

Unit 4



Growth Stages of Paddy Plant



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INTRODUCTION

It is necessary to understand the growth and development stages of a paddy plant. As management practices like weeding, irrigation, fertiliser application, etc., are almost linked with the growth and development of the plant, an understanding of the plant's growth pattern is, thus, essential. Paddy plant passes through a number of growth stages, starting from germination to maturity. Before going into details of the growth stages, it is important to understand the morphology (external appearance) of the plant.



Fig. 4.1: Root system

PARTS OF PADDY PLANT

There are two major parts of paddy plant.

Root system

As a rice grain germinates, a sheath or coleorrhiza (embryonic root) can be seen emerging from the soil. This is what happens in upland situation. But in submerged soils, it is the coleoptile (shoot meristem), which emerges ahead of the roots. The radicles (embryonic roots) emerge through the coleorrhiza. Shortly after the radicles appear, secondary roots develop

into lateral roots. Later, the embryonic roots disappear and are replaced by adventitious roots, emerging from nodes on the culm.

Shoot system

Plant parts that are visible above the ground, i.e., culm, leaves and inflorescence (panicle), constitute the shoot system.

Culm or stem

The culm or stem of the paddy plant is distinguished by a series of nodes and internodes. The culm is mostly hollow, except at the nodal portion. Leaves are attached to the nodes. The lower portion of the culm produces tillers, which may be primary, secondary or tertiary.

Leaf

The node or nodal region of the culm bears a leaf. The leaves are attached alternately on the culm in opposite direction. One leaf is produced at each node. The topmost leaf below the panicle is known as 'flag leaf'. Each leaf has two parts, i.e., sheath and blade, which are continuous. The leaf sheath is wrapped around the culm above the node. The swelling at the base of the leaf sheath, just above the node, is called 'sheath pulvinus'. It is, sometimes, incorrectly referred to as node.

Panicle

Like any other grass family member, paddy inflorescence is called a 'panicle', which consists of a number of 'spikelets' at the apical end of the culm. The panicle base is often called the 'neck'. The primary branch of panicle is divided into secondary and tertiary branches, which bear the spikelets.

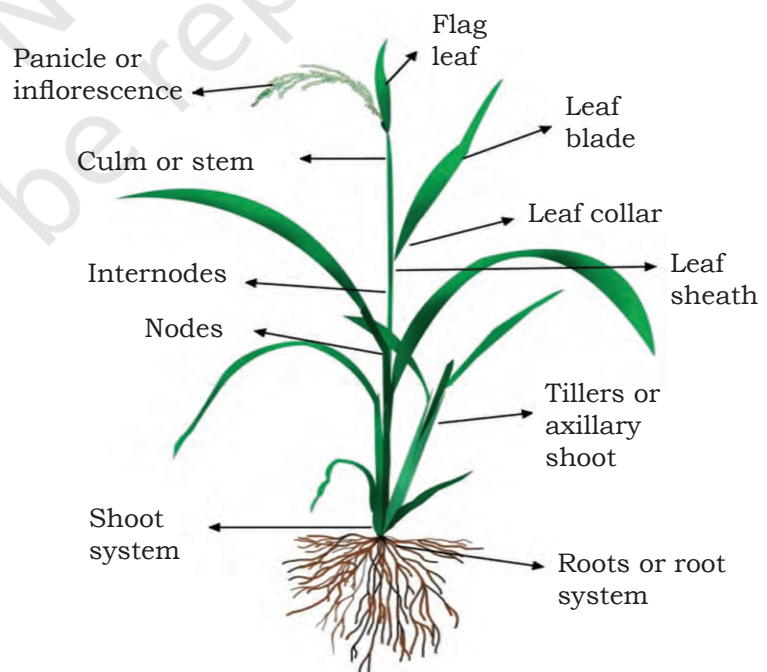


Fig. 4.2: Different parts of a paddy plant



Spikelets

These spikelets are borne on the primary and secondary branches. Spikelets are the basic unit of the inflorescence and panicle. Each spikelet consists of pedicel and floret.

Grain

The rice grain is a fertilised and ripened ovule, which has a live embryo capable of germination to produce a new plant.

GROWTH PHASES OF PADDY

There are three major growth phases of paddy plant — vegetative, reproductive and ripening.

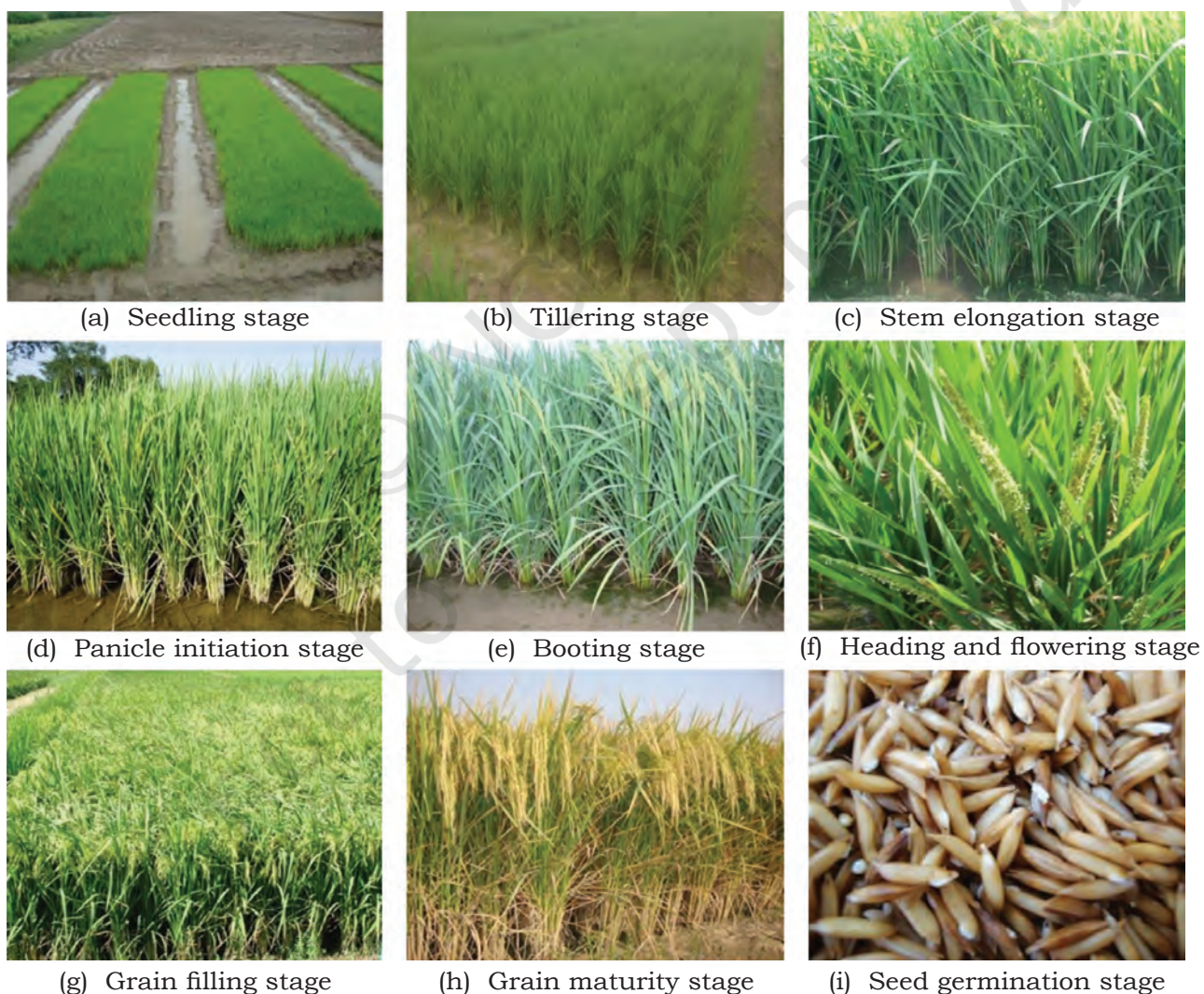


Fig. 4.3 (a-i): Different growth stages of paddy plant



Vegetative phase

This phase spans from germination to panicle initiation and can be divided into four stages.

Seedling stage

The growth period of paddy plant from the emergence of radicle to the initiation of tillering is referred to as the 'seedling stage'. Normally, this stage takes 15–30 days to complete. Generally, the appearance of the fourth leaf indicates the end of the seedling stage.

Tillering stage

This stage starts with the emergence of the first tiller and ends when the maximum tiller number has reached. The tillering stage continues with the formation of secondary and tertiary tillers. Tillers that bear a seeded panicle with fully ripened grains are called 'effective tillers'.

Stem elongation stage

This stage may start before panicle initiation or may occur during the latter part of tillering. Therefore, there may be an overlap of tillering and stem elongation stages. Generally, the growth duration of a variety is related to stem elongation.

Reproductive phase

The reproductive phase represents the period from panicle initiation to panicle emergence and development. The reproductive phase of all varieties can be divided into three stages.

Panicle initiation and booting stage

This stage starts with the initiation of panicle primordium at the tip of the growing shoot. The panicle primordium is visible to the naked eye about 10 days after initiation. In this stage, three leaves will emerge before the panicle finally emerges from the flag leaf. Panicle initiation occurs first in the main culm or primary tillers, followed by secondary and tertiary tillers. As the panicle continues to develop, the spikelets become distinguishable. The young panicle increases in



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size and its upward extension inside the flag leaf sheath causes the leaf sheath to bulge or swell. This bulging of the flag leaf sheath is called 'booting'

Heading stage

This stage is also called the 'panicle exertion stage'. It is marked by the emergence of panicle tip from the flag leaf sheath. The panicle continues to emerge until it partially or completely protrudes from the sheath of the flag leaf.

Flowering stage

This stage starts when anthers protrude from the spikelets, and later, fertilisation takes place. The flowering process continues until most spikelets in the panicle start blooming. Flowering occurs a day after the heading stage. Generally, the florets open in the morning. It takes about seven days for all spikelets in a panicle to open and get fertilised.

Ripening phase

The ripening phase begins after fertilisation of the female part. It continues through grain filling, milking and drying periods, and lasts 25–35 days. Grain filling occurs as nutrients and water get transported to the grain. It can be broadly divided into three stages.

Milky stage

The endosperm contents offer a milky consistency at this stage. This stage is susceptible to attack by insect-pests.

Dough stage

In the dough stage, milky liquid starts to thicken into a sticky white paste due to the onset of drying process.

Maturity stage

In this stage, the leaves of the plant begin to turn yellow. One way to explain the maturity stage is the endosperm becoming opaque and hard. Also, when about 90 per cent of the total grains reach a stage of containing 25–30 per cent moisture level (ripened), the matured grains, usually, show a change in colour and turn golden brown.



Photo period sensitivity

It is a natural mechanism, depending on a plant's ability to distinguish differences in day and night length. Photo period sensitivity is crucial for the reproductive phase and causes the plants to initiate flowering at a given day length along with the temperature. Photo sensitive varieties cannot be grown across different seasons but insensitive ones can be sown at any time of the year or season.

Practical Exercise

Activity

Visit a paddy field and identify the different growth stages of the plants being grown there.

Material required: notebook, pen, pencil, camera or smartphone etc.

Procedure

- Visit a paddy field in your area.
- Observe the different stages of the plants being grown there.
- Note down your observations in the notebook.
- Click photographs of the paddy plants in different stages.
- Present your observations before the class.

Check Your Progress

A. Fill in the Blanks

1. A natural mechanism based on a plant's ability to precisely distinguish day and night length is called _____.
2. The inflorescence of paddy plant is known as _____.
3. A phase from panicle initiation to panicle emergence and development is termed _____.
4. Paddy plants that cannot be grown across different seasons are called _____ varieties.

B. Multiple Choice Questions

1. _____ stage is susceptible to attack by insect-pests.

(a) Heading	(b) Ripening
(c) milky	(d) dough



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2. What is the moisture per cent in a grain at maturity stage in paddy plant?
(a) 5–10 (b) 10–15
(c) 15–20 (d) 25–30
3. The endosperm becoming opaque and hard is called _____ stage.
(a) milky (b) dough
(c) maturity (d) ripening
4. Panicle exertion stage is also known as _____ stage.
(a) heading (b) flowering
(c) booting (d) ripening

C. Match the Columns

A	B
1. Tillers come out from	(a) External appearance of plant
2. Morphology	(b) Culm
3. Vegetative stage	(c) Leaves begin to turn yellow
4. Photo period	(d) Tillering stage
5. Maturity stage	(e) Day and night length

D. Subjective Questions

1. Describe the shoot and root systems of a paddy plant.
2. Explain the various vegetative stages of a paddy plant.
3. Explain the different stages that constitute the reproductive phase of a paddy plant.
4. Write short notes on the following.
(a) Milky stage
(b) Dough stage
(c) Maturity stage

