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MANAGING FLOOD PRONE ECOSYSTEM FOR RICE PRODUCTION IN BIHAR PLAINS

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Abstract

A large area of the eastern region especially Bihar (0.5 million hectare) faces flood submergence and/or drought every year which creates an unfavorable environment for crop production. In this ecosystem only flood prone rice is grown whose cultivation is entirely different than normal rice crop. Managing the flood prone ecosystem for rice production needs to evaluate the reasons and a comprehensive appropriate technology through research efforts for better rice production under such harsh ecology. An attempt was made to develop a suitable agronomic package for rice cultivation during and after flooding in flood prone plains of Bihar.

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Introduction

Flood prone rice is characterized by stagnation of more than 50 - 400 cm water for longer period in field. In eastern India flood prone rice area occupies nearly 2.25 mha out of which 0.5 mha in Bihar plains (Singh and Khan, 2002). Because of several reasons, the average production of flood prone rice is very low (1.0-1.5 tones per ha). The varietal improvement has very meager scope to boost up yield under such harsh ecology and hence the scientific management plays a vital role to boost up the productivity.

Production Constraints

1. Flood prone rice is direct seeded by February - April and remains in 3-4-leaf stage till onset of rain. During the period of germination to early vegetative stage the crop faces moisture stress and consequently the rice plant population is reduced apart from the reduction in yield of mixed crop, generally sown with rice.

2. Sudden flash flood may cause moderate to complete damage of rice plant population at onset of rain.

3. The hydrology is irregular and uncertain. The crop at tillering may face drought and/or submergence, which complicates in choice of rice variety and cropping system.

4. Flood prone rice faces severe weed growth. In early stage, annual and perennial and at later stage, perennial and floating type wild rice weeds cause high yield reduction especially in fields having low rice plant population.

5. Varietal improvement has very meager scope in flood prone rice. Only tall or elongating type varieties are bred which have low yield potential. Unfortunately due to harsh ecology having low return, high yielding variety (HYV) has not been evolved for flood prone rice ecosystem.

6. Due to poor yield there is little economic feasibility of scientific weeding, plant protection, fertilizer use and harvesting, moreover, under highly submerged conditions (>100 cm) there is also problems in agricultural operations.

7. Fragmental holding and uncontrolled physiography leads to problem of on farm development and pisiculture in organized manner.

8. Flood prone rice growers are generally under poor economic conditions. These resource poor farmers have higher family size, low holding and illiteracy. Most of them are migratory agricultural labourer.

Opportunities in Flood Prone Ecosystems

In spite of aforesaid constraints, flood prone rice has few following opportunities for potential yield.

1. Sufficient soil moisture during summer season and good fertile soil favours short duration rain fed mixed crops with low input.

2. Scope of integration of spring (Boro) season rice with flood prone rice cropping in North Eastern Bihar plain is possible due to better availability of ground water and favourable climate.

3. There is good scope of pisiculture with local races on community basis.

4. Integrated farming approach of rice + fish + vegetable + pulses + *Sesbania* is possible in large size holdings.

Research Findings and Major Recommendations on Resource Management for Flood Prone Rice

Sowing time

Rice may be sown from mid February to May according to land situation. The mixed crops sown with rice may be sown according to crop. Sesame should be sown up to mid March, mung bean up to mid April, and sorghum for fodder and Jute for fiber may be sown up to May.

Seed rate

Normally 60-65 kg ha per hectare seed of rice is sufficient for direct seeding. There was no increase in rice yield with increasing seed rate from 60 to 120 kg ha per hectare. Sixty per cent of normal recommended seed rate of mixed crop may be sown with rice.

Choice of mixed crop

Rice + mung bean has been found best cropping system with 35 to 40 q/ha total rice equivalent yield (i.e. rice yield + mung bean yield in terms of rice grain). Mung bean is short duration (65 days) pulse crop and has much scope in diet besides it also enriches soil fertility. Sesame is highly profitable crop when there is good soil moisture but in general it faces the problems of viral disease. Fodder sorghum is suitable for the milch cattle if seeding is delayed beyond mid April. Jute for fiber as mixed crop has been found suitable for the farmers living adjoining to jute industry in North Eastern Bihar.

Varietal combination under mixed cropping

Erect and semi-erect type rice varieties with mung bean and prostrate and semi-prostrate type of growth habit varieties with sesame have been found suitable. Generally, Semi-prostrate are also good with mungbean. Pulses like mung bean variety having non-synchronous habit has been found suitable for resource poor and marginal farmers to utilize their family labour constantly in pod picking while synchronous type has been found suitable for other farmers for utilizing hired farm labourer.

Sowing /planting method

1. Under flash flood conditions (above 100 cm water submergence ecosystem), the direct seeding has been found superior over transplanting due to more number of panicles and tallness of plants at submergence.

2. There was no significant difference in rice yield due to seeding through broad casting, drilling, dibbling or line sowing. Although the yield increase was in order of broad casting, drilling, line sowing and dibbling. Line sowing and dibbling facilitates in identifying wild rice and weeding.

3. In heavy textured soils of flash flood-prone area where cracks in soil appears during summer, the direct sowing with 40 kg N per ha at first rain gave full establishment and taller crop plant before flood.

4. Transplanting of tall type (125-150 cm) rice varieties has been found suitable under semi-deep water (50-100 cm water) ecosystem where double cropping is possible and field passes through moisture stress in summer but no flash flood occurs at later stage.

5. In perennial water logged field transplanting should be done buy May-June as there is no scope of direct seeding.

Double transplanting *(Kharuhan)* of rice

In flash flood affected areas, rice nursery is raised at safe place and at 30 days after sowing, seedlings are uprooted and dense planted again at safer place. These planted seedlings may be again re-transplanted up to 45 days after planting in main field after floodwater is receded. For this purpose long duration (155 days) or photosensitive rice varieties have been found suitable.

Increasing vegetative vigour of rice

At onset of rain, under shallow deep water (up to 70 cm submergence), the direct seeded rice may be uprooted, and by splitting of tillers and transplanting gave an additional yield of 6-9 q/ha due to vigour vegetative growth.

Nutrient management

Normally flood-prone rice is grown without any nutrient application. However, nitrogen top dressing @ 20 kg per hectare at first rain has been found to increase vegetative growth and more tolerance against submergence.

Under mixed cropping, nitrogen application @ 20 kg per hectare each at sowing and at first rain have been found most efficient for increasing the yield of both the crops.

No response of phosphorus and potash application has been found in sole rice but under mixed cropping a dose of 20-25 kg P_2O_5 per ha at sowing has been found to increase the yield of mixed crop as well as more plant population of rice especially under flash flood conditions.

A dose of 60:30:15 kg per ha of N: P_2O_5: K_2O has been found optimum for double transplanted (Kharuhan) rice.

Pest Management

Flood prone rice faces severity of pests viz stem borer, wild rice, aquatic weeds and bacterial leaf blight (BMB) etc. The followings measures have been found effective to manage their ill effect.

1. Rice stubbles should be burnt after harvesting and when field is dry. This kills several pathogens and adds potassium in field.

2. In wild rice affected field, line sowing facilitates in identifying wild rice and weeding becomes easier. In such fields, a change in variety having different leaf or stem colour enables easy identification of wild rice.
3. Two hands weeding each at 30 days after sowing and after harvest of mixed crop has been found to increase the yield of mixed crop and desirable rice plant establishment.

4. *Sesbania* species planted at outside the field boundary has been found effective to check flood of water hyacinth in main field.

Integration of Boro and Flood Prone Rice

Boro (Spring) season rice is becoming more popular nowadays in flood prone areas due to higher assured yield. Under such conditions flood-prone rice may be integrated with boro rice. Suitable varieties for flood prone, drilled or broadcasted in standing boro rice crop before 15-20 days of harvesting in May. At 30 days after sowing (DAS), when field is free from boro crop, interculturing and top dressing of 20 kg N per ha in moist soil gives a good crop of deepwater rice.

Future thrust on flood-prone rice research

1. To develop the compatibility of promising rice varieties with various mixed crops under different hydrology – Semi-deep, deep and flash flood conditions.

2. Cleaning or incorporation of mung bean stubbles in field.

3. Nutrient requirement for high yield of mixed crop and optimum rice plant stand.

4. Integrated weed management.

5. Nutrient management for kharuhan (double transplanted) rice for flood effected areas.

6. Plant establishment techniques, nutrients and weed management for flood-prone rice integrated with Boro rice.

7. Large scale on-farm research trails for verification about social acceptance and economic viability of developed technologies.

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Reference

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