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Boro Rice: A Way to Crop Intensification in Eastern India

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Boro is a winter season, photo-insensitive, transplanted rice cultivated under low laying residual soil moisture condition with supplemental irrigation. This gives the farmers a chance to grow a *rabi* season crop which normally they could not grow. This practice is emerging as a new cropping system by its spreading even to those non-traditional areas where irrigation is available.

Boro Rice

The boro rice is commonly known as winter rice. The term boro is Bengali originated from the Sanskrit word "Boro" which refers to a cultivation from Nov.-May under irrigated condition. It is photo-insensitive, transplanted rice cultivated in waterlogged, low-lying or medium lands with supplemental irrigation during November to May. This gives the farmers a chance to grow a *rabi* season crop which normally they could not grow. This type of rice has been cultivated traditionally in river basin deltas of Bangladesh and Eastern India including Eastern U.P., Odisha, Bihar, West Bengal and Assam. Areas adjoining canals and roads, *Chaur*-lands/*Tal*-lands, are low-lying ditches with high moisture retention capacity where water is accumulated during monsoon months and cannot be drained out in winter months. Boro rice system takes advantage of residual moisture after the harvest of *kharif* rice. With the increase in irrigation facilities, boro crop is now being taken in areas outside its traditional boundaries and a new cropping system is emerging.

Why Boro rice?

1. Shallow water level and water logging low land can be utilized by using boro rice cultivation, which remains fallow in winter due to excessive moisture and late maturing rice.
2. Immense potential for improving boro rice yield over winter crops in low land areas.
3. Boro rice matures before on-set of monsoon and gets sufficient time for harvesting as compared to chaitie rice (spring).

4. Good market price of boro rice due to offseason production.
5. Reduces risk of natural calamities like flood for main season under flood prone areas using boro rice cultivation.

Benefits of Boro Rice Cultivation

Boro rice is known for high productivity (5-6 t/ha) in deepwater areas of Eastern India, where productivity has traditionally been very poor (<1 t/ha) during the *kharif*. This is mainly because boro is more manageable than *kharif* rice. For example, water management in boro is more systematic as it is an irrigated crop. Consequently, this crop responds well to higher doses of fertilizers resulting in higher production. Being a winter season crop, it is spared from insect-pest infestation. Moreover lower winter temperature during the early crop growth period facilitates the accumulation of photo-synthates, thereby increasing carbon: nitrogen ratio. Temperature rise during the ripening period, further facilitating the process. Variations in these parameters cause variation in yields across the boro growing areas.

Boro Rice Cultivation Practices

The boro rice cultivars have additional desirable traits over those of irrigated rice varieties grown during *kharif*. The cultivar has to be of short duration having physiological and plant type parameters to shorten the vegetative growth phase and more efficient dry matter accumulation. These would mean cold tolerance, lower loss of water due to transpiration, shade efficiency, less tillering and more effective tillers. Quick establishment capability after transplanting is also a desirable trait.

Popular Boro Rice Varieties

Gautam, Prabhat, IR 64, Krishna Hensa, IR-36, Joyamati, Vishnu Prasad, Jyoti Prasad, Chinsura *Hybrid-3*, BRRI dhan-29, BRRI dhan-35, BRRI dhan-36, Khumal –11 and Jaya gives good yield in boro season. As boro rice seeds are sown in early winter, the seeds of the cultivar should be able to germinate at lower temperatures say, ranging between 12-14^{o}C. The shape of vacuoles and thickness of mesophyll layer in the internal structure of the leaves need to be bigger enough to make the cultivar more cold tolerant. The cultivar needs to have low amylase content (20%-50%) in the grain. The expected yield level has to be 6-7 t/ha with harvest index of 0.50 to 0.55.

Nursery management

- ✓ Nursery for boro crop is sown in the last week of October to mid-September before onset of the winter season.
- ✓ Prepare the seed bed in low-lying areas near the source of irrigation.
- ✓ Irrigate seed beds frequently.
- ✓ Dust the seedlings periodically with fuelwood ash, straw ash, cattle dung ash, etc.
- ✓ Cover the seedlings with a plastic sheet at night to avoid yellowing of seedlings.

Transplanting

- ✓ Optimum time of sowing is 25 Oct. to 15 Nov. The transplanting is suitable when the minimum temperature of February becomes equal to 10^{o}C.
- ✓ Keep seedlings 18-20 cm high. Use of ash at interval of 15 days, cover of seedlings by plastic sheet in night and remove plastic sheet in day.
- ✓ Keep seedlings 5-6 cm in standing water.
- ✓ Place the seedlings 4-5 per hill at a spacing of 20x10-15 cm.
- ✓ Dense planting and/or higher number of seedlings are required to maintain the plant population.
- ✓ Depending upon the soil condition, apply 120-150 kg N, 60-75 kg P_2O_5 and 50-80 kg K_2O along with 20kg/ha of $ZnSO_4$ for optimum yield of boro rice.
- ✓ Need-based irrigations are given from ground water sources /canals/low-lying catchments. Altogether 12-15 irrigations are necessary during the crop period.

Constraints to Boro Rice Cultivation

Boro crop is a 190-200 days crop and may require more resources and care for a longer period. Moreover, improved varieties and agro-techniques are not available for boro rice cultivation. Lack of credit facilities and the small size of holdings are major challenges. Some of the environmental constraints are as follows:

1. **Weather fluctuation:** Low temperature at seedling stage can cause poor germination, slow and stunted seedling growth, yellowing of leaves, leaf spots, slow and delayed tillering and non-synchronous and delayed flowering. Dense fog, coupled with greater

temperature fluctuation or high day temperature at flowering may cause sterility of flowers.

2. **Pre-monsoon rain:** If seed has no dormancy, early pre-monsoon rain may affect germination. In coastal areas, it may cause grain shattering.
3. **Seedling mortality** takes place during nursery stage due to long cold spells. Duration of panicle initiation and maturity period also increases. This increases expenditure on additional irrigation and care. Cold spell also restricts root growth delaying proper establishment of the seedlings. To compensate, the farmer has to do dense transplanting and use more number of seedlings/hill.
4. Plant hoppers, leaf hopper, leaf folder, grass hopper, Gandhi bug and yellow stem borer (YSB) are some of the major pests of boro rice. Bird damage is also common at the time of grain ripening. Major plant diseases are sheath blight and blasts, which appear during ripening or maturity stage. Problematic weeds also grow.

Integrated Pest Management (IPM) Technology for Boro Rice

Insect pests in boro rice cause significant damage, especially during the reproductive stage of the crop, which coincides with the emergence of the first generation of stem borers after hibernation during winter. The IPM technology for boro rice includes:

1. Use of appropriate variety
2. Timely planting and
   Optimum plant population
3. Balanced fertilizer application
4. Split application of nitrogenous fertilizer
5. Regular pest monitoring using pheromone traps for YSB (to reduce pest population)
6. Use of Trichogramma egg parasitoids for YSB and leaf folders
7. Need-based application of pesticides
8. Use of indigenous
   technical knowledge such as use of bamboo perches, etc.

Strategies for Increasing Boro Rice Production in Eastern India:

1. **Identify Appropriate Varieties:** This may be done through germplasm collection, evaluation, selection and varietal/cultivars testing.

2. **Characterize Boro Rice Agro-ecosystem:** Undertake agro-ecosystem analysis through rapid rural appraisal (RRA)/ participatory rural appraisal (PRA), system diagnosis, remote sensing and geographic information system (GIS) to prioritize the problems and issues faced by farmers and find out possible solutions.
3. **Develop Crop Management Practices:** There is a need for a crop management package, which may include nursery management, optimum planting time, plant population, planting geometry, fertilizer, and irrigation requirements, weed management and integrated pest management (IPM). Evaluate cultivars/varieties in relation to these parameters.
4. **Develop Appropriate Water Management Techniques** Such techniques for varying low-lying water bodies help in better land utilization. Management of groundwater is equally important in medium lands. Proper drainage and pumping water from central portion to establish the crop and irrigation reduce menace of aquatic weeds.
5. **Develop Rice-fish Culture** Viable rice-fish culture enhances the income of poor farmers owning deepwater/low lying waterlogged areas. Boro rice-fish culture technology package helps farmers in increasing their incomes.
6. **Encourages Farmers' Participatory Research:** Technology transfer is an important component of agricultural development. Technologies should be well tested on the farmers' field before those are passed on to other farmers for adoption. This is better done by farmers' participatory approach including on-farm trials and demonstrations to test the technology's adaptability, compatibility and feedback information for refinement of technology according to farmers' needs.

Conclusion

Boro rice has made it possible to best utilization of the soil moisture in low lying areas with an additional crop to farmers. The crop has become very popular and emerging out as a new cropping system in the region. The need is to develop improved package and practices to make the system more popular.