

# VISUAL INDICATORS OF SOIL CONDITION

*Online Edition*

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# **PADDOCK SCALE OBSERVATIONS**

*CLICK TO OPEN*

# **PLANT & SOIL SCALE OBSERVATIONS**

*CLICK TO OPEN*

# **WEED OBSERVATIONS**

*CLICK TO OPEN*

1



**Dark green patches with greater growth of grass or clover, paler green in other areas.**

**Increased or fast pasture growth surrounding manure pats, shorter paler green growth elsewhere.**

**Observed:** Late winter to early spring

**WHAT COULD THIS INDICATE?**

2



**Yellowing or pale green colour in pastures.**

**Observed:** Late winter to spring

**WHAT COULD THIS INDICATE?**

3



**Grass dominant pasture with little or no legume and slow growth.**

**Observed:** Late winter to mid spring

**WHAT COULD THIS INDICATE?**

4



**Increased growth and high fertility indicator weeds growing on stock camps.**

**Observed:** During the growing season

WHAT COULD THIS INDICATE?

5



**Areas that stay green during summer but have reduced growth. Bare patches remain damp and white salt crystals may be visible on soil surface.**

**Different plants growing to the rest of the paddock.**

**Observed:** Late spring

WHAT COULD THIS INDICATE?

6



**Lucerne stunting or patchy poor growth following establishment.**

**Observed:** First three to four months after establishment

WHAT COULD THIS INDICATE?

1



**Small, stunted or dark green leaves on sub-clover plants.**

**Observed:** Early spring

WHAT COULD THIS INDICATE?

2



*Photo James Easton, CSBP*



*Photo Department of Agriculture Fisheries & Forestry*

**Bronzing of sub-clover leaf margins which develop into pale grey spots.**

**Observed:** Late winter to early spring

WHAT COULD THIS INDICATE?

3



*Photo Sue Briggs, CSBP*

**Stunted sub-clover plants, usually pale green in colour.**

**Rapid death of sub-clover plants.**

**Observed:** Autumn and winter

WHAT COULD THIS INDICATE?

4



Photo Jo Powell, NSW LSS

**Few or whitish nodules on legume roots.**

**Observed:** 12 weeks post-germination to early spring

WHAT COULD THIS INDICATE?

5



**Soil disturbance with lots of soil crumbs on the surface.**

**Observed:** Moist soil in winter and spring

WHAT COULD THIS INDICATE?

6



**Milky tea coloured water on soil surface.**

**Observed:** After rain

**Soils form surface crust and set hard when dry.**

**Observed:** Once soil is dry



WHAT COULD THIS INDICATE?

1



**Capeweed** (*Arctotheca calendula*)

**High content within pasture or in stock camps, gateways or adjacent to tree plantations.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

2



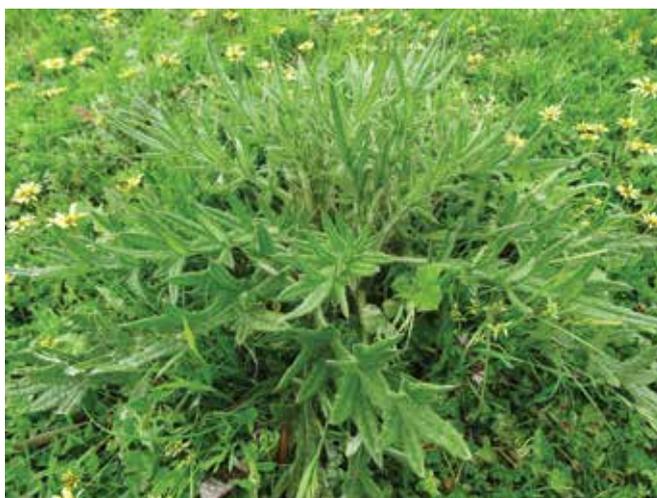
**Barley Grass** (*Hordeum leporinum*)

**High content within pasture or in stock camps, gateways or adjacent to tree plantations.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

3



**Thistles** (*Cirsium vulgare*)

**High content within pasture or in stock camps, gateways or adjacent to tree plantations.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

4



**Marshmallow** (*Malva parviflora*)

**High content within pasture or in stock camps, gateways or adjacent to tree plantations.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

5



**Flatweed** (*Hypochaeris radicata*)

**High content within pasture.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

6



**Sweet Vernal Grass**  
(*Anthoxanthum odoratum*)

**High content within pasture.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

7



**Bent Grass (*Agrostis spp*)**

**High content within pasture.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

8



**Fog Grass (*Holcus lanatus*)**

**High content within pasture.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

9



**Silver Grass (*Vulpia bromoides*)**

**High content within pasture.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

10



**Onion Grass (*Romulea rosea*)**

**High content within pasture.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

11



**Sorrel (*Rumex vulgaris*)**

**High content within pasture.**

**Observed:** Autumn to December

WHAT COULD THIS INDICATE?

1



## What do you see & when?

**Dark green patches with greater growth of grass or clover, paler green in other areas.**

**Increased or fast pasture growth surrounding manure pats, shorter paler green growth elsewhere.**

**Observed:** Late winter to early spring

## What could this indicate?

**Pale green areas deficient in nitrogen, potassium, phosphorus or sulphur.**

Dark green areas are urine patches or manure. Urine contains high levels of nitrogen and potassium and some sulphur.

Dung-affected areas also contain phosphorus.

**Selective grazing** – Stock avoid pasture near dung while odour remains (up to three months).

## What tests can I do to confirm?

- Soil testing with reference to potassium, nitrogen and sulphur. Avoid sampling the dark green areas.
- Test strips of potassium, nitrogen and sulphur fertiliser.

*Pictured: Nitrogen response (left) with 25kg/ha applied in May.*

*Photo Lisa Warn, Ag Consulting*



2



## What do you see & when?

**Yellowing or pale green colour in pastures.**

**Observed:** Late winter to spring

## What could this indicate?

**Deficiency in potassium, nitrogen or sulphur or trace elements.**

**Waterlogging**, resulting in transient nitrogen loss.

**Maturing/flowering winter grass (*Poa annua*)**

**Dying plants** caused by red-headed cockchafer pruning plant roots.

*Pictured: Winter grass and Onion grass (*Romulea rosea*) infected with yellow brown spots caused by *Helminthosporium* fungus.*



## What tests can I do to confirm?

- Soil test, with reference to phosphorus, potassium and sulphur. Tissue test for micronutrients, with attention to molybdenum.
- Abundance of low fertility weeds and absence of high fertility weeds.
- Test strips of nitrogen and / or potassium, sulphur and molybdenum fertiliser.

*Pictured: Potassium response in test strip.*



3



## What do you see & when?

**Grass dominant pasture with little or no legume and slow growth.**

**Observed:** Late winter to mid spring

## What could this indicate?

**Possible phosphorus or molybdenum deficiency**

**Low soil pH (soil acidity)**

**Inappropriate sub-clover management**

Inappropriate management includes leaving too much dry material at the autumn break, long rotations encouraging grass dominance or cutting hay in later maturing clovers.

## What tests can I do to confirm?

- Soil test, with reference to phosphorus, pH and aluminium.
- Plant tissue test for molybdenum.
- The dry material litter test in late summer/early autumn.

*Pictured: Amount of loose litter in late summer. Ideally one to two handfuls in 0.1m<sup>2</sup> quadrat promotes hard seed breakdown of sub-clover.*



4



## What do you see & when?

**Increased growth and high fertility indicator weeds growing on stock camps.**

**Observed:** During the growing season

## What could this indicate?

### High soil fertility

Stock empty out dung and urine, so nutrients concentrate.

### Bare ground at autumn or overgrazing

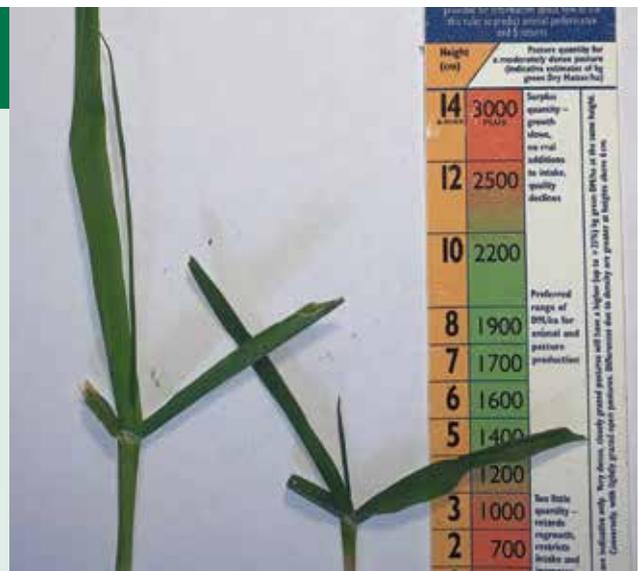
*Pictured: Bare ground at autumn and false breaks can favour capeweed growth.*



## What tests can I do to confirm?

- Identify if weeds growing on camp area thrive under high fertility.
- Compare size of fully-emerged leaf blades of the same grass species from the stock camp to the rest of paddock.

*Pictured: Larger yet same number of leaves due to higher fertility.*



5



## What do you see & when?

Areas that stay green during summer but have reduced growth. Bare patches remain damp and white salt crystals may be visible on soil surface.

Different plants growing to the rest of the paddock.

**Observed:** Late spring

## What could this indicate?

### Salinity

Caused by a salty water table less than two metres from the soil surface.

### Freshwater spring

## What tests can I do to confirm?

- Soil test with reference to electrical conductivity (EC).
- Identification of individual plant species to confirm their salt tolerance.

*Pictured: Examples of salinity indicator plants.*



Buckshorn plantain  
(*Plantago coronopus*)



Sea barley grass  
(*Hordeum marinum*)



Yellow buttons  
(*Cotula coronopifolia*)

6



## What do you see & when?

**Lucerne stunting or patchy poor growth following establishment.**

**Observed:** First 3-4 months of establishment

*Photo Malcolm McCaskill, Agriculture Victoria*

## What could this indicate?

### **Soil acidity with associated high soil aluminium**

This affects root growth, causing stunting, sideways growth of roots and plant loss.

**Waterlogging** may cause a similar effect.

*Pictured: Stunted lucerne with J-shaped roots from poor growth patches (left) compared to healthy plants.*

*Photo Neil James, Agriculture Victoria*



## What tests can I do to confirm?

- Soil test, with reference to pH and aluminium at 0-10, 10-20 and 20-30cm to detect top and sub soil acidity.

*Pictured: Soil pH tested along 30cm soil core using pH kit available from hardware stores or nurseries.*



1



## What do you see & when?

**Small, stunted or dark green leaves on sub-clover plants.**

**Observed:** Early spring when clover is adequately growing

## What could this indicate?

### **Phosphorus deficiency**

Only when phosphorus deficiency is extreme do leaf symptoms appear. Slow and poor growth of pasture occurs from “Hidden hunger” of all

nutrients before appearance of leaf symptoms.

Sub-clover leaves with adequate fertility should be the size of a 20 cent piece.

## What tests can I do to confirm?

- Soil test with reference to phosphorus.
- Test strips of phosphorus fertiliser.

*Pictured: Hand-operated soil sampler.*



2



Photo James Easton, CSBP



Photo Department of Agriculture, Fisheries & Forestry

## What do you see & when?

**Bronzing of sub-clover leaf margins which develop into pale grey spots.**

**Observed:** Late winter to early spring

*Pictured left: Sub-clover plants with symptom progression*

## What could this indicate?

### Potassium deficiency

Avoid confusion with red-legged earth mite feeding damage, which occurs randomly across the leaves.



## What tests can I do to confirm?

- Soil test with reference to potassium.
- Test strips of potassium fertiliser.

*Pictured: Potassium response in test strip.*



3



Photo Sue Briggs, CSBP

## What do you see & when?

**Stunted sub-clover plants, usually pale green in colour.**

**Rapid death of sub-clover plants.**

**Observed:** Autumn and winter

## What could this indicate?

**Soil acidity and associated high soil aluminium**

**Soil borne diseases** – caused by four main pathogens (*Phytophthora*, *Pythium*, *Aphanomyces*, *Rhizoctonia*).

*Pictured from left: Sub-clover with relatively healthy roots; diseased plant with root branch pruning (commonly seen symptom); extreme diseased roots with tap root pruning and brown lesions on roots.*

Photos Richard Simpson, CSIRO



Healthy • Branch Pruning • Diseased

## What tests can I do to confirm?

- Soil test, with reference to pH and aluminium.
- Test strips with lime. (Lime responses are often not seen in first year.)
- Inspect roots. Hostile soil conditions will result in stunted roots.
- Diseased roots are commonly yellow with reduced or pruned branches and may have brown/black lesions.
- Test strips of foliar fungicide.
- Predicta B to identify pathogen presence.

4



Photo Jo Powell, NSW LSS

## What do you see & when?

**Few or whitish nodules on legume roots.**

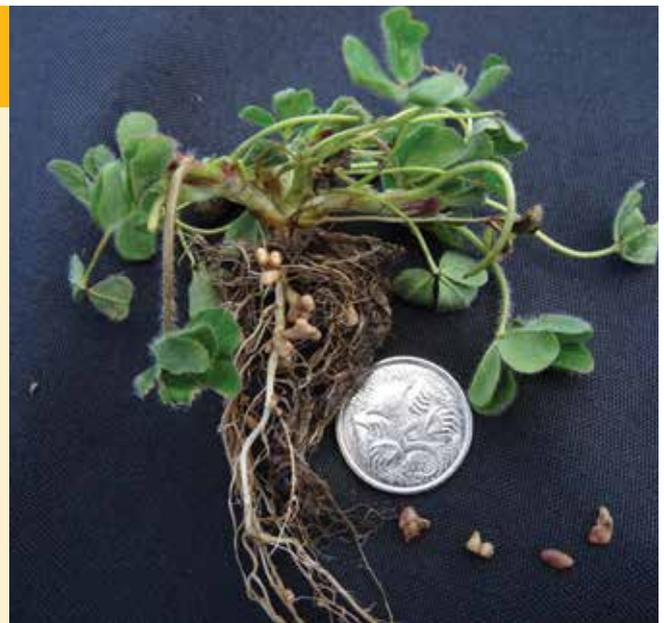
**Observed:** 12 weeks post-germination

## What could this indicate?

**Inadequate nodulation** – there could be many reasons for this, including:

- Soil acidity and high soil aluminium.
- Insufficient rhizobia in the soil as a result of cropping for many years.
- Residual herbicide damage.
- Molybdenum deficiency.
- Sulphur deficiency.

*Pictured: Healthy pink nodules.*



## What tests can I do to confirm?

- Inspect nodules. Look for many big pinkish coloured nodules rather than small white nodules.
- Conduct nodulation score.
- Examine cropping history as soil rhizobia declines after three years without a host.
- Tissue test clover leaves with reference to molybdenum.
- Test strips of sulphur and molybdenum fertiliser.

5



## What do you see & when?

**Soil disturbance with lots of soil crumbs on the surface.**

**Observed:** Moist soil in winter and spring

## What could this indicate?

### Earthworms

The disturbed soil is excreted waste called casts.

Avoid confusion with blackheaded cockchafer which form mounded tunnels.



## What tests can I do to confirm?

- Dig up the soil and check for earthworms.

*Pictured: Earthworms in soil clod eating decayed roots and microorganisms.*



6



## What do you see & when?

**Milky tea coloured water on soil surface.**

**Observed:** After rain

**Soils form surface crust and set hard when dry.**

**Observed:** Once soil is dry

## What could this indicate?

**Soil dispersion** – Individual clay particles separate from one another when soil becomes wet due to excessive sodium and insufficient organic matter binding the soil together.

**Slaking** – Soil crumbs break apart when wet due to low organic matter which results in surface crusting. Often seen around gateways.

*Pictured: Cloudy water indicating dispersion of soil crumbs; collapsed crumbs indicating slaking.*



## What tests can I do to confirm?

- Soil test with reference to the amount and proportion of sodium compared to calcium, potassium and magnesium.
- An aggregate stability test. This involves placing small soil crumbs (sized about 5-10mm) into a dish with distilled water and observing their reaction over time.

1-4

## HIGH FERTILITY INDICATORS



Capeweed (*Arctotheca calendula*)



Barley Grass (*Hordeum leporinum*)



Thistle (*Cirsium vulgare*)



Marshmallow (*Malva parviflora*)

### What do you see & when?

High content of capeweed, barley grass, marshmallow and/or thistles within pasture or in stock camps, gateways or adjacent to tree plantations.

Observed: Autumn to December

### What could this indicate?

**High fertility, particularly nitrogen**  
Presence of barley grass also indicates high phosphorus levels.

**Overgrazing in late summer**  
This provides ideal conditions for germination.

### What tests can I do to confirm?

- Soil test with reference to nitrogen and phosphorus.
- Note location where the weeds are most dominant.

5-6

## LOW FERTILITY INDICATORS



**Flatweed**  
(*Hypochaeris radicata*)



**Sweet Vernal Grass**  
(*Anthoxanthum odoratum*)

### What do you see & when?

**High content of flatweed and/or sweet vernal grass within pasture.**

**Observed:** Autumn to December

### What could this indicate?

**Low potassium**

Common on light textured soils (as potassium leaches) and on paddocks repeatedly cut for hay or silage.

### What tests can I do to confirm?

- Soil test with reference to potassium.

7-8

## LOW FERTILITY INDICATORS



**Bent Grass**  
(*Agrostis spp*)



**Fog Grass**  
(*Holcus lanatus*)

### What do you see & when?

**High content of bent grass and/or fog grass within pasture.**

**Observed:** Autumn to December

### What could this indicate?

#### **Low fertility**

Especially nitrogen but also phosphorus, potassium & sulphur.

#### **Soil acidity**

Favours growth as nitrogen fixation of legumes declines.

### What tests can I do to confirm?

- Soil test with reference to nitrogen, phosphorus, potassium, sulphur and soil pH.

9

## LOW FERTILITY INDICATOR



### What do you see & when?

**Silver Grass** (*Vulpia bromoides*)

**High content within pasture.**

**Observed:** Autumn to December

### What could this indicate?

**Low nitrogen**

**Soil acidity** – Favours growth as nitrogen fixation of legumes declines.

### What tests can I do to confirm?

- Soil test with reference to nitrogen, phosphorus and soil pH.

10

## LOW FERTILITY INDICATOR



### What do you see & when?

**Onion Grass** (*Romulea rosea*)

**High content within pasture.**

**Observed:** Autumn to December

### What could this indicate?

**Low phosphorus**

### What tests can I do to confirm?

- Soil test with reference to phosphorus.

## LOW FERTILITY INDICATORS



### What do you see & when?

**Sorrel** (*Rumex vulgaris*)

**High content within pasture.**

**Observed:** Autumn to December

### What could this indicate?

#### **Low potassium**

Common on light textured soils (as potassium leaches) and on paddocks repeatedly cut for hay or silage.

#### **Soil acidity**

### What tests can I do to confirm?

- Soil test with reference to potassium and soil pH.