

Working with earthworms – Boosting productivity with vermiculture



FACT SHEET #2: ARE EARTHWORMS WORKING FOR YOU?

We all know that earthworms are a sign of healthy and functioning soil. But what is a 'healthy' earthworm population? This worksheet explains how vegetable growers can check whether they have a healthy population of earthworms working for them and the types of earthworm they are likely to find when they are checking.

How to estimate earthworm numbers

The figure below shows how to assess where earthworm numbers are healthy. Digging holes also allows assessment of how earthworms and other farm practices are affecting soil structure.

Mature worms are usually larger and have a distinct 'saddle' or thicker 'bulge' towards the more pointed 'head' or front end of the worm. Smaller earthworms are often immature versions of common species and do not yet have a saddle. The presence of adults in samples suggests established and healthy populations. A large number of immature earthworms but few adults suggests a recovering population.

How many earthworms should there be?

Previous studies suggest a healthy minimum number of earthworms is 100-200 per square metre, or average of at least two to four earthworms per 150mm x 150mm x 300mm deep spade full. This level of earthworms will continually work, aerate and fertilise the upper 300-500mm of topsoil, depending on the depth of the soil. An earthworm population of this size or more will start to have visible impact on the soil structure, with burrows and 'casts' or droppings resulting in improved water infiltration and aeration. This can reduce the need for deeper tillage. The higher the earthworm population, the more work they will do to improve soil structure and health, and this further improves conditions for earthworm activity.

Figure 1 *How of check earthworm numbers*



1. Use a normal garden spade in areas that have not been cultivated for at least two to three months and have had good soil moisture down the profile during that period. In the warmer months do this in the early to mid-morning before the temperature gets above 25°C.
2. Randomly pick a sample point. Use the spade to measure and cut out a spade sized sod of approximately 15cm x 15 cm wide x 30-40cm deep (i.e. the width and depth of most spade blades). Do this as quickly as possible – earthworms will retreat down the soil profile when they sense digging.
3. Place the sod on the ground or on a tarp and sort through it by hand. Extract and count adult and non-adult earthworms. Adult earthworms are typically larger and have a distinct collar or 'saddle'. If the earthworm population is healthy, there will be an average of at least two to four larger earthworms per spade-sized sod. You might not find this number in every sample, but you should find it in most. Repeat the sampling and worm counts at least 5-10 other sampling points to get a feel for the average number.

What types of earthworm are present?

Although Australia has over 700 identified different species of native earthworms, only a small number of 'agronomic' worms are commonly found under agricultural systems. Most of these are introduced species that can survive, and under the right conditions thrive, under cropping and modified pasture systems. Native worms are less common under cropping systems.

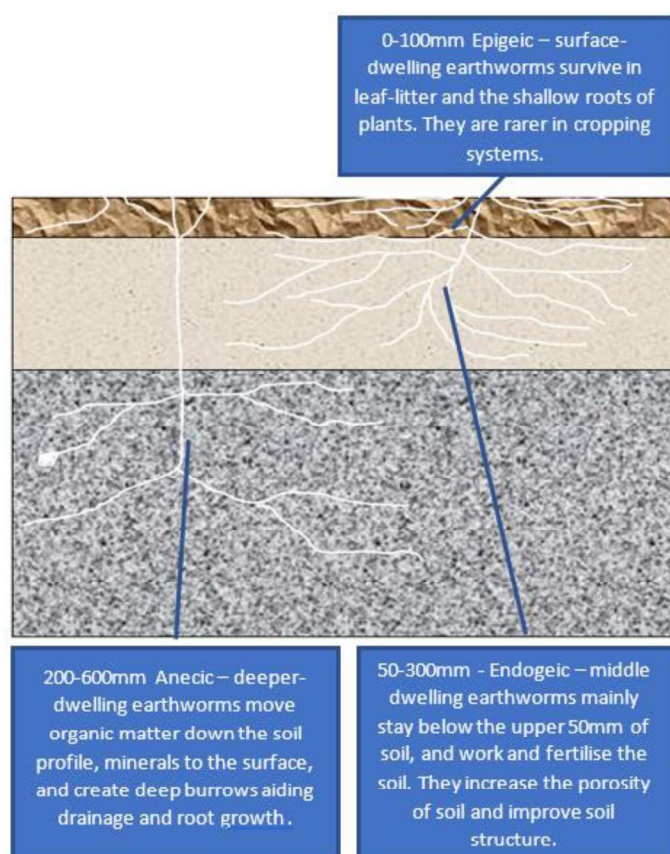
There are three main types of earthworms, shown in the figure below. They are:

- > **Surface dwelling or 'Epigeic' earthworms.** These earthworms live in organic matter at the surface of the soil, and only penetrate the upper few centimetres of the soil. They can be found in leaf litter and pasture, or under organic mulches. These earthworms convert organic matter into nutrient-rich casts at the surface, but only work the upper few centimetres of soil. They are not common in cropping systems and vegetable farming where there is not much organic matter at the surface. These earthworms are often smaller and thinner than deeper dwelling species and are often dark red or yellow in colour. Some Epigeic species breed

rapidly, including the 'compost' worms used in 'worm farms' to convert organic matter into vermiculture casts and liquid extracts. These earthworms are often bright red and banded/stripy.

- > **Sub-surface, middle-dwelling, or 'Endogeic'.** earthworms that live mainly in the upper 50-300 mm of the soil profile, these earthworms are the main potential 'workers' on vegetable farms. They feed on organic matter, bacteria, fungi and other soil microorganisms, including disease-causing pathogens and nematodes. They produce casts in the root zone of plants. Some species will burrow deeper, especially as upper soil dries and when earthworms hibernate/aestivate in the soil. Commonly found varieties include Grey, Purple, Red, Rosy-tipped and Orange-saddled worms.
- > **Anecic or deep-dwelling earthworms.** These earthworms live further down the soil profile, but mainly feed on organic matter at the surface. They are often larger than other types of earthworm and move organic matter and nutrients down the soil profile, creating deeper and freer draining soils. Tell-tale signs of these species are piles of casts around holes at the soil surface and deep vertical burrows when sods are dug. These earthworms are more common in pasture but are not common on the majority of vegetable farms due to the lower amounts of decaying organic matter at the surface on most farms. They are often longer and thicker than shallower dwelling species with darker red-brown heads and paler bodies.

Figure 2 Types of earthworm



Earthworms differ from pathogenic 'worms' or nematodes. They will not target living root or other plant tissue, and instead feed on dead and degrading organic matter and the bacteria and fungi living on this matter. Earthworms will not damage roots or plant growth and will usually improve root growth. Earthworms excrete chemicals that stimulate root growth and aerate the soil. On denser soils, roots can often be seen growing along old earthworm burrows.

Most earthworms are not prolific breeders, and even under good conditions some key species can take over a year to re-establish populations after events that reduce worm numbers.

Heavy tillage, prolonged low moisture, and some chemical applications can greatly reduce worm numbers. Building levels of soil organic matter and reducing tillage will increase earthworm activity and are vital to a healthy earthworm population.

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