

# GRAIN CROPS

## RICE

To exploit the yield potential of the existing rice varieties efficient management and adoption of appropriate technology is essential. To achieve this objective of harvesting high yield and judicious use of inputs, following improved practices are recommended:-

**Climatic Requirement:** Rice is basically a crop of humid tropics, but it varies widely in physiological adaptability, hence grown successfully both in tropical and temperate conditions upto an altitude of about 2250 m above sea level. It is normally grown where rainfall during the crop season is around 650 mm or more. Under sub-tropical conditions of Jammu division, it is grown during *Kharif* season where the temperature at sowing is higher (30°-35°C) and slowly declines until maturity. Temperature beyond 30°C with high light intensity affects fertilisation and grain filling. Moderately high temperature is congenial for vegetative growth, whereas the blossoming stage benefits from slightly lower temperature (22°-25°C).

**Soil Requirements:** Rice grows under varied soil conditions. Clay to clay loam soils, which turn into soft mud when puddled and develop cracks on drying, are most suitable for its growth. The rice soils with high percolation rate reduce the water use efficiency considerably. Therefore, rice cultivation needs careful attention in such soils.

**Varieties:** The following high yielding varieties of rice are recommended for different situations

S.No.	Group	Variety	Remarks
1.	Early	IET 1410	It is an early maturing variety, which matures in 115-120 days. It is recommended for sub-tropical areas of Jammu, Kathua, Udhampur and Rajouri districts under assured irrigation

2.	Medium	1. Ratna 2. Tawi (PC-19)	Medium duration varieties mature in 120-125 days and are recommended under assured irrigation conditions.
3.	Late	1. Jaya 2. PR-113 3. RR-8585 4. KHR-2 (Hybrid) 5. PHB-71 (Hybrid)	The late maturing varieties-mature in 135-140 days and are suitable for sub-tropical areas of Jammu and Kathua districts under assured irrigation conditions.
4.	Rainfed	China-1039 K-39 (SKAU-5)	These are recommended up to 1200 m elevation under rainfed conditions.

### Promising rice based cropping systems

#### 1. Early rice based cropping systems

a.	Rice IET -1410 (1 <sup>st</sup> June to 25 <sup>th</sup> June transplanting)	Toria local (3 <sup>rd</sup> week of September)	Wheat late sown variety (2 <sup>nd</sup> week of December)
b.	Rice IET -1410 (1 <sup>st</sup> June to 25 <sup>th</sup> June transplanting)	Potato: K-Sindhuri (3 <sup>rd</sup> week of September)	Wheat late sown variety (2 <sup>nd</sup> week of December)
c.	Rice IET -1410 (1 <sup>st</sup> June to 25 <sup>th</sup> June transplanting)	Potato: K-Sindhuri (3 <sup>rd</sup> week of September)	Moong /Mash Summer fodder PS-16 /Pant Jowar PS-7 / U-26 Cowpea (15 <sup>th</sup> March-15 <sup>th</sup> April) (15 <sup>th</sup> March-15 <sup>th</sup> April)
d.	Rice IET -1410 (15 <sup>th</sup> June to 15 <sup>th</sup> July)	Mustard: RLM-198 (2 <sup>nd</sup> fortnight of October)	Fodder (Mid March onwards)
e.	Rice IET -1410 (15 <sup>th</sup> June to 15 <sup>th</sup> July)	Berseem (Mid September to end October)	—
f.	Rice IET -1410 (1 <sup>st</sup> week of June)	Cauliflower: Snowball (Mid October)	French beans: Contender (Mid February)

## 2. Medium rice based cropping systems

a.	Rice (15 <sup>th</sup> June to 15 <sup>th</sup> July transplanting)	Wheat timely sown variety (7 <sup>th</sup> November to 21 <sup>st</sup> Nov.)	
b.	Rice (15 <sup>th</sup> June to 15 <sup>th</sup> July transplanting)	Wheat timely sown variety (7 <sup>th</sup> November to 21 <sup>st</sup> Nov.)	Moong: PS-16 or PS-17 (15 <sup>th</sup> April to 21 <sup>st</sup> April)
c.	Rice (15 <sup>th</sup> June to 15 <sup>th</sup> July transplanting)	Berseem (Mid September to End October)	
d.	Rice PC-19 (1 <sup>st</sup> week of June)	Peas: Arkal (Mid October to mid November)	Maize for cobs (Mid February)

## 3. Late rice based cropping system

a.	Rice (1 <sup>st</sup> June to 30 <sup>th</sup> June)	Wheat (7 <sup>th</sup> Nov. to 21 <sup>st</sup> Nov.)	
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## 4. Rainfed rice based cropping systems

a.	Rice (with the 1 <sup>st</sup> monsoon shower up to last week of May)	Wheat (Nov. sowing)	
b.	Rice (with the 1 <sup>st</sup> monsoon shower up to last week of May)	Mustard / Gram / lentil (2 <sup>nd</sup> fortnight of October)	

**Seed Rate:-** Use 40 kg of seed per hectare for fine varieties such as IET-1410, Ratna and Tawi (PC-19) and 40-45 kg per hectare for coarse varieties such as China-1039, K-39 and Jaya. For direct sowing, 75 kg of

seed per hectare is recommended. For hybrids, use seed rate of 15 kg/ha.

**Seed Treatment:** Before treating the seeds, hand winnowing of seeds with "Chhaj" to remove the false smutted grains is essential. Before sowing treat the seeds with 2.5g of Carbendazim 50 WP or Captafol 7.5g or carbendazim 5.0g + 2.5g antibiotics (based on Streptocycline sulphate + tetracycline hydrochloride) in 25 L of water and immerse 25-30 kg of seed for 12 hours and stir thoroughly after every half an hour. Remove the seeds at the end of 12<sup>th</sup> hour and sow directly.

For dry sowing treat the seed before sowing with Carbendazim @ 2g/kg of seed.

**Sowing Time:**

S.No.	Group	Variety	Optimum seeding period
1.	Early	IET-1410 & China-1039 or K-39	3 <sup>rd</sup> to 4 <sup>th</sup> week of May, however, sowing can be extended upto 3 <sup>rd</sup> week of June.
2.	Medium	Ratna & Tawi (PC-19)	2 <sup>nd</sup> to 3 <sup>rd</sup> week of May, however, sowing can be extended upto 3 <sup>rd</sup> week of June.
3.	Late	Jaya	1 <sup>st</sup> fortnight of May, however, sowing can be extended upto end of May.
4.	Rainfed	China-1039	On 1 <sup>st</sup> shower of Monsoon for direct sowing. For transplanting crop early sowing is preferred.

**Note:** Farmers are advised to use invariably the certified seed to ensure safety from seed born disease.

Use 10% higher seed rate in intermediate to temperate areas for late group.

**Nursery Raising :-**

**1.NURSERY LAND PREPARATION:-** Pulverize and level the soil thoroughly.

**Manuring of Nursery:-** Incorporate 15 kg of well rotten F.Y.M. or Compost, 60g of urea and 50 g of D.A.P. per 10 sq.m.of nursery bed.

or

When F.Y.M. or compost is not available, mix 120g urea and 100g of D.A.P. per 10 sq.m. of nursery bed.

or

When poultry manure is available, incorporate 25 kg of the manure per 10 sq.m. of nursery bed.

**2. PREPARATION OF NURSERY BED:**

- a) **Dry method:** Prepare raised beds 10 to 15 cm high each 1.25 m wide and of any convenient length. Provide channels all around the beds to facilitate irrigation, weeding and drainage. This method is recommended for early sown areas. 1/10 to 1/15th ha area is required for sowing nursery for one hectare of rainfed area and 1/15 to 1/20th ha for irrigated conditions.
- b) **Wet method:** Puddle the field thoroughly. Prepare levelled beds each 1.25 m wide and of any convenient length. This method is recommended for late transplantation areas.

**3. SOWING OF SEED:** Dry method: Sow the seeds in lines 5 cm apart and 3 cm deep. Cover the seeds with a thin layer of soil and irrigate upto 3/4<sup>th</sup> height of the seed bed. Again irrigate after 5 days of germination of seeds and keep water 1 cm deep in the beds. Drain the water occasionally.

**Wet Method:** Sow sprouted seeds uniformly on the wet seed beds. After the sprouts are 1-2 cm long, bed may be kept submerged with a shallow layer of water. Keep the beds free from weeds.

**NURSERY CARE:**

1. Keep the seedlings free from weeds either with hand weeding or by herbicide application i.e. Butachlor 5G @ 30 kg/ha after the emergence of first leaf in sprouted seeds.
2. In low-lying and water logged areas where thread worms and root weevil are the problems, incorporate Lindane 1.3 D @ 25 kg/ha in the soil at the time of last ploughing.
3. Protect seedlings from leaf hopper and stem borer by applying Phorate 10G @ 10 kg/ha or Carbofuran 3 G@ 20 kg/ha in 5-7.5 cm standing water and keep water standing at least for 72

hours after application or carbaryl 50% WP @ 1 kg/ha when there are 5% dead hearts per sq. m.

4. In case of surface hopper (Tidha) attack, dust the crop with Follidal 2% D @ 20-25 kg/ha in 750 L of water.
5. In case of seedling blight, spray the seedlings in the nursery with Zineb @ 1.5 kg/ha in 750 L of water.

**AGE OF SEEDLINGS AT TRANSPLANTING :** To obtain the best results, rice seedlings should be transplanted when they have attained 4 to 6 leaves. Such stage generally comes in early and medium groups of rice varieties IET-1410, China-1039, Ratna and Tawi in 25 days while in late group (Jaya) it comes in 25-30 days of sowing.

Physiological age (4 to 6 leaves/seedling) is more important than chronological age (days after sowing) for obtaining the best results.

**CONTINGENT PLAN FOR DELAYED TRANSPLANTING OF RICE :** In sub-tropical plain irrigated area sometimes it so happens that monsoon rains are delayed and irrigation water from canal becomes insufficient for transplanting of rice in time on large scale. And in some areas, where summer fodder cultivation is done, the land for rice transplantation is vacated late. Under such constraints it calls for contingent plans for delayed transplanting of rice to get economic return for which the following schedule may be adopted:-

S.No.	Variety	Delayed date of transplanting	Age of seedling
1.	IET-1410	Upto 21st July	4 to 5 week old
2.	PC-19	-do-	6 to 7 week old
3.	Jaya	-do-	7 to 8 week old
4.	Basmati-370	1 <sup>st</sup> week of August	7 to 8 week old

#### **LAND PREPARATION:**

1. If possible, grow Dhaincha as green manuring crop 1½ months before transplanting in the field where rice is to be grown. Sow Dhaincha seeds @ 60-65 kg/ha and incorporate full dose of D.A.P. as per recommendations for rice variety to be transplanted. Plough the green manure crop about 7-10 days prior to transplanting of rice seedlings and allow it to decompose in standing water.

2. In case the green manure crop is not grown, plough the land after harvest of wheat crop with Tawi plough (soil turning plough) and keep the soil open for few days. Before transplanting repair all bunds and again plough the land 2 to 3 times with disc harrow or desi plough. Put water in the field and puddle it with puddler/disc harrow to obtain a fine puddle. Incorporate the basal dose of fertilizer during puddling.
3. If well decomposed F.Y.M. or compost is available, incorporate it thoroughly @ 15 tonnes/ha in the soil after 1<sup>st</sup> ploughing and before subsequent ploughings.

**FERTILIZERS:** - For efficient use of chemical fertilizers, get soil tested well in advance of transplanting from the Soil Testing Laboratory and apply the recommended dose of fertilizers to crop accordingly. In absence of such tests following fertilizer schedule is recommended for soil of an average fertility.

S.No.	Variety	Nutrients kg/ ha			
		N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	ZnSO <sub>4</sub>
1.	IET-1410 & K-39	50	30	20	20
2.	China- 1039	40	30	20	20
3.	Ratna	80	40	25	20
4.	Tawi (PC-19)	120	60	25	20
5.	Jaya	120	60	30	20
6.	KRH-2(Hybrid)	120	60	30	20
7.	PHB-71(Hybrid)	120	60	30	20

These plant nutrients can be made available from the following fertilizer combination:

S.No.	Variety	Fertilizer (kg/ ha)			
		Urea	DAP	MOP	ZnSO <sub>4</sub>
1.	IET-1410 & K-39	85	65	33	20
2.	China- 1039	63	65	33	20
3.	Ratna	140	88	40	20
4.	Tawi (PC-19)	210	132	40	20
5.	Jaya	210	132	50	20
6.	KRH-2 (Hybrid)	210	132	50	20
7.	PHB-71 (Hybrid)	210	132	50	20

**Note:-**

- I. Zinc sulphate should be applied wherever deficiency is noticed.
- II. When full dose of phosphate is applied in wheat crop then reduce the quantity of phosphate by 25% to 50% in case of paddy.
- III. Phosphatic fertilizer can be top dressed upto 30 DAT if not applied as basal dose.

**FERTILIZER APPLICATION:**

1. When green manuring has been done the P should be applied to the green manure crop and full doses of K and 60% of the recommended dose of Nitrogen should be applied to the rice crop.
2. When F.Y.M. or Compost (15 tonnes/ha) has been applied, apply half of the recommended dose of N, P and K to the rice crop & rest half will be made available to the crop from the added F.Y.M. or compost.
3. Apply full quantity of DAP, MOP and Zinc Sulphate alongwith 1/3<sup>rd</sup> of N, from Urea at the time of puddling and incorporate fertilizers in the soil thoroughly, alongwith ZnSO<sub>4</sub>, remaining N be top dressed in two equal splits-one at mid tillering stage i.e. 25-30 days after transplanting and the other just before the panicle initiation stage. Drain off the water if possible before top dressing of fertilizer.
4. If in the standing crop yellowing of leaves from tips is noticed at any stage before flowering, the crop may be sprayed with a mixture of 3 g of Zinc sulphate, 15 kg Urea and 1 kg of Zineb/ha in 500 L of water with Knap Sack spray pump
5. In case the Zinc sulphate has not been applied during the land preparation and symptoms of Zinc deficiency are noticed in the standing crop, the recommended dose of Zinc sulphate may be mixed with equal quantity of dry soil and broadcast it in the affected fields.



6. In rice-wheat cropping system, yield stability & improvement in soil health can be brought about with the application of 50% recommended N through inorganic fertilizers and 50% through FYM in rice & 100 % recommended NPK through inorganic fertilizers in wheat.

**TRANSPLANTING:** - When puddle settles, transplant the seedlings 3 to 5 cm deep. Shallow transplanting ensures better establishment of plants and early tillering. Plant 2-3 seedlings per hill.

Following spacings for different varieties are recommended:-

I) Jaya, China-1039 and China-Mutant K-39	20 cm from row to row 15 cm from plant to plant 15 x 15 cm
II) IET-1410, Ratna and Tawi	20 cm from row to a row 10 cm from plant to plant.

**IRRIGATION AND WATER MANAGEMENT:** - Maintain 5 cm water, till 5 days after transplanting. Resume irrigation, when hair size cracks develop on soil surface and then follow alternate wetting and drying till maturity. Stop irrigation three weeks before harvest for uniform and early ripening of the crop.

**INTERCULTURE AND WEED CONTROL:** - To remove weeds and stir the soil, two weedings are important. If the crop has been transplanted in lines, interculture with a rice weeder may be done by running it in between the crop rows i.e. first weeding and hoeing 15 days after transplanting and second operation after a fortnight. In case the crop has not been transplanted in lines, two hand weedings may be given as per above time schedule.

Weeds can effectively be controlled by applying herbicides.

1. Apply Butachlor granules 5 G @ 30 kg/ha. Where there is no problem of stagnation of water in the field apply granules just after transplanting otherwise apply the granules 4 to 6 days of transplanting in standing water 2-3 cm, deep. Do not drain the field for one week after application of granules. Granules should be applied uniformly in well leveled land otherwise desired results will not be achieved.

2. Apply Anilophos + Ethoxy sulfuron @ 0.375+0.015 kg a.i./ha at 10 DAT.
3. Add 3 liter of Butachlor 50 EC in 150 kg of sand and broadcast in standing water within 2 DAT.

**Note:-** Use hand gloves while applying butachlor granules.

**PLANT PROTECTION:-** Rice crop is subjected to the attack of many insect pests and diseases. The pests and diseases cause considerable losses, if not controlled timely.

All the insects and diseases do not occur everywhere and in every field. The type of insect/disease is found according to the agro-climatic conditions suitable for their survival.

The important pests and diseases, which are generally found in Rice crop and their symptoms of attack along with control measures, are given below:

S. No.	Name of insect and symptoms of attack	Insect Management
1.	<b>ROOT WEEVIL (<i>Echinocnemus rhyzae</i>):</b> It is a serious pest in low-lying water logged areas of R.S. Pura, Bishnah and Kathua blocks. The adults are ashy grey in colour. The grubs are white legless and feed on the roots up to 1½ months after transplanting. The attack appears in patches but sometimes whole field is involved. The attacked plants turn yellow, remain stunted and do not tiller. The pest is active from 15th June onwards.	Field infested with root weevil and thread worm should be treated with Lindane 1.3% D or Chlorpyriphos 1.5 D @ 25 kg/ha at the time of field preparation.  OR Apply any of the following granular insecticides in 5-7.5 cm deep standing water 2-3 days of transplanting and do not drain the water for 72 hours.
2.	<b>THREAD WORMS:-</b> These are found clinging with root in the form of clusters Roots do not establish due to their constant movement and thus uptake of plant nutrients by the roots is restricted. The affected plants give sickly appearance, tillering is retarded and growth of plant is checked.	1. Phorate 10 G @ 10 Kg/ha 2. Carbofuran 3 G @ 20 Kg/ha. 3. Lindane 6G @ 25 kg/ha 4. Chlorpyriphos 10G @ 10 kg/ha

3.	<p><b>STEM BORER:-</b> (<i>Scirphaga innotata</i> and <i>S. incertulas</i>): It is a minor pest of rice. The pale yellowish larva with orange head of this insect bore into the stems and cause damage. The affected young plants show dead hearts where as the old ones produce empty ear heads, which turn white and stand erect.</p> <p>The pest is active from July to September</p>	<p>Apply the following granular insecticides:- Phorate 10 G @ 10 kg/ha. or Carbofuran 3 G @ 20 kg/ha. Apply the granules in 5-7.5 cm standing water and do not drain or irrigate the fields for 72 hours of application. Spraying be undertaken when there are 5% dead hearts or one egg mass/sq.m in case of stem borer.</p>
4.	<p><b>LEAF HOPPERS AND PLANT HOPPERS:-</b> These are main pests and cause considerable loss in all rice varieties. The adults of plant hoppers are green. These are active from early July to September. Both adults and nymphs suck cell sap from the leaves and thus plant loses vitality and give a sick look. On their faces shooty mould grows due to which whole of the field look blighted. The insects are also vectors of many diseases.</p>	<p>Spray the crop with Endosulfan 35 EC @ 1.5 L/ha or Methyl parathion 50 EC @ 750 ml/ha in 750 L of water when 5-10 insects per hill upto mid-tillering and there after 20 insects/hill in case of leaf hopper and plant hoppers.</p>
5.	<p><b>RICE HISPA</b> (<i>Di cladispa armigera</i>):- It appears sporadically in all the varieties of rice irrespective of locality. The grubs of this pest mine into the leaves whereas adults are external feeders. The grubs cause damage by producing white streak on leaves. The adults are small, shining oblong and bluish black in colour. It appears generally from beginning of August to September.</p>	<p>i) If attack of rice hispa (grub) is noticed in nursery stage, clip the affected tips of leaves before transplanting. ii) Spray the crop with Quinaphos 25EC 1 L/ha in 750 L of water when there is one adult grub or one damaged leaf/hill. iii) Use Endosulfan 35 EC @ 1.5 L/ha in 750 L of water.</p>
6.	<p><b>GRASS HOPPER:-</b> Both adults and nymphs feed on leaf margins in an irregular fashion in the nursery as well as in the transplanted crop. They also cut developing ear heads. The</p>	<p>i) Destroy eggs by scrapping the top soil bunds of field before monsoon. ii) With the onset of monsoon, spray the bunds within the</p>

	pest is active from June to November.	cultivable area with Methylparathion 2% D or Malathion 5% D @ 25 kg/ha. Repeat the spray after 21 days on need basis.
7.	<b>LEAF FOLDER</b> ( <i>Cnaphalocrocis medinalis</i> ):- The caterpillars feed on leaves and cut them to form tubular cases inside which they live and continue to feed, resulting in appearance of white streaks.	Spray Carbaryl 50% W.P @ 1.5 Kg/ha in 750 L of water or spray the crop with Monocrotophos 36 SL @ 750 ml/ha or Chlorpyriphos 20EC @ 1.5 L/ha.

## II. DISEASES AND THEIR MANAGEMENT

S. No.	Name of disease and Symptoms	Disease Management
1.	<b>BROWN LEAF-SPOT:-</b> Small necrotic spots surrounded by reddish brown circular margins appear on the leaves and grains.	Seed treatment with Carbendazim @ 2g /kg seed Spray the crop with Mancozeb @ 0.25 or Hinosan @0.1% at the appearance of disease.
2.	<b>BACTERIAL LEAF BLIGHT:-</b> Greenish yellow stripes appear along the leaf margins and extend both length & breadth wise. The leaf starts drying from the tip, becomes white and in server cases, dries up completely. In Jammu division the disease is invariably noticed at the flowering stage.	On appearance of disease, drain the field. Then irrigate with fresh water after four days. Avoid field to field irrigation. Delay the application of urea. Soak the seeds for 12 hr in solution of Streptocycline (2.5g) + Copper oxychloride (25g)/ 10L of water. Spray the crop with Streptocycline (100g) + Copper oxychloride (500g) in 500 L of water at appearance of disease.
3.	<b>BACTERIAL LEAF STREAK:-</b> Small translucent streaks appear in the inter venial areas of the leaf. The streaks gradually extend in size and turn reddish when plant is near maturity.	Same control measures as above under Bacterial Leaf Blight.

	In severe cases plants dry up and fields give a burnt appearance.	
4.	<b>SHEATH BLIGHT:-</b> Causes spots on leaf sheath. Spots are ellipsoid or ovoid at beginning and enlarge afterwards. Centre of spot is greyish white with brown margins. Sclerotia are formed on or near the spot. In field the spots are usually observed near waterline.	<ol style="list-style-type: none"> <li>1. Seed treatment with Carbendazim @ 2g /kg seed</li> <li>2. Spray with Carbendazim @ 0.1 % at appearance of disease &amp; at Boot stage.</li> <li>3. Follow the crop rotation.</li> </ol>
5.	<b>SHEATH ROT: -</b> Rot occurs on upper most leaf sheaths enclosing young panicles. Lesions appear oblong to irregular with brown margins and grey centers or grayish brown throughout. Lesions coalesce, whitish powdery growth may be seen in the affected sheaths and young panicles are rotted.	As for sheath blight.
6.	<b>FALSE SMUT: -</b> The disease so far not considered as a serious one, is gradually becoming severe one. In place of normal grains mehndi coloured smut balls are formed under favorable conditions. Most of the high yielding varieties are attacked and the incidence varies from 5% to 20%.	Spray the crop with copper oxychloride fungicide 0.2% at 50 % flowering stage.
7.	<b>Khaira Disease: -</b> Bronze coloured irregular spots appear on the leaves. Disease mainly appear at 15 days after transplanting	<ol style="list-style-type: none"> <li>1. Apply 25 kg Zinc Sulphate in the soil</li> <li>2. Spray the crop with solution of 5 kg Zinc Sulphate + 2.5 kg lime in 800 L of water</li> </ol>

**HARVESTING & THRESHING:-** Harvest the crop when 80% of the grains in a panicle are of golden colour. Thresh the crop immediately after harvesting by hand thresher or with the help of bullocks. Dry the produce in shade for safe storage.

#### MATURITY DAYS

S. No.	Variety	Days from Seed to Seed
1.	IET-1410	115-120 days
2.	China-1039	100-110 days
3.	Ratna	120-125 days
4.	Tawi (PC-19)	120-130 days
5.	Jaya	135-140 days

#### RICE CULTIVATION IN TEMPERATE AND SEMI-TEMPERATE REGION OF JAMMU DIVISION

Rice is also cultivated in cold and warm temperate region of Jammu division comprising some parts of Doda, Udhampur, Rajouri, Poonch and Kathua Districts. To boost the rice production in this region, following improved agricultural practices are recommended.

**CLIMATIC REQUIREMENTS:-** In the temperate areas rice crop is sown at low temperature (14°-20° C) complete the early growth period stage in rising temperature cycle (20°-25°C) and after flowering, and completes the growth in declining temperature (24°-25°C). For tillering optimum day temperature is 32° to 34° C, low night temperature (16°-21°C) except during tillering and the late ripening, favours grain production. Water temperature in rice fields at active vegetative stage below 20°C affects the crop adversely. As such in low temperature areas in the hills, it is advisable to pond the water for several days to increase the temperature instead of allowing the water to flow from one terrace to another.

**SOIL REQUIREMENT:-** Rice grows on low-lying to upland soils. Clay to clay loam soils, which turn into soft mud when puddled and develop cracks, are the best soils for rice cultivation.

Following improved high-yielding varieties are recommended for cultivation:-

S.No.	Variety	Area of Adoption
1.	K 84 K 39 (SKAU-5)	Parts of Poonch, Doda, Rajouri, Udhampur and Kathua districts which fall between 900-1500 m height and having Southern aspects.
2.	Giza-14	Rajouri, Poonch District, Sangldan & Gool area of Udhampur District, Upper areas of Billawar block where occurrence of hail- storm is frequent (900-1350 m).
3.	China-1039 SKAU-23 (Chenab) SKAU-27 (Jhelum) SKAU-5 (K-39)	Area falling between 900 to 1550 m height.
4.	Barkat (K-78) K-332	Barkat (K-78) is suitable upto 1800 m above mean sea level and K-332 greater than 1800 m

**CROP ROTATION:-** Following crop rotations are recommended altitude-wise:-

1.	900-1350 m	Rice-----Wheat Rice-----Sarson/Barley/Lentil Rice-----Oats. Rice-----Vegetable peas Rice-----Berseem
2.	1350-1500 m	Rice-----Sarson/Barley Rice-----Oats Rice-----Peas (Vegetable)
3.	1500-1650 m	Rice-----Sarson/Peas/Barley.

**SEED TREATMENT:-** Same as mentioned under seed treatment for sub-tropical rice.

**SOWING:-** April is the optimum time for sowing of nursery but for higher altitude, sowing should be done in last week of March to last week of April depending upon suitable weather conditions.

**SEED RATE:-** Use 50 to 60 kg. of seed for raising seedlings for transplanting in a hectare.

**NURSERY RAISING:-** Incorporate 15 kg. of well rotten F.Y.M. or Compost, 60 g of Urea and 50 g of D.A.P. per 10 sq m. area. In case of wet sowing, puddle the land thoroughly and prepare beds each 1.25 m

wide and of any convenient length. Provide channels all around the seed beds. Soak the treated seeds for 25 hours. Incubate the seed in warm moist conditions for 36 to 48 hours till germination occurs.

Broadcast the sprouted seeds in the puddled seed beds uniformly. Keep the beds moist but not flooded for the first few days. When the sprouts are 1- 2 cm long, beds may be kept submerged with a shallow layer of water and keep the beds free from weeds.

**LAND PREPARATION:-** To obtain optimum tilth of the land, plough once with soil turning plough (Tawi plough) followed by 1-2 ploughings with desi plough or soil stirring plough. Irrigate the land and puddle the soil with a puddler or disc harrow (4 disc).

**FERTILIZER REQUIREMENT:-** Soil should be got tested from the nearest soil testing laboratory before transplantation and apply fertilizers as per soil test result. However in absence of such test, the following schedule of fertilizers is recommended for medium fertility.

Variety	Nutrients (kg/ha)			
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Zinc sulphate
China- 1039	60	40	20	20
Other varieties	80	40	20	20

The above plant nutrients can be met from the following fertilizers:-

Variety	Fertilizer (kg/ha)			
	Urea	DAP	MOP	Zinc sulphate
China - 1039	95	90	33	20
Other varieties	140	90	33	20

**NOTE:-** Zinc sulphate should be applied wherever deficiency is noticed.

**FERTILIZER APPLICATION:-** When 15 tonnes of F.Y.M. or Compost is applied/ha, apply one half of the recommended dose of N.P and K and rest half will be available from the F.Y.M. or Compost.

Apply full quantity of D.A.P., MOP and Zinc Sulphate along with 1/3<sup>rd</sup> of total N through Urea at the time of puddling and incorporate into soil thoroughly. Broadcast the remaining 2/3<sup>rd</sup> Urea in two equal splits-one 30 days after transplanting (DAT) & the other 50 DAT. Drain off the water if possible, before application of second



and third dose of nitrogen and re-irrigate the crop after 24 to 36 hours of fertilizer application.

**OPTIMUM TIME FOR TRANSPLANTATION:-** Transplant the seedlings when they have attained 4 to 5 leaf stage.

**METHOD OF TRANSPLANTING:-** Transplant the seedlings in lines. Put 2-3 seedlings per hill,

**WATER MANAGEMENT:-** Water level should be maintained at about 3 to 4 cm which may be increased further to a depth of about 6 cm as soon as the seedling establish in the field. Drain the field now and then at tillering stage. Do not drain the field at flowering stage.

Drain the fields 12 to 24 hours before top dressing of fertilizers and re-irrigate the fields after 24 to 36 hours of fertilizer application.

**INTERCULTURE:-** Give two weedings one after 15 days of transplanting and the other after a fortnight. If paddy weeder is available, same can be used for this operation otherwise hand weeding may be done. Weeds can effectively be controlled by applying herbicides.

1. Apply Butachlor granules 5 G @ 30 kg/ha 2-5 days after transplanting in standing water of 2-3 cm depth and don't drain the field for 4-5 days.
2. Apply Anilophos + Ethoxy sulfuron @ 0.375+0.015 kg a.i./ha at 10 DAT.

It is beneficial to go for one hand weeding 15-20 days after herbicides application.

#### **PLANT PROTECTION:-**

##### **I. INSECT AND THEIR CONTROL**

S. No.	Name of insect and symptoms of attach	Control
1.	<b>STEM BORER:-</b> Same as mentioned under sub-tropical areas	Same as recommended for sub-tropical areas.
2.	<b>GRASS HOPPERS AND SURFACE GRASS HOPPERS:-</b> Same as mentioned under sub-tropical areas	-do-

3.	<b>ARMY WORMS:-</b> Greenish or dusky brown with pale & brown striped caterpillars on the leaves feed at night and rest during day. In severe infestation feeding may be noticed during day time also. It is a sporadic pest in hilly areas on rice and maize crops, caterpillars remain hidden in leaf whorls during day time.	Spray the crop with Endosulfan 35 EC @ 1.5 L or Carbaryl 50% W.P. @ 1.5 kg/ha in 750 L of water and direct the spray nozzle into the whorls.
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## II. DISEASES:-

Name of disease and symptoms	Control Measure
<b>BLAST:</b> It causes eye shaped spots on the leaves before and after ear emergence. The spots are ashy coloured in the centre and surrounded by brownish margins. In severe cases leaves, leaf sheaths, neck and ear heads are also attacked causing considerable losses	1. Seed treatment with Carben-dazim @ 2g/kg seed. 2. Spray the crop with Carben-dazim @ 0.2% or Hinosan @ 0.1% or tricyclazole @ 0.06%

**Note:-** If other insects and diseases appear on the crop, adopt the control measure as recommended in case of sub-tropical areas of Jammu Division.

**HARVESTING:-** Harvest the crop when 80% of the grains in the panicle are of golden colour. Thresh the crop immediately after harvesting and dry the produce in shade for safe storage.

**DIRECT SEEDING OF RICE:-** Direct seeding is usually practised in upland rice cultivation. However, it has been observed from several years experimentation at R.S. Pura that direct seeded rice under low land irrigated conditions, yields at par or even higher than transplanted, rice. Infact, direct seeding at optimum moisture yields higher in comparison to transplanting done after first week of July.

It saves labour, time, irrigation water and energy, since there is no need to go for cumbersome operation of puddling and transplanting. Thus large area can be covered within a short period by this method. As such 30-50% of each holding can be sown by this method so that in rest of the area transplanting is complete well in

time, resulting in total increase in yield from each holding with less inputs. The details of direct seeding techniques are as under:

**LAND PREPARATION:-** The land is tilled soon after the harvest of previous rabi crop, Irrigate the field prior to sowing and give 2 to 3 harrowing when it comes to proper moisture conditions. This can also be achieved by ploughing the field 3 to 4 times with desi plough. However, two ploughing should be done before and after irrigation to ensure fine tilth.

#### **SOWING**

**(A) Method of Sowing:-** Sow the seed by seed drill manually or bullock or tractor operated. Pora can also be used with narrow opening so that seeds are dropped at the narrowest possible distance width-wise within the single line. This way seeding is made easier both within and between the lines.

**(B) Seed rate:-** Use 75 kg/ha seed. It is both for coarse and fine varieties.

**(C) SPACING:-** 20-25 cm apart in lines.

**(D) Depth of Sowing:-** 3 to 5 cm

**(E) Time of Sowing:-** Sowing time is spread over longer period i.e from 15th May to middle of June before the start of heavy monsoon showers. It varies in relation to variety. Earlier sowing i.e 1st May will require an additional irrigation. However the most suitable time of sowing variety- wise is as under:-

S.No.	Variety	Time of sowing
1.	Jaya, Tawi (PC-19)	15 <sup>th</sup> May to 15 <sup>th</sup> June
2.	IET-1410, Ratna	15 <sup>th</sup> May to 15 <sup>th</sup> June
3.	China-1039 or K-39, any other variety of similar duration.	1 <sup>st</sup> June to 4 <sup>th</sup> July

**FERTILIZER APPLICATION:-** The need of N, P and K varies in relation to variety and is applied accordingly:-

S. No.	Variety	Nutrient Requirement (kg/ha)			Fertilizer (kg/ha)		
		N	P	K	Urea	DAP	MOP
1.	Jaya	100	60	30	167	132	50
2.	Ratna	80	40	20	140	88	33
3.	IET-1410	50	30	20	84	66	33

1/3<sup>rd</sup> N, full P and K are applied as basal while remaining N is top dressed in two equal splits. First top dressing is done at the time of 1<sup>st</sup> interculture operation i.e. after 1<sup>st</sup> irrigation and second at the flag leaf stage of crop.

**IRRIGATION:-** After sowing, 1<sup>st</sup> irrigation is to be given at 4 to 6 leaf stage of the crop. Only one irrigation is sufficient for earlier sown crop till the monsoons start. Thereafter, irrigation schedule to be followed is the same as in case of transplanted rice i.e. 5 + 3 cm submergence at active tillering and reproductive phase and near about saturation at vegetative and maturity stage. However, at earlier stages of crop, moisture is maintained like other dry sown crops.

**WEED CONTROL:-** The success of this method is directly related with the efficiency of weed control. For the control of weeds first interculture operation is to be done when field comes to proper moisture conditions after first irrigation. For this purpose Blade hoe, V.shape hoe or Medium cultivator can be used which require 10 labourers to cover one ha a day. If need arises, depending upon the intensity of weed, Roto weeder can be used in standing water after the start of monsoon rains. In case of late sowing i.e. during first week of June or beginning of July one interculture operation is sufficient with paddy weeder in standing water at 4 to 6 leaf stage of the crop.

Butachlor granules can effectively be used to control weeds in direct sown crop. Apply 30 kg of Butachlor granules/ha just before first irrigation when the crop is at 4 to 6 leaf stage.

Application of herbicides has about 80% weed control efficiency. The remaining 20% of the weed can be used as fodder after surface cutting when weeds attain the height of 20 to 30 cm.

**PLANT PROTECTION:-** Same as mentioned under rice cultivation in subtropical areas.

**HARVESTING:-** Direct seeded rice matures a week earlier than the transplanted crop. The crop should be harvested when 80% grains in the panicle are of golden colour. Thresh the crop immediately after harvesting and dry the produce in shade for safe storage.

**YIELD:-** It varies in relation to variety:

IET-1410	..... 35 to 45 q/ha
Ratna, PC-19	..... 45 to 50 q/ha
Jaya	..... 50 to 55 q/ha

## BASMATI RICE

As regards climate, soil requirement, seed treatment, nursery raising, land preparation, inter culture and weed control, plant protection, harvesting and threshing, the recommendations already made for rice cultivation in sub-tropical parts, hold good for Basmati cultivation too.

Besides above, following recommendations may be followed to boost the Basmati production.

- VARIETIES:-**
1. B-370
  2. Local Basmati
  3. Sanwal Basmati

**CROP ROTATION:-** Rotate Basmati with wheat crop.

**TIME OF SOWING:-** Sowing of nursery should be completed from 1<sup>st</sup> fortnight of May to end of May.

**TRANSPLANTING:-** (a) In typical water logged area where inundation of water takes place just after first heavy showers in the month of July, the transplanting should be completed from 15<sup>th</sup> June to July.

(b) In other areas the transplanting should be completed from 1<sup>st</sup> of June to 10<sup>th</sup> of June.

**FERTILIZERS:-** In absence of soil analysis test, following fertilizer schedule may be followed for an average fertility soil.

Nutrient (kg/ha)			Fertilizer (kg/ha)		
N	P	K	Urea	DAP	MOP
30	20	10	50	44	16

**FERTILIZER APPLICATION:-** Same as recommended for other varieties under sub tropical conditions.

**AGE OF SEEDLINGS AT TRANSPLANTING AND SPACINGS:-** Age of seedling should be 25 to 30 days at transplanting. Plant 2 to 3 seedlings per hill keeping row to row distance of 20 cm & plant to plant distance of 10 cm within the rows.

**IRRIGATION AND WATER MANAGEMENT:-** For Basmati rices follow the same irrigation practices as recommended for other varieties. However, Basmati rice is suitable for typical water logged area where no drainage facilities are available and where crop remains submerged.

#### **IMPORTANT HINTS FOR MAXIMIZING RICE YIELDS**

1. Select suitable variety to grow.
2. Use certified seed, certified seed alone has the yield potential.
3. Raise healthy seedlings, free from weeds, pest and diseases.
4. Transplant seedlings at 4 to 6 leaf stage and at proper time.
5. Always transplant 2 to 3 seedlings per hill.
6. Maintain proper plant population by maintaining proper spacing between plants. This is most important to get higher yields
7. Gap filling may be done twice, once within 7-8 days of transplanting and second time within 2<sup>nd</sup> week of transplanting if necessary.
8. Use recommended dose of manures and fertilizer.
9. Save the crop from insect, pest and diseases. Adopt timely plant protection measures.
10. Control weeds at proper time otherwise they will compete with crop plants and reduce production considerably.
11. Harvest at proper time. Over ripening will result in shattering of grains and thus reduce the yield.
12. To check lodging, lopping of the upper half of crop canopy (Basmati) after 45 DAT may be done.