

## 04. WHEAT AND BARLEY - ORIGIN, GEOGRAPHIC DISTRIBUTION, ECONOMIC IMPORTANCE, SOIL AND CLIMATIC REQUIREMENT, VARIETIES, CULTURAL PRACTICES AND YIELD

### WHEAT (*Triticum aestivum*)

#### VERNACULAR NAMES

Gom (Bengali), Ghau (Gujarati), Gehun (Hindi), Godhi (Kannada), Ku'nu'kh (Kashmiri), Gothmbu (Malayalam), Gahu (Marathi), Gahama (Oriya), Kamak (Punjabi), Godumai (Tamil), Godhumalu (Telugu).

#### ORIGIN

De Candolle believed that Valley of Euphrates and Tigris was the origin of wheat. But Vavilov stated origin of Durum wheat is probably Abyssinia and soft wheat groups are in the region of Western Pakistan, South west Afghanistan, and Southern parts of mountainous Babshara.

#### GEOGRAPHIC DISTRIBUTION

Wheat is widely cultivated cereal, spread from 57°N to 47°S latitude. Hence, wheat is cultivated and harvested throughout the year in one country or other. China, India, Russian federation, USA, France, Canada, Germany, Pakistan, Australia and Turkey are most important wheat growing countries. In India, UP, Punjab, Haryana, MP, Rajasthan, Bihar, Gujarat, Maharashtra, Uttaranchal and West Bengal are the important wheat cultivating states.

#### ECONOMIC IMPORTANCE

Wheat is the world's number one cereal in area. Cultivation of wheat is as old as civilization. It is the first mentioned crop in Bible. Wheat is eaten in various forms by more than 1000 million people in the world. In India, it is second important staple food crop next to rice. In areas wheat is staple cereal food; it is eaten in the form of 'chapattis'. In areas where rice is the staple cereal food, wheat is eaten in the form of 'puris' or in the form of 'upma' (cooked from 'suji' or 'rawa'). In addition to this, wheat is also consumed in various other preparations such as 'dalia', 'halwa', 'sweet meals', etc. In most of the urban areas of the country, the use of backed leavened bread, flakes, cakes, biscuits, etc. is increasing at a fast rate. Besides staple food to human, wheat straw is a good source of feed for a large population of cattle in the country.

#### SOIL AND CLIMATIC REQUIREMENT

##### Soil

Wheat is cultivated in a variety of soils of India. Soils with a clay loam or loam texture, good structure and moderate water holding capacity are ideal for wheat cultivation. Care should be taken to avoid very porous and excessively drained soils. Soil should be neutral in its reaction. Heavy soils with good drainage are suitable for wheat cultivation under dry conditions. These soils absorb and retain in rain water well. Heavy soils with poor structure and poor drainage are not suitable as wheat is sensible to water logging. Wheat can be successfully grown on lighter soils provided their water and nutrient holding capacities are improved.

##### Climate

Wheat has hardening ability after germination. It can germinate at temperature just above 4°C. After germination it can withstand freezing temperatures by as low as -9.4°C (Spring wheat) and as low as -31.6°C (Winter wheat). Normal process starts above 5°C under the presence of adequate sunlight. Wheat can be exposed to low temperature during vegetative and high temperature and long days during reproductive phases. Optimum temperature is 20-22°C. Optimum

temperature for vegetative stage is 16-22°C. Temperature above 22°C decreases the plant height, root length and tiller number. Heading is accelerated as temperature rose from 22 to 34°C, but, retarded above 34°C. At grain development stage, temperature of 25°C for 4-5 weeks is optimum and above 25°C reduces the grain weight.

It is long day plant. Long day hastens the flowering and short day increase the vegetative period. But, after the release of photo-insensitive varieties, no issues of photo-sensitiveness..

### **SPECIES OF WHEAT**

There are 7 in the world, only 4 is important in India, they are:

#### **1. Common wheat (*T. vulgare / aestivum*)**

It is also called as Bread wheat. Most suited for chapati and bakery. It is cultivated throughout India. Common wheat may be sub-divided in to,

- Hard red winter wheat – commercial class
- Hard red spring – where winter is too severe, high protein and excellent bread making characteristics
- Soft red winter – grown in humid conditions, grains are soft, low protein, flour more suitable for cakes, cookies
- White wheat – mainly for pasty purpose

#### **2. Duram wheat (*T. durum*)**

Also called as *Macroni* wheat. It is best suited for preparation of noodles, vermicelli, etc. Has spring habit and cultivated in Central & Southern India.

#### **3. Emmer wheat (*T. dicoccum*)**

Otherwise called as Winter / spring wheat. Wheat suitable for cultivation in Tamil Nadu, Gujarat, Maharashtra, AP. Preferred for granular preparation.

#### **4. Short wheat (*T. sphaerococcum*)**

Commonly known as Indian dwarf wheat. Practically, gone out-off cultivation due to low productivity. Small extent North India and West Pakistan for local consumption.

### **WHEAT VARIETAL DEVELOPMENTS IN INDIA**

Wheat selection programme was carried out in PUSA, Bihar. They released *T. aestivam* cultivars. Durum and Emmer wheat varieties were released before independence. Wheat Improvement Programme done by Dr. B.P. Pillai in IARI, New Delhi. Introduction of semi-dwarf wheat varieties was made in 1963 from Mexico. Most important varieties released are Sonora 64 & Lerma Rojo which has non-lodging, higher yield and Fertilizer response. Increase in wheat production during 63-67 was called as “Green revolution”.

Further genetic advancement in these led to Kalyansona, Sonalika, UP 301 which increased area and productivity. Currently, Sonak was released to replace Sonalika and HD 2285, PBW 343, HD 2687, WH 542, UP 2336, Raj 3077, CPAN 3004, PDW 215 etc. are released for cultivation.

### **CULTIVATION PRACTICES**

**Suitable districts in Tamil Nadu:** Plains & adjoining areas near to hills and hills in Theni, Dindigul, Karur, Coimbatore, Erode, Salem, Dharmapuri, Vellore, Thiruvannamalai and Kancheepuram districts.

**Season:** Ideal sowing time is 15<sup>th</sup> October to 1<sup>st</sup> week of November. Sowing must be completed within the first fortnight of November.

**Variety:** COW (W) 1 – Duration of 90 days. Non lodging, non shattering; tolerance to stem and leaf rust; suitable for chappathi and bread making.

**Seed rate:** 100 kg/ha

**Field preparation:** Plough twice with an iron plough and two to three times with cultivator and prepare the land to a fine tilth.

**Application of FYM or compost:** Spread 12.5 t/ha of FYM or compost on the unploughed field.

**Seed treatment with fungicides:** Treat the seeds with Carbendazim or Thiram at 2 g/kg of seeds 24 hours before sowing.

**Forming beds and channel:** Form beds with size of 10 m<sup>2</sup> or 20 m<sup>2</sup>. The irrigation channels are to be provided sufficiently.

#### **Application of fertilizers**

- Apply NPK fertilizer as per soil test recommendation as far as possible. If soil test recommendation is not available, adopt a blanket recommendation of 80:40:40 NPK kg/ha.
- Apply half of N and full dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O basally before sowing and incorporate in the sowing.

**Sowing:** Draw the lines in 20 cm apart and sow the seeds continuously after application of fertilizers to a depth of 5 cm. Avoid deep sowing.

#### **Weed management**

- Apply Isoproturon @ 800 g/ha as pre-emergence spraying 3 days after sowing followed by one hand weeding on 35<sup>th</sup> day after sowing.
- If herbicide is not applied, give two hand weedings on 20<sup>th</sup> and 35<sup>th</sup> day after sowing.

#### **Water management**

The crop requires 4-6 irrigations depending on the soil type and rainfall. Wheat crop requires minimum of 5 irrigations at the following critical stages such as, immediately after sowing, crown root initiation (15-20 DAS), active tillering stage (35-40 DAS), flowering stage (50-55 DAS) and grain filling stage (70-75 DAS). Crown root initiation and flowering are the most critical stages. Water stagnation should be avoided at the time of germination.

**Top dressing:** Apply remaining half of N at crown root initiation stage (15-20 DAS).

**Harvesting:** Harvest the crop when the grains become hard and straw becomes dry and brittle. Trash and winnow the grains. Use mechanical threshers to reduce the cost of threshing and winnowing.

**Yield:** Grain yield of wheat in north India is around 3000 kg/ha with straw yield of 5000 kg/ha. In Tamil Nadu, wheat yields are about 2500 kg/ha.

## **BARLEY (*Hordeum vulgare*)**

### **ORIGIN**

Near-East region as probable place of origin for Barley. Abyssinia is believed as centre of origin for barley by one group and south East Asia (China, Tibet, Nepal) by another group.

### **GEOGRAPHICAL DISTRIBUTION**

Barley is cultivated all most similar to wheat crop. In the world, Europe is the most predominant continent growing Barley followed by Asia. The countries such as, Russian federation, China, Canada, USA, Spain, France, Australia, UK and India cultivate barley. In India, UP, Rajasthan, MP, Haryana, Punjab and HP are the major states cultivating barley.

### **ECONOMIC IMPORTANCE**

It is important next to rice, wheat, maize in area and production. It is more suitable than wheat in India. Due to hardy nature, it can withstand adverse agro-environments like, drought, salinity, alkalinity, varied topography like plain, hill, under rainfed and irrigated conditions, etc. It is the crop preferred by farmers where wheat is not possible.

It is a *Rabi* cereal crop and food for people of cooler and semi-arid part of the world. In India, 90% of barley is used as human food. Used for preparation of malt, beer, whisky and industrial alcohol, vinegar. Energy rich drinks like bournvita, boost, horlicks and biscuit are from barley malt. Medicinal value of barley reduces cholesterol level in liver and also stimulates fatty acid synthesis in liver. In USA as cattle feed and horse feed. Barley has great demand to malting industry. Good quality grain production may open foreign exchanges. Protein - 11.5%, carbohydrate - 74%, fat - 1.3%, crude fibre - 3.9%, ash - 1.5%.

### **SOIL AND CLIMATIC REQUIREMENT**

#### **Soil requirement**

Barley is tolerant to salinity and alkalinity, but, sensitive to acidity. Barley, being salt tolerant, best substitute for sodic soil. Drained, fertile deep loam soil with pH 7-8. Barley grown in high N soils, often lodges.

#### **Climatic requirement**

Climate necessary for successful barley cultivation is similar to wheat. It performs well in cool climate. Warm and moist conditions are not conducive for barley growth. It can't tolerate to frost and frost and hail storm at flowering are more detrimental.

**Season:** Under rainfed sow barley before end of October. In irrigated condition, first or second fortnight of November is optimum time of sowing. In Hilly zones barley is sown as summer crop in April-May months.

**Seed rate:** Irrigated condition – 100 kg/ha; Rainfed – 80-100 kg/ha

**Spacing:** 22.5cm row spacing for irrigated and 22.5 to 25 for rainfed situation is optimum for better yields. Depth of sowing must be 5cm under irrigated situation, whereas, in rainfed condition it is 6-8cm.

### **Varieties**

- Two types: Huskless and Hulled barley.
- Huskless barley is preferred; Karan 18 & 19 are popular varieties and have more demand from farmers.
- Suited for hills: Himani, Dolma, Kailash.
- Suited for rainfed areas: Ratna, Vijay, Azad, Ameru (best for malt).
- Suited for irrigated areas: Jyoti, Ranjit, Clipper (best for malt & brewing), Karan 18 & 19.
- Dual purpose (fodder and grain): Ratna, Karan2, Karan 5, Karan 10

### **CULTURAL PRACTICES**

**Land preparation, Seed treatment, Method of sowing** - Similar to wheat

#### **Nutrient management**

- Apply FYM 12.5t/ha.
- Irrigated situation: 60:30:20 kg NPK/ha
- Malt barley: 30:20:20 kg NPK/ha
- Rainfed condition: 40:20:20 kg NPK/ha
- Method of application: 50% N and 100% P&K to be applied as basal. Remaining 50% N must be applied during first irrigation.
- Rainfed condition: 100% NPK as basal.
- Light soils, N must be given in three equal splits such as basal, first irrigation and second irrigation.

#### **Water management**

- Water requirement is 200-300mm. 2-3 irrigations give good yields.
- Critical periods are, seedling / sprouting, active tillering, flag leaf and milking or soft dough stages.
- Tillering and grain filling so crucial.

#### **Weed management**

- Up to 30 days is critical weed free period for barley crop.
- Pendimethalin (pre-emergence) 1.0kg/ha or Post emergence herbicides Isoproturan @ 0.75kg/ha + 0.5 kg 2,4DEE 3-5 leaf stage + one hand weeding proved effective weed control.

#### **Cropping systems**

- Best barley based cropping systems are, Rice-barley, Sorghum–barley, Pearl millet-barley, Cotton-barley, Blackgram-barley.
- Mixed cropping: Barley is raised as mixed crop with Chickpea, pea, mustard, linseed, lentil

**Harvest:** Similar to wheat

**Yield:** 3.0 – 3.5t/ha under ideal irrigated condition with straw of 4.0-5.0t/ha. In rainfed situation, depending on the weather condition, yield levels vary from 1.5-3.0 t/ha.