

WHEAT – (*Triticum aestivum*) $2n = 6x = 42$

Wheat is the most important cereal in the world, giving about one-third of the total production, followed closely by rice. In temperate regions it is the major source of food. The chief use of wheat is, the flour for making bread. Wheat is grown in all the continents except Antarctica. It is the staple food of the 1/3rd of the world's population.

Place of origin:

Diploid	(2n=14)	:	Asia minor
Tetraploid	(2n=28)	:	Abyssinia, North Africa
Hexaploid	(2n=42)	:	Central Asia

Distribution

USA, Canada, Latin America, Europe, China, Japan, Argentina, Mexico, India, Pakistan
Every month of the year a crop of wheat is harvested some where in the world. In India extensively cultivated in North West India, Eastern part, Central plain to some extent Southern peninsular zone.

Classification:

Ploidy level	Species	Common name	Genome
Diploid (2n=14) 2 species	<i>T.boeoticum</i>	Wild einkorn	AA
	<i>(T.aegilopoides)</i>	Einkorn	AA
	<i>T.monococum</i>		
Tetraploid (2n=28) 7 species	<i>T.dicoccoides</i>	Wild Emmer	AA BB
	<i>T.dicocum</i>	Emmer	AA BB
	<i>T.durum</i>	Macaroni wheat	AABB
	<i>T.persicum</i>	Persian wheat	AABB
	<i>T.turgidum</i>	Rivet wheat	AABB
	<i>T.polonicum</i>	Polish wheat	
	<i>T.timopheevi</i>	-	
Hexaploid (2n= 42) 5 species	<i>T.aestivum</i>	Common or bread wheat	AABBDD
	<i>T.compactum</i>	Club wheat	AABBDD
	<i>T.sphaerococum</i>	Dwarf wheat	AABBDD
	<i>T.spelta</i>	Spelt wheat	AABBDD
	<i>T.macha</i>	Macha wheat	AABBDD

Fourteen species of wheat according to Vavilov:

- a. *T.boeoticum*
- b. *T.monococum*
- c. *T.dicoccoides*

- f. *T.turgidum*
- d. *T.polonicum*,
- e. *T.timopheevi*,
- f. *T.aestivum*,
- g. *T.sphaerococcum*,
- h. *T.compactum*,
- i. *T.spelta*,
- j. *T.macha* .
- k. *T.dicoccum*
- l. *T.durum*,
- m. *T.persicum*,
- n. *T.turgidum*
- o.

Origin of diploid wheat:

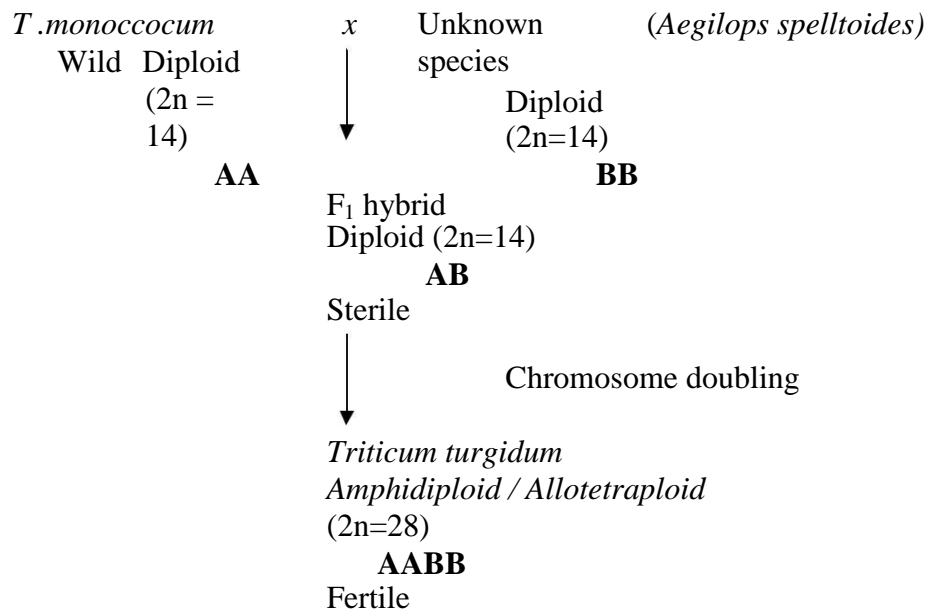
(Wild einkorn) *T.boeoticum* (*T.aegilopoides*)

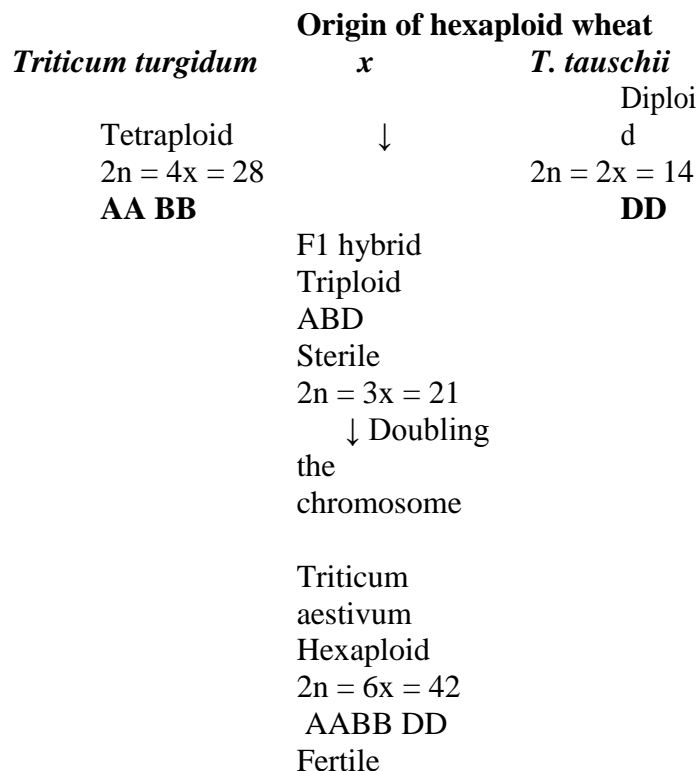
↓
Natural mutation and selection

↓
T.monococcum Cultivated diploid
($2n = 14$)

T. boeoticum is probably the ancestor for all the cultivated wheats:

Origin of Tetraploid wheats:





Breeding objectives

1. High yield

High yield depends on

The number of heads / unit area

The number of grains / head.

The average weight of grain

While breeding for high yielding varieties all the above three components must be looked into. Omitting any one of them may not yield results. Further while breeding for high yield it is necessary to combine into a variety a favourable combination of genes influencing all yield process.

2. Breeding non- lodging varieties:

This is achieved after the identification of dwarfing gene in Japanese variety Norin 10.

Most of our dwarf wheats are two gene dwarfs. E.g. Sonara 63, sonara 64, kalyan sona.

Emphasis is now on triple gene dwarfs.

3. Breeding for disease resistance

Rust is the major disease. Both stem rust and leaf rust are important ones. There are different races of rust. So while breeding for rust resistance horizontal resistance is to be looked into. Back cross method of breeding and development of multi lines are the methods.

4. Breeding for insect resistance

Hessian fly is the major pest. Resistance in most varieties is thro' Antibiosis.

5. Breeding for quality.

Different wheat varieties vary greatly in their chemical composition which is considerably influenced by environment. The varieties of hard wheat or bread wheat which have higher gluten content. The soft wheat contain lesser gluten content which is suitable for cake making, pastries etc. The durum wheats are unsuited for either cakes or bread but they are suitable for making macaroni.

So depending upon the use the quality breeding objective is to be fixed.

BREEDING PROCEDURES:

1. Introduction :

Semi dwarf wheat from Mexico, Sonara 63, Sonara 64, Mayo 64, Lerma Roja 64

2. Pure line selection :

Earlier varieties like P₄, P₆, P₁₂ evolved at Pusa institute are result of pure line selection from local population.

3. Hybridisation and selection

a) Inter varietal:

A number of successful derivatives were developed at IARI New Delhi and Punjab. NP 809 - New pusa multiple cross derivative.

However all these varieties were lodging and poor yielder when compared to other countries. Hence the wheat hybridization programme was changed by Dr. M.S. Swaminathan during 1963. **Borloug** was invited to our country and he suggested for introduction of semi dwarf varieties from Mexico. As a result four commercial spring wheat varieties viz., Sonara 63, Sonara 64 Mayo 64 and Lerma Roja 64 were introduced. However they had red kernel hard wheats. These were utilised in our breeding programme and amber colour wheat varieties like Kalyan Sona, Safed Lerma, Sharbati Sonara were released, these are double gene dwarfs.

b) Inter specific crosses

To get Hessian fly resistance. So also for rust resistance.

c) Back cross method of breeding

Rust resistance in Chinese spring from Thatcher.

4. Hybrid wheat :

At Kansas Agri. Expt. Station USA male sterile lines were identified by crossing *T. timophevi* x *T. aestivum* Bison variety By repeated back crossing a male sterile line resembling Bison was evolved. At present USA and Canada are doing work on this.

5. Mutation breeding

Dr. M. S. Swamina than did extensive work on this with gamma rays. Sharbati Sonara with increased protein content was evolved

6. Development of multilines

Borlaug developed multilines against rust. MLKS 15 was developed at IARI. Multiline is a mixture of pure lines which are phenotypically similar but genotypically dissimilar. Each line is produced by separate back cross method of breeding. Each line having resistance against a particular race of a disease.

Breeding centers:

International Maize and Wheat improvement Centre (CIMMYT) Mexico.

Directorate of Wheat Research (DWR), Karnal.

All India Coordinated Wheat Improvement Project (AICWIP) – Karnal (earlier New. Delhi)

Practical Achievement:

The semi dwarf varieties of wheat have been developed through the use of Japanese line Norin 10 as a source of dwarfing gene which led to “green revolution” in wheat production. The productivity of Semi dwarf varieties is about two and half times more than old tall growing varieties. More over these varieties are highly resistant to lodging and are highly responsive to fertilizer doses.

