Integrated nutrient management:

Integrated nutrient management (INM) is an approach to soil fertility management that combines organic and mineral methods of soil fertilization with physical and biological measures for soil and water conservation".

It is based on three fundamental principles:

- Maximize the use of organic material
- Ensure access to inorganic fertilizer and improvement in use efficiency
- Minimize losses of plant nutrients

Integrated Disease Management:

Selection and application of a harmonious range of disease control strategies that minimize losses and maximizes returns.

The basic strategies include:

- Conducts disease survey in each season
- Practice farm hygiene principle
- Use resistant varieties where available
- Provide a balanced crop nutrition
- Manage crop residues to minimize carryover of pathogens to next crop
- Develop a sound crop rotation strategy
- Use chemical and biological means to control diseases, if required

Integrated Pest Management:

A systematic approach to crop protection that uses increased information and improved decision-making paradigms to reduce purchased inputs and improve economic, social, and environmental conditions on the farm and in society. Moreover, the concept emphasizes the integration of pest suppression technologies that include biological, chemical, legal, and cultural controls.

(a) Components of Integrated Pest Management:

- Knowledge
- Monitoring
- Economic threshold
- Adaptability

(b) Control Techniques in IPM:

- Physical Control
- Biological control
- Chemical Control Integrated weed management

Integrated weed management:

Combination of two or more weed control measures at low input levels in order to reduce weed competition in a given cropping system below ETL. Integrated weed management means maintaining/managing a population below a threshold level, which may not cause substantial economic damage to crops.

Research priorities for the future:

- Delineate areas most suitable for adoption of ICM practices.
- Identify the varieties/hybrids that are most suitable for ICM practice.
- Development of machinery for weeding, planting and harvesting.
- Detailed studies on nutrient and microbial dynamics of soil health aspects of ICM.
- Quantification of saving in water and other inputs.
- Efficient production of organic materials for soil fertility management.
- Studies on ICM vis-à-vis disease and pest management.
- Standardization of eco-friendly methods of pest and disease management with ICM.