1-Wheat: *Triticum astevium* L.

Prepared

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2-Wheat Morphology

(Wheat) Triticum.sp

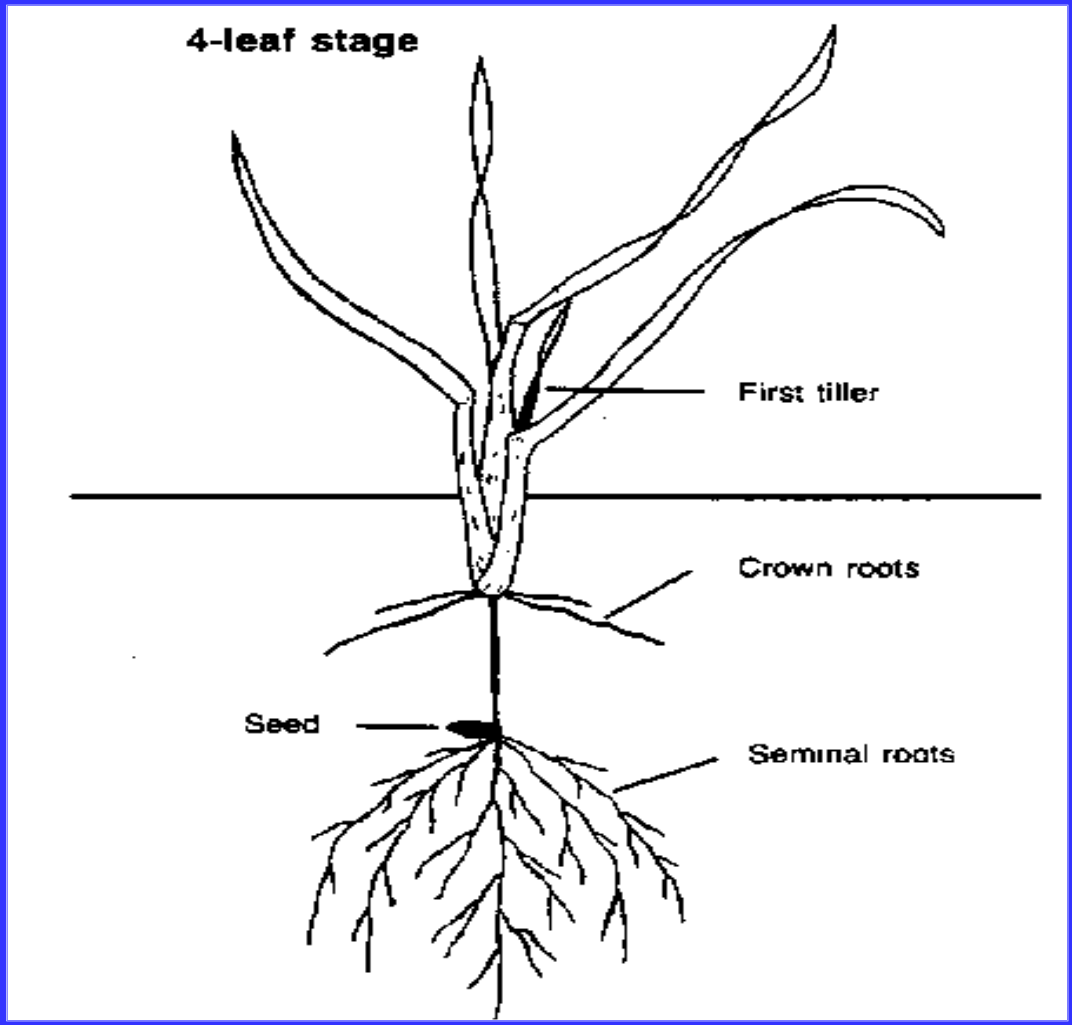
Fam: poaceae (Gramineae)

MATURE PLANT

The ‘mature’ wheat plant is the culmination of all the development and growth processes throughout the life cycle. All the structures, such as leaves, tillers and ears, have attained their full size.

Plant

The plant is made up of a root and shoots system. Two types of roots are found, the seminal roots and the nodal roots (adventitious or crown roots), which arise from the lower nodes of the shoot.

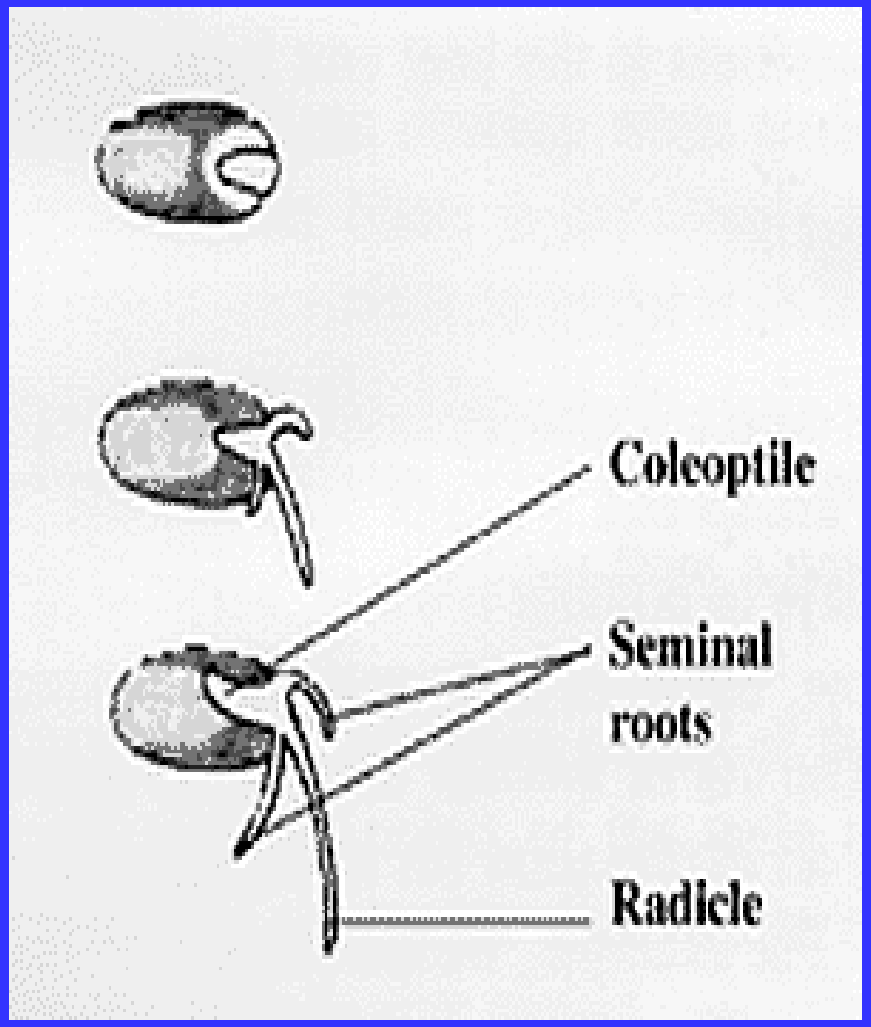


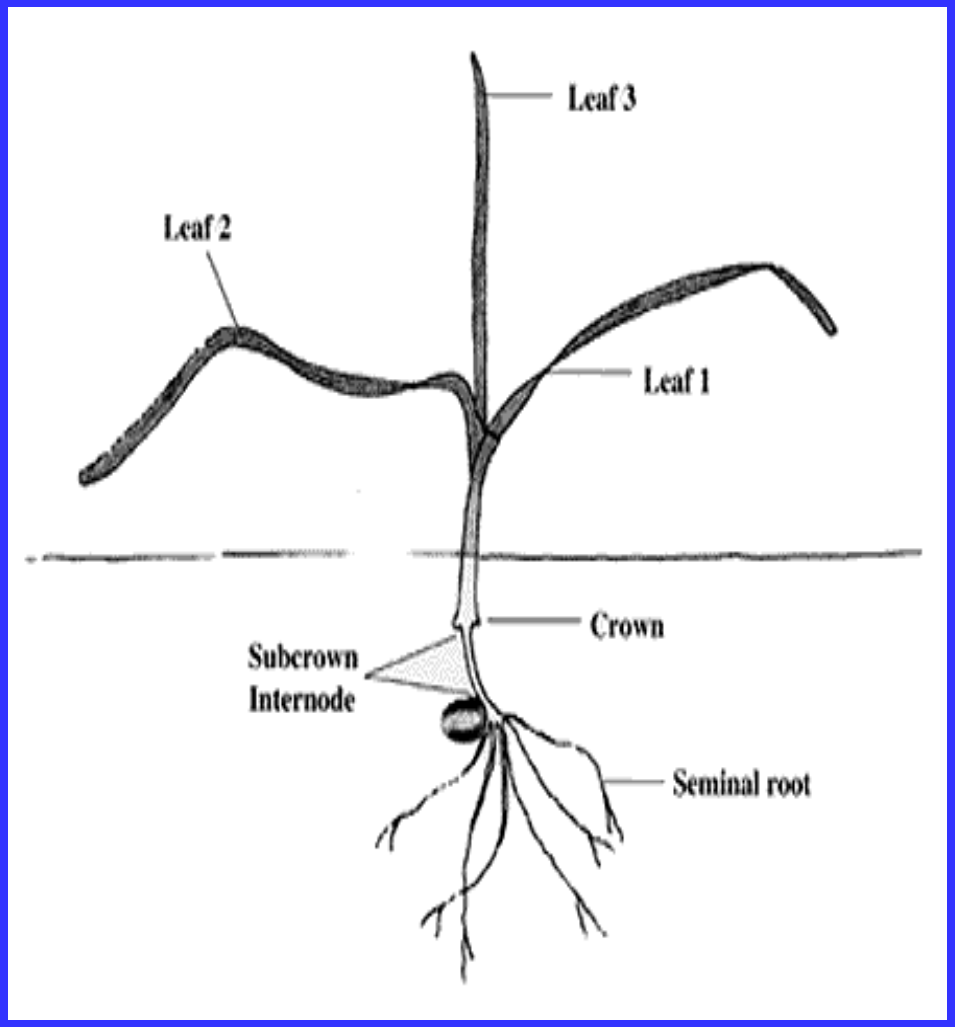
Wheat Seedling

ROOTS

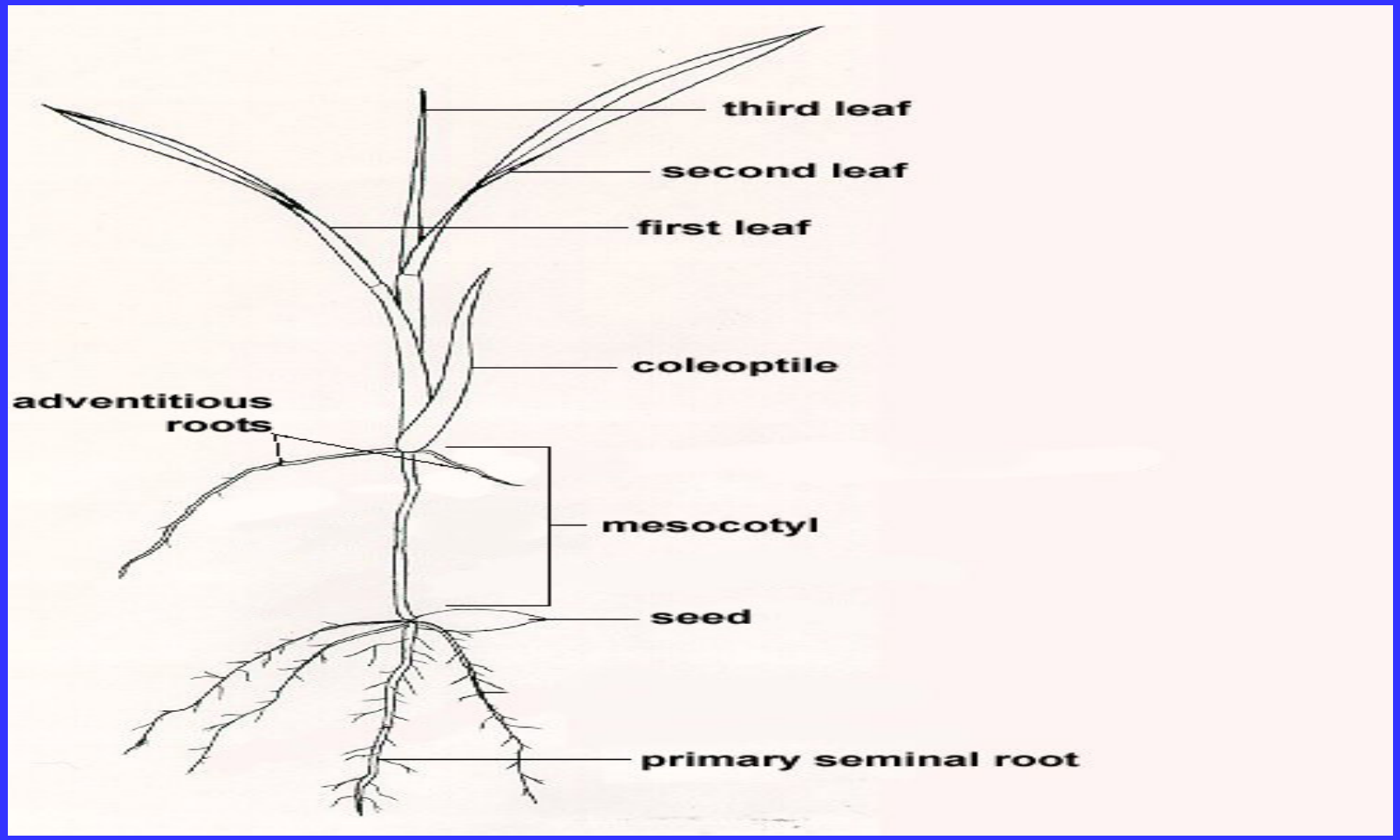
It has two types of roots, the seminal (seed) roots and roots that initiate after germination, the nodal (crown or adventitious) roots. About six root primordial are present in the embryo. At germination, the primary root bursts through the coleorhiza, followed by the emergence of four or five lateral seminal roots. These form the seminal root system, which may grow to 2 m in depth and support the plant until the nodal roots appear.

Nodal roots are associated with tiller development and are usually first seen when the fourth leaf emerges and tillering starts. Compared with the seminal roots, they are thicker and emerge more or less horizontally; when they first appear they are white and shiny (the ‘white root’ stage). Nodal roots occur on the lower three to seven nodes (depending on environmental conditions and final number of leaves on the shoot).





Wheat Seedling

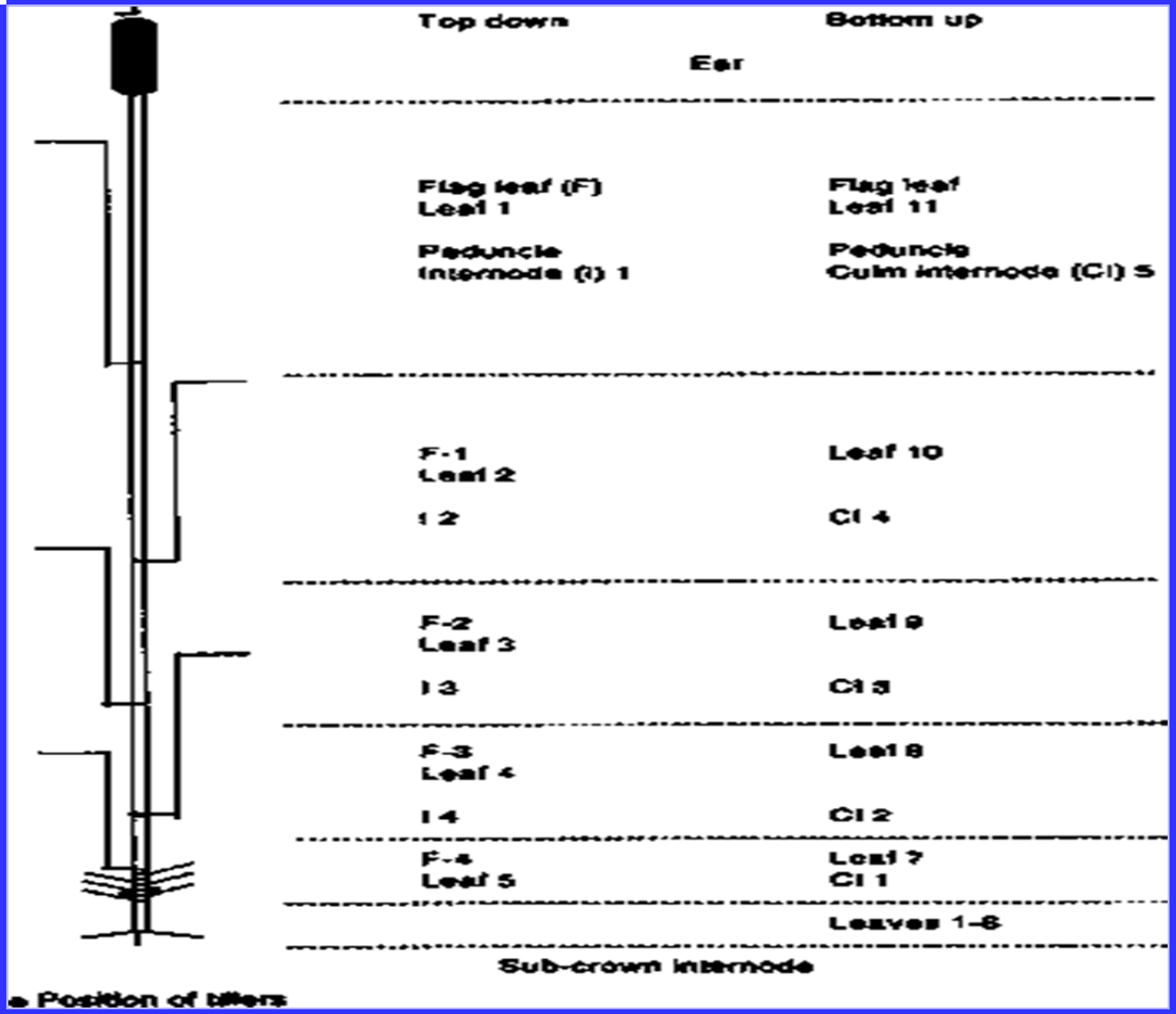


Wheat seedling stricture

Seedling Fibrous Roots

Culum

The portion of the shoot with elongated internodes is the elongated stem or culm. In the proximal or basal units, the internodes remain short and the nodes are packed closely together. (Figure 2). The terminal four to seven internodes of the shoot elongate to form the flowering stem or culm, and internode elongation is complete by the time of anthesis. Internodes increase in final length from the base of the culm to the uppermost internode, which carries the ear. The elongated distal internodes increase in length from the basal to the most.



Plant Internodes

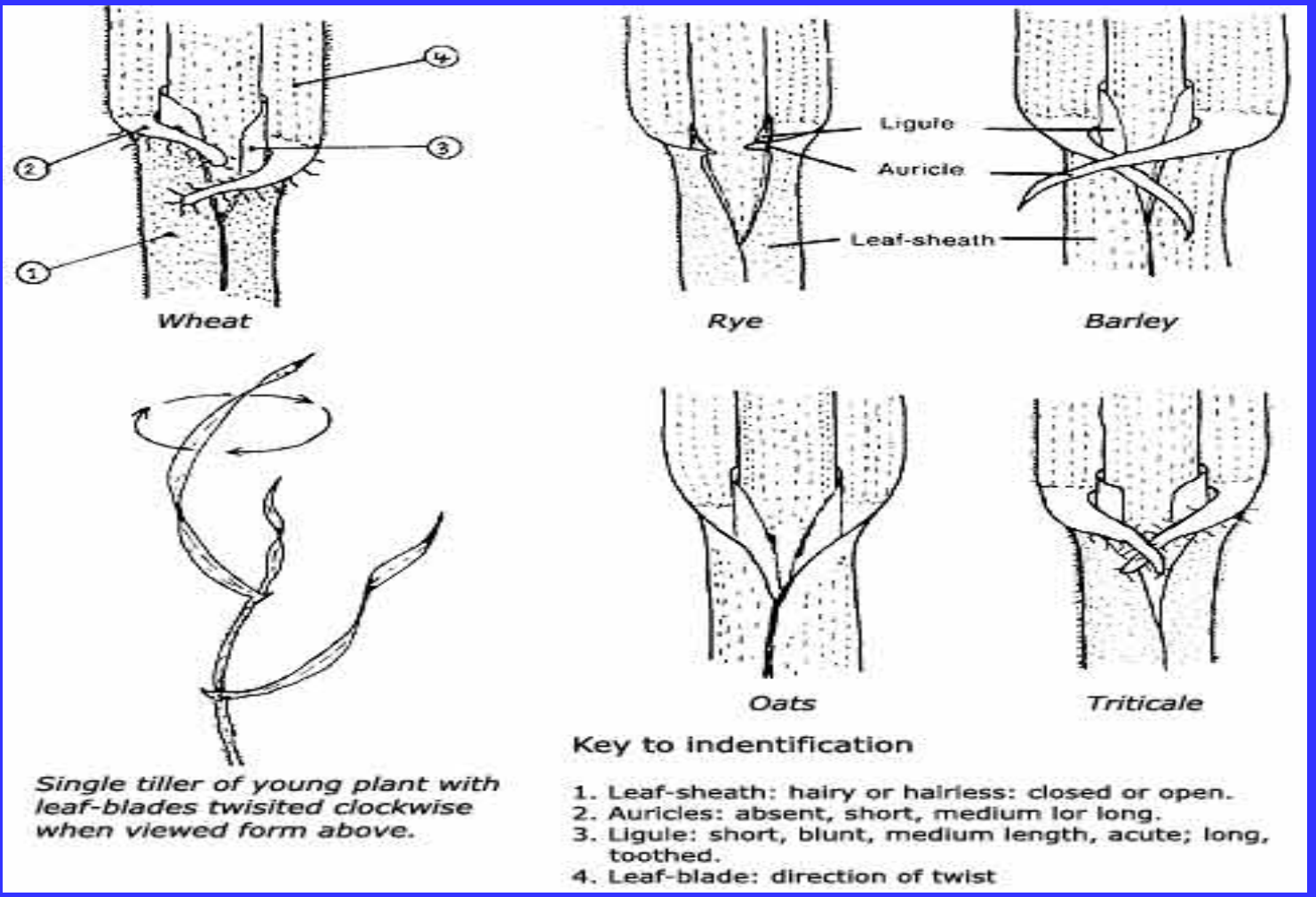
Tillers

The shoot is terminated by an ear or spike bearing about 20 spikelet.

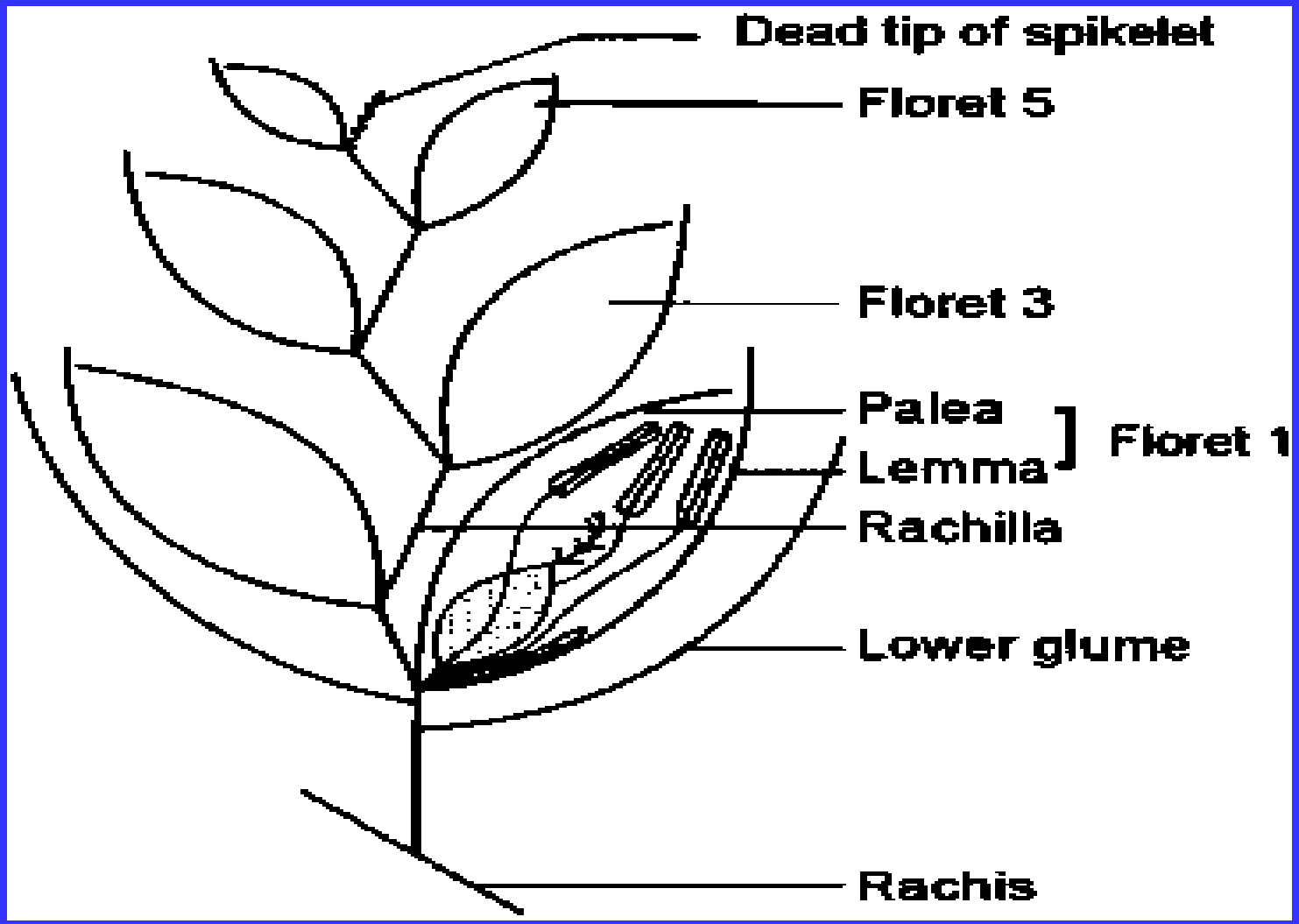
Tillers, which have the same basic structure as the main shoot, arise from the axils of the basal leaves. At anthesis, only some of the tillers that have developed survive to produce an ear. Others die and may be difficult to find in the mature plant.

Leaves

Each leaf comprises the sheath, wrapping around the subtending leaf, and a lamina (blade). At the junction of the sheath and lamina, there is a membranous structure, the ligule, and the auricles.



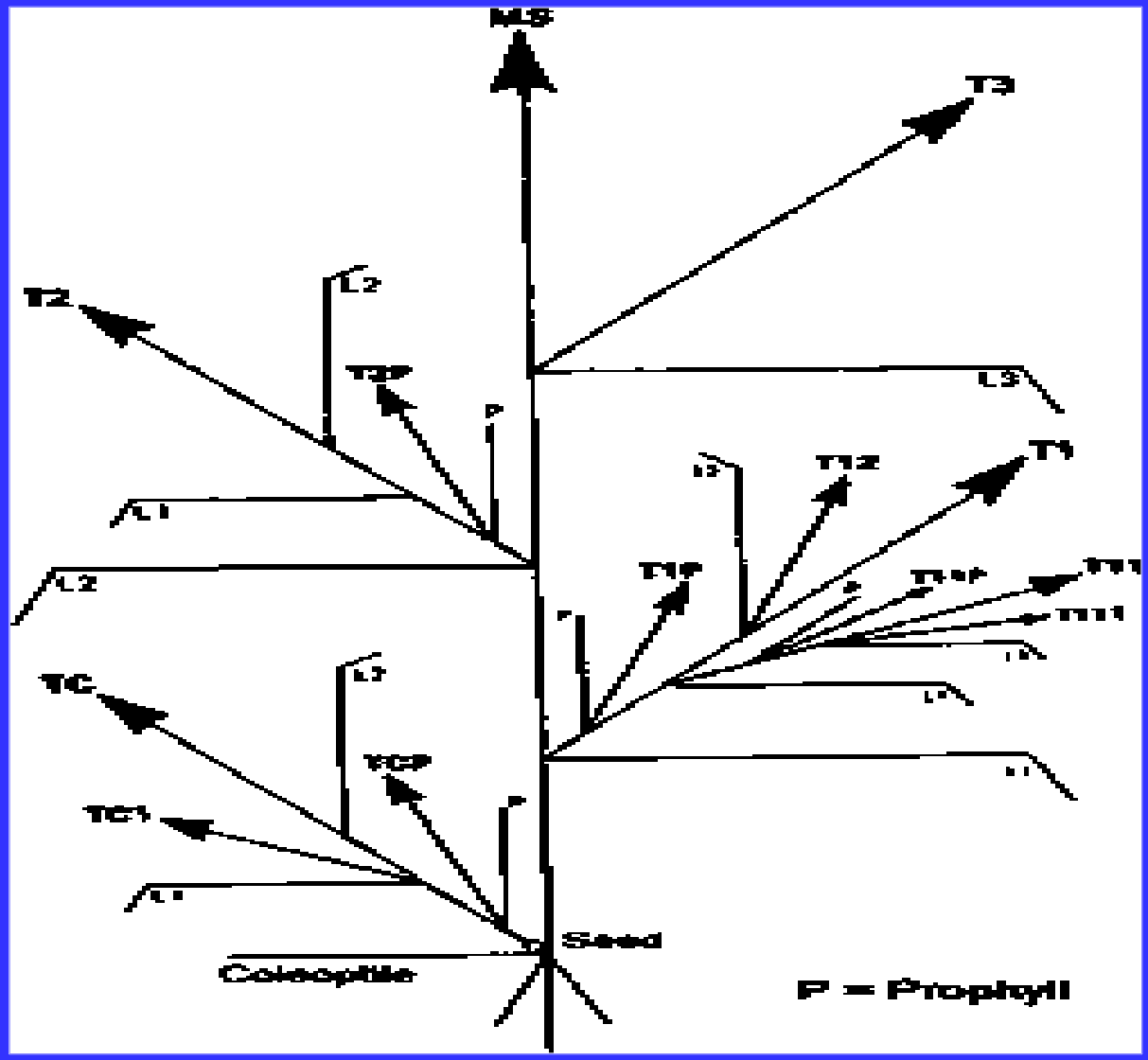
The leaf sheath in grasses



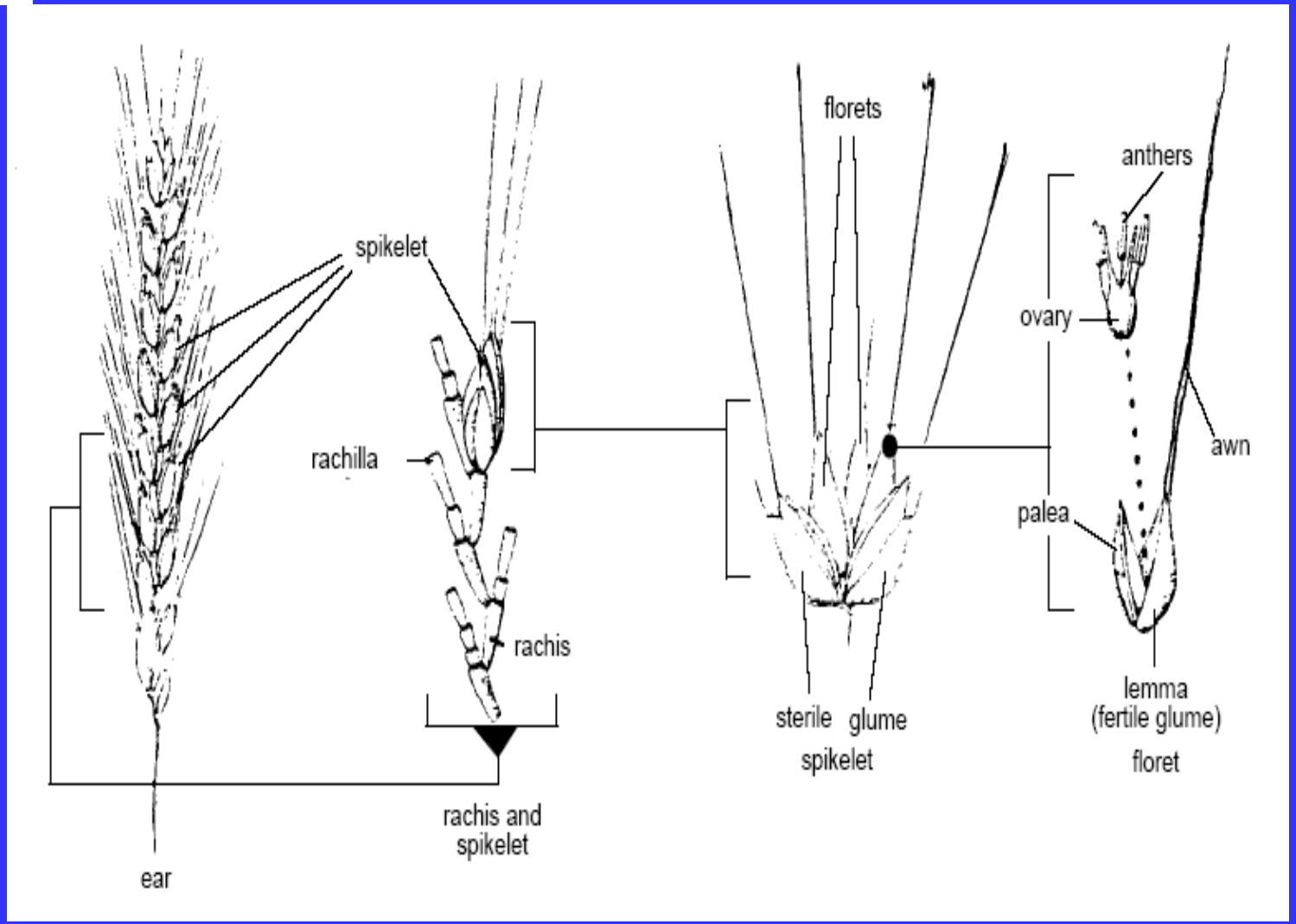
Wheat Spikelet

Tillering:

The wheat plant has the ability to tiller, i.e. to produce lateral branches. At the end of the vegetative phase of development, the plant will consist of, in addition to the main shoot, a number of tillers. Exactly how many are present at this stage varies widely depending on factors such as plant population, sowing date, mineral nutrition and the application of plant growth regulators. Of the tillers present at this time, only a proportion will survive, the rest dying without producing an ear, possibly due to competition for resources, such as light or nutrients.



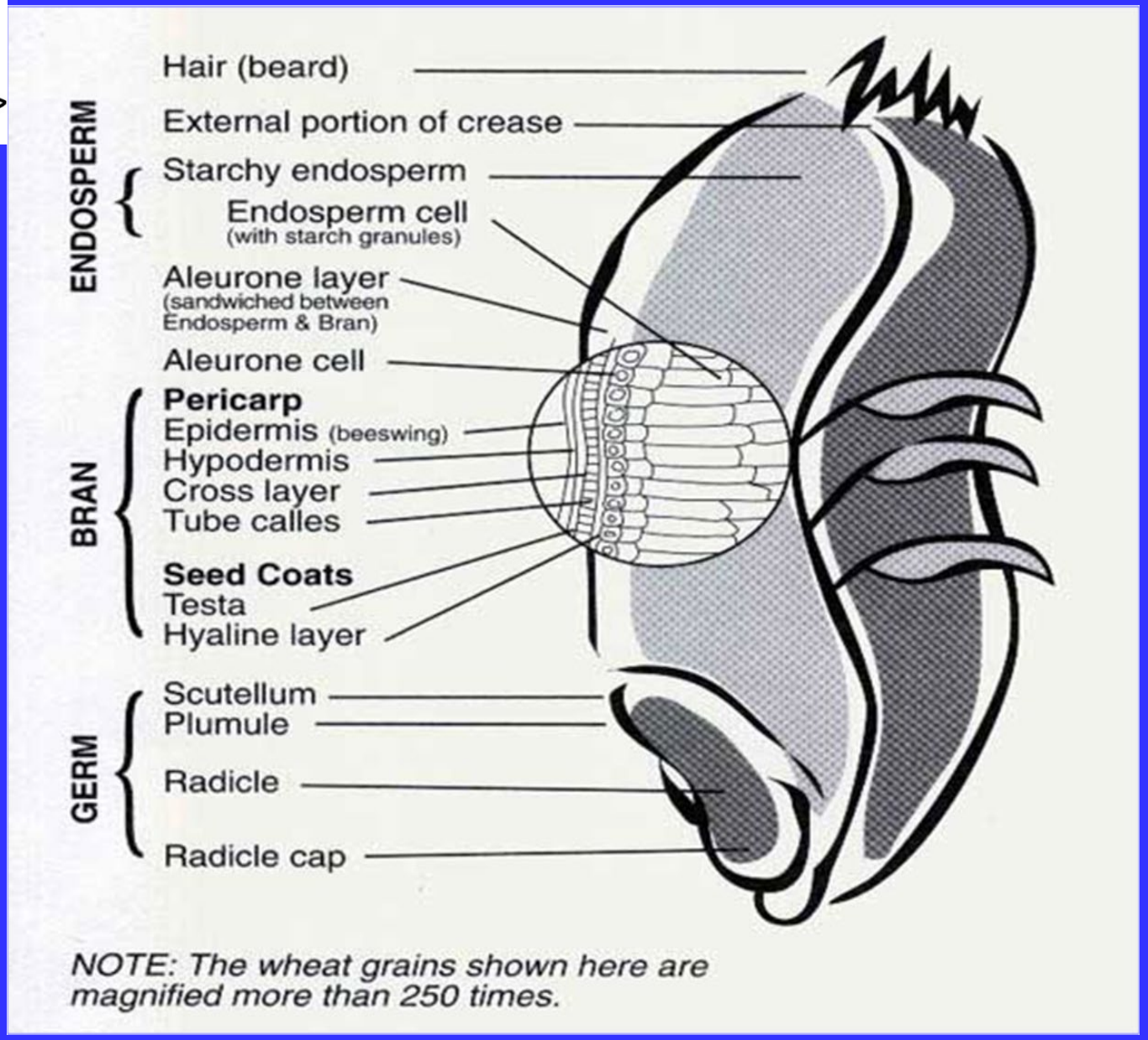
Tellers distribution


florets
anthers
spikelet
ovary
rachilla
awn
palea
rachis
sterile glume
spikelet
lemma
(fertile glume)
floret
rachis and
spikelet
ear

Wheat Spike

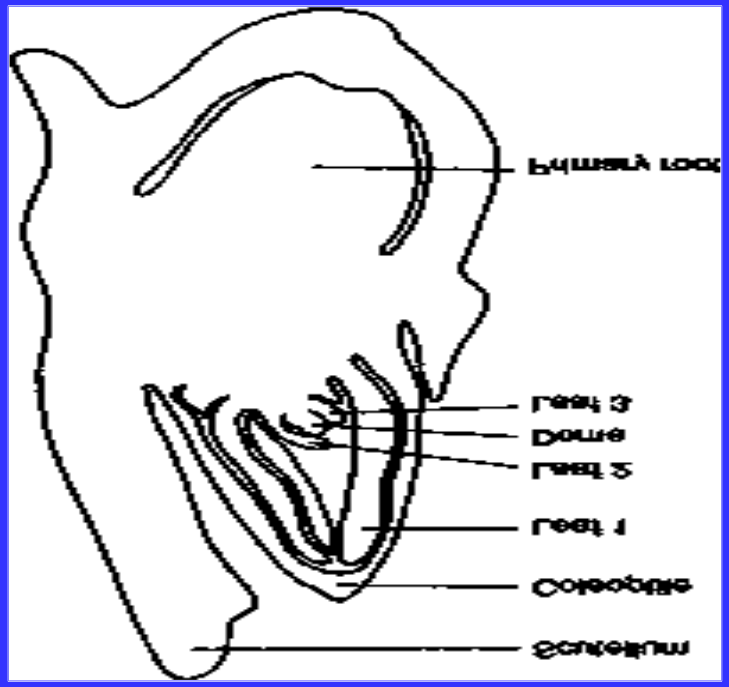
SEED

The seed, grain or kernel of wheat (more pedantically, the caryopsis) is a dry indehiscent fruit. The dorsal side (with respect to the spikelet axis) is smoothly rounded, while the ventral side has the deep crease



Wheat grain stricture

The embryo is made up of the scutellum, the plumule (shoot) and the radicle (primary root). The scutellum is the region that secretes some of the enzymes involved in germination and absorbs the soluble sugars from the breakdown of starch in the endosperm.



Longitudinal section of the embryo from a mature grain.

Germination

The leaf stages

The leaf is divided at the ligule into a cylindrical sheath and the flat blade or lamina. The sheath is tubular at the base, but nearer to the blade it is split and the margins overlap.

The lamina has a fairly well-marked midrib, along which runs the major vascular bundle of the leaf. It divides the blade into two sub equal parts, each of which has a number of parallel lateral ribs or veins.with the ligule are the auricles, two small earlike projections fringed with unicellular hairs.

First Leaf of wheat

Ear and ear formation:

As it approaches anthesis, the ear is completely formed and the pollen grains and carpel are fully developed. After anthesis, the florets open, pollen is released and the carpels are pollinated. The stamens and lodicules, their role fulfilled, die and shrivel, and further growth and development takes place in the carpels, the developing grains. At this stage, the ear consists of the main axis or rachis with each internode ovoid in section and curving around the spikelet.

A single spikelet is attached at each node, and the rachis terminates in a spikelet set at right angles to the lateral spikelets. There is a gradient of size and maturity along the ear, with the largest and most advanced spikelet situated in the mid-part of the ear. Under unfavourable growing conditions, the lowermost spikelet and those at the top of the ear may be poorly developed and devoid of fertile florets. the flag leaf is somewhat shorter than the longest leaf.

The basal part of the carpel, the ovary, is obconical or obviate and white in colour with a smooth surface except at the tip, which has numerous unicellular hairs. The ovary contains a single ovule oriented so that the nucellar apex (micropyle) is slightly below the horizontal mid-plane of the ovule. The ovule has two integuments enclosing the nucellus embedded in which is the embryo sac The embryo sac contains an egg nucleus with two associated nuclei (the egg apparatus.

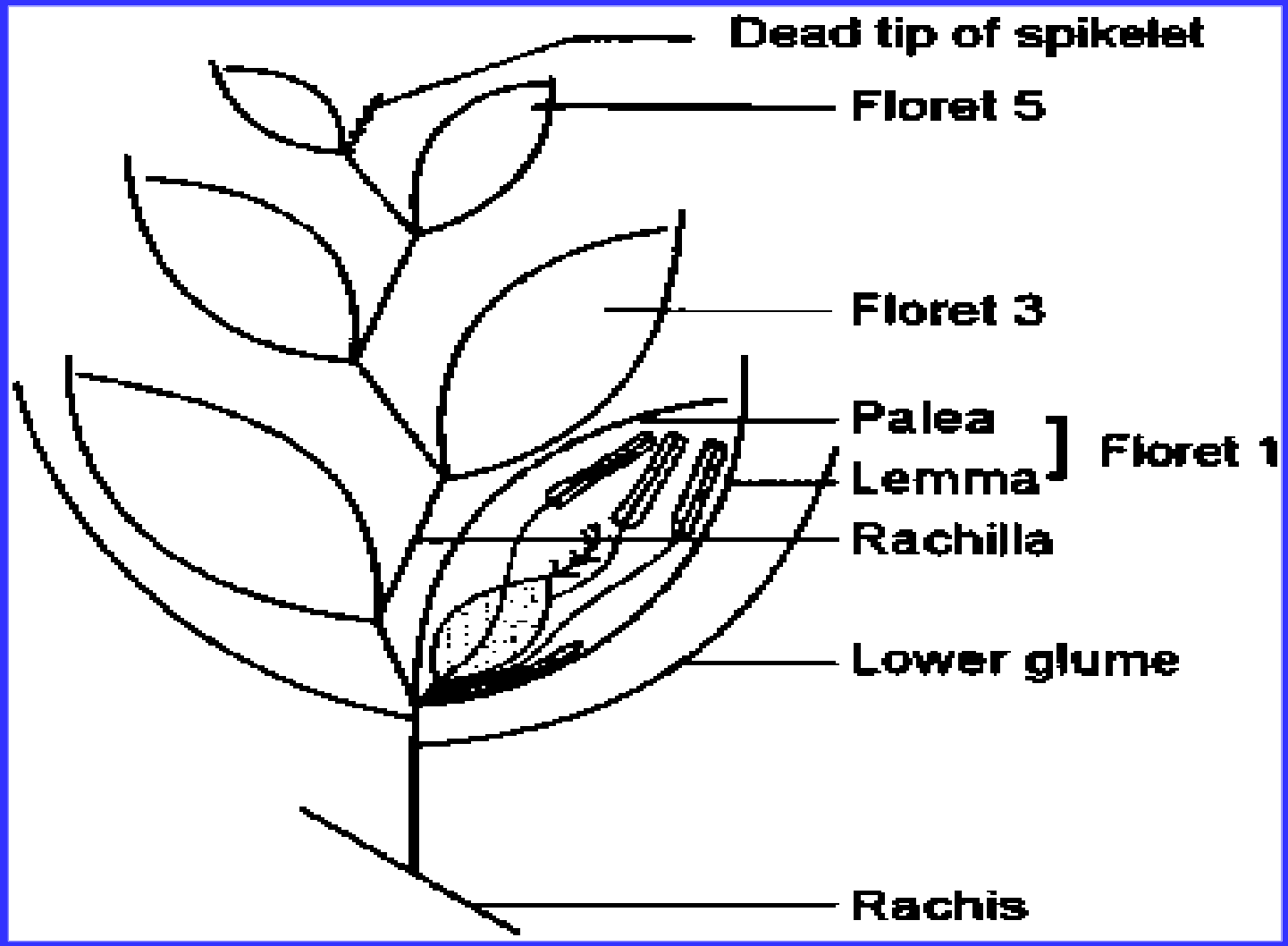


Diagram of a spikelet

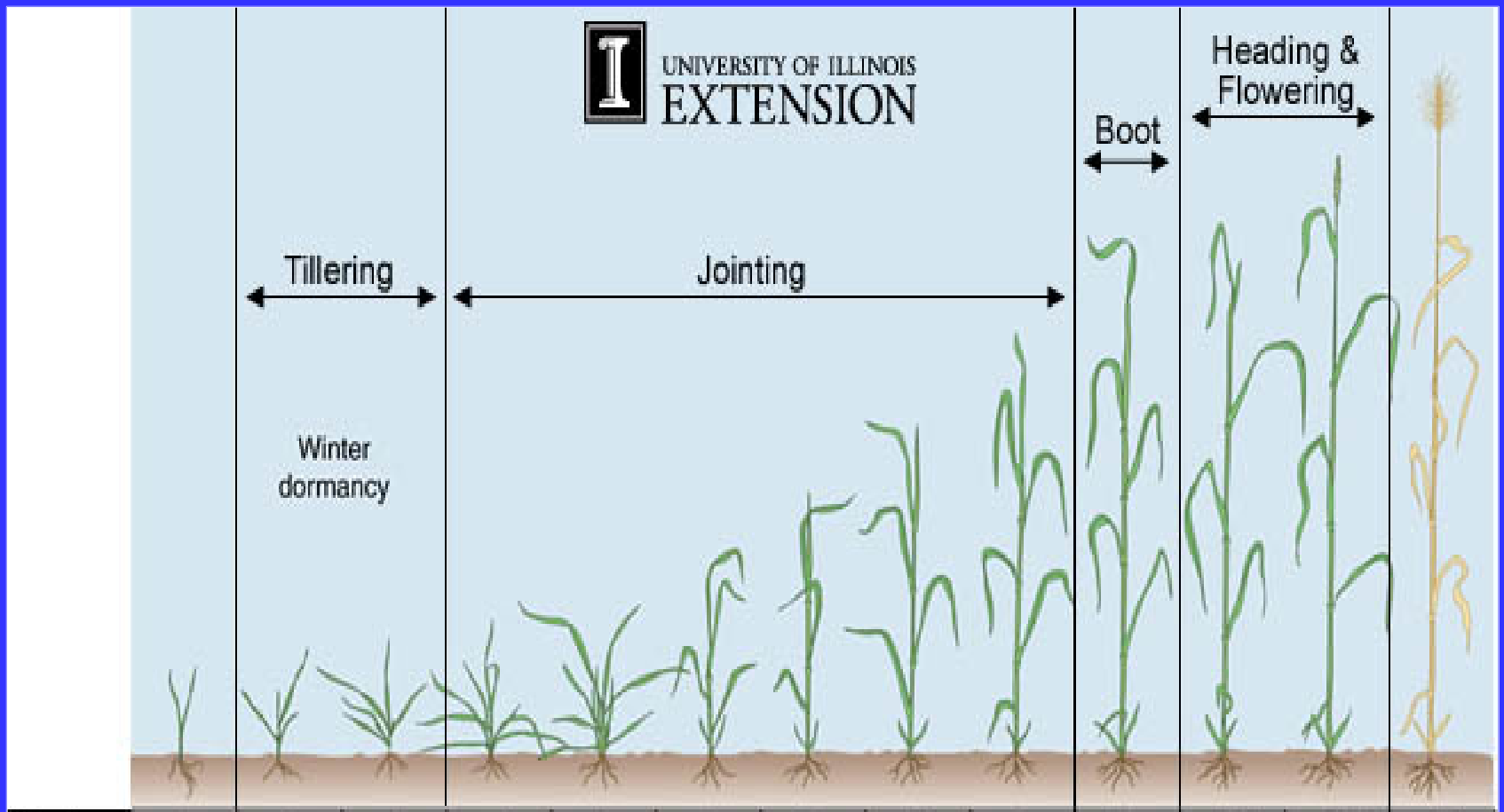
Ear development

After initiating leaves, the apex changes in form and initiates about 20 spikelet primordial, terminating in a terminal spikelet. Throughout ear development, the most advanced primordial occur in the mid-part of the ear. From the double ridge stage onwards, the various structures of the spikelet are initiated in a centrifugal succession. Thus, the primordial of the glumes are initiated first, followed in succession by the florets. About ten floret primordial are eventually initiated, after which the spikelet apex ceases activity and eventually degenerates.

Thus there is a gradient of development of the florets within the spikelet, the most mature floret occurring at the base while the most distal florets develop very little and eventually die.

Within the spikelet, initiation also precedes centrifugally, the lemma and palea forming first and finally the carpel. The development of each floret is determinate as the floret apex is transformed into the carpel. As the stamens develop, they become differentiated into a filament and anther, which eventually has four chambers or loculi containing the pollen grains.

Growth stage of wheat



Feekes	1	2	3	4	5	6	7	8	9	10	10.1	10.5	11
Zadoks	10	21	26	30	30	31	32	37	39	45	50	60	90

Stage:1

First true leaf is fully expanded and the second leaf is unrolling.

Stage2:

the beginning of tillering, which usually occurs in the fall. Tillers are secondary shoots that develop from nodal buds on the older wheat shoots.

Stage 3:

Tillers continue to be formed at this stage and the plant has 6 tillers.

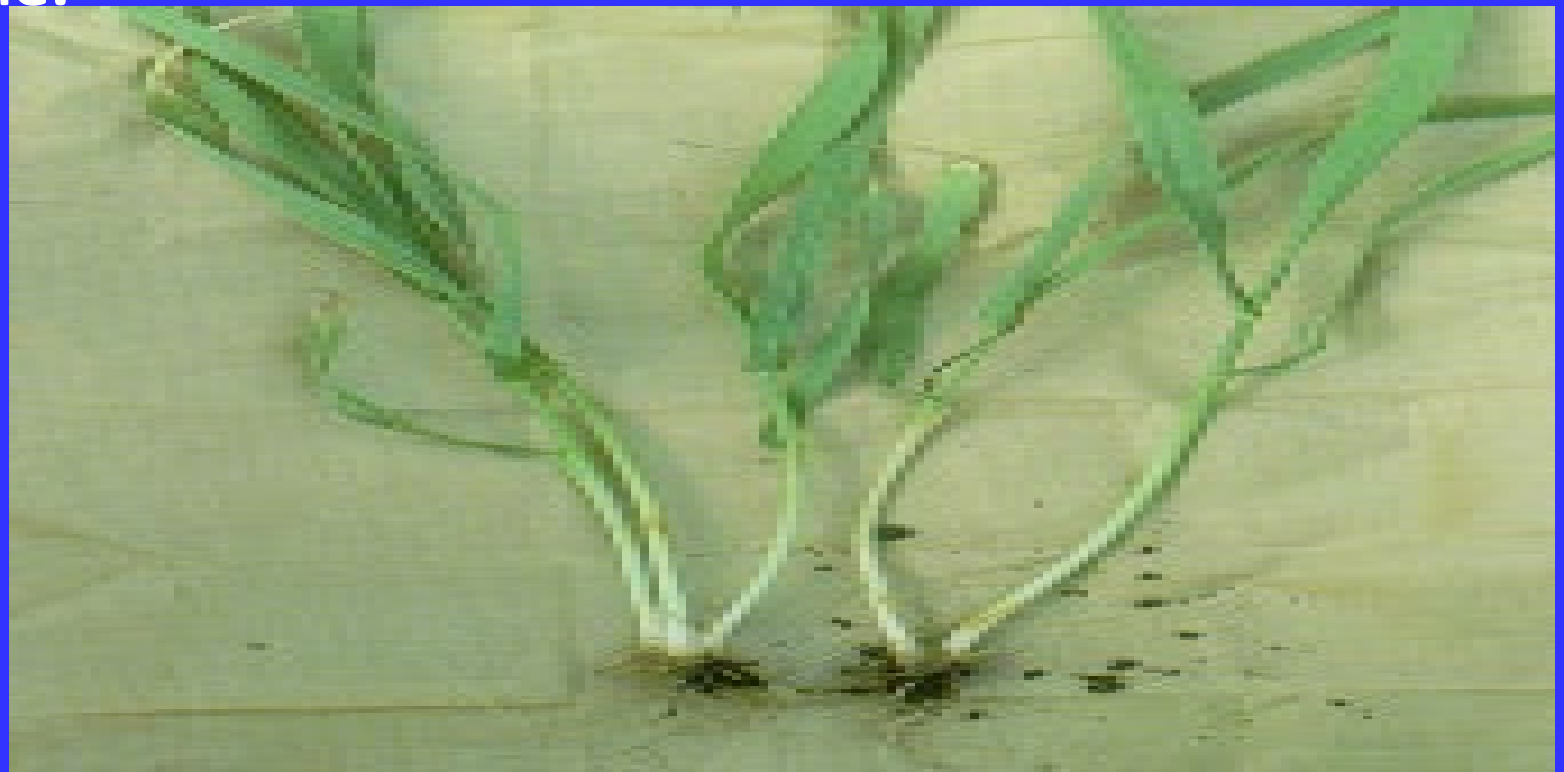
Stage 4:

Stem elongation begins at this stage. Most tillers have formed by this stage, and the secondary root system is developing.

Stage 5:

Leaf sheaths are strongly erect at this stage. the number of spikelets per spike (head size) is determined. No yield can be expected from tillers developed after this stage.

Stage 6: At this stage the first node is visible on the main stem. Prior to this stage, all the nodes have been developed and are squished together so that they are not distinguishable. The first node is swollen and appears above the soil surface and the stem is hollow below this node.



Stage7:

The second node has become visible on the main stem and one node is visible on tillers one and two. This stage is characterized by rapid spike expansion.

Stage 8.

The flag leaf is visible at this growth stage. The flag leaf begins to emerge from the whole while the second node is visible. When the flag leaf has fully emerged, three nodes are now visible and the flag leaf makes up nearly 75% of the effective leaf area that contributes to grain fill

Stage 9

Flag leaf and ligule are just visible at this stage. From this growing stage on, leaves are referred to in relation to the flag leaf.

Stage 10

This is the boot stage. The head is developed and can be seed in the swollen section of the sheath of the flag leaf.

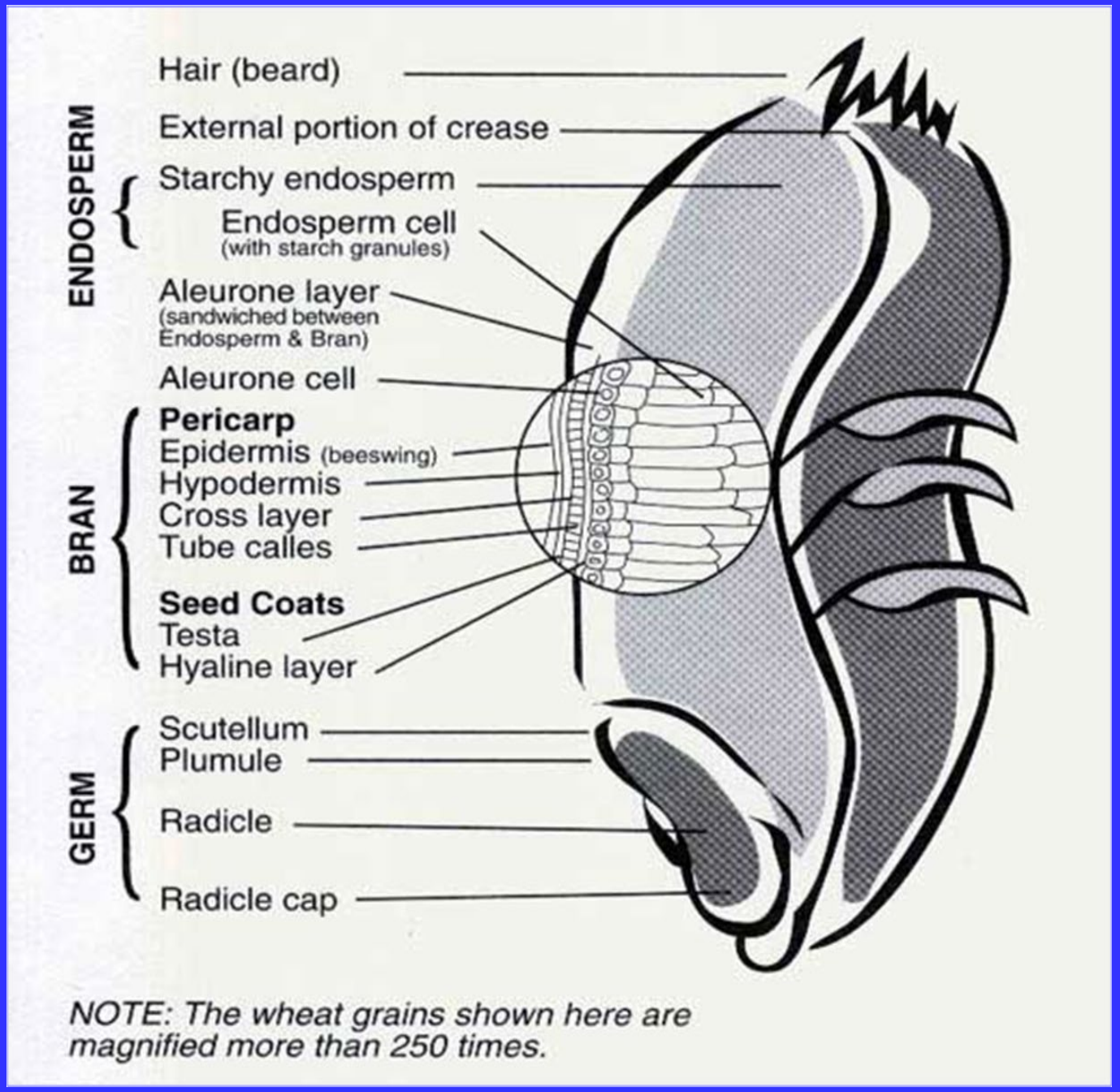
Stage 11

At this stage awns are visible and heads are emerging through the slit of the flag leaf sheath, with approximately 50% of heads emerged from the flag leaf in a given area.

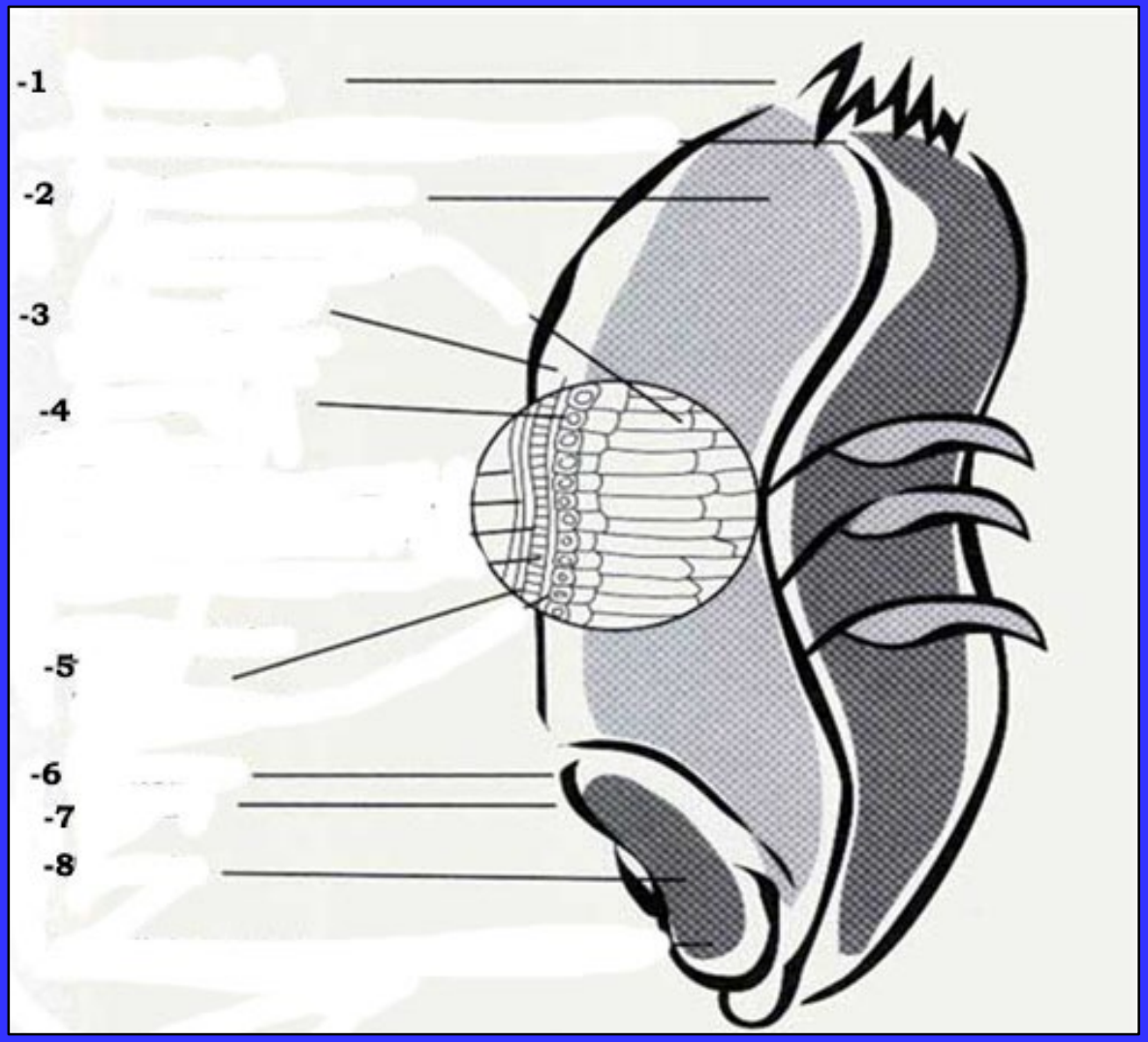
Stage 12.

This stage denotes physiological maturity. This is followed by kernel ripening and grain drying

	Triticum astivum L. Germaine Poacese
Germination	Hypogeal : grains remains below the ground
Root	Fibrous: 4-5 seminal roots- Adventitious roots (node)
Stem	Erect, cylindrical, and hollow except at the nodes 4-7 internodes the short in the base- the long the uppermost
Leaf	Compound- 1-blade with midrib- 2-sheath cylindrical tubular on stem -3-ligule-4-aurticles
Inflorescence	Spike- spikelets-2-9 floret-Rachis-Rachilla
Flowers	Perfect- palea-lemma- stamens-stigma-ovary – Self pollination
Fruits	Grain-Kernel– Caryopsis- dry indehiscent fruit


Hair (beard)
External portion of crease
ENDOSPERM
Starchy endosperm
Endosperm cell
(with starch granules)
Aleurone layer
(sandwiched between
Endosperm & Bran)
Aleurone cell
BRAN
Pericarp
Epidermis (beeswing)
Hypodermis
Cross layer
Tube calles
Seed Coats
Testa
Hyaline layer
GERM
Scutellum
Plumule
Radicle
Radicle cap
NOTE: The wheat grains shown here are
magnified more than 250 times.

Complete the following Figure:



Wheat questions

1-The wheat embryo is consist of the:

A-scutellum, plumule

b- kernel

c- Scutellum, plumule and the radicle

d- answer a and b

2- ……..is the region that secretes some of the enzymes involved in germination and absorbs the soluble sugars.

a-Scutellum b-plumule

c- primaryroot d- kernel

3-the type of root that found in wheat plant are:-

a-the seminal roots b- crown or adventitious roots.

C-both a and b

4- In……., lamina length increases with increasing leaf number from the base,

a-spring wheat b- winter wheat c autumn wheat

5- internode elongation is complete by the time of a- anthesis. B- stem emergence

c- pollination d- No answer of the above.

6- There is a gradient of size and maturity along the ear, with the largest and most advanced spikelets situated in

a-the mid-part of the ear. b- top of the ear

c- lower part of the ear d- Answer b + c

7-True or false:

(True) the lowermost spikelet and those at the top of the ear.

8- Within each spikelet of wheat, there are usually from:

a- 2 -4 potentially fertile florets.

b- 3- 7 potentially fertile florets

c- 3-10 potentially fertile florets

D- 3-5 potentially fertile florets

9- The floret of wheat comprises:

a-two lodicules, three stamens and the carpel

b-two lodicules, six stamens and the carpel

c-three lodicules, three stamens and the carpel

d-no answer of the above

10- The ovule has …… enclosing the nucellus embedded in which is the embryo sac

a- two integuments

b- three integuments

c- five integuments

d- one integuments

11- Within the spikelet, initiation also precedes centrifugally:

a-the lemma and paleta forming first and finally the carpel

b-the carpel forming first and finally the lemma and paltea

c-the lemma , palea and the carpel forming at the same time.

12-Anthesis of wheat occurs about ….. Days depending on the environment.

a- 3- 10 b-10 -20 c- 20-25 d- 2-7

13-If the floret has not been pollinated, the stigmas remain receptive for up to about ……days after anthesis and the floret may open again.

a- 5 b- 6 c-7 d- answer both a + b

14-true or false:

(false)the second tillers is fully expanded and the second leaf is unrolling are the mark of first growth stage of wheat .

15- ..... which usually occurs in the fall are the mark of the second growth stage of wheat.

a- the beginning of tillering

b- the beginning of flowering

c- the beginning of maturing

d- answer both a + b

16- The number of tillers that will form on a given wheat plant is determined by:

a-the seeding rate

b- soil moisture and fertility

c- temperature, and variety

d- answer a+b+c

17- true or false:

(true)-At the third growth stage of wheat Most tillers that will contribute to grain yield have formed by this stage.

18- At fourth growth stage of wheat :

a-Stem elongation begins at this stage.

b-Most tillers have formed by this stage

c-the secondary root system is developing.

d-emergence of flower

19- At fifth growth stage of wheat :

a-Leaf sheaths are strongly erect at this stage

b-the number of spikelet per spike (head size) is determined.

c- No yield can be expected from tillers developed after this stage

d-answer a+ b and c

20- At sixth growth stage of wheat :

a-the first node is visible on the main stem

b-all the nodes have been developed above the soil surface and the stem is hollow below this node

d-the number of spikelet per spike is determined

e- Answer both a + b

21- At Seventh growth stage of wheat :

a-The second node has become visible on the main stem

b-one node is visible on tillers one and two.

c-This stage is characterized by rapid spike expansion.

d-Answer all the above a, b, c

e- No answer of all

22-At eighth growth stage of wheat :

a-The flag leaf is visible at this growth stage.

b-The flag leaf begins to emerge from the whole while the second node is visible.

c-three nodes are now visible and the flag leaf makes up nearly 75% of the effective leaf area that contributes to grain fill. d- flowering makes up nearly 75%

d-Answer all the above

23-AtNinth growth stage of wheat :

a-Flag leaf and ligule are just visible at this stage.

b-From this growing stage on, leaves are referred to in relation to the flag leaf

c- Answer a and b

D- No answer of the above

24-The wheat flower consists of a pistil (female organ) and …… stamens (male organs).

a-three b- six c- five d- tow


Thank
You!