

# WHEAT

## PACKAGE OF PRACTICES FOR INCREASING PRODUCTION



ICAR

INDIAN COUNCIL OF AGRICULTURAL RESEARCH  
KRISHI BHAVAN NEW DELHI INDIA

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**PACKAGE OF PRACTICES FOR  
INCREASING PRODUCTION**



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TAKEAWAY  
HANDBOOK OF SEEDS  
AND SOWING MATERIAL

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## **FOREWORD**

THE Indian Council of Agricultural Research through its network of All-India Co-ordinated Crop Improvement Projects, central research institutes and agricultural universities has developed a large number of improved agricultural technologies. These technologies include development of high-yielding varieties, agronomic practices, and plant-protection measures, which ensure high level of production of most of the crops cultivated in the country. However, there is wide gap between the national average yields and the potential achievable yields of most of the crops as demonstrated by the agricultural scientists on the farmers' fields through National Demonstrations. This is mainly because the transfer of technology is slow.

There has been a widespread demand for information about the package of production practices to be adopted by the farmers in different parts of the country. To bridge this gap, the ICAR has decided to bring out a series of publications on 'Technologies for Better Crops'. The publication *Wheat: Package of Practices for Increasing Production* (Revised) is the first in this series. I am sure, this will be of interest to all those who are engaged in the extension of proven technologies to the farmers for increasing the production of these important crops all over India.

The credit for assembling this information and preparation of this bulletin goes to the Deputy Director-General (Crop Sciences), Project Director (Wheat), and the Publications and Information Division of the Council. I greatly appreciate their co-operation and prompt response in bringing out this bulletin.

New Delhi  
1 October 1984

O.P. Gautam  
Director-General

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## WHEAT

### Package of practices for increasing production\*

IN 1983-84 production of wheat was 45.2 million tonnes. In 1982-83, 23.15 million hectares were under wheat in India, producing more than 42.5 million tonnes of grain, showing an increase of 12.4% over previous year. The major wheat growing states continued to be Uttar Pradesh (8.22 million ha), Madhya Pradesh (3.37 million ha), Punjab (3.05 million ha), Rajasthan (2.06 million ha), Haryana (1.72 million ha), Bihar (1.64 million ha), Maharashtra (1.02 million ha) and Gujarat (0.64 million ha). Other states where considerable area under wheat was planted were Himachal Pradesh (0.36 million ha), Karnataka (0.33 million ha) and West Bengal (0.27 million ha). The largest grain quantities were produced in Uttar Pradesh (15.28 million tonnes), Punjab (9.18 million tonnes), Haryana (4.34 million tonnes), Rajasthan (3.78 million tonnes), Madhya Pradesh (3.68 million tonnes) and Bihar (2.20 million tonnes). The yields per hectare were high in Punjab (3,007 kg/ha), Haryana (2,526 kg/ha) and Gujarat (2,091 kg/ha), but low in Madhya Pradesh (1,092 kg/ha), Maharashtra (785 kg/ha) and Karnataka (603 kg/ha).

In addition to the large variations in the yield per hectare achieved in different wheat-growing states, there are marked variations in the yield levels of different agroclimatic regions within a state. The variations in different regions are partly owing to the agroclimatic, cultural and environmental factors, and the extent of popularization of the right type of varieties.

It is a known fact that the average yields in several districts being realized in most of the agroclimatic zones are very low and in several cases lower than even the lowest potential achievable under the low-yielding, rainfed, low-fertility environment of the same region. Thus there is a vast potential of increasing the yields under all cultural conditions in all the wheat-growing regions of the country.

In view of the low average yields being realized in various agroclimatic regions of different wheat-growing states, it was decided to compile specific technologies for each agroclimatic region for dissemination among the appropriate agencies and transmission to the cultivators.

## **WHEAT-GROWING REGIONS**

According to similarities in agroclimatic factors, soil type and other relevant components, the wheat-growing regions in India have been grouped into 9 zones. These are given below:

1. Northern Hills Zone (NHZ), comprising the humid western Himalayan regions
2. Northern Plains Zone (NPZ), comprising the parts of sub-humid Satluj-Ganga alluvial plains and some part of arid western plains
3. North-Western Plains Zone (NWPZ), comprising the arid western plains.
4. North-Eastern Zone (NEZ), comprising the sub-humid Satluj-Ganga alluvial plains, except Chhotanagpur plateau and Bundelkhand tract
5. Far-Eastern Zone (FEZ), comprising the humid Bengal-Assam basin, humid eastern Himalayan region, far-eastern states and Bay Islands, and parts of sub-humid Satluj-Ganga alluvial plain
6. Central Zone (CZ), comprising the parts of arid western plains (east) and semi-arid lava plateau and central highlands (north)
7. South-Eastern Zone (SEZ), comprising the sub-humid to humid eastern and south-eastern uplands
8. Peninsular Zone (PZ), comprising the semi-arid lava plateau and central highlands (south) and humid to semi-arid Western Ghats and Karnataka Plateau
9. Southern Hills Zone (SHZ), comprising the humid to semi-arid Western Ghats and Karnataka plateau

These zones transgress the state boundaries and several of the states have parts in more than one agroclimatic zone. Specific recommendations are available for each zone in several cases, which should be specifically adopted if full potential of the agroclimatic is to be realized in the form of wheat yields. These technologies are given in brief.

## **SELECTION OF VARIETIES**

Varieties recommended for each agroclimatic region of different wheat-growing states and for each of the cultural environments are given in Appendix. This information would be helpful in the selection of right type of varieties and their popularization in different parts of states.

## ADOPTION OF CORRECT CULTURAL TECHNIQUES

Use of improved variety alone is not sufficient, and it must be cultivated according to suitable improved technologies. Sometimes broad generalizations are possible but each specific cultural environment has a specific requirement which must be fulfilled for the optimum results. These are specified below.

### Time of planting

The crop should not be planted till the mean daily temperatures drop down in 22-23°C. For each planting period right type of varieties should be selected. The optimum date around which the seeding should be done to get the best yields in each agroclimatic region and the right type of varieties for each cultural environment are listed in Appendix.

### Seed rate (all regions except Peninsular Zone\*)

#### A. Irrigated

##### a. *Timely sown*

(i) Medium-grained varieties: 100 kg/ha

(ii) Bold-grained varieties: 125 kg/ha (Seed rates are adjusted according to the grain size, taking the requirement of 100 kg/ha seeds for a variety with 38 g/1,000-grain weight).

In the North-Eastern Zone, under the rice-wheat rotation where direct seeding is required to be done in *kharif* rice stubbles, the seed rate should be increased by 25%.

##### b. *Late sown*

Increase the seed rate by 25%.

#### B. Rainfed

Same as under irrigated timely sown conditions.

### Row spacing (all zones)

#### A. Irrigated

(i) Timely sown: 20-22.5 cm

(ii) Late sown: 15-18 cm

Recently a row spacing of 15 cm or criss-cross sowing using normal seed rate has been recommended.

\*In the Peninsular Zone the recommended seed rates are 120 kg/ha for the medium-grain varieties and 150 kg/ha for bold-grain varieties.

B. Rainfed  
20-22.5 cm

#### Depth of sowing (all zones, all conditions)

The seed should be placed about 5-6 cm deep.

#### Method of sowing

To achieve good germination and crop stand, the seed must be sown in moist soil at a depth of 5-6 cm. The job can be done best by the use of seed drill. *Desi* plough can also be used to open furrows of appropriate depth and seed dropped in the open furrows (*kera* method) and covered by planking. If the seed is sown through a funnel attached to the *desi* plough (*pora* method), planking should never be done. The best results are achieved by the use of seed-cum-fertilizer drill.

#### Fertilization

The maximum possible amount of farmyard manure should be applied to the extent possible, as a combination of organic manure and synthetic fertilizers give superior results than the use of synthetic fertilizers alone.

#### A. Dose of fertilizers

The quantity of synthetic fertilizers to be applied depends mainly on the soils status and the preceding field management. In general, the recommended doses are as follows:

Cultural conditions	N (kg/ha)	P <sub>2</sub> O <sub>5</sub> (kg/ha)	K <sub>2</sub> O (kg/ha)
Irrigated			
Timely sown	80-120	40-50	40*
Late sown	60-80	40	40*
Restricted irrigation	60-80	40	40*
Rainfed	40	20	Nil

\* All doses should be adjusted on the basis of the results of soil tests and potassium should be applied only, if required.

#### B. Method of fertilizer application

a. *Irrigated crop.* Half the amount of the nitrogen and the total

amount of phosphorus and potassium should be drilled 5 cm below the seeds at the time of sowing. This can be done best by the use of seed-cum-fertilizer drill of *pora*. If drilling is not possible, the fertilizers may be broadcast uniformly before the last cultivation. The remaining amount of nitrogen should be top-dressed along with first irrigation.

b. *Rainfed crop.* The total quantity of nitrogen and phosphorus should be drilled 3-4 cm below the seeds at or before sowing.

### Irrigation schedule

#### A. Adequate water availability

Four to 6 irrigations may be necessary, depending upon the soil texture and the extent of natural precipitation during the crop season. If 6 irrigations are given, these should be applied at the following crop-growth stages: crown-root-initiation stage (CRI), late tillering, late jointing, flowering, milk stage, and dough stage.

If only 4 irrigations are given, those at late jointing and dough stages may be avoided. Similarly, if 5 irrigations are given, the last irrigation at dough stage can be avoided.

If enough rainfall occurs at any of the above stages, that particular irrigation can be omitted.

#### B. Restricted water supply

(i) If only 1 irrigation is possible, it should be applied between the crown-root-initiation and tillering stages.

(ii) If 2 irrigations are possible, the first should be applied at crown-root-initiation stage and the second at boot stage.

(iii) If 3 irrigations are possible, the first should be given at crown-root-initiation stage, second at boot-leaf stage and third at milk stage.

### Weed control

Weed control is done both by chemical and cultivated methods as described below.

#### A. Chemical methods

These methods are recommended where infestation of weeds is very heavy.

a. Broad-leaved weeds (*bathua*, *Krishan neel*, *pohli* or *katiari*) can

be effectively controlled with spray of 2,4-D at 0.4 kg ai/ha in 750 litres of water 5-6 weeks after sowing.

b. Among Graminaceous weeds, when the dominant weed is *Phalaris minor*, use:

(i) Isoproturon (Tolkan, Arelon, Graminon etc.) @ 0.75 kg ai/ha as post-emergence spray, (ii) Metoxuron (Dosanex) @ 1.5 kg ai/ha as post-emergence spray, (iii) Pendimethaline (Stomp) @ 1.0 kg ai/ha as pre-emergence spray.

When dominant weed is wild oat or mixed population of *Phalaris minor* and wild oat, use Isoproturon @ 0.75 kg ai/ha or Metoxuron @ 1.5 kg ai/ha as post-emergence spray.

The pre-emergence herbicides should be sprayed immediately after sowing. The post-emergence herbicides should be sprayed 30-35 days after sowing (7-10 days after first irrigation). The specified quantity of the weedicide should be mixed with 750 litres of water for use in 1 ha area and sprayed uniformly.

#### B. Cultural methods

- (i) Plant the wheat crop at the optimum time, using the right variety for different sowing intervals and use weed-free seeds
- (ii) Keep the weeds under check by interculturing and hoeing
- (iii) Remove weeds before they set seeds
- (iv) Keep bunds and irrigation channels free of weeds and the spread of weed through irrigation water should be prevented
- (v) Grow suitable alternative winter-season (*rabi*) crops in rotation with wheat in heavily weed-infested fields

### PLANT PROTECTION

#### Diseases

The best strategy is to grow resistant varieties.

1. *Rusts*. Under normal conditions most of the improved varieties tend to show varying degrees of resistance to the 3 rusts, viz. brown, yellow and black. No specific chemical control measures are recommended. As soon as a variety shows susceptibility, it should be replaced at the earliest.

2. *Loose smut*. It is predominant in Northern and Western Plains Zones, Eastern Zone and Northern Hills Zone.

Among the present commercial varieties only 'VL 421' and 'WL 410' are resistant.

Seed dressing with carboxin (Vitavex) or carbendezim (Bavistin) @ 2.5 g/kg seed gives complete control. Solar heat treatment is also quite effective.

3. *Karnal bunt*. It is predominant in north-western India, *tarai* belt of Uttar Pradesh, Punjab, Haryana, part of Rajasthan, Himachal Pradesh, and Jammu and Kashmir.

The released varieties show different degrees of infection, but none is completely resistant. 'WL 711' and 'HD 2009' are most seriously affected.

There is no specific recommended fungicide to control the disease. Use of Thiram or MEMC @ 2.5 g/kg seed helps in reducing the load of seed-borne inoculum.

4. *Hill bunt*. Its occurrence is restricted to the northern hills. 'Kalyan Sona' is a resistant variety.

The disease can be very effectively controlled by treating the seeds with organomercurial fungicides such as Ceresan or Agrosan, when used @ 2 g/kg seed. Carboxin or Carbendezim @ 2.5 g/kg seed are also very effective.

5. *Flag smut*. It is present in Punjab, Haryana, Rajasthan, Delhi, Himachal Pradesh and Uttar Pradesh. None of the commercial varieties is resistant. Seed dressing with organomercurial compounds like Ceresan or Agrosan @ 2 g/kg seed and non-mercurial compounds such as Carboxin, Carbendezim @ 2.5 g/kg seed control the disease.

6. *Powdery mildew*. It is prevalent in hills of north and south and submountainous and *tarai* area of the north.

No commercial variety is resistant, although varying degrees of tolerance exists.

Use of sulphur dust and Kerathane can check the disease.

7. *Leaf-blight* (*Alternaria* spp.) and *leaf-spot* (*helminthosporium* spp.) Leaf-blight is prevalent in Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Bihar, Orissa, West Bengal and Andhra Pradesh, whereas leaf-spot occurs in humid areas like West Bengal, Bihar, Uttar Pradesh and Orissa. The latter can occur in some other parts also sporadically.

Complete resistance to both these diseases is not observed in the commercial varieties, though they show different degrees of tolerance.

Spray with dithiocarbamates such as Dithane Z-78 or Dithane M-45 @ 0.25% with the first appearance of the disease and regular

repetitions after every 15 days thereafter offers an effective control.

8. *Root-rot or damping-off*. It is common in warm and humid areas of eastern, central and peninsular India.

Seed treatment with MEMC @ 2 g/kg seed and Brassicol @ 6 g/kg seed is effective.

### Nematodes

1. *Ear-cockle and tundu*. These are the 2 phases of the same nematode complex. The disease is prevalent in north India and has been reported from Punjab, Haryana, Himachal Pradesh, Rajasthan, Delhi, Uttar Pradesh and Bihar.

It can be controlled by the use of seed free from nematode galls.

2. *Molya disease*. It is widespread in Rajasthan and has also been reported from Punjab, Haryana, J&K, Delhi and Western U.P. The infection causes stunted and weak plants. No commercial variety is resistant. Soil application of DBCP 60% EC @ 30 litres/ha is effective but is very expensive.

Two summer ploughings at 10-day intervals during May-June help reduce the nematode population to a level that would not harm the wheat crop.

One-year or 2-year rotation with non-host crops like carrot, radish, marigold and resistant varieties of barley can be helpful.

### Insects

1. *Termite (White-ant)*. It can affect the crop in any part of the country specifically in low soil-moisture conditions. Its infestation can be severe particularly in northern and central parts of the country. Effective control is achieved by treating seeds with Aldrin 34 EC @ 400 ml/q seed before sowing.

Soil application of Aldrin 5% or BHC 10% @ 25 kg/ha after final ploughing but before planting is also effective.

2. *Brown wheat mite*. This pest is important in Rajasthan, Madhya Pradesh, Uttar Pradesh, Delhi, Haryana and Punjab. It is particularly serious in the rainfed crop. Effective control is achieved by spraying Anthio 25 EC @ 650 ml/ha, Dimecron 100 @ 250 ml/ha or Metasystox 25 EC @ 650 ml/ha.

The spray should be given on the first appearance of the pest. These sprays will also control aphids and jassids. The spray should be repeated after 15 days if necessary.

3. *Armyworms, cutworms, grain caterpillars and pyrilla*. These

are sporadic but are prevalent throughout the country. These can be effectively controlled by the use of (i) Sevin 50 WP @ 2.5 kg/ha, (ii) Folithion 1000 @ 500 ml/ha or Sumithion 50 EC @ 1 litre/ha, or (iii) Nuvan 100 EC @ 500 ml/ha.

## PHYSIOLOGICAL DISORDERS

### Micronutrient deficiencies

The adoption of intensive cropping systems in various parts of the country has resulted in occasional micronutrient definciences. Some of the common ones are listed below.

1. *Zinc deficiency.* This has been reported from various areas of the country. The deficiency symptoms are failure of stem elongation and necrosis and chlorosis in the plant leaves.

These can be rectified by applying zinc sulphate @ 25 kg/ha along with the fertilizers.

2. *Sulphur deficiency.* In some areas of Punjab, sulphur deficiency has also been reported. The deficiency symptoms are stunted growth, a general yellowing of leaves and delayed maturity.

The situation can be avoided by using sulphur-containing fertilizers like ammonium sulphate and single superphosphate.

### Adverse soil conditions

Alkalinity and salinity are the important adverse soil conditions widely prevalent in several wheat-growing states.

A. *Alkaline soils.* Such soils are frequent in Haryana, Punjab, Uttar Pradesh, parts of Bihar and Madhya Pradesh. Alkalinity is caused by an excessive concentration of carbonates and bicarbonates of sodium. The crop stand is reduced owing to poor seedling emergence, low tillering and weak plant growth. If the pH is above 9.2, wheat crop should not be grown without the adoption of recommended soil-amendment practices. These may involve the use of gypsum @ 10 to 15 tonnes/ha, depending upon soil test and adoption or rice-wheat rotations. Other specific recommendations for increasing the wheat production from alkaline soils are:

1. Use 10-15% higher seed rate than normal
2. Apply 20% higher dose of nitrogen
3. Restrict phosphorus and potassium application only when soil tests justify their use
4. Use compost, wherever possible

5. Follow a strict schedule for field preparation to avoid bad seed-bed conditions

B. *Saline soils.* Saline soils are prevalent in Haryana, Punjab, Rajasthan, Uttar Pradesh, Gujarat, Maharashtra, Karnataka and Andhra Pradesh. The situation arises because of an excessive concentration of chlorides and sulphates. The crop germination and growth is restricted and yield starts declining beyond 3-4 EC. Significant yield reduction occurs beyond 6-8 EC in most high yielding varieties.

Recommendations to ameliorate the situation are:

1. Use slightly higher seed rate
2. Follow a rigid water-management schedule, which involves a heavier-than-normal first irrigation, followed by frequent light irrigations with occasional heavy irrigations
3. Use normal recommended levels of nitrogen but split into 3 equal doses to be applied at seedling, tillering and grain-filling stages

C. *Acidic soils.* Such soils are found in several high rainfall areas with excessive leaching which results in low bases content. These are commonly encountered in far eastern states viz. Bihar, West Bengal and certain high altitude areas of North Western Hills. Typical symptoms include restricted plant growth and reduced P uptake. These symptoms start becoming acute below 5.5 pH. Rectification can be achieved by applying lime. Recommended dose of lime varies from 1-2 tonnes per hectare but the exact requirement must be got determined by actual soil test.

#### HARVESTING

To minimize losses from shattering and other environmental hazards, the crop must be harvested soon after maturity. The best time for harvesting is at a grain moisture of about 15% and when the seed has become hard. If the straw is wet, it should be dried till the stem can be broken by hand.

Several types of wheat threshers are available and are very helpful. The optimum speed recommended by the manufacturers of the threshers should be followed, keeping in view the capacity of the machine, grain breakage and size of the *bhusa* particles.

#### POST-HARVEST CARE

To avoid losses in storage, the grains should be dried in sun to the

moisture content of less than 10%. Improved storage structures like Pusa Bin or other recommended bins can be used for storage. The store should be regularly inspected for pest infestation. Fumigation of the seed in the stores by aluminium phosphide tablets @ 1 tablet per tonne is recommended.

Empty godowns before storage, should be fumigated likewise or the surface of godowns and outer surface of storage structures can also be treated before storage of grains with Melathion 50 EC @ 15 ml diluted in 4.5 litres of water and sprayed per 93 m<sup>2</sup> of the surface.

The surface treated with an insecticide must not come in direct contact with grains.

**Appendix. Location-specific recommended improved technologies for cultivation of wheat in agroclimatic regions of various states**

Agroclimatic region	Area covered	Cultivation conditions	Optimum sowing time	Current commercial/ identified varieties	Remarks
<b>1. Andhra Pradesh</b>					
Entire state (PZ)	Kurnool, Anantapur, Cuddapah, Chittoor Nizamabad, Medak, Mahaboobnagar, Adilabad, Hyderabad, Nalgonda, Khaman, Nellore, Ongole, Guntur, Krishna, West Godavari, Visakhapatnam, Srikakulam, Warangal, Karimnagar, Rajahmundry, East Godavari	Irrigated Timely sown	Mid-Nov	'NI 5439', 'HD 2189', 'Kalyan Sona', 'DWR 39**', 'HD 2278**', 'Malvika (d)'	1. Do not delay late sowing beyond 15 Dec
Entire state	Patna, Nalanda, Gaya, Nawada, Aurangabad, Bhojpur, Rohtas, Saran, Siwan, Gopal Ganj, Champaran East Champaran West, Muzaffarpur, Vaishali, Sitamarhi	Irrigated Timely sown	II fortnight of Nov	'Sonalika', 'UP 262', 'K 7410', 'HP 1102', 'HUW 37**', 'HUW 55**', 'HUW 206**	1. Do not delay the sowing beyond 15 Dec
(except Chhotanagpur area) (NEPZ)		Late sown	I fortnight of Dec	'Sonalika', 'HP 1209', 'UP 115', 'HD 2307**', 'HUW 213*', 'K 8020**', 'HUW 234**	2. Control leaf-blight and leaf-spots

Darbhanga, Madhubani,  
Samastipur, Begusarai,  
Monghyr, Bhagalpur,  
Saharsa, Purnea, Katihar,

Giridih  
Chhotanagpur  
area of Bihar  
(FEZ)

Rained

End of Oct 'C 306', 'K 8027\*\*

Santhal Parganas,  
Hazaribagh, Ranchi,  
Palamu, Singhbhum  
Dhanbad

Irrigated

II fortnight  
of Nov

'Sonalika', 'UP 262',  
'HP 1102',  
'Sonalika', 'HP 1209',  
'BW 11\*\*

Do not delay  
late sowing  
beyond 15 Dec

**3. Delhi**  
Entire Delhi  
(NPZ)

Delhi region

Irrigated

Timely sown

Mid-Nov

'Sonalika', 'HD 2009',  
'HD' 2204', 'WL 711';  
'MLKS 11', 'KSML 3',  
'HD 2281\*\*', 'CPAN 1676\*\*',  
'HD 2329\*', 'PBW 34(d)\*',  
'DWL 5023 (d)\*\*',  
'Sonalika', 'HD 2285\*\*\*', 'HD 2270\*\*'

1. Do not delay  
late sowing  
beyond 25 Dec

2. Take precautions  
for loose-smut

3. Sow varieties  
tolerant to  
Karnal bunt

**4. Far-Eastern States**  
Arunachal  
Pradesh,

Plains region

Irrigated

II fortnight

of Nov

'Sonalika',  
'UP 262', 'HP 1102',  
'Sonalika', 'HP 1209',  
'UP 115', 'BW 11\*\*'

1. Do not delay  
late sowing beyond  
15 Dec

2. Check leaf-blight

Agroclimatic region	Area covered	Cultivation conditions	Optimum sowing time	Current commercial/ identified varieties	Remarks
and other Far-Eastern States (FEZ)		Rained	End of Oct	'C 306'	and leaf-spots
Hilly regions		Irrigated Timely sown Late sown Rainfed	Early Nov Early Dec II fortnight of Oct	'Sonalika' 'Sonalika' 'Sonalika'	
5. Gujarat	Ahmedabad, Banaskantha, Gandhinagar, Mehsana, Sabarkantha Kutch, Rann of Kutch	Irrigated Timely sown	Mid-Nov	'Kalyan Sona'; 'Sonalika'; 'HD 2009'; 'J 24'; 'WH 283'* 'Raj 1972*', 'J 1-7'; 'Raj 2535*' 'Raj 1555 (d)* 'Sonalika' 'WH 291'* 'Raj 2184*' 'VW 120'*	1. Do not delay late sowing beyond 25 Dec 2. Control leaf-blight and leaf-spots
Northern Gujarat (NWPZ)	Baroda, Broach, Bulsar, Kaira, Panchmahals, Surat, Amreli, Bhavnagar, Jamnagar, Junagadh, Rajkot, Surendranagar Dangs	Irrigated Timely sown	Mid-Dec	'C 306'; 'Kalyan Sona'	
Southern Gujarat (CZ)		Rained	End of Oct		
		Irrigated Timely sown	Mid-Nov	'J 24'; 'Kalyan Sona'; 'Sonalika'; 'WH 147'; 'Lok 1**', 'HD 2236***', 'HD 2278***', 'Raj 1555 (d)* 'Sonalika', 'Lok 1**', 'Swati**', 'J 405*', 'Sujata **', 'A 206(d)'	Do not delay late sowing beyond 15 Dec
		Late sown	I fortnight of Dec		
		Rained	End of Oct		

**6. Haryana**  
Eastern Haryana  
(NPZ)

Irrigated	Kurukshetra, Ambala, Karnal, Sonepat	Timely sown	Mid-Nov

1. Do not delay late sowing	'Sonalika', 'WH 147', 'HD 2009', 'HD 2204', 'WL 711', 'MLKS 11', 'KSM 3', 'HD 2281**', 'CPAN 1676**', 'HD 2329**', 'PBW 34(d)**', 'DWL 5023(d)**', 'Sonalika', 'HD 2285**', 'HD 2270**'
2. Do not grow	'Sonalika'
3. Do not sow	varieties highly
4.	susceptible to Karnal bunt
5.	Control loose-smut and flag-smut

- Phalaris minor*
1. Do not delay late sowing beyond 25 Dec
  2. Do not grow
  3. Do not sow varieties highly
  4. Control loose-smut and flag-smut
  5. Use weedicides to control

1. Do not delay late sowing beyond 25 Dec	'Sonalika', 'Kalyan Sona', 'HD 2009', 'WH 283*', 'Raj 1972*', 'Raj 1555(d)*', 'Sonalika', 'WH 291*', 'Raj 2184*', 'YW 120*', 'Kalyan Sona', 'C 306'

Irrigated	Hissar, Sirsa, Bhiwani, Rohtak, Gurgaon, Faridabad, Jind, Mohindergadh	Timely sown	Mid-Nov

**Western Haryana**  
(MWPZ)

1. Do not delay late sowing beyond 15 Dec	'Sonalika', 'Shailaja', 'HS 86**', 'CPAN 1796*', 'HB 208***', 'CPAN 1922**', 2. Control hill

**7. Himachal Pradesh**

Entire state except Sirmur and Una district (NHZ)	Bilaspur, Chamba, Hamirpur, Kangra, Kinnaur, Mandi, Simla, Solan, Kulu

Agroclimatic region	Area covered	Cultivation conditions	Optimum sowing time	Current commercial/ identified varieties	Remarks
Districts of Una and Sirmur (NPZ)	Sirmur, Una (NPZ)	Late sown	I fortnight of Dec	'Sonalka'	burnt, flag-smut and powdery mildew
		Rainfed	End of Oct	'Sonalka', 'VL 421'; 'HB 208**', 'HS 86**', 'CPAN 1796*', 'CPAN 1922*', VL 616*	3. In high altitudes plant in mid-Oct and use 'Girija'
		Timely sown	Sept/Oct		
		Early sown			
		Irrigated	Timely sown	'Sonalka', 'HD 2204'; 'MLKS 11'; 'KSMML 3', 'HD 2281**', 'CPAN 1676**', 'HD 2329*', 'PBW 34(d)*', 'DWL 5023(G)**', 'Sonalka', 'HD 2285**', 'HD 2276**'	1. Do not delay late sowing beyond 25 Dec
			I fortnight of Nov		2. Sow only the varieties tolerant to Karnal bunt
		Late sown	Mid-Dec		
		Rainfed	End of Oct	'C 306', 'IWP 72', 'WL 410', 'WL 2265**', 'WH 331*', 'PBW 65*	
	Srinagar, Badgam, Anantnag, Puliwama, Baramulla, Muzaffarabad, Kupwara, Punch, Mirpur, Udhampur, Doda, Rajauri	Irrigated	I fortnight of Nov	'Sonalka', 'HS 86**', 'HB 208**', 'CPAN 1769**', 'CPAN 1922*', 'Sonalka'	1. Do not delay late sowing beyond 15 Dec
		Timely sown	I fortnight of Dec		2. In high

Rainfed	Timely sown	End of Oct	'Kalyan Sona', 'VL 42*', 'CPAN 1796*', 'CPAN 1922*', 'VL 616**'	altitudes, the recommended varieties are 'Sonalka'; 'Grija', plant in mid-Oct
Irrigated	Timely sown	Mid-Nov	'Sonalka', HD 2009, 'HD 2204', 'MLKS 11', 'KSML 3', 'Sonalka', 'HD 2285**', 'HD 2270**'	1. Do not delay late sowing beyond 31 Dec 2. Grow only the varieties tolerant to Karnal bunt
	Late sown	Mid-Dec	'C 306', 'IWP 72', 'WL 410', 'WL 2265**', 'WH 331*', 'PBW 65**'	
Rainfed		End of Oct		
Jammu area (foot-hills) (NPZ)	Jammu, Kathua	Irrigated Timely sown	Bangalore, Belgaum, Bellary, Beda, Bijapur, Chikmaglur, Chitradurga, Dharwad, Gulbarga, Hassan, Kodagu, Mandyā, Mysore, Raichur, Shimoga, Tumkur, Kolar, Uttar Kanda	1. Do not delay late sowing beyond 15 Dec 2. Control leaf-blight and leaf-spots
Entire state (PZ)		Mid-Nov	'Kalyan Sona', 'HD 2189', 'DWR 39*', 'HD 2278**', 'Malvika (d)' 'Sonalka'	
9. Karnataka		Late sown	I fortnight of Dec	
Entire state (PZ)		End of Oct	'NI 5439', 'Bijaga Red (d)', 'Bijaga Yellow (d)', 'Amrut (d)', 'MACS 1967 (d)**'	

Agroclimatic region	Area covered	Cultivation conditions	Optimum sowing time	Current commercial/ identified varieties	Remarks
<b>10. Maharashtra</b> Entire state (PZ)	Thane, Nasik, Dhulia, Jalgaon, Pune, Ahmadnagar, Satara, Sangli, Sholapur, Kolhapur, Aurangabad, Parbhani, Bhir, Nanded, Osmanabad, Buldhana, Akola, Amravati, Yeotmal, Wardha, Nagpur, Bhandara, Chandrapur	Irrigated Timely sown  Late sown  Rainfed	Mid-Nov  I fortnight of Dec  End of Oct	'Kalyan Sona', 'HD 2189', 'HD 2278**', 'DWR 39*', 'NI 5439', 'Malvika (d)', 'Sonalika'  'NI 5439', 'NI 747-19', 'N 59 (d)', 'MACS 1967 (d)*'	<p>1. Do not delay late sowing beyond 15 Dec</p> <p>2. Control leaf-blight and leaf-spots</p> <p>3. In Bhandara and Chandrapur districts the varieties recommended for South-Eastern Zone should be grown preferably</p>
<b>11. Madhya Pradesh</b> All regions except south, south-eastern and northern parts (CZ)	Datia, Shivpuri, Guna, Vidisha, Rajgarh, Mandsaur, Ratlam, Ujjain, Shahapur, Jhabua, Dhar, Indore, Dewas, Sehore, Bhopal, West Nimar, East Nimar, Hoshangabad, Betul, Raisen, Sagar,	Irrigated Timely sown	Mid-Nov	'Sonalika', 'WH 147', 'Lok 1', 'HD 2236**', 'Kalyan Sona', 'HD 2278**', 'J 405*', 'HD 4530 (d)', 'Raj 1555 (d)**', 'Sonalia', 'Lok I**', 'Swati', 'HI 784**', 'J 405**'	<p>1. Do not delay late sowing beyond 15 Dec</p> <p>2. Control root-rot, damping-off</p> <p>3. In Gwalior, Bhind and Morena districts the</p>

Chhindwara, Narsimhapur,  
Seoni, Damoh, Tikamgarh,  
Chahatterpur, Panna  
Satna, Rewa, Jabalpur,  
Gwalior, Bhind, Morena

South and south-eastern state (SEZ)	Rained	End of Oct	'C 306', 'Sujata**', 'Narbada 4', 'Mukta', 'Hyb 65', 'Meghdoot (d)', 'A 9-30-1 (d)', 'JU 12(d)**'	varieties recommended for the Northern Plains Zone should be grown preferably
Sarguja, Bilaspur, Durg, Raipur, Bastar, Mandla, Sidhi, Raigarh, Rajnandgaon, Shahdol, Balghat, Dharam, Jaygarh	Irrigated Timely sown	Mid-Nov	'Sonalika', 'Kalyan Sona', 'Lok 1', 'WH 147', 'Raj 155(d)**'	Do not delay late sowing beyond 15 Dec
Balasore, Bolangir, Cuttack, Dhenkanal, Ganjam, Kalandi, Keonjhar, Koraput, Mayurbhanj, Phulbhanji, Puri, Sambalpur, Sundergarh	Late sown	Mid-Dec	'Sonalika', 'Swati**', 'Lok 1**', 'C 306', 'Hyb 65', 'Mukta', 'Sujata**', 'A 9-30-1(d)', 'Meghdoot (d)'	
Entire state (SEZ)	Rained	End of Oct	'C 306'	1. Do not delay late sowing beyond 15 Dec 2. Control leaf-blight and leaf-spots

### 12. Orissa

Balasore, Bolangir, Cuttack, Dhenkanal, Ganjam, Kalandi, Keonjhar, Koraput, Mayurbhanj, Phulbhanji, Puri, Sambalpur, Sundergarh

### 13. Punjab

Hoshiarpur, Jalandhar Ludhiana, Ferozepur, Amritsar, Gurdaspur,

Entire state (NPZ)	Irrigated Timely sown	Mid-Nov	'WL 711', 'HD 2009', 'HD 2204', 'MLKS 11', 'KSML 3'; 'HD 2281**'	1. Do not delay late sowing beyond 31 Dec
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Agroclimatic region	Area covered	Cultivation conditions	Optimum sowing time	Current commercial/ identified varieties	Remarks
Kapurthala, Bhatinda, Patiala, Sangrur, Ropar, Faridkot			Late sown Rainfed	'CPAN 1676**', 'HD 2329*', 'PBW 34 (d)*', 'DWL/5023 (d)**', 'PBW 12*', 'HD 2270', 'Ska ML', 'Sonalika', 'HD 2285**', 'C 306', 'WLP 72', 'WL 410', 'WL 2265**', 'WH 331*', 'PBW 65*', Mid-Dec End of Oct	<p>2. Use weed-free seeds; apply weedicides</p> <p>3. Control loose-smut and flag-smut</p> <p>4. Do not sow varieties highly susceptible to Karnal bunt</p> <p>5. Use pesticides to control armyworm, pyrrilla and brown wheat mite</p>
Entire state except eastern and southern parts (NWPZ)	Bikaner, Churu, Jhunjhunu, Bagaur, Jodhpur, Jaisalmer, Barmer, Sirohi, Pali, Ajmer, Jaipur, Sawai Madhopur, Tonk, Bundi, Bhilwara, Jalore	Irrigated Timely sown	Late sown	'Kalyan Sona'; 'Sonalika', 'HD 2009', 'WH 283*', 'Raj 1972*', 'Raj 1555 (d)*', 'Sonalika', 'WH 291*', 'Raj 2184*', 'VW 120*', 'C 306', 'Kalyan Sona'	<p>1. Do not delay late sowing beyond 25 Dec</p> <p>2. Control flag-smut</p> <p>3. Check <i>molya</i> disease</p>

				4. Use pesticides to control armyworm, pyrrila and brown wheat mite
Eastern Rajasthan (NPZ)	Alwar, Bharatpur, Sriganganagar	Irrigated Timely sown	Mid-Nov	'Sonalika', 'MLKS 11', 'KSML 3', 'HD 2204**', 'HD 2281**', 'CPAN 1676**', 'HD 2329*', 'Raj 1482**', 'PBW 34(d)**', 'DWL 5023(d)**', 'Sonalika', 'HD 2285**', 'HD 2270**' 'C 306 IWP 72', 'WL 410', 'WL 2265*', 'WH 331*', 'PBW 65**'
		Late sown Rainfed	Mid-Dec End of Oct	'C 306 IWP 72', 'WL 410', 'WL 2265*', 'WH 331*', 'PBW 65**'
	Kota, Udaipur, Dungarpur, Jhalawar, Banswara, Chittorgarh (CZ)	Irrigated Timely sown	Mid-Nov	'Kalyan Sona', 'Sonalika', 'Wh 147', 'Lok 1', 'HD 2236**', 'HD 2278**', 'HD 4530 (d)', 'Raj 1555(d)**', 'Sonalika', 'Lok 1**', 'Swati**', 'J 405**', 'C 306', 'Mukta', 'JU 12**', 'Sujata**', 'A 9-30-1(d)'
		Late sown Rainfed	Mid-Dec End of Oct	

Agroclimatic region	Area covered	Cultivation conditions	Optimum sowing time	Current commercial/ identified varieties	Remarks
<b>15. Tamil Nadu</b>					
Entire state (except Nilgiris) (PZ)	North Arcot, Salem, Dharmapuri, Coimbatore, Madurai	Irrigated Timely sown	Mid-Nov	'HD 2189'; 'DWR 39'*, 'HD 2278*', 'Malvika (d)', 'NI 5439'; 'NI 747-19' 'MACS 1967 d**'	Use pesticides to control armyworm, pyrilla and brown wheat mite.
Hills (SHZ)	Nilgiris	Rained	End of Oct	'HW 517'; 'HW 741*', 'HW 971*', 'NP 200' (dicoccum)	Only highly rust-resistant varieties should be grown
				Two crops are taken in one year; the optimum time of sowing whole of Oct and mid-May to mid-June	
<b>16. Uttar Pradesh</b>					
Western Uttar Pradesh (NPZ)	Saharanpur, Muzaffarnagar, Meerut, Ghaziabad, Bulandshahr, Aligarh Mathura, Mainpuri Bijnore, Moradabad,	Irrigated Timely sown	Mid-Nov	'HD 2204'; 'UP 2003*', 'UP 368*', 'MLKS 11', 'KSM 3'; 'KML 7406', 'HD 2281**', 'CPAN 1676**',	1. Do not delay late sowing beyond 25 Dec 2. Do not sow

Badaun, Etah, Rampur,  
Bareilly, Agra.

'HD 2329\*',  
'PBW 34 (d)\*'  
'DWL 5023 (d)\*\*'  
'Sonalika', 'HD 2285\*\*\*', 'HD 2270\*\*  
'C306', 'IWP 72',  
'WL 410', 'WL 2265\*\*'  
'WH 331\*\*', 'PBW 65\*\*

Rained

End of Oct

Irrigated

Timely sown

Mid-Nov

Eastern  
Uttar  
Pradesh  
(NEPZ)

Pilibhit,  
Shahjahanpur,  
Farrukhabad, Etawah,  
Kheri, Hardoi, Kannpur,  
Bharatpur, Sitapur,  
Lucknow, Unnao,  
Fatehpur, Gonda,  
Barabanki, Raibareli,  
Basti, Faizabad,  
Sultanpur, Pratapgarh,  
Allahabad, Gorakhpur  
Deoria, Azamgarh, Ballia,  
Jaunpur, Ghazipur,  
Varanasi, Mirzapur  
Jhansi, Lalitpur,  
Jalaun, Hamirpur,  
Banda

varieties highly  
susceptible  
to Karnal  
bunt in  
*Tarai* area  
3. Control loose-  
smut and  
flag-smut

1. Do not delay  
late sowing  
beyond 20 Dec

2. Check leaf-  
blight and  
leaf-spot

3. Control  
loose-smut  
and root-rot

Jhansi  
Division  
(CZ)

'Sonalika', 'UP 262',  
'K 7410', 'HP 1102'; 'HUW 37\*\*\*',  
'HUW 55\*\*', 'HUW 206\*',  
'Sonalika', 'HP 1209\*',  
'HD 2307\*',  
'HUW 213\*', 'K 8020\*', 'HUW 234\*\*  
'C 306', 'K 65', 'K 8027'

Irrigated  
Timely sown  
Mid-Nov

Do not delay  
late sowing  
beyond 15 Dec

'Raj 1555 (d)\*\*'

Agroclimatic region	Area covered	Cultivation conditions	Optimum sowing time	Current commercial/ identified varieties	Remarks
Hills of Uttar Pradesh (NHZ)	Uttar Kashi, Tehri-Garhwal, Chamoli, Pithoragarh, Almora, Garhwal, Naini Tal, Dehra Dun	Late sown Rainfed Irrigated	Mid-Dec End of Oct Timely sown (in high altitudes end of Oct)	'Sonalika', 'Lok 1**', 'Swati' ('HI 784')**, 'J 405*' 'Sujata', 'K 65'; 'A 9-30-1' 'Sonalika', 'VL 421'; 'VL 401', 'HS 86**', 'HB 208**', 'CPAN 1796*', 'CPAN 1922** (in high altitudes end of Oct) use 'Sonalika', 'Girija' and 'VL 404' 'Sonalika', 'VL 404'	1. Do not delay late sowing beyond 15 Dec 2. Control powdery mildew, hill bunt and flag-smut 3. In very high altitude plant by the end of April or early May, after melting of snow 4. For very early plantings use 'VL 401', 'VL 616' only
		Rainfed	I fortnight of Dec (in high altitudes early Oct)	'Sonalika', 'VL 421'; 'VL 401**', 'HB 208**', 'HS 86**', 'CPAN 1796*', CPAN 1922** (in high altitudes end of Oct)	
		Early sown	Sept/Oct		

17. West Bengal  
Entire state

Irrigated  
24 Parganas (North),

(FEZ)	24 Parganas (South), Nadia, Murshidabad, Burdwan, Birbhum, Bankura, Midnapore (East), Midnapore (West), Hooghly, Howrah, Jalpaiguri, Maldà, Darjeeling, West Dinajpur, Purulia, Cooch-Behar	Timely sown Late sown	Mid-Nov 1 fortnight of Dec	'Sonalika', 'UP 262', 'HP 1102' 'Sonalika' 'BW 11'	1. Do not delay late sowing beyond 15 Dec 2. Control leaf- spots and leaf- blight by fungicides
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\*Identified varieties, \*\*recently released varieties.

S, State release; d, *durum*.

The varieties in italics should be replaced.

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