Rice (*Oryza sativa*)
Sali rice (Winter rice)

Varieties

Varieties	Year of release	*Agro-climatic zone	Duration (days)	Sowing time	Avg. plant height (cm)
A. Transplanted normal Sali :					
i) Semi dwarf					
IR 36	1982	U,C	110-125	July	85
AAU-Kmj Dhan-46 (Surma Dhan)	-	N,U,C,L,B,H	140-145	July	120
Bahadur	1994	N,U,C,L,B,H	150-155	June	114
Piolee	-	N,U,C,L,B,H	150-155	do	102
Kushal	1994	N,U,C,L,B,H	150-155	do	116
Moniram	-	N,U,C,L,B,H	150-155	do	105
Ranjit	1994	N,U,C,L,B,H	150-155	do	102
ii) Glutinous :					
Bhogalee	1994	N,U,C,B	155-160	June	99
Aghoni	-	N,U,C,B	160-165	June	105
AAU-Diphu Dhan 6 (Diyung)	-	H	140-145	July	105
iii) Multiple cropping :					
Satyaranjan	1999	N,U,L,B	130-135	do	113
Basundhara	1999	N,U,C,L	130-133	do	107
iv) Tall :					
Mahsuri	-	N,U,C,L,B,H	140-145	Mid June	130
v) Scented Rice					
Keteki Joha	2006	N,U,C,B	155-165	June	100-140
B. Post flood transplanted (late Sali):					
Manohar Sali	1969	N,U,C,L,B	-	Mid Jul to1st week of Aug.	130
Solpona	-	N	-	do	130-140
Prasadbhog	-	N	-	do	do
Govindabhog	-	N	-	do	do

C. Direct Seeded late Sali :					
Luit	1997	N,U,C,L,B	90-95	do	110-115
Kapilee	-	N,U,C,L,B	90-95	do	110-115
Dishang	1998	N,U,C,L,B	90-95	do	110-115

* Refer to page iii for full forms of agro-climatic zones

N.B.

- IR 50 is recommended for double cropped medium land rice areas where Jaya is grown as *ahu* in Barak Valley Zone.
- Varieties with plant height more than 130cm are considered as tall varieties

Rice varieties suitable for staggered planting in *sali* season with aged seedlings

Variety	**Year of release**	**Plant height (cm)**	**Duration (days)**	**Sowing time**	**Trans-planting time**	**Age of seedlings**	**Yield (t/ha)**	**Agro-climatic zone**	**Disease reaction**
Prafulla	-	134	150-160	June	July-Sep	30-75	4.5-5.0	All except Hills zone	R to Sheath rot, MR to blast & BLB, S to sheath blight
Gitesh	2017	130	150-160	June	July-Aug	30-60	5-5.5	All except Hills zone	R to Sheath rot, MR to blast, T to BLB, S to sheath blight

- Varieties with plant height more than 130cm are considered as tall varieties

Submergence tolerant rice varieties for rainfed, lowland flash flood situation

Variety	**Year of release**	**Plant height (cm)**	**Duration (days)**	**Sowing Time**	**Transplanting time**	**Age of seedlings**	**Yield (t/ha)**	**Agro-climatic zone**	**Disease reaction**
Jalashree	2017	133	150-155	June	July	30-35	4.0	All except L& H	T to BLB & sheath blight MR to blast
Jalkunwari	2017	138	150-155	June	July	30-35	4.0	All except L & H	-do-

- Varieties with plant height more than 130cm are considered as tall varieties
- *Refer to page iii for full forms of agro-climatic zone

Rice varieties for low input situation:

Variety	Sowing Time	Duration (days)	Fertilizer (N:P:K) dose (kg/ha)	Grain Yield (t/ha)	*Agro-climatic diseases zone	Reaction to insect pests and diseases
Gandhari (JR 1)	June 15-30	125	20:10:10	4.2	C	R to blast, BLB, stem borer & rice bug; MR to sheath blight; MS to leaf folder
Mohan (JR 5)	-do-	126	-do-	4.1	C	R to blast, stem borer & rice bug; MR to sheath blight; MS to leaf folder
Srimanta (JR 2)	-do-	138	20:10:10 40:20:20	4.4 5.1	U,C,H	R to blast, stem borer; MR to BLB & sheath blight; MS to leaf folder
Bharati (JR 7)	-do-	138	20:10:10 40:20:20	4.1 4.8	U,C,H	R to blast, BLB & rice bug; MR to sheath blight & stem borer; MS to leaf folder

Rice varieties for organic situation

Variety	Sowing time	Duration (days)	Organic nutrients	Grain yield (t/ha)	*Agro-climatic zones	Reaction to insect pests & diseases
AAU Diphu Dhan 5 (Langpi)	June	140-145	As stated in organic package for rice	5.8	H	R to sheath blight & blast; MR to rice bug, stem borer & leaf folder

New rice varieties recommended for different situations

Variety	Year of release	Duration (days)	Yield (t/ha)	Adaptation	Disease and pest reaction	Zone for which recommended
Shraboni (TTB 404)	-	135	5.00	*Sali*	Moderately resistant to sheath rot, neck blast & RTD and moderately resistant to GLH, PH & stem borer	All Zones
Mulagabhoru (TTB103-21-1)	-	135	4.60	*Sali* in multiple cropping situation	Tolerant to blast, brown spot & sheath blight	All Zones
TTB 303-18-3 (Chakra lahi)	-	138	4.76	*Sali* with waterlogged situation up to 50 cm	Resistant to brown spot; MR to blast & BLB; tolerant to sheath blight & stem borer	UBVZ, NBPZ, LBVZ & BVZ
TTB 303-2-23 (Diphalu)	-	137	5.11	*Sali* with waterlogged situation up to 50 cm	MR to blast, brown spot, BLB & Sheath blight; tolerant to stem borer	UBVZ, NBPZ, LBVZ & BVZ
TTB 303-1-42 (Dhansiri)	-	139	4.84	*Sali* with waterlogged situation up to 50 cm	MR to brown spot & sheath blight; tolerant to blast, BLB & stem borer	UBVZ, NBPZ, LBVZ & BVZ
TTB 303-1-26 (Manah)	-	138	4.66	*Sali* with waterlogged situation up to 50 cm	-	UBVZ, NBPZ, LBVZ & BVZ
Swarna Sub1 (IR 82809-237)	-	145-150	4.5-5.0	Survives up to 12 days of complete submergence	-	All Zones
BR 11 Sub1	-	150	4.5-5.0	Submergence tolerance for 10-12 days (Flash flood situation)	-	All Zones
Ranjit Sub1	2018	145-150	5.5-6.0	*Kharif* (withstand 10-12 days of submergence)	Moderately resistant to neck blast; tolerant to stem borer and moderately resistant to BPH	All Zones

Bahadur Sub1	2018	140-145	5.5-6.0	*Kharif* (withstand 10-12 days of submergence)	Moderately susceptible to brown spot, bacterial leaf and sheath blight;tolerant to stem borer & moderately resistant to BPH	All Zones
AAU-TTB Dhan 40 (Dholi)	-	130	5.0-5.5	Submergence tolerance up to 12 days		All Zones
Numoli	2020	130-135	5.0-5.5	*Kharif*	Moderately susceptible to leaf blast, grain discoloration, neck blast, brown spot, sheath blight,BLB and sheath rot; moderately resistant to RTD, GLH, PH, stem borer and WM; tolerant to leaf folder, brown PH, gall midge and WBPH	All Zones

Rice hybrids recommended

Varieties	Adaptation	Zone for which recommended	Grain yield (t/ha)	Disease & pest reaction
NK 5251	*Kharif*	UBVZ, NBPZ & LBVZ	5.19	Resistant to blast, GM; moderately resistant to SB
CRHR 5	*Kharif*	UBVZ, NBPZ & LBVZ	6.10	Moderately resistant to BL, BLB & SB
PAC 835	*Kharif*	UBVZ, NBPZ & LBVZ	5.83	Moderately resistant to BL, BLB & SB
US 312	*Kharif*	UBVZ, NBPZ & LBVZ	5.90	Resistance to blast, GM; moderately resistant to SB
PA 6444 Gold	*Kharif*	UBVZ, NBPZ & LBVZ	5.80	Resistance to GM and BLB; moderately resistance to

* Refer to page iii for full forms of agro-climatic zones

Seed Selection:

Put the seeds in plain water, stirred well, sunken seeds are selected and the floated ones are rejected.

Seed Treatment:

A. Wet Method: After selection, the seeds should be soaked directly in the following fungicidal suspensions for 24 hours. One litre of fungicide solution is required to treat one kg of seed.

Fungicide	Dose (g/kg seed/lit of water)
Carboxin	2.0

Treated seeds should be kept for incubation for 48hrs.

B. Dry method for dry sowing: As mentioned in case of Direct seeded normal *ahu* rice.

RAISING OF SEEDLINGS:

A. Normal practice:

a) Preparation of seedbed: Land is thoroughly puddled and seedbeds of 10 m length and 1.25m breadth are prepared with 30 cm gap in between the beds. The length of the bed may vary according to convenience.

b) Manures and Fertilizers: In each seedbed 20-30 kg cow dung/compost, 80 g urea, 80g SSP and 40g MOP are to be applied and mixed well with the soil.

c) Seed rate: Well germinated seeds are to be sown @ 650g to 1kg per bed depending on grain size. Requirement of seed for transplanting one hectare of main field is 40-45 kg.

d) Water Management: Irrigation water should be applied in furrows to maintain saturated condition in the surface soil of the nursery bed. However, standing water to a depth of 2-3 cm should be maintained at least 2-3 days before uprooting.

e) Plant protection in seedbed:

- As soon as one or two blast spots are seen, Ediphenphos @ 1 ml/lit of water is to be sprayed.
- **Root knot nematode**: Apply, *Pseudomonas fluorescens* @ 20g / sq. m at the time of sowing

B. Mat nursery for mechanical transplanting:

The success of mechanical transplanting (i.e. using self-propelled rice transplanter or manually operated mechanical transplanter) depends upon the quality of seedling. Therefore, all care should be taken to prepare good quality mat nursery. Preparation of mat nursery is described below:

a. Materials required: Polythene sheet, wooden or iron frame, well pulverized & well-sieved soil, FYM, sprouted and treated paddy seed.

b. Preparation seed: Seeds are treated as per recommendation and kept immersed in water for one night in a jute bag. Seed bags are taken out of water and kept in open air for sufficient period till the length of sprouting becomes 1-2 mm. Lumps if any are broken gently to ensure uniform distribution.

c. Dimension of plot to accommodate seedling: A leveled plot of land free from any undulation and grass, etc. should be selected to accommodate seedling bed. Three numbers of beds, with effective length of 16 m and effective width of 1 m, each are needed to prepare seedlings for 1 ha of cropped area. The dimension of the plot

should be selected as per the seedling requirement.

d. **Frame:** Removable frame is used to ensure uniform mat size. The dimension of the mat frame should be equal to the dimension of the tray of the machine. Wooden bar or mild steel bar (2.5 cm × 0.3 cm) may be used as the boundary of the frame.

e. **Preparation of soil cow dung mixture:** The soil crushed and sieved (particle size less than 4 to 5 mm) is mixed with FYM in the ratio of 2 : 1. The FYM is also crushed to ensure homogenous mixture. The mixture should be free from stone or any other foreign objects.

f. **Preparation of seedling bed:** Polythene sheets (130 cm × 1650 cm) are placed on the selected plot of land. The frames are placed over the polythene sheet such that clear width remains 100 cm. Pulverized soil-FYM mixture is used to fill up the frame over the sheet to have a bed dimension 100 cm × 1600 cm × 1.5 cm. Wooden mallet may be used to level as well as to provide mild compaction to the soil-FYM mixture.

g. **Sowing of sprouted seeds:** Sprouted seeds are uniformly sown in the soil bed at the rate of about 1 kg/sq.m. Beds are sprinkled with water after sowing.

h. **Water management:** Beds are covered with light jute bag or straw and water should be sprinkled on the bed for 4 days under covered condition so that soil never dries. The covers are removed after four days. The sprinkling of water may need to be continued up to one week. After about one week seedling would attain some height and water may be applied by flooding. The depth of water should be half of the seedling height.

i. **Uprooting of seedlings:** Seedlings become ready for transplanting when its height becomes 15 cm with 3 to 4 leaves. The seedling mats are then cut into pieces to be used for transplanter.

j. **Field preparation**: Field should be prepared thoroughly by ploughing 4 to 5 times followed by harrowing and laddering. Ploughing should be started at least 21 days ahead of transplanting so that weeds are dried up/decayed.

Land preparation by bullock drawn modified helical blade puddler:

Modified helical blade puddler is an improved bullock drawn implement of puddling operation. The weight of the implement is about 26 kg and it covers about 50 cm in one pass. It can be operated by all types of bullocks available in Assam. One or two passes of puddler operation followed by one pass of mould board plough are sufficient for obtaining good quality puddle soil. The puddler can cover 2 to 2.5 bigha of land per day.

Considerations for efficient use of the modified helical blade puddler:

The well ploughed field should be covered with water at the time of puddler operation. To protect the sharpness of the blade the implement should never be operated over stones or hard ground. At the end of its operation the puddler should be properly cleaned and stored dry. Painting is advisable to avoid rusting.

Manures and Fertilizers:

Well rotten FYM or compost @ 10 t/ha has to be applied during field preparation. In addition, the following nutrients are to be applied at rates given below in areas with moderate fertility level.

Nutrient	Requirement (kg/ha)	Form	Fertilizer requirement	
			kg/ha	kg/bigha
A. Semidwarf varieties				
N	60	Urea	132	18
P_2O_5	20	SSP	125	17
K_2O	40	MOP	66	9
B. Tall varieties:				
N	20	Urea	44	6
P_2O_5	10	SSP	62	8
K_2O	10	MOP	16	2

In case of poor soil, the rates of fertilizers may be required to increase to the extent of 60 : 30 : 30 kg/ha N, P_2O_5 and K_2O respectively.

Diammonium phosphate (DAP) in combination with rock phosphate or alone at the recommended nutrient level (40 : 20 : 20) can be applied.

In monocrop *sali* areas of Barak Valley Zone, sowing of *dhaincha* is recommended as green manuring crop before *sali* rice.

The optimum doses for NPK for HYV of *sali* rice is 60 : 20 : 40 and 60 : 20 : 20 for low and medium fertility classes of soil respectively in Hills zone.

Time of Application of Fertilizers:

a) For short duration varieties (100-120 days).

i) Half of urea and whole of super phosphate and muriate of potash should be applied at the time of final puddling. In standing water, urea along with super phosphate and muriate of potash can be applied in pallet form.

ii) Second dose (half) of urea should be applied at the time of panicle initiation stage.

b) For medium and long duration varieties (120-150 days):

i) Half of urea and entire quantity of super phosphate and muriate of potash should be applied at the time of final puddling.

ii) Of the remaining part of urea, half at tillering stage i.e. 20-30 days after transplanting and other half at panicle initiation stage should be applied.

iii) For long duration varieties under rainfed lowland situation with water depth between 30-50 cm, basal incorporation of prilled urea at 30 kg N/ha is recommended.

iv) Split application of potassic fertilizer half as basal and half at maximum tillering stage is recommended for North Bank Plain Zone.

N.B.

i) Urea should be applied by mixing with moist soil in 1 : 10 proportion i.e. 1 part of urea with 10 parts of moist soil and incubate for 48 hours.

i) In case single super phosphate is not available diammonium phosphate (DAP) may be used with appropriate adjustment with urea.

iii) In the case of non-availability of single super phosphate in time, application can be delayed up to 30 days of transplanting.

iv) Standing water, as far as practicable, should be drained out before application of fertilizer.

v) In case bacterial leaf blight symptoms appear, stop top dressing of urea.

OR

Mixed Fertilizers: Granular mixed fertilizer of 15 : 15 : 15 grade can also be used to meet the NPK requirement of rice crop. 133 kg/ha (19 kg/bigha) of 15 : 15 : 15 grade mixed fertilizers will be equivalent to 20 : 20 : 20 kg/NPK/ha (3 : 3 : 3 kg/bigha) which is to be supplemented by top dressing of 45 kg/ha urea to give 40:20:20 kg/ha (6 : 3 : 3 kg/ bigha) of NPK. Half the dose will give 20 : 10 : 10 kg/ha (3: 1.5 : 1.5 kg/bigha) of NPK.

Recommendation for use of Rock Phosphate (If super phosphate is not used):

1. For raising two successive rice crops i.e. *ahu* followed by *sali* 60 kg P_2O_5/ha (300 kg/ ha MRP) should be applied at least 20 days ahead of *ahu* transplanting
2. For monocrop rice apply 30 kg P_2O_5/ha (150 kg as rock phosphate) at least 20 days ahead of ahu transplanting.

Application of FYM as per recommendation helps in rapid release of phosphorus from this source.

Use of Azolla to Supplement Nitrogenous Fertilizer:

Inoculate 500 kg of fresh Azolla/ ha in the field after transplanting. Allow it to grow for 2-3 weeks to cover the water surface. After coverage, either incorporate to the soil or allow it for self-decomposition.

To obtain 500 kg fresh Azolla, add 16 kg inoculum to an area of 400 cm water surface and allow it to grow for 3-4 weeks. Depending on the growth of Azolla, top dressing of nitrogen could be avoided.

OR

Integrated nutrient management:

Integrated nutrient management (INM) package of organic manure @ 1 t/ha (on dry weight basis) mixed inocula of *Azospirillium amazonense* A-10 and *Bacillus megaterium* P-5 @ 4 kg/ha (0.4 to 0.5 kg/bigha), rock phosphate @ 10 kg P_2O_5(56 kg/ha or 7.5 kg/bigha), MOP @ 40 kg K_2O/ha (67 kg Potash/ha or 9 kg/bigha) is recommended for rice in rice-rice, rice-legume-rice and sole rice sequence.

In low land *kharif* rice (Sali), incorporation of 45 days old dhaincha can substitute 50% of recommended NPK in Hills Zone.

Method of application of bio-fertilizer: Same as Normal *ahu*.

Potash Solubilizing Bacteria for K Nutrition in rice:

Apply consortia of potash solubilizing bacteria (*Bacillus proteolyticus* + *Serratia liquifaciens*) @ 3.5 kg/ha or 500 g/bigha as seedling root dip treatment with NPK @ 60:20:20 Kg/ha

Zinc Solubilizing Bacteria for Zn Nutrition in rice:

Apply Zn solubilizing bacteria (biofertilizer) @3.5 kg/ha or 500 g/bigha as seedling root dip treatment in Zn deficient soils for rice along with recommended NPK.

Application of boron and zinc:

In rice–toria sequence, applyboron as basal @1.5 kg / ha (15 kg borax/ha or 2 kg borax/bigha) + Zinc @ 5 kg /ha (25 kg zinc sulphate heptahydrate/ha or 3 kg zinc sulphate heptahydrate/bigha) along with recommended NPK for rice.

Foliar application of boron:

In late planted sali rice, spray 0.4 ppm boron (2.3 mg boric acid per litre of water) at the initial stage of flowering to reduce spikelet sterility and increase grain yield. For one hectare 100 litres of solution is required.

FERTILIZER RECOMMENDATIONS AS PER FERTILIZER PRESCRIPTION EQUATIONS (FPE)

Fertilizer prescription equations can be used to find out the amount of NPK fertilizers required to obtain a certain yield target of the crop based on soil test values for NPK. The FPEs can be used under cultivation practices where only chemical fertilizers are used and where chemical fertilizers + FYM/Vermicompost/Enriched compost etc. are applied. The FPEs are valid for different varieties of the same crop having not more than 15% variations in yield. The amount of NPK fertilizers will vary according to yield target and soil test values. Yield targets must not cross the potential yield of a particular crop.

FERTILIZER PRESCRIPTION EQUATIONS (FPE) FOR HIGH YIELDING VARIETY OF WINTER RICE

Only Chemical Fertilizers

FN = 5.22 x T - 0.75 x STVN

FP = 0.67 x T - 1.64 x STVP

FK = 5.12 x T - 1.70 x STVK

Chemical Fertilizers + FYM

FN = 5.22 x T - 0.75 x STVN - 0.11 x OM

FP = 0.77 x T - 1.64 x STVP - 0.10 x OM

FK = 5.12 x T - 1.70 x STVK - 0.30 x OM

where, FN, FP, FK-Fertilizer N, P_2O_5, K_2O; STVN, STVP, STVK-Soil Test Values for N, P_2O_5, K_2O, T-Targeted yield, OM- Organic component (FYM, Vermicompost, Enriched Compost etc).

Ready Reckoners for two yield targets and two FYM levels for this equation are given in Appendix-XIV a & XIVb

Age of seedlings and spacing for Normal *sali*

Varieties	**Age of seedlings (**days)	**Spacing (cm)**
1. Short and medium duration varieties (upto 120 days)	25	20 × 15
2. Medium long duration varieties (beyond 120-130 days)	30-35	20 × 15
3. Long duration varieties (beyond 130 days)-		
*Pankaj	30-40	20 × 20
Mashuri	35-40	25 × 20
Manohar Sali and other tall varieties	35-45	25 × 25
Ranjit	35-40	25 × 20
Bahadur	35-40	25 × 20
Kushal	35-40	25 × 20

*Transplanting of Pankaj seedlings can be delayed up to 60 days from the date of sowing (i.e. transplanting around 20th Aug.) in BVZ.

Age of seedlings and spacing for late *sali* (transplanted):

Varieties	**Age of seedlings (days)**	**Spacing (cm)**
1. Short and medium duration varieties (upto 110 days)	20-25	10 × 15/ 15×15
2. Medium long duration varieties (beyond 120-130 days)	30-35	20 × 15
3. Long duration varieties (beyond 130 days)-		
Mashuri	35-40	25 × 20

Manohar Sali and other tall varieties	35-45	25 × 25
Prafulla	30-80	20×15
Gitesh	30-60	15×15/20×15

N.B.: For late transplanted crop fertilizers @ 40 : 20 : 20 kg/ha of N, P_2O_5 and K_2O respectively should be applied as basal

Number of Seedlings per Hill:

i) 2-3 seedlings for normal planting (July – August)

ii) 4-6 seedlings for late planting (September).

Depth of Planting: 4-5 cm depth of planting should be maintained for all varieties.

Interculture:

i) Two weedings should be given with paddy weeder or hoe at 20 and 40 days after transplanting.

ii) For weed control: Pretilachlor @ 0.75 kg/ha or Anilofos is to be applied @ 0.4 kg/ha at 3 days after transplanting.

Water Management:

In s*ali* rice, application of 5 cm irrigation water 3 days after disappearance of ponding water is recommended in medium and heavy soils.

In rainfed *kharif* rice, height of bunds should be 30 cm to retain rain water for higher yield of rice as well as to conserve residual moisture for better yield of succeeding relay crops.

Plant Protection Measures in the Field:

The most common pests are thrips (in the seedbed) stem borer, hispa (in endemic areas of Sivasagar, Cachar, Karimganj and Kamrup districts), swarming caterpillar and gall midge. Amongst the diseases, blast, sheath blight and bacterial leaf blight are most common. Close surveillance is necessary for timely control of the pests.

A. Insect pests:

i) Plant protection measures should be adopted against insect pests at their economic threshold levels as given in Table 1.

ii) Bio-control measures against stem borer and leaf folder: 6-8 releases of *Trichogramma japonicum* @ 50,000 Nos./ha/week (6700 Nos. /bigha) starting from 30 days after transplanting gives significantly good control (30-60% parasitization) of rice stem borer and leaf folder. The performance of *Trichogramma* is at par with the chemical control in respect of control efficiency as well as economic benefits.

Since *Trichogramma* is an egg parasitoid, it's releases should have coincided with

the egg laying activity of the pest. Timely releases are crucial. Releases should be made over the entire infested area throughout the egg laying period of the pests, which results in uniform and effective control**.**

Method of application: Each 'Trichocard' is to be cut into 6-12 pieces and distributed over the entire field by fixing them to the plants by using a stapler or adhesive. The parasitoids emerging from these disperse themselves.

To control rice pests, erect 50 'T'-perches per ha 2 ft (60 cm) above crop canopy as roosting site for insectivorous birds, which are to be removed before flowering in order to prevent activity of granivorous birds

Bio-intensive IPM Package: Bio-control based IPM against foliar (Leaf folder, Rice hispa, Case worm), borers (Rice stem borer) and sucking pests (Green leaf hopper, Rice bug, Mealy bug, Thrips) pests, the following measures is to be followed.

i) Two sparys of NSKE-5% (4 ml/lit) at 30 and 55 DAT against foliar and sucking pest

ii) Erection of T-perches (bird perches) @ 50 Nos./ha (7 Nos/bigha). T-perches should be placed 2 ft (60cm) above crop canopy as resting site for insectivours birds, which are to be removed before flowering in order to prevent activities of grainivorous birds.

iii) Six releases of *Trichogramma japonicum*@ 50,000 Nos./ ha (6700 Nos. /bigha) at 10 days interval starting from 25 DAT against rice stem borer and leaf folder.

B. Diseases:

i) Blast:

a) Grow tolerant varieties, *viz*. Monohar Sali, Prasad, IR 36, Pankaj

b) Treat the seed as explained under seed treatment.

c) Monitoring of blast is most important to schedule spraying. Observe the top five leaves and if 5% leaf area is damaged take resort spraying. Normally three sprays can control the disease. Spray hexaconazole 5EC @ 2ml/lit of water at tillering stage (30 days after sowing) and subsequently give two sprays of edifenphos @ 1 ml/ lit of water at panicle initiation stage and when the tip of panicle just comes out.

ii) Bacterial leaf blight: Grow tolerant varieties, *viz*. Lakhimi and Mahsuri

iii) Sheath blight:

a) Two sprays of hexaconazole 5EC (2ml/lit) should be given, first at the appearance of symptoms and the other at 10 days after the first spraying.

b) Spraying of two commercial plant-derived Cymbopogon products @ 5 ml/lit and Neem based fungicide @ 3 ml/lit is recommended for management of sheath blight disease of rice. The first spraying should be given as soon as symptom of the disease is observed in the field followed by a second spraying at 10-12 days interval.

iv) Brown spot disease:

Dry or wet seed treatment with Carboxin 2g/kg of seed followed by one spraying of ediphenphos @ 1 ml/lit at initial symptom development stage is recommended for managing brown spot disease.

v) Bakanae disease:

a) Soak the seeds for 24 hrs. in a suspension of carboxin @ 2g/lit of water.

b) Rogue out the infected tillers (elongated) from infected hills.

Management of Direct Seeded Late *Sali*:

a. Field should be prepared just after recession of flood by ploughing, cross ploughing and laddering to bring it to a puddle condition.

b. Sprouted seeds should be sown in lines 20 cm apart.

c. A seed rate of 75 kg/ha should be maintained.

d. Need based fertilizer application is advocated.

e. Pre-emergence herbicide pretilachlor @ 0.75 kg a.i./ha should be applied 2-3 days after sowing.

f. Wherever water management is possible, two irrigations at PI and flowering stages are recommended.

C. Rodent Pest Management

For rodent pest management in rice, baiting with bromadiolone (0.005%) at panicle initiation stage followed by local bamboo traps (*Endur chitap*) @ 30 traps/ha (4 traps /bigha) at milky stage should be used which gives up to 65-70% reduction in rodent population.

D. Storage insect pest management:

Application of chlorantraniliprole 20SC @ 2 ppm a.i. (0.01 ml/kg seed) gives effective protection of stored paddy seed against storage insect pests for up to 9 month without affecting germination.

CONTINGENCY PACKAGE OF PRACTICES ON RICE FOR CHRONICALLY FLOOD AFFECTED AREAS

A. Raising Community Nurseries: Community nurseries may be raised to meet the seedling requirement of flood affected areas. Community nursery may either be raised by the farmers of flood affected areas in non-flood prone or high lands or by other farmers from flood free areas to help distressed farmers.

1. Varietal Selection: Select recommended varieties for late planting having wide flexibility in respect of seedling age and transplanting time under the following situations.

a) In occasionally flood affected areas if flood recedes early and rice can be transplanted bymidAugust, use varieties *viz*., Kushal, IET-6666, Pankaj, Biraj,

Anderw Sali, Solpona, Gitesh and Prasadbhog.

b) In chronically flood affected areas where flood is expected to recede by the last part of August, varieties like Andrew Sali, Biraj, Monohar Sali, Kmj-1-19-1, Luit, Kapilee, Dum Sali, Gitesh and Prafulla should be selected. In absence of these varieties any traditional photoperiod sensitive coarse grain *sali* variety can be used.

c) In areas where transplanting is not possible before mid September, extra early varieties such as Luit, Kapilee, Culture-1, Heera and Disang should be selected.

2. **Seedbed preparation:** Seedbed should be initially ploughed with addition of adequate FYM/compost. The Flat beds may be selected and a gap of 30 cm (1 ft.) may be left at an interval of every 1.25 m (4 ft.) as passage between the beds. Beds within the strip should be well levelled Chemical fertilizers @ 500 g urea, 500 g SSP and 250 g MOP for the area should be used to transplant one bigha of land should be applied at the time of final puddling. Strip beds to be made after levelling the field.

3. **Seed Rate:** About 10 kg seeds are needed to transplant 1 bigha of land i.e. ten strips of 10 m × 1.25 m size @ 1 kg seed/bed.

4. **After care:** The gap of 30 cm may be converted into channels one week after sowing for draining out excess water during heavy showers and to supply water to the channels to keep the raised beds moist in the event of drought.

5. **Transplanting:** Transplanting may be done at a convenient time particularly soon after flood recession. It is to be noted that moisture stress is a common feature after flood recession in flood affected areas.

6. **Plant population:** Closer planting is essential in case of late planting since tiller development is checked due to emergence of non-effective tillers. In case of modern varieties 36 hills/sq.m (20 cm × 15 cm) and in case of tall varieties 25 hills/sq. m (20 cm × 20 cm) are to be maintained.

7. **Seedlings/hill:** In late planting situations, the only option to have maximum panicles per unit area is from that of the main culm and primary tillers. Therefore, 6-8 seedlings per hill may only yield 18 panicles per hill, as the growth phase of the rice plant almost expires in the seedbed.

8. **Fertilizer:** In chronically flood affected areas where high silt deposition occurs; there may not be any need for fertilizer application. However in occasionally flood affected areas irrespective of varieties, a basal application of fertilizer should be done. The fertilizer doses are 40 : 20 : 20 or 20 : 20 : 40 N, P_2O_5, K_2O) as the case may be.

B. Double Transplanting: Double transplanting is a method for seedling multiplication under seedling scarcity condition. Traditional or improved varieties may be transplanted during July with closer spacing of 20 × 10 cm (50 hills/sq.m) and each tiller developed may be separated and planted once again, which fulfills the seedling requirement by 5-7 times.

1. **Varietal Selection:** Traditional or improved varieties with long duration (150 days or more) having photoperiod sensitivity, should be selected.
2. **Sowing:** Sowing should be done during early part of June in well prepared seedbeds as indicated earlier.
3. **First transplanting:** Transplanting should be done in early part of July with 25-30 days old seedlings. About 50 hills/sq.m (20 cm × 10 cm) is to be maintained during first planting. Fertilizers @ 20 : 10 : 10 kg/ha is to be applied for rapid and healthy tiller development.
4. **Second transplanting:** Uprooting should be done at 25-30 days after the first planting and each tiller may be separated and re-transplanted with a single tiller/hill. In case of further delay however, 3-4 tiller/hill may be planted with closer spacing. In flood affected areas, there is no need of any fertilizer application in second transplanting if planting is delayed beyond August and fertilizer is added only in first planting.

C. Direct Seeding (Wet Sowing): This is an effective and remunerative method of rice cultivation in flood affected areas after recession of flood. In general very short duration or extra-early (less then 100 days), such as Luit, Kapilee, and any traditional photo period sensitive coarse grain varieties are suitable for wet sowing in the main field.

Seeds @ 75 kg/ha are to be soaked for 24 hours and incubated for 24-48 hours for sprouting. In the meantime the field has to be puddled with minimum tillage and levelled properly by laddering to ensure uniform moisture retention. Sprouted seeds are then broadcast uniformly on to the puddled and levelled field after application of basal dose of fertilizer @ 40 : 20 : 20 kg/ha. Nitrogen should be applied in 2 splits, *viz*., top dressing at 20 days after sowing and at 45-50 days after sowing. Only P and K are to be applied as basal dose.

Direct seeding of sprouted seeds on puddled soil can be done at any convenient time after flood recession upto September 10. The main drawbacks of this system are:

Water management as moisture stress is a common problem after flood recession. Late sowing may result in spikelet sterility if temperature falls early.

SPECIAL PACKAGE FOR LOW AND DELAYED RAINFALL AREAS OF UPPER BRAHMAPUTRA VALLEY ZONE

I. PRE SOWING OPERATION: Follow ploughing after harvest of rice in light soil either with tractor or M.B. plough for moisture conservation.

II. VARIETAL SELECTION:

A. Direct Seeded *Ahu*:

a) Traditional variety for early *ahu.*

b) Lachit, Chilarai, Luit, Kapilee, Govind, Rasi and other recommended varieties for regular *ahu*.

B. Direct Seeded Rice (*Kharif*): Use modern recommended varieties.

C. Transplanted *Sali* Rice:

i) As per recommendation for normal situation.

ii) Varieties that can be grown up to August 15 with 45-50 days old seedlings: Pankaj, Kushal, Lakhimi

iii) Varieties that can be grown upto the end of August with 60 days old seedlings: Luit, Kapilee and traditional varieties.

III. SEEDLING RAISING:

i) Treat the seeds with 4% MOP (KCl) (600 ml/kg of seed) for 24 hours, dry in shade for 24 hours and sow.

ii) Prepare dry, well bunded, flat seedbed with adequate FYM (30 kg), 80 g urea, 80 g SSP and 80 g MOP per bed size of 10 m × 1.25 m.

iii) Under zero tillage condition, mulch with dry FYM powder upto 2 cm thickness and keep the beds moist.

IV. APPLICATION OF FERTILIZERS:

1. If drought situation appears, top dress additional quantities of MOP @ 5 kg/bigha and incorporate it.
2. Spray 2% muriate of potash solution on leaves if and when drought appears.
3. Top dressing of urea may be delayed upto heading if drought prevails at the stage of top-dressing. Other recommendations will be as per Package of Practices.

PEST MANAGEMENT PRACTICES IN ENDEMIC AREAS WITH SPECIAL REFERENCE TO RICE HISPA

a) Destruction of initial population.

b) Destruction of alternate hosts (*Dol, Uridol* etc.)

c) Burning of stubbles after harvesting.

d) Deep ploughing during Feb- April.

e) Monitoring at regular intervals.

f) Avoidance of staggered planting.

g) Seedbed treatment or root dip treatment.

h) Clipping of leaf tips before planting

i) Use recommended insecticides at proper dosage and spray volume. Add 1% urea and 2% potash to spray fluid.

j) Planting of moderately resistant varieties.

k) Spray 1% neem seed oil using sticker (23 g/litre).

For more details of pest management practices against rice hispa, refer to page132.