

5. *How other pasture plants grow*

Learning outcomes:

This chapter will help you understand:

- How species other than ryegrass grow.
- How to graze species other than ryegrass.

We have dealt with ryegrass in great detail because it is generally the best pasture plant for dairy production in Victoria. However, other pasture species can be useful, particularly in areas where growing conditions are less suitable for ryegrass.

For example, the order in which grasses can **cope with warmer and drier conditions**, with the ones able to cope best at the top, is:

- Paspalum.
- Phalaris.
- Cocksfoot.
- Prairie grass.
- Fescue.
- Ryegrass.

Other species usually require different grazing management from ryegrass to get the best out of them. Getting the best from a species ensures that:

- It **produces** large quantities of dry matter.
- It is kept at its best **quality**.
- The cows eat or **utilise** most of it.
- It **persists** in the paddock.

Generally, it is best not to mix the different grass species in one paddock because:

- A particular grazing rotation and post-grazing point will not get the best production and quality from **all** species.
- When one species slows growth (for example, short-rotation ryegrasses in summer), the paddock has **patchy growth** or, worse, **weeds** may invade.

A **perennial** plant (such as perennial ryegrass or white clover) lives all through the year. Perennials produce more feed over the whole year than annuals, but they must have sufficient rainfall (or irrigation) during summer to survive.

However, if you have a paddock that contains a mixture of species:

- Decide which species is predominant and graze to suit that one.
- Keep in mind that you will not always be doing the best by the others.

This chapter looks at how best to graze species other than ryegrass.

The following is a brief **outline of ryegrass grazing principles**, because most of the same principles apply to all the other pasture plants:

1. Allow the plant to **regrow its full complement of living leaves** before grazing it again.
2. But, to minimise waste, **graze before the older leaf dies**. Check for yellowing in the base of the plant to see if leaves are dying.
3. Allow light to the base of the plant to **encourage more growing points** and tillering.
4. While the plant is **vegetative, don't graze so low that the stored sugars or, even worse, the growing point is removed**.
5. Once the plant is **reproductive, do remove (graze) the growing point**.

Points 1 and 2 are achieved by the correct pre-graze point (using the correct grazing rotation), and points 3 and 4 are achieved by the correct post-graze point, which is 4 to 6 cm average for all species.

An **annual** plant grows for only a part of the year and then dies. For example, subterranean clover dies during summer, but its seeds survive to germinate the following autumn. Annual plants produce more feed per day than perennials while they are actually growing.

5.1 **White clover (*Trifolium repens*)**

Perennial white clover:

- Grows **best at 25°C** and stops growing at 8 to 9°C.
- Requires **more soil phosphorus** than grasses to grow at its best.
- Includes such varieties as Dutch White, Irrigation, Haifa, Huia, Pitau, Kopu, Mink and Sustain.

Clovers are legumes and therefore are able to **convert nitrogen (N) in the air in the soil** into a form that they can use:

- The **air** contains about **80% nitrogen**; therefore, it is a limitless source.
- Shortly after clover plants germinate, their roots become infected with **rhizobium bacteria**, around which **nodules** (lumps) develop.
- These bacteria in the nodules absorb the nitrogen from the air in the soil and **convert it to nitrates**.
- If air cannot get into the soil (for example, when **waterlogged**), the **bacteria cannot get the nitrogen**.
- The nitrates are used to manufacture plant **protein**; consequently, clovers are higher in protein than grasses are.

- When eventually the clover plant, or parts of the plant, say roots, die or are eaten and passed out, they become part of the **decomposing organic matter** in the soil.
- In this way, the nitrogen content of the soil is increased to the **benefit of the other species** in the pasture, particularly the grasses.

Figure 5-1: A pasture with a high proportion of white clover



A pasture might need about 350 to 550 kg of nitrogen per hectare per year to produce well:

- As a very rough guide, each **10% of clover** content in a pasture, **100 kg of nitrogen** (kg N) is provided by the clover per hectare.
- For example, 30% clover content (which would be quite a high content) would provide 300 kg N per hectare per year.
- There is a large release of nitrogen from clover when it dies, mostly in late spring, summer, or autumn, so it does not supply year-round nitrogen.
- So, although clovers can provide nitrogen for the grasses, the **grasses usually grow better if more nitrogen** is applied by fertiliser, which of course costs money.

Clovers have a **higher feed value than grasses**:

- They are more digestible so have **higher metabolisable energy** per kilogram of dry matter.

- They **maintain their high feed value** much better as they mature, even when flowering.
- Cows prefer to, and can, **eat more** clover than grass, if given a choice.

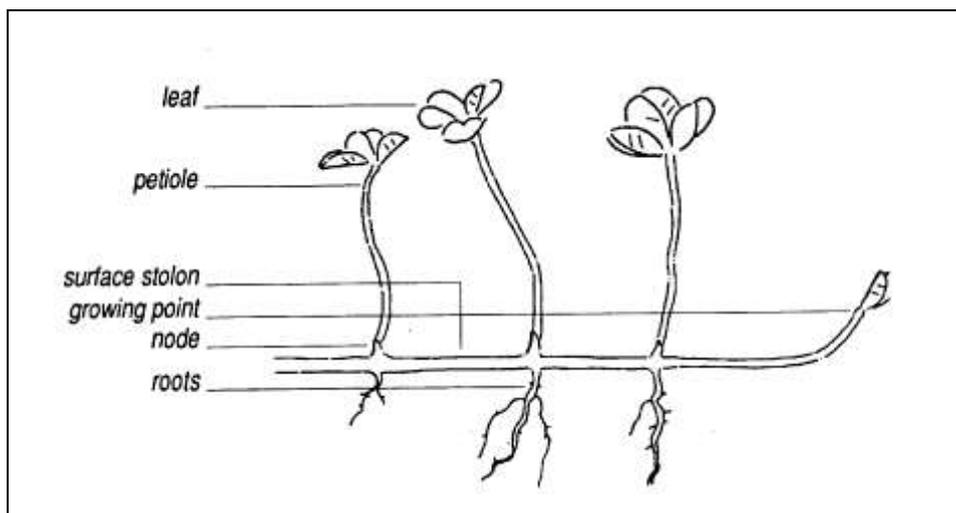
5.1.1 *White clover structure and growth*

A mature clover plant has the following parts:

- A main stem, called a **stolon**, which normally runs along the ground.
- From points along the stolon, called **nodes**, the following parts can develop:
 - A **leaf** will grow on a smaller stem called a petiole.
 - A new set of **roots** usually grows.
 - Another **stolon branch**, called a daughter stolon, can grow.
 - And, sometimes, a **flower** can also grow.

Figure 5-2 shows the stolon, petiole, leaf, growing point, node and roots.

Figure 5-2: Structure of a white clover plant

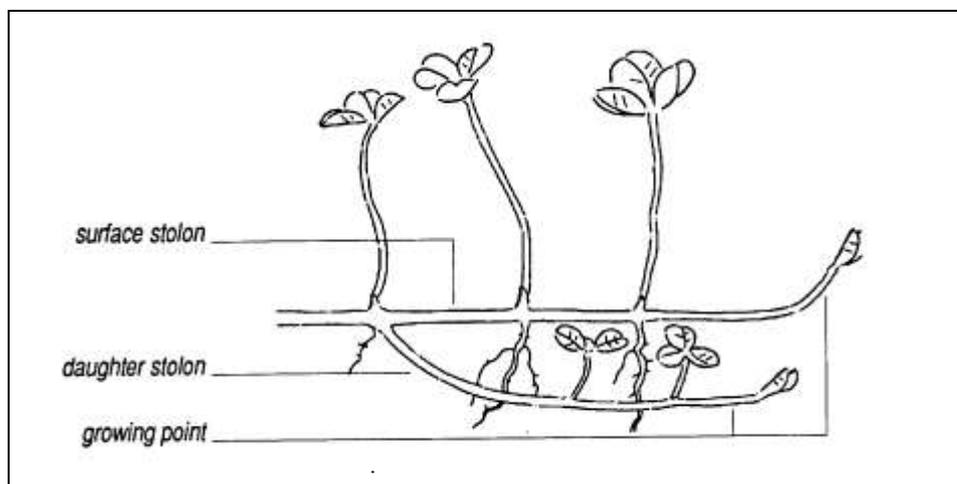


White clover stolons:

- Usually **stay close to the ground** so cows do not usually graze them off.
- Unlike ryegrass, the **growing point** of white clover is **at the tip** of the stolon. As the stolon tip grows forward, it produces the youngest leaf.
- After leaves are grazed off, the **stolon provides energy** for new leaf growth.
- If the stolon is **shaded**, the **growing tip will rise** above the ground and be at more risk of being grazed off. If the tip is grazed off, the stolon dies.

- Each stolon can produce more **stolon branches**, which results in a network of stolons covering the ground. A stolon is more likely to branch if light can get to it.

Figure 5-3: White clover plant with daughter stolon



White clover leaves:

- A white clover stolon usually has only **three growing leaves**.
- Once a particular leaf is **grazed off nothing will regrow** from that point on the stolon.
- In favourable conditions, a new **leaf can appear every three days**, at the tip of the stolon, in half the time of most grass leaves.
- But clover leaf appearance is **very slow in winter**, between 30 and 60 days.
- In winter, clover leaf size is generally smaller, and petioles are shorter.
- The last two points mean that clover does not compete well with ryegrass in winter.

White clover roots:

- The **tap root** that grows when a clover seedling first germinates lives for about **8 to 18 months**.
- When the tap root dies, the plant must be supported by **new roots on stolons**. This makes the plant more susceptible to summer drought.
- As new roots develop at new nodes, the older roots behind die off.
- If a node doesn't develop roots, a daughter stolon will not form at that point.

White clover flower:

- At some nodes on a stolon, a **flower head** develops.
- It produces seeds that can germinate to produce a new clover plant. In drier areas, clover must be allowed to set seed each year or two or it won't persist in the pasture.
- However, in areas where summer moisture is adequate, flowering and **seeding are not necessary**, because clover can spread by stolon branching.
- Clover is able to produce a flower and seedhead while still growing leaves, so it **maintains quality while reproducing**.
- If a flowerhead is produced at a node, that node doesn't produce roots or a daughter stolon. So, in spring when the white clover plant is flowering, the number of new daughter stolons is reduced.

5.1.2 *How to graze white clover*

To graze a pure stand of white clover:

- The rotation length should ensure that grazing occurs when the lower (that is the youngest) leaves are just starting to become lighter green or yellow, that is when shading is starting to have a negative affect. (Keep in mind that it is the youngest part of the stolon that usually stays close to the ground).
- The post-graze point should be about 4 to 6 cm.

However, clover is usually mixed with grasses in a pasture. Grazing that suits ryegrass generally suits white clover. The main difference between ryegrass and clover grazing is that flowering is not a quality problem with clover but it is with ryegrass.

Grazing to suit ryegrass will generally **minimise the shading** of clover by the grasses, so that:

- **More daughter stolons** will develop, which means more growing points and more leaf production and growth.
- More stolons will grow in spring, which means clover will **survive a dry summer** better due to the increased stolon reserves available.
- There is **less chance** of the growing **tip being grazed off**.

White clover is a high quality plant that provides nitrogen to the soil. However, to grow well, it requires warmth and soil moisture and must not be shaded by the grasses. For these reasons it can be difficult to keep in the pasture.

5.2 *Subterranean clover (Trifolium subterraneum)*

Subterranean clover, often called sub clover, is a major species in lower summer-rainfall dairy pastures and is often grown with irrigation from autumn through to spring:

- It is an **annual** species.
- It **germinates in late summer** or autumn and **dies in late spring** early summer.
- Its **growing season** varies from **five to nine months**, depending on the season and cultivar.
- It therefore suits a Mediterranean climate, which is winter rainfall, summer dry.
- It grows **best** at about **22°C**.
- It is distinguishable from white clover because sub clover **leaflets are hairy** underneath.

Sub clover **persists in drier conditions** because:

- Many of its **seeds are “hard”**, so they all do not germinate at the first sign of moisture. Unseasonal summer rain may germinate some (which then die as the soil dries out again), but many will still be present when the true autumn break of rain occurs.
- Once germination is triggered, the large seeds help sub clover **germinate rapidly**.

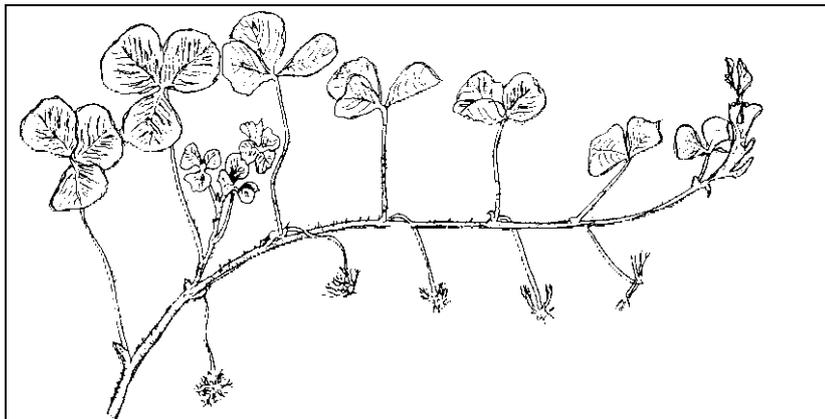
5.2.1 *Sub clover structure and growth*

Vegetative growth:

Sub clover has long and **highly branched runners**:

- They are not stolons like white clover, because they depend on the **one central root system** and do not form new roots at a node.
- The **growing point is at the tip** of the runner.
- A leaf grows from the runner until the next one appears, the later leaves being bigger, and on longer leaf stems, than the first.
- In shaded conditions, the rate of new leaf and stem production is decreased.
- Sub clover **leaves appear more rapidly than white clover** leaves.
- Shading causes longer leaf stems.
- While still vegetative (from germination until spring), the plant remains fairly small with only limited internodal elongation.

Figure 5-4: Sub clover plant



Reproductive growth:

- **Once becoming reproductive** (in late spring) **the plant spreads** through the pasture by the rapid elongation of the runners between the nodes.
- Leaf loss by grazing at this time reduces the rate of runner elongation.
- Small groups of flowers are produced on stems coming from the base of the leaves.
- The number of **flower stems is very dependent on** the amount of **light** reaching the runner.
- The flowers fold back along the flower stem, developing a burr.
- The flower stem then bends over and grows toward the ground burying the flower head in the soil.
- The seeds produced by sub clover cultivars are about 3 mm in diameter and are either purple-black or cream in colour.
- Loss of leaves, by grazing or mowing, during seed set can reduce the quantity of seed.

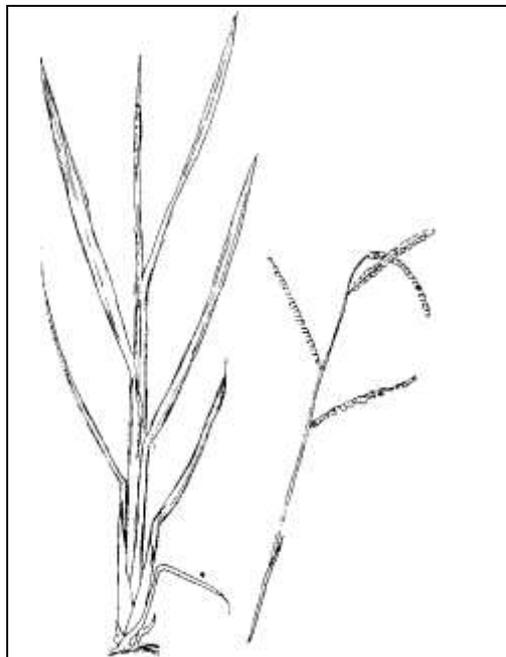
5.2.2 *How to graze sub clover*

- Maintain a minimum height of 5 cm (about 1,500 kg DM/ ha) and a maximum height of 15 cm (3,000 to 4,000 kg DM/ ha).
- From an early March start, sub clover will not reach 5 cm until mid April. So hold off grazing until then, unless grasses or other weeds are dominating.
- In the first year of sub clover pasture establishment, a more lenient grazing may be warranted in late spring to ensure a good seed set.

5.3 *Paspalum* (*Paspalum dilatatum*)

- *Paspalum* is a **common grass** species in irrigated, or high summer rainfall, dairy pastures.
- It is a **deep-rooted perennial** that grows to 150 cm, if ungrazed.
- If grazed hard, it forms a flat, **prostrate crown**.
- It **spreads** via very short underground stems, called **rhizomes**.
 - The number of rhizomes per plant is fairly constant.
 - Rhizomes produce tillers that have 3 to 8 leaves, but **usually only three leaves** are alive and green.
- It can produce **more dry matter in summer** (December to March) than either perennial ryegrass or white clover.
- It grows **best** when the **day AND night temperatures are “hot”**, in other words, average night temperature are greater than 15°C.
- Night temperatures tend to vary more than day temperatures and to decrease more quickly at the end of summer, causing *paspalum* **growth to start and stop** and then **finish suddenly**.
- During summer, a new leaf is **produced very rapidly, every 2 to 4 days**.
- It is **dormant during winter**, producing few or no leaves.

Figure 5-5: *Paspalum* plant



- Even at its best, it is **poorer quality** feed than ryegrass (about 9 MJ ME compared to 11 MJ ME).

- During summer, about **14 days** after each grazing or topping, even if most leaves and stems were removed, the paspalum plant will be starting to produce more **stems and flowers**.
- The flowering **stem is very poor quality** feed.
- Paspalum is a **tough plant**. It grows very well if soil moisture and fertility are ideal, but it still grows **reasonably well** in both **dry and waterlogged conditions**.
- This means that if **poor irrigation management** causes periods of dry soil, followed by periods of waterlogging, **paspalum** will become **dominant** in white clover and perennial ryegrass pasture.

5.3.1 *How to graze paspalum*

If a paddock is largely paspalum, and it is growing strongly in summer, it needs to be grazed about every 14 days. This will ensure:

- It grows about **three leaves**, but no more.
- It is leafy and therefore of reasonable **quality**.
- The **stems and flower heads are minimised**.

On pastures with a mixture of ryegrass, white clover **and** paspalum, a compromise grazing rotation of say 18 to 20 days in late spring and summer:

- Will keep the paspalum in reasonable control.
- Will allow about 2 ryegrass leaves to grow.
- Will not shade the white clover too much.

At the end of summer:

- Paspalum growth will reduce rapidly.
- Typically, the ryegrass will not take over very quickly because it has been grazed on too short a rotation.
- Therefore, even while the paspalum is growing well at the end of its season, a longer rotation may be warranted to get the ryegrass ready.
- The paspalum quality may then be difficult to maintain by grazing alone, so topping before or after grazing is often warranted.

5.4 *Italian ryegrass (Lolium multiflorum) and hybrid ryegrass (Lolium hybridum)*

Annual ryegrasses (such as Italian ryegrass), as compared to perennial ryegrasses (*Lolium perenne*):

- Grow for **one season** (autumn to spring) only.
- Establish quicker and grow **faster** during autumn to spring.
- Have **higher sugar levels** in their leaves.
- Are **slightly better quality** feed.

- Are possibly **more palatable** and therefore grazed harder by cows.
- Do **not need the cold** period to become reproductive.
- So **go to seed** in spring or summer, **regardless** of the winter conditions.
- Do **not tiller as readily**.

Perennial ryegrasses:

- Will **survive indefinitely** (if there is adequate summer moisture).
- **Grow all year, but not as well** as the annuals during their growth period.
- **Must have a cold period to become reproductive**.

Short-rotation ryegrasses:

- Are hybrids **bred from annual and perennial ryegrass**.
- Have varying proportions of the two parents' qualities.
- Can be **biennial**, that is, **survive for two to even four years**.

Tetraploid ryegrasses:

- Some ryegrass cultivars have a **double set of chromosomes** and are called tetraploid.
- The leaves are **larger and softer, with less fibre**.

Grazing short rotation ryegrasses:

- **All ryegrasses have about 3 live leaves per tiller**.
- However, **short-rotation ryegrasses seem to suffer more** than perennials **from bad grazing management**.
- Particularly avoid grazing at less than 2 leaves, and control the cows' inclination to graze these varieties harder than 4 cm.

Short-rotation ryegrasses are useful if you:

- **Don't mind resowing** every few years.
- Want a **large quantity spring crop** that can be conserved.
- Want **higher feed quality over a particular period**.
- Are **prepared to graze properly**, that is, not graze at less than 2 leaves.

5.5 *Tall fescue (Festuca arundinacea)*

Tall fescue:

- Is a **deep-rooted perennial** grass.
- It is more **difficult to get established** than ryegrass. Therefore, more effort is needed to minimise any other plant competition when the seedling is young; and more care is needed at first grazing to ensure that the plant is not pulled out.
- Once established, it grows **better at higher temperatures, and on wetter soils**, than ryegrass.
- It has about **2.5 live leaves per tiller**.
- However, the time required for fescue to reach the 2.5-leaf stage might be as long as, or longer than, the time required to reach the 3-leaf stage in ryegrass, except in late spring or summer, when it may take less time.
- Its **quality declines rapidly as it develops a stem** and seed head.
- It does not tiller well if continually grazed below 4 cm in height.
- Generally, it should be **grazed when it has reached between the 2- and 3-leaf stage**, which is usually about 10 cm high. In summer, on irrigated farms, this might be between 12 to 14 days; but on non-irrigated farms, it might be up to 40 days. In winter, 3 leaves may take 50 days to grow.
- When **seed heads** are developing it should be **grazed at the 2-leaf stage**, which might be as often as every 10 days.

5.6 *Prairie grass (Bromus unioloides)*

Prairie grass:

- Quality and production is **as good as perennial ryegrass**.
- Will persist **only on well-drained and highly fertile soil**.
- Needs careful grazing to maintain tillering and to avoid treading damage.
- Is best grazed at about the **4-leaf stage**.

5.7 *Cocksfoot (Dactylis glomerata)*

Cocksfoot:

- Is a perennial grass with flattened tillers and **bluish green** leaves.
- Produces **more in drier conditions and lighter soils** than ryegrass and responds faster to summer rainfall, mainly because it has a **very active root system**.
- Is tolerant of grub attack, which can badly affect ryegrass and fescue.

Compared to ryegrass:

- It has better **heat tolerance**.
- Is better able to **cope with lower soil fertility**.
- Is better adapted to **acid soils**.

Grazing cocksfoot:

- Cocksfoot may be best grazed between the **3- and 4-leaf stage**.
- If kept green and leafy, with no dead leaf build up, quality can be maintained with ME values of 12 to 12.5MJ.
- Older cocksfoot cultivars seem to go stemmy, no matter what the management is, so **topping may be necessary**.

5.8 *Phalaris* (*Phalaris aquatica*)

Phalaris:

- Is a **very deep-rooted perennial** grass.
- Is particularly **suited** to soils that are **wet in winter and dry in summer**.
- Has **good winter and early spring** production.
- Can go **dormant in dry summers**.
- Has **poorer quality** than ryegrass.
- Seems best grazed at around the **4-leaf stage**.

5.9 *Kikuyu* (*Pennisetum clandestinum*)

Kikuyu:

- Like paspalum, is a **subtropical perennial** grass.
- **Grows very well in summer** if soil moisture is adequate.
- Easily **dominates the pasture in summer**.
- Goes **dormant in winter**, its presence **severely restricting winter growth** of other plants.
- Is relatively **poor quality** feed. The leaf is about 9 MJ ME and 21% crude protein, and the stem about 7 MJ ME and 17% crude protein.
- Has about **4.5 green leaves per tiller**, so if more than 4.5 leaves are allowed to grow the proportion of stem and dead leaves increases sharply.
- At peak growth, may regrow **4.5 leaves after grazing in 12 days**, but may take up to 35 days to regrow in late autumn
- Has **regrowth** soon after grazing that is too **high in nitrates and potassium** and too **low in calcium and magnesium**.

Kikuyu needs to be grazed to keep it **leafy**:

- Allow enough for the cows so that they **graze leaf only** and no stem.
- **Remove remaining stem** immediately after grazing by mulching, slashing or mowing.

5.10 Summary

All the pasture plants grow and need to be grazed in a similar way to ryegrass. They all:

- Grow a certain number of leaves, then the **older leaves die**.
- **Store sugar** so that they can regrow after grazing, without any leaves capturing sun.
- Have **poorer quality reproductive tillers** than vegetative tillers (except the clovers).
- Need **light to the base** to produce daughters tillers, stolons, or runners.