

# 1: CROP DESCRIPTION

## 1.1 Scientific Name: *Triticum* spp.

*Triticum sphaerococcum*- Indian wheat

*Triticum aestivum*- common Bread Wheat

*Triticum durum*- Macaroni wheat

*Triticum dicoccum*- Emmer Wheat.

## 1.2 Origin of the crop:

Wheat is cultivated since pre-historic times in the world. From all possible records, it seems that its center of origin is South Western Asia. It is believed that Aryans brought wheat grains to India and since then it is being grown in India. Records from ancient China show that it is raised there since 2700 BC, and it was also known to Egyptians and inhabitants of Switzerland as early as Stone Age. The Centers of origin of *Triticum* species are given below.

**Table- 1.1: Centers of origin of *Triticum* species**

Species (Ploidy level)	Common name	Centre of origin
aestivum (6x)	Bread wheat	Central Asia, North East
dicoccum (6x)	Emmer wheat	Abyssinia
durum (4x)	Macaroni wheat	Near East, Mediterranean Region Abyssinia

*Source: Zeven and Zhukovsky (1975) and Hawkes (1982)*

**1.3 Importance:** Wheat is the one of the staple foods of north Indian population. Wheat grains are ground in to flour (atta) and consumed mostly in the form of chapati or leavened bread. Soft wheat is used for making chapati, bread, cake, biscuits, pastry and other bakery products whereas hard wheat is used for manufacturing rawa, suji, and sewaya. In areas where rice is a staple food grain, wheat is also eaten in the form of puri etc. It is also used for making cakes and sweet meats etc. Wheat grain is used for preparing starch. Wheat straw is used as fodder, padding material and mulching material.

**1.4 Morphology:** Wheat is an annual plant belonging to the family Poaceae (Gramineae).

**1.4.1: Roots** – Wheat plant consists of two sets of roots viz seminal roots and clonal roots (crown roots). Seminal roots arise from germinating seedlings and the crown roots arise from the basal node of plant. The crown roots form the permanent root system while the seminal roots dry after about 30 days of the seedling emergence.

**1.4.2: Stem:** - Wheat stem (culm) is erect, cylindrical, jointed and smooth. The solid joints are termed as nodes which separate the plant into sections known as internodes and these nodes/internodes are differentiated when plants start elongating. The lower internodes are shorter while the upper ones are progressively longer. The main culm produces branches at the base close to the ground called the tillers (primary) and the tillers produce the additional tillers known as secondary and tertiary tillers.

**1.4.3: Leaves:** Wheat leaves consist of two parts, the leaf sheath which encircles the stem and the blade that bends away from the stem. The foliage arrangement on culm is opposite.

**1.4.4: Inflorescence:** The inflorescence is called ear or spike. Three to five florets are arranged in spikelets on rachis node. Each floret contains three anthers (androecium) and one ovary (gynoecium) bearing bifurcated feathery stigma. Cleistogamous condition i.e. pollination takes place in closed flower favours self pollination. But out crossing to the extent of 5% many take place depending upon the floral morphology of varieties.

**1.4.5: Seed:** Wheat seed is called caryopsis with a thin walled pericarp enclosing single seed coat and testa is fused with pericarp. The seed shape is oval and the colour is red, white or amber.

**1.5: India's global position, Crop Species grown and their distribution:** Currently, India is second largest producer of wheat in the world after China with about 15% share in total world's wheat production. Currently, India is surplus in wheat production and in a position to export. Three species of Wheat namely, (i) *T. aestivum*, (ii) *T. durum* and (iii) *T. diococcum* are being cultivated in the country, the details are as under:

**Table- 1.2: Wheat Species-wise contributions in production in India**

Sl. No.	Species	Percentage share of Production	Major growing areas
1.	<i>T. aestivum</i>	95%	Major growers are Uttar Pradesh, Punjab, Haryana, Rajasthan, Bihar, West Bengal, Assam, Parts of Madhya Pradesh, Himachal Pradesh, Jammu & Kashmir, Gujrat, Maharashtra, Uttarakhand and Chattisgarh
2.	<i>T. durum</i>	4%	The durum cultivation is confined to Madhya Pradesh, Maharashtra, Gujrat, Southern Rajasthan and few locations in Punjab.
3.	<i>T. diococcum</i>	1%	Karnataka, Maharashtra & Tamil Nadu

**1.6: Nutritional value:**

Wheat is used by human being in the form of flour for making Chapatias, Semolina and Pasta products. It is also used for preparation of bread, biscuits, cookies, cracks, noodles, dalia, maida, vermicelli, etc. Wheat contains about 70% carbohydrates, 12% protein, 1.7% fat, 2.7% minerals, 2% fiber and 12% moisture.

**1.6.1: Quality Parameters:**

Significant nos of wheat grain samples are analysed every year under All India Coordinated trials. These are evaluated during the research trials(2<sup>nd</sup> Year AVT). The promising specific genotypes the have been evaluated for specific wheat products so far are as follows:

**Table- 1.3: Product-wise Quality Wheat Varieties**

Product for which evaluated	Qualifying Score	Promising quality wheat varieties or genotypes
Chapati	8.0 out of 10	C-306, Raj-3765, HD-2285, PBW-226, PBW-175, K-8027, K-9107, MACS-6145, UP-262, NW-1014, HUW-234, HUW-533, LOK-1, Sujata, HI-1500, HW-2004, DL-788-2, GW-173, GW-273, G-322, Raj-3077, HD-2833
Bread	More than 575 ml loaf volume	HS-240, VL-738, HD-2285, PBW-396, HD-277, HD-2733, NW-2036, LOK-1, GW-120, GW-173, GW-496, HI-977, HD-2189, HD-2501, HD-2781, DWR-162, DWR-195, MACS-2496, NE-5439
Biscuit	More than 8.0 spread factor	Sonalika, UP-2425, HS-490
Pasta	More than 6.5 score out of 9.0	PDW-233, WH-896, PBW-34, HI-8498, HD-4672, Raj-1555, A---30-1, MACS-2846, DDK-1009, NP-200

The parameters considered important for determining wheat quality are the grain Protein Content,  $\beta$ -Carotene Content, Hectolitre Weight, Sedimentation Value, Moisture content, Gluten(wet,dry and gluten index), Grain Hardness index/appearance, Test weight, Alkaline Water Retention Capacity and Yellow Berry Incidence.

Hard wheat (*T.aestivum*) with strong gluten content are the main quality requirements for bread making. For biscuit making, the requirements are Low protein with weak gluten content found in *diococcum* type of wheat or soft what and for chapatti making, the requirements are medium to high protein and medium gluten .Hard type of wheat (*T.durum*) with strong gluten, high protein with high  $\beta$  - Carotene Content are required for Pasta and traditional products making.

The Indian bread wheat or aestivum and pasta or durum wheat varieties possess low levels of grain iron (27-55 ppm), and zinc (20-50 ppm). Therefore, there is a requirement of enhancing the iron, zinc and micronutrient content in wheat through biofortification. With an objective of developing biofortified wheat, many cultivars or genotypes have been identified or developed for cultivation through implementation of suitable breeding strategies. Some promising cultivars recently identified for best quality and nutritional parameters are as follows:

**Table- 1.4: Parameter-wise Quality Wheat Varieties**

Parameters	Promising types of <i>T.aestivum</i>	Promising types of <i>T.durum</i>
Sedimentation Value	HS576, HS536, HPW349, HPW399, HD3117, PBW688, UAS348, MP3288, K1116, NI5439	MACS3929, A-9-30-1, UAS446, GW1292
Grain Hardness Index	UP2848, HD3070, C306, HD2888, BRW3723, HD3123, MACS6568, NIAW1415, COW(W)1, HW4042 (-90), VL967 HS490, VL3001	PDW291, HI8739, UPD94, A-9-30-1, AKDW2997-16, UAS446 (-90)
Yellow Pigment	VL907, HS542, PBW373, NW2036, UAS334	MACS3929, HI8713, DDW23, MPO1255, HI8735
Iron	K8027, HD2888, MP3288, DBW93, NIAW1415, NI5439, HW5224, COW(W)1, HW2044, HW5216	MPO1244, HI8627, HI8742, UAS446, GW1292
Zinc	HS578, HUW668, WH1136, UP2845, HW2044, HW5216, HW4013, HW5237, HW1900	HI8736, WHD948, NIDW699

**1.7: Wheat Growing zones and crop distribution in India:** Based on soil characterization, rainfall, temperature and terrain, six main Agro-climatic zones for wheat cultivation in India have been identified. The classification of wheat growing zones & details of Zone-wise area coverage of wheat are given below:

**Table- 1.5: Agro-climatic Zones of Wheat in India**

Sl. No.	Zones	States/regions covered	Approx Area during 2013-14 (million ha)
1	<b>Northern Hill Zone (NHZ)</b>	Hilly areas of Jammu & Kashmir (except Jammu, Kathua and Samba districts), Himachal Pradesh (except Una & Paonta valley), Uttarakhand (excluding Tarai region) & Sikkim	0.8
2	<b>North Western Plains Zone (NWPZ)</b>	Punjab, Haryana, Western Uttar Pradesh (except Jhansi Div), Rajasthan(excluding Kota & Udaipur div), Delhi, Tarai region of Uttarakhand, Una & Paonta valley of Himachal Pradesh, Jammu, Samba & Kathua districts of Jammu & Kashmir and Chandigarh.	11.5
3	<b>North Eastern Plains Zone (NEPZ)</b>	Eastern Uttar Pradesh (28 dist), Bihar, Jharkhand, West Bengal, Assam, Odisha and other North Eastern states (except Sikkim)	11.1
4	<b>Central Zone</b>	Madhya Pradesh, Gujarat, Chhattisgarh, Kota & Udaipur Div of Rajasthan& Jhansi Div of Uttar Pradesh.	6.08
5	<b>Peninsular Zone</b>	Maharashtra, Tamil Nadu (except Nilgiris & Palani Hills), Karnataka & Andhra Pradesh	1.6
6	<b>Southern Hill Zone (SHZ)</b>	Nilgiris & Palani Hills of Tamil Nadu	0.1
		<b>Total</b>	<b>31.18</b>

Wheat is grown in India on an area of about 31.18 Million ha. with a production of 95.91 Million tonnes and productivity of 3.1 t/ha (2013-14). Analysis of area, production and productivity of wheat during the last decade (1999-2000 to 2013-14) indicated that the major wheat producing states that achieved the average productivity of 3t/ha and above are Uttar Pradesh (98.56 lakh ha), Punjab (35 lakh ha), Haryana (25.22 lakh ha), Rajasthan( 30.80 lakh ha). The significantly contributing states are Madhya Pradesh (57.92 ha), Bihar (22.57 lakh ha), Jharkhand (1.73 lakh ha), Gujarat(13.51 lakh ha), West Bengal (3.35 lakh ha) and Uttarakhand (3.48 lakh ha) are with the productivity category range of 2-3 t/ha. Maharashtra (10.97 lakh ha), Jammu & Kashmir (2.93 lakh ha) and Himachal Pradesh (3.56 lakh ha) are largely rainfed wheat growing states and have little more than 1.5 t/ha productivity. These States contribute about 99% of total wheat production in the country. Remaining States namely, Karnataka, Assam, Chhattisgarh, Delhi and other North Eastern States contribute only about rest 1 % of the total Wheat production in the country and are below 2t/ha productivity. The record production of 95.91 million tonnes of wheat in the country ( 4<sup>th</sup> Advance Estimate, DES, GoI, 2013-14) against the targeted production of 92.50 million tonnes during 2013-14 from an area of 31.3 million ha with the average productivity of 3.05 tonnes/ha is the significant achievement in wheat production in the country(*Annexure I*).