

Improved cultivars of rice for different ecologies of north eastern India

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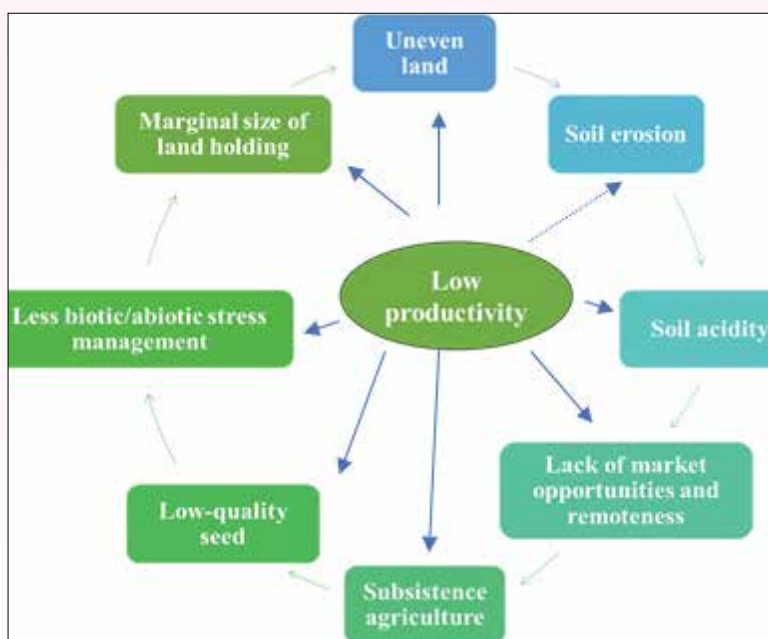
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Quality seeds of improved rice varieties play a significant role in augmenting the productivity in north eastern region of India. ICAR Research Complex for NEH region has developed a total of 42 high yielding varieties (HYVs) of rice. Among these, 16 varieties for lowland, 3 varieties for upland, 14 varieties for both lowland and upland, 1 black rice variety and 3 varieties for high altitude lowland conditions were developed. Farmers' orientation, field demonstration cum awareness programmes were conducted at Institute farm vis a vis farmers' field in order to augment the area under HYVs. Participatory seed production programme was also implemented with active involvement of progressive farmers in order to meet the seed requirement. As a result, more than 30 percent of area under paddy cultivation in north eastern region of India has been occupied by high yielding varieties developed by the institute.

Keywords: Paddy, Participatory seed production, Quality seeds, Varieties

RICE being an integral part of north eastern India as a source of food, income, customs, traditions and nutritional security signifies itself as most important food crop. The various tribes of the north eastern hill (NEH) region maintain around 10,000 landraces in diverse ecosystems like high altitude, upland rice in Jhum cultivation, steep terrace rice, cultivation in floodplains, and deep water. The seven sister states comprising of Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Assam and Tripura, is surrounded by four countries namely, Bhutan, China, Myanmar and Bangladesh and considered as an Indo-Burma biodiversity hotspot. The rice crop is cultivated on 2.14 percent (0.99 m ha) area with the total production of 2.08 percent (2.70 m tonnes) of the total contribution of the country. The average productivity of these states is lesser (2.47 t/ha) as compared to national average and thus not able to fulfil the requirement of the growing population in NEH region, resulting in imports from other states. There are several constraints for reduced yield namely, rainfed conditions, less connectivity with transport

facilities, poor market infrastructure, higher cultivation cost, less or marginal land holding, subsistence type of agriculture with low inputs in terms of nutrient, disease



Reasons for low productivity in north eastern hilly region of India

and pest management, low/poor availability of quality seeds, etc.

Majority of constraints can be managed by adopting infrastructure and policy reformation vis a vis empowering farmer with scientific technologies and methods of scientific cultivation practices. Availability of quality seeds remains a problem; and ICAR-Research Complex for North Eastern Hill Region, Umiam, Meghalaya since its inception in 1975, has been consistently working on availability of quality seeds through development and release of numerous rice varieties suitable to the needs of local population.

As formal system of seed production is lacking in these states, ICAR-Research Complex for NEH Region, Umiam, Meghalaya has been consistently putting efforts in order to link the farmers with technologies by implementing participatory seed production techniques, training and orientation of farmers towards quality seed production, creation of seed villages under TSP and buyback of quality seeds after proper inspection from progressive farmers. As a result, the varieties developed by the institute has been grown on 324260 ha (32.65 percent of total rice area) in the seven sister states of NEH region. The Institute has developed 42 rice varieties suitable to various ecologies of NEH region.

Table 1. Improved varieties of rice released for NEH region

States	No.	Improved cultivars
Tripura	17	Gomati Dhan/ TRC 2005-1, Khowai/ TRC 2005-3, Tripura Chikan Dhan/ TRC 2008-4, Tripura Nirog/ TRC 2008-6, Tripura Hakuchuk-1/ TRC 2013-4, Tripura Hakuchuk-2/ TRC 2013-5, Tripura Jala/ TRC 2008-1, Tripura Aush/ TRC 2013-12, Tripura Khara Dhan-1, Tripura Khara Dhan-2, Tripura Sharat Dhan/ TRC 2008-5, Naveen/ CR-749-20-2, NICRA Aerobic Dhan-1/ TRC 2015-5, ICAR-NEH Hill Rice 14-8/ TRC 2014-8, ICAR NEH NICRA-Boro Dhan 1/ TRC 2016-14, ICAR-NEH NICRA Hill Rice 2022-2/ TRC PSM-1720-B-B-5-1, ICAR NEH NICRA Aerobic Dhan-2/ TRC 2020-14
Meghalaya	08	Bhalum 1, Bhalum 3, Bhalum 5, Sharsarang, Megha SA2, NEH Megha Rice 1, NEH Megha Rice 2, NEH Megha Rice 3
Manipur	12	RC- Maniphou 4, RC- Maniphou 5, RC- Maniphou 6, RC- Maniphou 7, RC- Maniphou 10, RC- Maniphou 11, RC- Maniphou 12, RC- Maniphou 13, RC Maniphou-14, RC Maniphou-15, RC Maniphou-16, RC Manichakhao 1 (black rice)
Sikkim	05	Sikkim Dhan-1, Sikkim Dhan-2, Sikkim Dhan-3, VL- Sikkim Dhan-4, Sikkim Organic Chirakey Selection-1

Description of varietal characteristics (Tripura state)

Lowland conditions:

- **Gomati Dhan/ TRC 2005-1:** The variety was released in 2012 and recommended for rainfed shallow lowlands and irrigated conditions in *kharif*.

The variety was developed from a cross between Pyzam and BPT 5204. The variety is 105 cm tall with dark green foliage, and medium slender white grains. The maturity duration and yield potential of the variety is 130–135 days (seed to seed) and 5.8–6.0 t/ha, respectively.

- **Khowai/ TRC 2005-3:** The variety was released in 2012 and recommended for rainfed shallow lowlands and irrigated conditions for both *kharif* and boro season. The variety was developed from a cross between Jagannath and Jaya. The variety is 118 cm tall with dark green foliage, and medium slender white grains. The maturity duration and yield potential of the variety is 120–125 days, (seed to seed) and 5.4–6.0 t/ha, respectively.
- **Tripura Chikan Dhan/ TRC 2008-4:** The variety was released in 2014 for rainfed shallow lowlands and irrigated lands during *kharif* season. The variety was developed from a cross between C53 and IR 28224-3-2-3-2. The plant matures in 135 days with a yield of 6.2-6.4 t/ha. The height of plant is 106 cm.
- **Tripura Nirog/ TRC 2008-6:** The variety was released in 2014 for rainfed shallow lowlands and irrigated condition in *kharif*. The high-yielding variety was developed from a cross between IR 24594-204-1-2-3-2-6-2 and IR 28222-9-2-2-2-2. With a plant height of 113 cm, the variety matures in 122–125 days with a yield potential of 6.5 t/ha.
- **Tripura Sharat Dhan/ TRC 2008-5:** The variety was released in 2014 and recommended during both *kharif* and boro season. The variety was developed from a cross between IR 72870-120-1-2-2 and IR 72870-19-2-2-3. The variety is 104 cm tall with dark green foliage. The maturity duration and yield potential of the variety is 125 days (seed to seed) and 5.8 6.0 t/ha in *kharif* season and 6.0–6.2 t/ha in boro season, respectively.
- **ICAR NEH NICRA-Boro Dhan 1/ TRC 2016-14:** The variety was released in 2022 recommended for boro cultivation in Tripura, West Bengal, Assam and other neighbouring north eastern states. The variety was developed from a cross between Pyzum with Sambha Mahsuri. The plant matures in 150–155 days with a yield of 6.4 t/ha in boro season. The height of plants is 100 cm with good foliage.
Both lowland and upland conditions:
- **Tripura Hakuchuk-1/ TRC 2013-4:** The variety was released in 2014 and recommended for early rainfed lowland, uplands and jhum conditions. The variety was developed from a cross between IR 78877-208-B-1-2 and IR 74371-54-1-1. The variety is 123 cm tall with dark green foliage, and medium slender white grains. The maturity duration (90–92 days in direct seeded and 98–100 days in transplanted) and yield potential (6.2 t/ha in *kharif* and 7.2 t/ha in boro season) are quite comparable.
- **Tripura Hakuchuk-2/ TRC 2013-5:** It was released in 2014 for early rainfed lowland, uplands and Jhum conditions. The variety was developed from



ICAR NEH NICRA Aerobic Dhan-2



ICAR-NEH NICRA Hill Rice



ICAR NEH NICRA-Boro Dhan 1

a cross between IRRI 132 and IR 74371-54-1-1. The plant matures in 100–105 days under transplanting and 92–94 days under direct seeding with a yield of 5.7 t/ha in *kharif* and 6.8 t/ha in boro season. The height of plants is 124 cm with dark green foliage, compact panicles and long, slender white grains.

- **Tripura Jala/ TRC 2008-1:** It was released in 2014 for rainfed lowland, uplands and jhum conditions in *kharif*. The high-yielding variety was developed from a cross between TRC 229-F-41 and Jaya, and suitable for waterlogging conditions. With a plant height of 115 cm, the variety matures in 145 days with a yield potential of 4.9 t/ha.
- **Tripua Aush/ TRC 2013-12:** It was released in 2014 and developed from a cross between IR 78877-208-B-1-2 and IR 74371-54-1-1. The variety is 119 cm tall with dark green foliage. It matures in 98–100 days in transplanted and 90–92 days under direct seeded conditions. The yield potential is 5.7 t/ha in *kharif* and 6.1 t/ha in boro season.
- **Tripura Khara Dhan-1:** It was released in 2014 for shallow lowlands under drought stress conditions during *kharif* season. The variety was developed through marker-assisted backcrossing, incorporating drought tolerance QTLs namely, qDTY2.2 and qDTY4.1 in IR 64 background. The plant matures in 120–125 days with a yield of 5.3 t/ha and plant height of 140 cm.
- **Tripura Khara Dhan-2:** It was released in 2014 for shallow lowlands under drought stress conditions during *kharif* season. The high-yielding variety was developed by incorporating drought tolerance QTLs in IR 64 background. With a plant height of 105 cm, the variety matures in 115–120 days with a yield potential of 5.2 t/ha.
- **Naveen/ CR-749-20-2:** It was released in 2012 for rainfed shallow lowland, irrigated land and upland ecosystem in both aman and boro seasons. The variety was developed from a cross between Sattari and Jaya Sattari. The plant matures in 115–120 days with a yield of 5.0–5.5 t/ha in *kharif* season and 5.5–6.0 t/ha in boro season.
- **NICRA Aerobic Dhan-1/ TRC 2015-5:** It was released in 2021 for aerobic conditions of Jharkhand, Chhattisgarh, Karnataka, Tripura and other neighboring north-eastern states. The high-yielding variety was developed from a cross between

Naveen with a drought tolerant local jhum (shifting cultivation) variety-Kataktara. With a plant height of 100 cm the variety flowers in 85–86 days with a yield potential of 6.3 t/ha.

- **ICAR-NEH Hill Rice 14-8/ TRC 2014-8:** It was released in 2021 and recommended for lower hills of Himachal Pradesh, Karnataka, Tripura and other neighboring north eastern states. The variety was developed from a cross between IR 78878-208-B-1-2 and IR 74371-54-1-1. The variety is 93 cm tall with dark green foliage. The maturity duration and yield potential of the variety is 125–130 days (seed to seed) and 4.3 t/ha under hill ecologies, respectively.
- **ICAR-NEH NICRA Hill Rice 2022-2/ TRC PSM-1720-B-B-5-1:** It was released in 2022 for the upland hills of Himachal Manipur, Tripura and other neighboring north eastern states. The high-yielding variety was developed from a cross between Pyzum and BPT 5204. With a plant height of 95 cm, the variety matures in 120–125 days with a yield potential of 3.4 t/ha in hill ecology.[®]
- **ICAR NEH NICRA Aerobic Dhan-2/TRC 2020-14:** The variety was released in 2024 for aerobic conditions of Bihar, Haryana, Tripura and other neighboring north-eastern states. The high-yielding variety was developed from a cross between Hakuchuk-1 with Naveen. With a plant height of 101 cm, the variety matures in 117 days with a yield potential of 5.3 t/ha in hill ecology.

Description of varietal characteristics (Meghalaya state)

Upland conditions-mid altitudes:

- **Bhalum 1 (RCPL 1-29):** Released by state seed sub committee in year 2002 for Meghalaya state. The genotype is recommended for main *kharif* season for mid altitude upland conditions. Bhalum 1 is a high yielding, non-lodging and moderately resistance to blast. The plant height is intermediate (105–115 cm) with a maturity duration of 120–125 days and yield potential is 3.5–3.8 t/ha.
- **Bhalum 3 (RCPL 1-115):** Released by state seed sub committee in year 2010 for Meghalaya state. The genotype is recommended for main *kharif* season for mid altitude upland conditions. Bhalum 3 is a high yielding, non-lodging and moderately resistance to blast. The plant height is intermediate (100–105 cm) with a flowering duration of 100–105 days and yield



potential is 3.6–3.9 t/ha.

- **Bhalum 5 (RCPL 1-412):** Identified for Meghalaya and Himachal Pradesh by Varietal Identification Committee meeting in 2015. The genotype is recommended for main *kharif* season for mid altitude upland conditions. Bhalum 5 is a high yielding and non-lodging variety. The plant height is intermediate (100 cm) with a maturity duration of 130 days and yield potential is 3.6–3.9 t/ha.

Lowland conditions-mid altitudes:

- **Megha SA 2 (RCPL 1-160):** Released by state seed sub committee in year 2010 for mid altitude lowland conditions of Meghalaya state. The variety is high yielding, non-lodging and moderately resistance to blast. It maintains a moderate level of aroma when grows in hills. The maturity duration of this variety is 140–145 days with a yield potential of 3.8–4.0 t/ha.
- **Shahsarang 1 (RCPL 1-87-8):** Released by state seed sub committee held in year 2002 for Meghalaya state. The genotype is recommended for main *kharif* season for mid altitude lowland conditions. The variety is a high yielding, non-lodging with intermediate plant height (100 cm). The maturity duration and yield potential of the variety is 135–140 days and 4.0–4.2 t/ha, respectively.

Lowland conditions-high altitudes:

- **NEH Megha Rice 1:** Released by state seed sub committee held in year 1992 for Meghalaya state. The genotype is recommended for main *kharif* season for high altitude (1500–2000 m above msl) lowland conditions. NEH Megha Rice 1 is a high yielding, non-lodging and tolerant to low temperature and phosphorus deficiency. The plant height is intermediate (110 cm) with a flowering duration of 125–135 days and yield potential is 2.9–3.3 t/ha.
- **NEH Megha Rice 2:** Released by state seed sub committee held in year 2002 for Meghalaya state. The genotype is recommended for main *kharif* season for high altitude (1500–2000 m above msl) lowland conditions. NEH Megha Rice 2 is a high yielding, non-lodging and tolerant to low temperature and phosphorus deficiency. The plant height is intermediate (115 cm) with a flowering duration of 120–130 days and yield potential is 2.8–3.1 t/ha.
- **NEH Megha Rice 3:** Released by state seed sub committee in year 2009 for Meghalaya state. The

genotype is recommended for main *kharif* season for high altitude (1500–2000 m above msl) lowland conditions. NEH Megha Rice 3 is a high yielding, tolerant to low temperature and phosphorus deficiency. The plant height is intermediate (110 cm) with a flowering duration of 117 days and yield potential is 3.0–3.2 t/ha.

Description of varietal characteristics (Manipur)

Lowland condition:

- **RC Maniphou-4:** The variety was released in the year 1993 by state seed subcommittee and is recommended for early-*kharif*/*kharif*/summer/ boro season under medium low land area. The variety was evolved from a cross between Kalinga-2 and Palman. It is a fine grain variety bearing about 150–200 spikelets per panicle and yield ranges about 4–4.5 t/ha under good management. It's a short duration variety (110–120 days).
- **RC Maniphou-5 (RCM-8):** It was released in the year 1993 by state seed subcommittee and is recommended for early-*kharif*/*kharif*/summer/boro season under medium low land area of Manipur. Under irrigated and low land, it takes 125 days to mature and in rainfed, 110 days. It has a yield potential of 4.5–5.0 t/ha on an average.
- **RC Maniphou-7 (RCM-9):** It was released in the year 2008 by state seed subcommittee and is recommended for irrigated/waterlogged (5–15cm) low land with medium to high soil fertility, early to medium and early to late planting for main *kharif*. The variety was evolved as a mutant culture of Punshi. It matures in 135 to 145 days with high tillering ability (15–20/hill) and long panicles with 300–450 spikelets and yield potential of 5.5–7.0 t/ha.
- **RC Maniphou-12:** It was released in the year 2012 by state seed subcommittee and is recommended for pre-*kharif* as well as *kharif*. season in medium low land areas of Manipur valley. It is a derivative of the cross Leimaphou (KD-2-6-3) × Akhanphou and evolved. This variety matures in 90–105 days in summer (March-April sowing) season under Manipur conditions. This crop can successfully be followed by main *kharif* crop. It bears about 150–200 spikelets per panicle and yield about 4.0–5.0 t/ha under good management.

- **RC Maniphou-13:** It was released in the year 2016 and is recommended for irrigated/rainfed valley areas with medium to high soil fertility under normal sowing in main *kharif* season. The variety was evolved from a cross between Leimaphou and Akhanphou. It is photo-insensitive with yield potential of 7–8 t/ha. It is resistant to leaf and neck blast diseases under natural disease pressure in Manipur. It has got good tillering ability and bears about 250 numbers of filled grains per panicle.
- **RC Maniphou-14:** It was released in the year 2021 by state seed subcommittee and is recommended for rainfed/irrigated ecosystem of Manipur. RC Maniphou-14 is a progeny of the biparental cross, IR 64 × Phougak. It is a semi-dwarf, medium duration fertilizer responsive variety and suitable for main *kharif* season of the Manipur state. It is photo-insensitive with a yield potential of 7 t/ha with 75% hulling percentage, 65% milling percentage, 53% head rice recovery and medium amylose content ~ 24 %.
- **RC Maniphou-15:** It was released in the year 2021 the rainfed/irrigated low land ecosystem of Manipur. RC Maniphou-15 is a derivative of a cross between KD 2-6-3 (Leimaphou) and Phougak. It is a semi-dwarf, medium duration fertilizer-responsive culture with a yield potential of 7.8 t/ha with 79% hulling percentage, 69% milling percentage and 57% head rice recovery.
- **RC Maniphou-16:** It was released in the year 2021 rainfed/irrigated low land ecosystem of Manipur. The variety was evolved from a cross between RCM 10 and RCM 9. It has photo-insensitive with a yield potential of 7.3 t/ha on average with 75% hulling percentage, 65% milling percentage and 52% head rice recovery and amylose content 16.7%. It has soft cooking quality.
Both lowland and upland conditions:
- **RC Maniphou-6:** The variety was released in the year 2000 by state seed subcommittee and is recommended for upland foot hill slopes, terraces and jhum area up to 1350 m above msl. The variety was evolved from a cross between CH-988 and IR-24. Grain quality is fine and sticky in nature. It exhibits moderately resistant to stem borer, gall midge, resistance to blast and BLB with yield potential of 5 t/ha.
- **RC Maniphou-10 (RCM-10):** The variety was released in the year 2008 by state seed subcommittee and is recommended for lowland/waterlogged and terraced land of hill areas up to and altitude of 1250 m above msl. The variety is medium tall (70–90 cm), maturity duration of 120–125 days and derivative of cross between Prasad and IR-24. Its average yield is 5 t/ha.
- **RC Maniphou-11 (RCM-21):** The variety was released in the year 2011 for valley and terraced areas of Meghalaya and Manipur up to an altitude of 1000 msl. RC Maniphou-11 is a medium tall (70–90 cm) derivative of cross between Prasad and

IR-24. This variety matures in 120/125 days and is suitable for the main *kharif* season (110-120 days) with a potential yield of 6–7.5 t/ha.

Black rice variety for lowland condition:

- **RC Manichakhao 1:** The variety was released in the year 2024 for irrigated lowland ecosystem of Manipur. RC Manichakhao 1 is a progeny of the cross, Chakhao Poireiton × RC Maniphou 7. It is a semi-dwarf variety with a height of ~100 cm, effective tiller/hill of 11 with improved cooking quality of ASV value 6. It is a medium maturing variety of 130 days. It is tolerant to leaf and neck blast, and false smut diseases under the natural condition of Manipur. It is photo-insensitive with a yield potential of 4.5 to 5 t/ha on average with amylose content of 11%. It has soft cooking quality with the original Chakhao grain quality.

Description of varietal characteristics (Sikkim) under organic conditions

- **Sikkim Dhan-1:** It is suitable for rainfed upland and irrigated organic conditions of Sikkim. It has maturity duration of 135 days, plant height of 115 cm and average grain yield of 3.5 t/ha for upland and 4.5 t/ha for irrigated transplanted conditions.
- **Sikkim Dhan-2:** Suitable for irrigated organic conditions of Sikkim. It has a maturity duration of 135 days, plant height of 70 cm and average grain yield of 4.6 t/ha.
- **Sikkim Dhan-3:** Suitable for rainfed upland conditions of Sikkim. It has a maturity duration of 134 days, plant height of 90 cm and average grain yield of 2.9 t/ha.
- **VL Sikkim Dhan-4:** The variety is suitable for irrigated organic conditions of Sikkim. It has a maturity duration of 135 days, plant height of 89 cm and average grain yield of 4.8 t/ha.
- **Sikkim Organic Chirakey Selection-1:** Recommended for irrigated transplanted conditions of Sikkim (up to an altitude of 1350 m above msl). The variety is resistant to lodging and shattering, responsive to organic manures with a yield potential of 3.5 t/ha.

SUMMARY

In north eastern part of country, quality seed is the major bottleneck towards maximizing crop productivity. There are many reasons like insufficient seed production of seeds of high yielding varieties (HYVs), unavailability of quality HYVs seeds through market, inefficient distribution of seeds, lack of seed certification agencies and higher prices due to which farmers are forced to use low quality seeds of low/average yielding varieties. Understanding the importance of quality seeds of high yielding rice varieties suitable to NEH region is the key towards increasing productivity and profitability. ICAR-Research Complex for NEH region is continuously working towards development of varieties which in turn will increase the self-sufficiency in terms of rice production of the region.

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