

Barley

Cultivation in India

Pocket Guide



ICAR - Directorate of Wheat Research
Karnal - 132 001 (Haryana)



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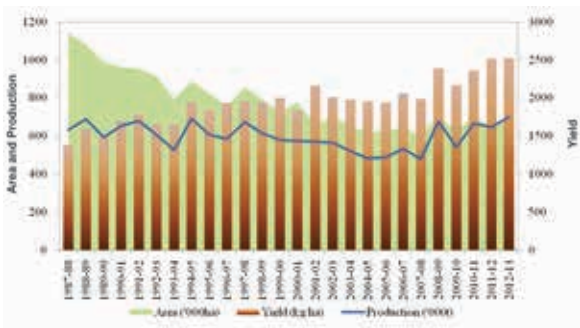


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Introduction

Barley is an important rabi crop of northern plains of India. During to 2012-13, 1.75 million tonns of barley was produced from 0.69 million hectares with per hectare productivity of 2521kg/ha. It is commonly grown in the states of UP, Rajasthan, MP, Bihar, Punjab, Haryana, HP and J&K. Barley thrives well in marginal, saline or alkaline soils and in water scarce areas as rainfed crop. It is also cultivated for malting and brewing purposes in Haryana, Western U.P., Punjab and Rajasthan with relatively better management to get good grain quality.



Soil

Sandy loam to loamy stand soils of Indo-Gangetic plains having neutral to mild saline reaction and medium fertility are the most suitable types for barley cultivation, however, it may be grown on a variety of soil types, viz; saline, sodic and lighter soils. Being salt resistant, its cultivation has become possible on saline coastal areas of Sunderban in West Bengal and saline black soils of canal irrigated areas of northern Karnataka.

Selection of variety

Most of the farmers even today are growing old barley varieties like Manjula, Azad, Jagriti (U.P.), BH 75 (Haryana), PL 172



(Punjab), Sonu & Dolma (H.P.) though their yield is quite low. Under such conditions farmers have to grow new varieties to get a better yield. An appropriate variety should be selected as per the requirement of the area, climatic & environmental conditions and use. In case of barley cultivation for industrial uses, proper malt type variety may be selected. Table containing improved barley varieties released in recent years has been given.

Barley varieties for different production conditions in India

Varieties	Production condition	Av. yield (q/ha)	Utility
North Western Plains Zone (NWPZ): Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur regions), Western UP, Tarai regions of Uttarakhand, Jammu and Kathua district of J&K and Una and Paonta valley of HP.			
RD 2794*	Irrigated, Timely sown, Salt tolerant	29.90	Feed
BH 946	Irrigated, Timely sown	51.96	Feed
DWRB 92*	Irrigated, Timely sown	49.81	Malt
DWRUB 52*	Irrigated, Timely sown	45.10	Malt
RD 2668*	Irrigated, Timely sown	42.50	Malt
RD 2035	Irrigated, Timely sown, Nematode resistant	42.70	Food & fodder

RD 2552	Irrigated, Timely sown	46.10	Food & fodder
RD 2715	Irrigated, Timely sown	26.30	Food & fodder
BH 902	Irrigated, Timely sown	49.75	Food
BH 393 (Haryana)	Irrigated, Timely sown	44.60	Food
PL 426 (Punjab)	Irrigated, Timely sown	25.00	Food
RD 2592 (Rajasthan)	Irrigated, Timely sown	40.10	Food
RD 2052 (Rajasthan)	Irrigated, Timely sown, Nematode resistant	30.68	Food
ND B 1173	Irrigated, Timely sown, Salt tolerant	35.20	Food
DWRB 91*	Irrigated, Late sown	40.62	Malt
DWRB 73	Irrigated, Late sown	38.70	Malt
DWRUB 64	Irrigated, Late sown	40.50	Malt
RD 2508	Rainfed, Timely sown	23.10	Food
RD 2624	Rainfed, Timely sown	24.89	Food
RD 2660	Rainfed, Timely sown	24.30	Food & fodder
PL 419 (Punjab)	Rainfed, Timely sown	29.80	Food
North Eastern Plains Zone (NEPZ): Eastern U.P., Bihar, Jharkhand, Odisha, West Bengal, Assam and Plains of North Eastern States.			
BCU 73*	Irrigated, Timely sown	21.60	Malt
K 551	Irrigated, Timely sown	37.64	Malt
RD 2794*	Irrigated, Timely sown, Salt tolerant	29.90	Feed
RD 2552	Irrigated, Timely sown, Salt tolerant	38.37	Food & fodder
NDB 1173	Irrigated, Timely sown, Salt tolerant	35.20	Food & fodder
K 508 (UP)	Irrigated, Timely sown	40.50	Food
Narendra Barley-1 (UP)	Irrigated, Timely sown, Salt tolerant	22.30	Food

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Narendra Barley-3 (UP)	Irrigated, Timely sown, Salt tolerant	35.00	Food
Narendra Barely-2 (UP)	Irrigated, Late sown	32.40	Food
K 560	Rainfed, Timely sown	30.40	Food
K 603	Rainfed, Timely sown	29.07	Food
JB 58 (MP)	Rainfed, Timely sown	31.30	Food
Northern Hills Zone (NHZ): Western Himalayan region of J&K (except Jammu & Kathua district), HP (except Una district and Poanta valley) Uttarakhand (except Tarai Regions) and Sikkim			
BHS 400	Rainfed, Timely sown	32.71	Feed
UPB 1008	Rainfed, Timely sown	26.44	Feed
VLB 118	Rainfed, Timely sown	30.84	Food
HBL 113*	Rainfed, Timely sown	25.52	Food
HBL 276**	Rainfed, Timely sown, Resistant to cold and rust diseases	23.00	Food & fodder
BHS 169	Rainfed, Timely sown	25.54	Food
BHS 380	Rainfed, Timely sown	20.97	Food
BHS 352**	Rainfed, Timely sown	21.90	Food
HBL 316 (HP)	Rainfed, Timely sown	25.63	Food
VLB 56 (Uttarakhand)	Rainfed, Timely sown	25.80	Food
VLB 85	Rainfed, Timely sown	15.60	Food
Central Zone (CZ): MP, Chhattisgarh, Gujarat, Kota & Udaipur district of Rajasthan and Bundelkhand region of UP			
RD 2786	Irrigated, Timely sown	50.20	Food
PL 751	Irrigated, Timely sown	42.30	Food
RD 2715	Irrigated, Timely sown	26.30	Food & fodder
JB 58 (MP)	Rainfed, Timely sown	31.30	Food
Peninsular Zone (PZ): Plains of Maharashtra & Karnataka			
DL 88	Irrigated, Timely sown	27.80	Malt
BCU 73*	Irrigated, Timely sown	29.70	Malt

* Two row barley; ** Huskless Barely



BHS 352



DWRUB 64



DWRB 73



DWRB 91



DWRUB 52

Seed and seed treatment

Farmers have to use quality seed from better production. The better quality seeds could be obtained from National Seed Corporation (NSC), State Seed Farm Corporation (SFCI), research institutions agricultural universities and KVKs. Seed treatment is very essential to control the seed born diseases in barley crop. For the control of loose smut (Kangiari), seed should be treated with Vitavax or Bavistin @2g/kg seed. The covered smut can be controlled by seed treatment with 1:1 mixture of Thiram + Bavistin or Vitavax @ 2.5g per kg or 1gm Raxil/kg seed. Termite problem is observed in many fields, treat the seed with 150 ml of Chloropyriphos (20EC) or 250 in 5 litre of water for 100 kg of seeds to avoid the loss due to termite attack.

Field preparation

In barley cultivation, field is prepared with disc harrow and cultivator followed by planking. As barley is sensitive to nitrogen and water hence, field should be well leveled. Leveling of field with laser land leveler is must for proper distribution and saving of water. Bunds are made to harvest and retain rain water in the field. In irrigated areas, field should be prepared after pre sowing irrigation for proper germination. Farmers can sow barley on raised beds too with a specially designed raised bed planter for saving of seed, fertilizer and water.



Seed rate, time of sowing, spacing and fertilizer requirement

Production condition	Seed rate (kg/ha)	Time of sowing	Spacing (cm)	Fertilizer requirement (kg /ha)
Irrigated				
a) Timely sown	100	1-25 Nov.	23	60 N:30 P:20 K
b) Malt	100	1-25 Nov.	18-20	80 N:40 P:20 K
c) Late sown	100	1-25 Dec.	18-20	60 N:30 P:20 K
Rainfed				
Plains	100	25 Oct.-10 Nov.	23	30 N:20 P:20 K
Hilly Region	100	20 Oct.-7 Nov.	23	40 N:20 P:20 K

In case of bold seeded varieties, seed rate should be kept higher.
N=Nitrogen, P=Phosphorous, K=Potash

Fertilizer application

In irrigated areas, $\frac{1}{2}$ N+ full P and K at the time of sowing and remaining $\frac{1}{2}$ N after first irrigation. In rainfed condition, full NPK should be applied as basal at the time of sowing. In case of Zn deficiency, apply $Zn SO_4$ @ 20 kg/ha. Application of other micronutrients should be done on the basis of soil testing and deficiency symptoms.

Method of sowing

Sowing with a seed cum fertilizer drill is the best method of sowing. Another traditional method of line sowing in some areas is dropping seeds with a Chonga (a tube connected with a funnel like structure



behind country plough) attached to a desi-plough is also popular. Dropping seeds in open furrows behind desi-plough and broadcasting are found to be inferior compared to line sowing with seed drill. Soil should be made compact by planking or running a roller for better seed-soil contact.

Irrigation

Barley can be grown under irrigated, rainfed and limited irrigation conditions. Generally it requires 2-3 irrigations for better yield. The malt barley requires 3 irrigations to ensure better yield, grain uniformity and grain quality. Depending upon the water availability irrigation should be given at suitable stages. In dry area of Rajasthan the number of irrigation should be increased to 5-6.

No. of irrigation	Days after sowing	Stage of crop
1	30-35	CRI
2	30-35, 65-70	CRI, Panicle emergence
3	30-35, 65-70, 90-95	CRI, Panicle emergence, Grain formation

Weed control

Barley is a fast growing crop and generally weeds may not be able to compete if proper crop stand is maintained. If necessary weed control measures can be taken up.

Nature of weeds	Herbicides	Dose (per / ha)	Method of application
Narrow leave <i>Avena fatua</i> (Wild Oat), <i>Phalaris minor</i> (Kanaki), Poa ghas, Lomar ghas	Pinoxaden (Axial 5 EC)	87.5 ml	30-35 days after sowing in 300 litres of water for one hectare.

Broad leaf <i>Chenopodium album</i> (Bathua), kharbathu, jangali palak, maina, metha, malwa grass, makoi, kandai, <i>Convolvulus arvensis</i> (hirankhuri), <i>Anagalis</i> <i>arvensis</i> (krishna neel), <i>Cronopus didymus</i> (wild carrot), pyaji, chatari-matari	Metsulfuron (Algrip) 2,4-D (Weedmar)	10 gm 1250 gm	30-35 days after sowing in 300 litres of water for one hectare.
Both (broad and narrow leaf)	Isoproturan (Iso Guard 75 WP)	1250 gm	30-35 days after sowing in 300 litres of water for one hectare.
	Pendimethalin (Stomp)	3125- 3750 ml	3 days after sowing in 300- 375 litres of water for one hectare.

Important points

- Always use weed free seeds for sowing.
- Spray herbicides at proper time in proper quantity with appropriate spray technique.
- Rotate herbicides every year for better result.
- In crop rotations use forage crops such as berseem. and oat for weed management.
- Use flat fan nozzle for spray.
- In case of resistance in *Phalaris minor* against Isoproturan use Pinoxaden (Axial) or Pendimethalin (Stomp).

Precautions

- Do not mix Pinoxaden with 2,4 D, spray 2,4 D one week after the spray of Penoxaden.
- Do not use under/over dose of herbicide.
- Do not allow the seed formation of weeds in fields.
- Spraying should be done within 30-35 days after sowing.

Diseases and insect-pests

Loose and covered smut

Seed treatment with Vitavax/Bavistin @ 2g/kg seed for loose smut, and Vitavax & Thiram in the ratio of 1:1 or Tebuconazole 1.5 g/kg seed for covered smut should be used. Seed can be given solar treatment during the month of May -June. Soak the seed for four hours in water and keep it in sunshine for 10-12 hours. Afterwards, store the seeds in a dry place. In the field, collect the smutted earheads and burn them outside the field.



Loose smut



Covered smut

Rust

Rusts are multiple cycle diseases and spread like a wild fire under favourable environments. Though chemicals are available, the control by sprays may not be cost effective. Frequent sprays may be needed at regular intervals,



Yellow rust

which is not feasible for low input crop like barley. The use of resistant varieties is highly recommended and a number of resistant/tolerant varieties are available such as DWRUB52, DWRB73, DWRUB64, DWRB91 and DWRB92. Spraying with Tilt 0.1% or Bayleton 0.1% or Folicur 0.1% (1 ml in 1 litre water) immediately after appearance of the disease should be done.

Leaf Blight

It is severe in areas where the day is warm and humid especially in north eastern parts. The source of inoculum

is both soil and seed and therefore seed treatment with Vitavax and Spraying with Bayleton 0.1% or Tilt @ 0.1% or Folicur 0.1% (1 ml/litre of water) is recommended. Grow resistant/tolerant varieties such as DWRUB52, DWRB73, DWRUB64, RD2552.



Leaf blight

Aphid

Barley crop is affected by aphid which causes heavy loss to the crop as well as the grain quality in susceptible variety. Spraying with Imidacloprid @ 20 g ai/ha or Clothianidin @ 15 g ai/ha in 1000 litres of water. In case of heavy incidence the second spray can be made at an interval of 15 days.



Aphid

Molya disease

The CCN affected soils are common in sandy areas of north eastern Rajasthan and adjoining Haryana. This causes heavy losses in crop by drastically reducing tillering and earhead formation. The use of resistant varieties like RD2052 and RD2035 and RD2592 should be encouraged for such areas.

Harvesting, threshing and storage

Barley crop gets ready for harvest by the end of March to first fortnight of April. Since barley has shattering



character, it should be harvested when it ripens to avoid breaking of spikes due to dryness. Barley grain absorbs

water from the atmosphere and should be stored at an appropriate dry place to avoid storage pest losses. For industrial purpose, choose an appropriate variety, sow and harvest timely with proper management.

Growing barley under contract farming for industrial purposes

In ancient times, barley was used for flour and sattu making (local preparations) and also used as animal feed. The grain as well as straw or the green ripe



crop is used as fodder for feeding the dairy animals. The other most important use of barley is for malt used in chocolate, infant food, weaning baby food, milk based beverages, for beer and spirits. The medicinal properties of barley include for diuretics and kidney stone ailments. Due to the liberalized trade policies at present industry for beer preparation increased and so the malt requirement in India has shot up. Today, the industrial requirement of barley is about 3.5 to 4.0 lakh metric ton and it is growing at annually the rate of 10 percent. At present 20-25% of the total barley production is utilized for malt preparation. The six row barley is lacking in desired quality of malt and because of this, many companies have started contract farming on two row barley at farmers field in Punjab, Haryana, Rajasthan western U.P. and Uttarakhand. The companies provide quality seeds to the farmers and if required they will provide fertilizers, herbicides and they are purchasing the produce at a pre decided cost.

Growing barley for green fodder

Barley has been traditionally used as a grain crop for human consumption and animal feed in India.



It is grown during the winter season (rabi) in the northern plains as well as in northern hills, mostly under rainfed or limited irrigation condition on poor to marginal soils.

In the recent years it has been observed that because of severe drought in the direr parts of northern plains (Rajasthan, Southern Haryana, south west Punjab and western U.P.) there is an acute shortage of green fodder in the months of November to January. Since both berseem (*Trifolium* spp) and sugarcane top are mostly used as green fodder in northern India in addition to oats (*Avena sativa*). All these require frequent irrigation, which are not available under water scarcity condition.

Barley can be utilized as a source of green fodder in such conditions. The crop can be given one cut at 50-55 days after sowing for green fodder and the regenerated crop can be utilized for grain purposes. In Northern hills the cut for green foods can be taken at 70 DAS. Since both the green fodder and grain can be utilized for animal fodder/feed purposes, the crop can be advantageous over oats, because of its dual utilization as well as less water requirement. It needs only two to three irrigations. The experiments have indicated that two barley varieties RD2715, RD2035 and RD2552 in plains and BHS 380 in hills can be sown as dual purpose barley with good yield of the green fodder (200 to 250 q/ha) and grain (25 to 35 q/ha).

4 W & 1 H of barley cultivation

What to do?	When to do?	How to do?	Why to do?	What not to do?
Soil testing	October / after harvesting of crop in May- June	Take samples from all corners and middle of field and mix well. Draw 500 gm soil sample from it and get it tested in nearby soil testing laboratory.	It will give information about soil fertility of the particular field so that one can apply fertilizer as per soil requirement / recommendations.	Don't collect the soil sample from heap of the compost /residue / standing crop to get the accurate results.
Field preparation	Field preparation should starts from October by good ploughing followed by planking for moisture conservation and field leveling.	Field should be well prepared by disc harrow and cultivator as per requirement of the soil. Land laser leveler can be used for perfect land leveling. It can be arranged from nearby source, if not available in the village.	Good field preparation will help in weed control. Irrigation will be uniform and saving of irrigation water in the leveled field.	To conserve soil moisture, there should not be deep/ heavy cultivation. If sowing is to be done by zero tillage, then harrow cultivation should be avoided.
	For sowing on raised bed, field should be well prepared.	Three four field preparation operations should be done and then do leveling through planer	Irrigation will be faster and saving of irrigation water in the raised bed field.	In heavy soils, avoided bed planting due to clod formation & crop stubbles may affect germination.

Sowing method	Drill should be used for sowing	Sowing is to be done by drilling seed and fertilizer. Seed and fertilizer pipes should be checked carefully during drilling operation. Zero tillage can be practiced in hand harvesting field.	By sowing the crop through drill, there will be time saving and proper germination. Productivity will be more in line sowing as compared to broadcasting as in broadcasting population density may not be uniform. Birds may also damage the germinating seeds. Under zero tillage sowing, field should not be prepared.	Heavy tillage operations should not be followed as it will save diesel, time and money. Never use planker after drill sowing as the seeds may go deeper by extra soil put on by it, resulting in poor germination.
Selection improved varieties.	In October	Selection of recommended / suitable varieties should be done through discussion with the representative of research centre/ state agriculture department / friends etc.	It will increase productivity of the crop and good quality may fetch higher prices in the market.	Don't use old varieties. There may be damage through diseases and productivity may be lower than the new ones.
Balanced and integrated use of fertilizers	At the time of sowing and after the first irrigation. Micronutrients may be applied as per requirement and deficiency.	Half of nitrogen, full of phosphorus and potash may be applied at the time of sowing. Rest of nitrogen may be applied after first irrigation through broadcast.	All essential nutrients are made available to the plants through balanced and integrated fertilizer application. The crop will be healthy, with higher productivity.	Deficiency of one element may affect availability of other element. Seed and fertilizer should not be placed at the same place in the soil, it will affect germination adversely and productivity will be less.

<p>Irrigation</p>	<p>The pre sowing irrigation in October followed by as per requirement and availability.</p>	<p>Bunds may be prepared in and around the field and field should be divided in equal parts so that irrigation may be uniform, easy and quick.</p>	<p>It will help in field preparation, better germination and production of bumper crop. There should be judicious use of irrigation water.</p>	<p>Don't apply heavy irrigation in standing crop otherwise there may be loss instead of benefit.</p>
<p>Weed control</p>	<p>Pre emergence immediately after sowing (within 2-3 days) and at 30-35 days after sowing as the case may be.</p>	<p>Spray proper and recommended dose herbicide through flat fan nozel for uniform application. Use only recommended herbicide for barley.</p>	<p>There will be economic loss by weeds if their population goes beyond threshold level.</p>	<p>Don't mix two or more herbicide without recommendations. Wheat herbicide should not be used in barley without recommendations.</p>
<p>Use of resistance varieties</p>	<p>October</p>	<p>There will be no danger of disease in resistant varieties and healthy seeds.</p>	<p>Selection of suitable variety resistant to prevalent disease/ pest of the area</p>	<p>Don't use varieties which are not recommended, otherwise there may be danger of disease spread.</p>
<p>Seed treatment</p>	<p>At the time of sowing</p>	<p>Seed treatment may give protection to soil and seed borne diseases. Germination will be better; plants will be healthier and have capacity to fight against diseases.</p>	<p>Tebuconazole @1.25g /kg seed or Vitavax @ 2.5g /kg seed or Thiram+Vitavax (1:1) may be used for seed treatment for smuts. Seed treatment drum may be used for seed treatment. Sowing of seed one day after seed treatment.</p>	<p>Don't sow seed without seed treatment otherwise smuts (covered and loose) may cause heavy losses. Covered smut is also mixed as black balls of spores with grain.</p>

Treatment against termite	3-4 days after first irrigation	Broadcast pest treated sand/ soil to avoid termite damage.	In the termite prone areas, seed treatment with chloropyrifos @ 0.9g a.i./kg seed, be taken up for their management. Seed treatment with thiamethoxam 70WS (Cruiser 70WS) @ 0.7 g a.i./kg seed or Fipronil (Regent 5FS @ 0.3 g a.i./kg seed) is also very effective. In the standing crop, the broadcasting of the insecticide treated soil 15 DAS be practiced. For this, chloropyrifos @ 3 Litre mixed in 50 Kg soil be used for one hectare field.	Don't use termite treatment in areas of no termite attack. Do not apply termite treatment, if field is not having enough moisture.
Aphid control	Only after visual appearance of aphid	Use imidacloprid to control aphid. At initial stage aphid affect the borders and then inside the field. Aphid control at the border may protect the inside crop.	To control aphid, apply imidacloprid (confidor 200 SL) @15 ml in 35 L water. The application should be around the borders 2-3 meters inside the field.	Don't broadcast the chemical for aphid control in whole field. It may affect the friendly pest like lady bird bittle.

Harvesting	Hand harvesting when the grain moisture is 15-20 percent. Harvest by combine when the grain moisture is below 14 percent	If the grains appear hard when breaking under teeth, then the crop is ready for harvest.	Grain quality will be better at optimum time of harvesting. There may be less damage due to pest under proper storage and germination will be better.	Doesn't use combine harvester if the moisture is more otherwise grains will be damaged and the grain quality will be affected fetching lower prices.
Storage	Moisture should be below 12 percent.	Storage should be at airy open space. Use pesticides in rainy season.	In rainy season, grains will absorb moisture and may be damaged by storage pests.	Don't store at high moisture condition, otherwise it may lose viability or storage pest damage may occur.



