

Improved production technology for Boro rice in Eastern India

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Boro rice is transplanted puddle rice and is grown during winter in lowland conditions. This was cultivated traditionally in eastern India. Development of high-yielding and hybrid Boro rice varieties grown in winter (rabi) season with sufficient irrigation facility, as well as increased use of fertilizers, pesticides, and improved crop management enhanced rice production in the country. These strategies offered farmers to cultivate rice crop during rabi that they were not typically able to grow during this period and was necessary to keep up with the expanding population and diminishing natural resources.

Keywords: Boro rice, Nursery management, Planting management, Varieties

MORE than 90% of global rice is produced and consumed in Asia. For millions of families, rice farming is a steady source of job and income. Unfortunately, as rising input costs and labour has discouraged production of rice in the recent years, overall productivity and profitability has been declining. It is most common crop and contributes significantly to income and employment. It is cultivated in India's three primary growing seasons, viz. from February–March to July–August for Aus rice, June–July to November–December for Aman rice, and November–December to May–June for irrigated Boro rice, i.e. winter (*rabi*) season popularly known as Boro season. Traditional rice growing regions in eastern India include eastern Uttar Pradesh, Bihar, West Bengal, and Assam. Since, there are little rains during *rabi* season, Boro rice is completely irrigated. Introduction of high-yielding and hybrid Boro rice varieties, grown throughout dry-season with irrigation, as well as increased use of fertilizers, pesticides, and herbicides, and improved crop management have enhanced the rice production. Use

of ground water irrigation has made an extensive possibility of Boro rice production. Increased Boro rice yield is necessary to meet the increasing demand for food and nutritional security of India's growing population. A major issue for country in future is to increase the food production from the diminishing available resources, particularly water and land and to keep up with expanding population. Even utilizing the currently existing technologies, there are significant chances to increase rice production by lowering volatility in rice yield at the farmers' fields.

Using Boro rice for cropping intensification

- Compared to spring rice, Boro rice matures before start of monsoon and gives ample time for harvesting and planting for succeeding crops.
- Because of off-season production, Boro rice has a good market price and returns.
- There exists lot of potential to improve yield of Boro rice compared to winter crops in low-lying areas.
- Land having high water levels,



Boro rice panicles

waterlogging and lowland, which remains barren in winter can be exploited for Boro rice cultivation.

- There is a normalized effect of natural disasters like floods during primary growing season in flood-prone areas by Boro rice.



Boro rice at harvesting stage

Table 1. Important boro rice varieties and their specific characteristics

Variety	Maturity in Boro season (days)	Grain yield (t/ha)	Resistance/Tolerance	Area of adaptation
Gautam	195	10.0	-	Bihar
Sujata	209	5.0	Resistant to Bacterial leaf blight (BLB), Leaf blast (LB) and Brown spot (BS)	Bihar and Uttar Pradesh
Mahsuri	215	4.5–5	Moderately resistant to BLB	Bihar
Jaya	205	5.50	Resistant to rice blast	All India
IR36	200	3.50	Moderately resistant to Blast, BS, BLB, Rice tungro virus (RTV), Golden shiner virus (GSV) and Bacterial leaf streak (BLS), and resistant to Brown plant hopper (BPH)	Odisha, West Bengal, Assam, Meghalaya, Manipur, Uttar Pradesh and Kerala
Pusa 2-21	158	5.40	-	West Bengal, Odisha, Tamil Nadu, Haryana and North-eastern hill (NEH) region states
Arize 6444	-	7.0	-	-
Ajay	170	7.0	Resistant to Blast and White backed plant hopper (WBPH)	Odisha
CR Dhan 601	185	7.0	-	Odisha, West Bengal and Assam
Kshitish	150	5.50	-	-
Chandrama	185	6.5–7.0	-	-
Jaymati	170	5.5–6.0	Resistant to Blast, BLB, Shoot borer (SB) and Gall midge (GM)	Assam
Saroj	175–180	6.5–7.5	-	-
Dhanlaxmi	155–160	5.5–6.0	-	-
Richharia	160–170	5.5–6.0	-	-
Prabhat	155–160	5.5–6.0	-	Andhra Pradesh
Naveen	170	5–5.5	Resistant to Blast, Sheath blight, BS and Stem borer	Odisha
Rajendra Bhagwati	175–185	5.5–6.0	-	Bihar
IR 8	185–195	5.5–6.0	Moderately resistant to rice Blast and Green leaf hopper (GLH)	Madhya Pradesh, Punjab, Odisha, Maharashtra, Bihar and Uttar Pradesh

Varieties

The variety preferred for Boro rice is the one which has attributes of semi-dwarf to semi-tall plant type with a stout culm and moderate tillering capacity (8–12 tillers/hill), early maturity, medium-slender grain type, tolerance to main insect-pests and diseases, and high grain production potential (8–10 t/ha). Such traits allow rice varieties to take the advantage of ample sunshine and largely risk-free growing environment in Boro season (Table 1).

Obstacles to growing Boro rice

Mortality of seedling: Seedling mortality takes place due to prolonged cold period throughout nursery stage. Days to panicle initiation and maturation period likewise lengthen due to low temperature. This raises cost of additional irrigation and

maintenance. Cold spell limits the root growth, which delays seedlings' proper establishment. Farmers must use more seedlings/hill and perform extensive transplanting to compensate.

Rain before monsoon: Early pre-monsoon rain may have an impact on germination if seed is not dormant.

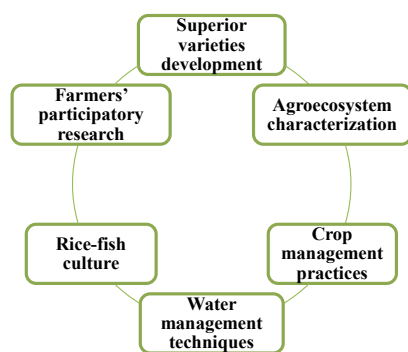
Insect pest and disease: Plant hoppers, leaf folder, grasshopper, leaf hopper, yellow stem borer and gundhi bug are some of the major pests of Boro rice. Major plant diseases are blast and sheath blight, which appear at ripening and adversely affect Boro rice.

Irregular weather: Poor germination, slow and stunted seedling growth, leaf spots, slow and delayed tillering, and non-synchronous and delayed flowering are effects of low temperature at seedling stage. Sterility of flowers

may be brought by dense fog, increased temperature fluctuation, or high daytime temperatures during flowering.

Approaches for increasing production

Through collection, analysis, selection, and testing of germplasm, superior varieties may be identified. Prioritization of challenges, difficulties faced by farmers and conducting agro-ecosystem analysis using participatory rural appraisal, system diagnostics, remote sensing, and geographic information systems may be helpful in increasing production. Crop management package is required which contains information on nursery management, ideal planting times, plant populations, planting geometry, fertilizers, irrigation need, weed control and integrated pest management. Improved land use results from methods for



Techniques for raising Boro rice production

altering low-lying water bodies through Boro rice cultivation. Aquatic weeds are less of a threat with proper drainage and water pumping from central portion to establish the crop and provide irrigation. Income of poor farmers who own deep-water or low-lying waterlogged regions is increased by successful rice-fish culture. Best way to accomplish this is by farmer participation, which includes on-farm trial, demonstrations to test the technology adaptability, compatibility, and feedback data for technology improvement based on farmers' needs.

Improved production technology

Nursery management: November–December to May–June is the

growing month for Boro rice. Low temperature stress affect crop growth stages, i.e. seed germination, emergence, seedling establishment, early vegetative growth during *rabi*. Low temperatures impair seed germination and cause seedling to grow slowly. As a result, Boro rice requires special management of nursery to avoid the cold injury (Table 2).

Land preparation: When enough water is available, field should first be ploughed 3–4 times before being laddered. After a week, field needs to be ploughed twice more, followed by laddering in wet condition to produce puddles.

Transplanting: After second week of January, when temperature begins to rise over 10°C, Boro rice is transplanted. Depending on variety, a Boro rice seedling can grow to a height of 12–15 cm and 4–6 leaves in two months. In puddled soil at a depth of 2–3 cm, 2–3 seedlings/hill are transplanted in rows with spacing of 15 cm × 15 cm.

Water management: At tillering, panicle initiation, flowering and grain filling, Boro rice should be irrigated. At 30 DAT (Days after transplanting), there should be standing water of 2–3 cm in the field.



Field view after 45 days of transplanting

After transplanting, water level of 4–5 cm should be maintained for 30–40 days. About 3 cm of water should be maintained from panicle initiation to heading. After heading, there should be 2-day break before applying 2–3 cm of irrigation.

Nutrient management: At first ploughing, organic manure should be applied @5 t/ha through FYM/compost. Based on soil test, inorganic fertilizer recommendation for high yielding Boro rice cultivars is 100-50-30 kg of N-P-K/ha. Basal application should consist of a full dose of P, 75% dose of K, and a 25% dose of N. Remaining N should be applied in two splits, with first 25% applied at the maximum tillering and 50% at panicle initiation. At panicle initiation, 25% potash dose should also be applied.

Weed management: Generally, 2 hand weeding at 20 and 40 DAT is beneficial in reducing weed growth in Boro rice. Herbicides like Butachlor (Machete) 5% granule @30 kg/ha in 3–4 cm standing water during 2–4 DAT are sprayed to manage grassy weed in cases, where there is a lack of labour. If herbicide granules are not available, Butachlor in liquid form can be applied @1.5 kg a.i./ha mixed with 400 litres of water. Benthocarb (Saturn) can be applied @1.5 kg a.i./ha just after 48 hours of transplanting in 3–5 cm of standing water.

Harvesting and threshing: The right time to harvest the crop is when panicles turn golden yellow in colour and grains have moisture content of 20%. Around 10–12 days prior to the anticipated crop harvesting date, field water should be completely drained. Using

Table 2. Improved nursery management technique for Boro rice

Attribute	Remark
Time of sowing	November to mid-December.
Seed rate	Varieties and hybrids, 40 kg and 20 kg/ha respectively.
Nursery area	1000 m ² area for 01 ha
Seed treatment	Dip seed in 2.5% solution of common salt (NaCl) and floating seeds should be discarded and then washed in clean water to remove common salt. To protect seedling from diseases, Carbendazim 50 WP @1.0 g/kg seed or Emisan-6 @2g/kg seed is used.
Manures and fertilizers	FYM/compost @2000 kg/1000 m ² is applied during first ploughing of nursery bed. N-P ₂ O ₅ -K ₂ O @10-5-5 kg/1000 m ² is applied in split mode. The schedule of fertilization is 5-5-5 kg: N-P ₂ O ₅ -K ₂ O as basal, 2.5 kg N at 20 DAS and 2.5 kg N seven days before uprooting of seedlings.
Preparation of seed bed	Land should be thoroughly puddled and perfectly levelled before transplanting it in main field.
Insect-pest and disease control	For rice tungro disease (RTD), Carbofuran 3 G @5 kg/1000 m ² or Phorate 10 G @1.5 kg/1000 m ² area is applied 3 WAS. As a preventive measure against stem borer infestation in main field, Cartap 4 G @1.8 kg/Carbofuran 3 G @5 kg or Phorate 10 G @1.5 kg/1000 m ² area is applied 01 week before uprooting of seedlings. Spraying of Carbendazim 50 WP @1 g/litre of water one week before uprooting of seedlings is done to control the blast disease.
Irrigation in the nursery	Light irrigation on regular basis is performed for proper seedling growth.

paddy harvester or manually with serrated edged sickles, mature crop can be harvested. Bullocks are used to trample grain, lift bundles, and strike them on an elevated wooden platform, or use power-driven threshers.

SUMMARY

Boro rice is the certain kind of rice cultivation that takes place in lowland areas from November–May. It makes use of moisture that remains in soil after *kharif* paddy,

longer moisture holding capacity of soil, and water that is stored in nearby ditches. Boro rice production is crucial for self-sufficiency in rice production for food and nutritional security. Rice production has been intensified through introduction of high-yielding and hybrid Boro rice varieties, cultivated in dry season using irrigation and increased use of agro-chemicals, and better crop management. Farmers are urged to start cultivating it during the season wherever irrigation facilities

are available. Boro rice has allowed the farmers to increase their yield, while making the greatest use of soil moisture in low-lying areas. To meet the growing demand for food and nutritional security for increasing population of India, immediate attention is required to increase the yield of Boro rice.

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