

Botanical description and floral biology

Wheat – *Triticum sp.* ($X = 7$)

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.

Systematic position:

- ✓ **Division** : Phanerogams
- ✓ **Sub-Division** : Angeosperms
- ✓ **Class** : Monocotyledon
- Series : Glumacea
- Sub class : Glumiflorae
- ✓ **Family** : Poaceae
- Tribe : Triticeae
- ✓ **Subfamily** : Pooideae

Chromosome number:

Diploid : $2n = 14$, **Tetraploid** : $2n = 28$, **Hexaploid** : $2n = 42$

Diploid: Asia minor, **Tetraploid** : Abyssinia, North Africa, **Hexaploid** : Central Asia

Structure of Wheat Seed:

Fruit is a dry, one seeded indehiscent fruit known as caryopsis. The dorsal (back side) convex surface of kernal is smooth except at the base where the fruit coat is wrinkled indicating the position of embryo, it may be either hard or soft in texture with a creamy white, the ventral surface (front side) is flat and characterized by a deep furrow or groove.

The following 4 structures are recognized in wheat grain

i. Seed coat, ii. Nucellar epidermis, iii. Endosperm and iv. Embryo.

Reproduction

Sexual reproduction

The time and duration of flowering is dependent upon geographical location. Sunny weather and temperatures of at least 11 - 13°C are required for flowering (OECD 1999). Florets on the spike of the main tiller open first and flowering commences in the middle of each spike and proceeds synchronously towards the tip and the base. In a study of wheat sown in May in Narrabri (northern NSW) the time from sowing to flowering was approximately 105-120 days and the time from flowering to maturity was approximately 35-45 days (in the ten year period 1990-2000; Sadras & Monzon 2006).

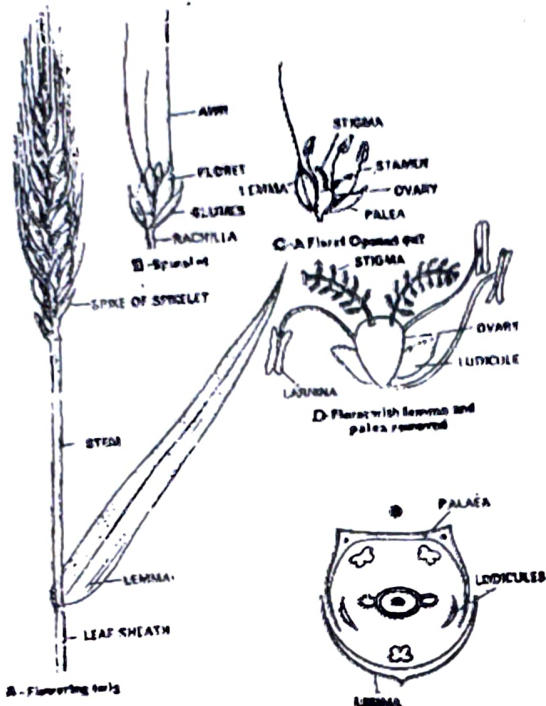
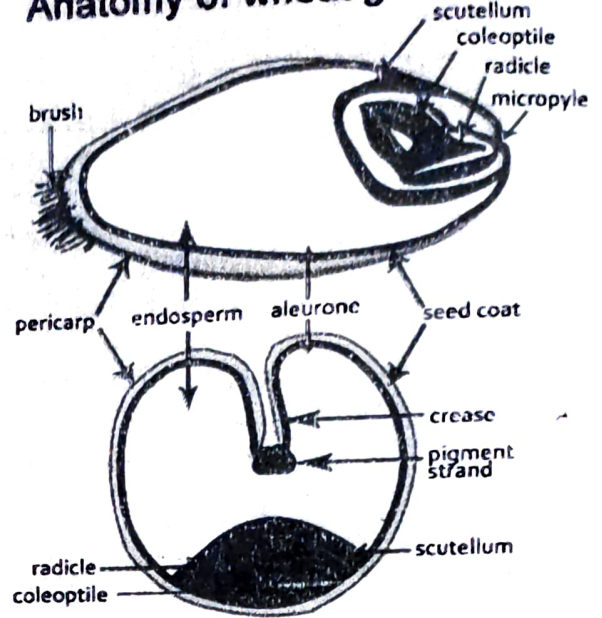


Fig. 11B.1. *Triticum aestivum*.

Anatomy of wheat grain



• PERICARP/FRUIT COAT

Outer pericarp

- Beard/Hairs of brush
- Epidermis/Beeswing
- Hypodermis

Inner pericarp

- Cross cells/Mesocarp
- Tube cells/Endocarp

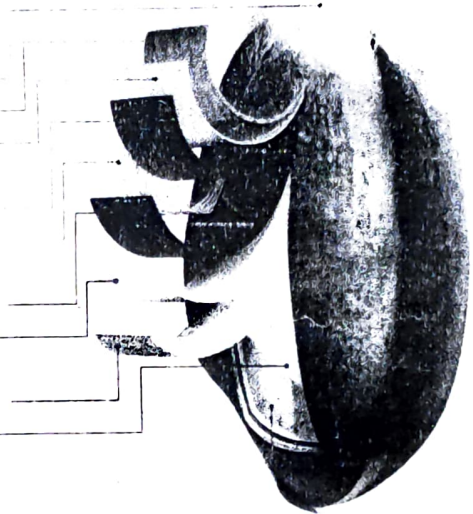
• SEED COAT

- Testa/Seed coat/Spermoderm
- Hyaline layer/Nucellar layer

• ENDOSPERM

- Aleurone cells/Aleurone layer
- Starchy endosperm/Flour

• EMBRYO



Pollination and pollen dispersal

Wheat is largely cleistogamous, which means that pollen is shed before the flower opens (Frankl & Galun 1977) and thus wheat is primarily self-pollinating with low rates of out-crossing. Any out-crossing that may occur is facilitated by wind dispersal. Generally, wheat flowers lack nectaries to attract insects and the role of insects in cross-pollination is considered to be minimal (Glover 2002).

Seed development

The rate of endosperm cell division is influenced by light intensity, water stress, temperature and genotype (Wardlaw 1970; Brocklehurst *et al.* 1978). Starch deposition begins 1-2 weeks after anthesis and initiates a 2-4 week period of linear increase in kernel dry weight. This process is also influenced by water stress, temperature and genotype (Simmons 1987). The growth and final weight of an individual kernel depends on the spikelet and floret position, the kernels formed in central spikelets and proximal florets within an individual spikelet are usually largest (Kirby, 1974; Simmons, 1987). Each wheat ear can produce approximately 30 to 50 kernels while the number of ears a wheat plant produces depends on the number of tillers produced and the number of tillers that produce a mature ear (Tennant *et al.* 2000).

Seed Production Technology:

1. **Time of sowing:** The seed must be sown at optimum time of sowing i.e. between 15th to 30th November when average of day and night temperature is about 25^oc. Wheat sowing can be extended upto late December but desired result may not be achieved.
2. **Suitable land:** Wheat seed production can be taken up in any kind of soil with good drainage system. Clay loam to sandy loam soil with neutral pH is most ideal for seed production. Avoid repeated cultivation of wheat over seasons to minimize the weed problem usually caused by wild oat and *Phalaris minor*. Sometimes volunteer plants of previous crop may exist and contaminate the seed plot. Practicing long term crop rotation is also considered helpful in minimizing risk of Karnal bunt disease problem. Karnal bunt is known to be soil borne and seed borne in nature and primary infection to the standing crop occurs at flowering stage when bunt sporidia are blown from soil surface to the wheat floret.
3. **Isolation requirements:** Crop must be kept away from undesirable pollen source. Though wheat is self pollinated crop, out crossing ranged from 1 to 4% may occur. To avoid the out crossing, the seed must be isolated with 3m strip all around the seed plot. Maintain 150m isolation from any other wheat plot where loose smut infection is exceeding 0.5%.
4. **Preparation of seed field:** One to ploughing and two harrowing is required before irrigating the seed plot. For good and uniform germination of seeds, presowing irrigation is necessary.
5. **Source of seed:** For certified seed production, seed have to collect from any authentic source as approved by seed certification agency.
6. **Seed treatment:** The entire seed have to treat with Vitavax @2.55g/ Kg if already not treated.
7. **Seed rate:** 80 to 100 Kg seed is required for one ha of land.
8. **Fertilizer requirement:** Wheat requires about 120 kg nitrogen, 60 kg phosphorus and 60 kg potassium per hectare depending upon the soil test values. Half amount of N and full amount of P₂O₅ and K₂O fertilizers are applied just before the final land preparation. The remaining half of N i.e. 60^{kg} applied at 25 days after sowing.
9. **Spacing:** Row to row have to maintain at a distance 23 cm ^(22-25 cm) and continuous planting in 3cm depth.

10. **Irrigation:** For higher seed production six irrigations are needed. The six stages are (i) crown root initiation (ii) tillering stage (iii) stem extension stage (iv) booting stage or flag leaf stage (v) flowering stage (vi) milk stage/ dough stage. Much care should be adhered while irrigating the crop is post flowering stages. Even a mild wind may cause lodging in loose soils. Prefer to apply irrigation during night's hours when wind is generally calm.
11. **Weed control:** Timely weeding and interculture are desirable at initial growth stage. Weeds are becoming great nuisance in intensive wheat cropping areas and many times over dominate the crop resulting very poor yields. Pendamethelin @ 1kg a.i. per hectare in 750 liters of water just after sowing or Isoproturon @ 1kg a.i. per hectare in 750 liters of water just after 35 days of sowing may be used to control the weed.
12. **Rouging:** Two to three rouging is essential for removal of off type plants. The variant plant may have differences for morphological characters or susceptibility to disease like rust (*Puccinia* sp). The first rouging must be completed before the flowering initiation. The diagnostic characters of importance at this stage are plant growth habit, size shape and angle of flag leaf, colour of flag leaf, anthocyanin pigmentation of auricles, hairyness on flag leaf sheath and leaf blade, plant height etc. The second rouging may be started just at heading stage and should be completed quickly to avoid any chance of cross pollination from off type plants should be removed by uprooting. Third rouging should be done once the crop is reaching to maturity and heads have turned the colour. Character which should be looked at these stages is colour of ear head, awns and pubescence on glumes.
13. **Harvesting:** Once the crop is dry mature and seeds are hard and give cracking sound on pressing between teeth in mouth the crop is ready for harvest. At this stage the seed moisture is expected to be around 10-12%. Harvesting should be done quickly to avoid shattering and losses due to uncertain weather. Harvesting may be done by sickles or by combine harvester. In combine harvester the seeds are automatically harvested.
14. **Yield:** 34-38 quintal hectare

Minimum field standard of wheat:

Classes of seed	Minimum		Maximum%			
	Isolation (m), / iso for loose sowing affected plant(m)	No. of field inspection	Off types	Inseparable other crop plants	Objectionable weed plants	Plants affected by designated diseases
FS	3, /150	2	.05	.01	-	.10
CS	3, /150	2	.20	.05	-	.50

Minimum seed standard of wheat:

Class es of seed	Minimum					Maximum%			Moisture	
	Germin ation%	Pure seed%	Innert mater%	Other crop seed (no./kg)	Weed seed (no./kg)	Obj. Weed seed (no./kg)	Disease d seeds (% by no.)	ODV seeds (no./kg)	Ordinary pack (%)	Vapour prop pack (%)
FS	85	98	2	10	10	2	.05*, none**	-	12	8
CS	85	98	2	20	20	5	.25*, none**	-	12	8

Note: * karnal bunt, **nematode galls of earcockle & tundu