Chapter B4. Poor seedling emergence

PURPOSE OF THIS CHAPTER

To discuss the problem of poor seedling emergence and strategies for its control

CHAPTER CONTENTS

- poor seedling emergence
- compaction
- biological repair
- mechanical repair
- importance of moisture

ASSOCIATED CHAPTERS

- B6 ‘Does my soil need gypsum?’
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- D5 ‘Sodic soil management’
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POOR SEEDLING EMERGENCE

Patchy crops reduce yield and profit. Poor seedling emergence is more of a problem under minimum tillage, because there is less soil disturbance and more stubble retention. It is less of a problem under conventional tillage, because the seedbeds are finely worked and the seeds are planted into bare ground. However, rather than reject minimum tillage because of its problems, it is preferable to address those problems.

POSSIBLE CAUSES

Poor seedling emergence may be due to:

- poor seed–soil contact
- inaccurate seed placement
- a soil temperature that is too low or too high
- soil insects or soil-borne disease
- surface crusting after sowing
- poor quality seed.

Poor seedling vigour and establishment after emergence may caused by the presence of compacted soil beneath the seedling. The soil may have already compacted before sowing, or the planting tine may have smeared the bottom and sides of the seed trench.

Planting machinery

If poor seedling emergence is due to poor seed–soil contact or inaccurate seed placement, then adjusting your sowing machinery correctly will help to improve emergence.

Surface crusting

Rain after sowing and before seedling emergence may form a surface crust that reduces emergence.

Once seedlings have emerged, the problem of surface crusting is less. However, until the crop reaches full ground cover (and protects the surface from raindrop impact) surface crusting will continue to reduce infiltration.

All soils seal under raindrop impact—even self-mulching soils seal if they are bare. On some soils, the seal is weak or it cracks as it dries; it offers little resistance to seedling emergence. However, on other soils, the seal forms a crust on drying, and this crust prevents seedling emergence.

Further light rain will help emergence by softening the surface; further heavy rain will hinder emergence by strengthening the surface crust.

Clay soils can crust if the surface is sodic. The treatment for such soils is gypsum.

COMPACTION MANAGEMENT

A small degree of compaction can be beneficial. Soil that is too loose may not be good for plant growth: a loose seedbed dries out too quickly and gives poor contact between the seeds and the soil; seeds may not germinate. The optimum level of compaction depends on the soil types, the plant, and the irrigation management during the growing season. Too much compaction can cause yield reduction.

To reduce soil compaction:

- time mechanical operations carefully
- reduce axle loads
- keep livestock off wet cropping country
- confine traffic to laneways
- use low ground pressure (wide) tyres (with caution).

The method of compaction repair will depend on the soil's capabilities. A cracking clay that swells and shrinks behaves quite differently to a hardsetting, fine, sandy or silty soil. If a soil swells and shrinks on wetting and drying you can use that natural action to break up a compacted layer. If a hardpan has developed in a soil with little clay, you will need to consider other options, for example:

- biological repair—that is, using growing plants to break up a compacted layer (such repair includes 'biological ripping' and 'biological drilling'—see below) or increasing the soil organic matter content
- mechanical repair—that is, deep ripping or mouldboard ploughing.

BIOLOGICAL REPAIR

Biological repair means using growing plants to restore soil structure. It usually involves a yield penalty. The plants will suffer in restoring the soil structure, and will produce a lower yield. Repair of compaction should therefore work in with the season, the market prices, and your long-term plans.

Biological repair includes:

- biological ripping (using plants to dry and crack the soil)
- biological drilling (using tap-rooted plants to ‘drill’ through a compacted layer)
- increasing soil organic matter content.

Biological ripping

The easiest way to restore soil structure in compacted cracking clays is to dry the soil, using any plants with a vigorous root system. Drying causes the soil to shrink and crack, allowing water, air and roots to penetrate through the cracks. The process is called biological ripping.

Biological drilling of non-cracking soils

In soils that don’t crack, such as sandy, silty or loamy soils, ‘biological ripping’ is not an option. However, ‘biological drilling’ is possible.

A strong tap-rooted plant such as lucerne can force its way through a compacted layer and leave root channels for subsequent plant roots to use. This is ‘biological drilling’. The compacted layer must be moist: no root will enter dry soil. Depending upon how badly compacted the subsoil is, some roots will not be able to penetrate the compacted layer and the crop will suffer.

Increasing soil organic matter

Some soils, such as fine sandy and silty soils, depend heavily on organic matter for the maintenance of their structures. Even cracking soils benefit from increased organic matter content. Increasing the organic matter of a soil content is a slow process. A pasture phase incorporated into your vegetable crop rotation is perhaps the most cost-effective way to achieve this.

MECHANICAL REPAIR

Deep ripping and mouldboard ploughing are sometimes useful for quick results, but they are expensive operations. The initial success of the operation depends on the moisture content of the soil and the depth of tillage. Continuing success depends on managing traffic to avoid having machinery on the soil when it is too wet.

The importance of moisture content

Soil moisture is important when you are working soil. A soil (particularly a clay) that is worked too wet will compact, while a silty or fine sandy soil that is worked too dry may powder. In both instances the soil will then structurally degrade.

Before deep ripping, dig a hole to see if there is a compacted layer. If there is, check the layer’s depth, thickness, and moisture content.

The severity of compaction will also influence your decision on deep ripping.

If there is no compacted layer, there is no need to deep rip. Deep ripping is expensive, and it could do more harm than good if the soil is too wet—a costly way of creating soil structural damage where none existed before!

A compacted layer must be at the right moisture content to benefit from the ripping operation (Figure B4–1). When you are cultivating clays (or when the compacted layer is clay) the layer must be dry enough to shatter, rather than smear. When the compacted layer is other than clay, some moisture is desirable so that the layer does not powder.

The depth and thickness of the compacted layer indicates how deep to set the ripper tine. To be effective, the tine should work just below the compacted layer. Dig a hole after a short run and check the effectiveness of the ripping operation.

Figure B4–1.

Solar powered data logger as used in Environscans® for measuring soil moisture at Yanco Research Station in Asian vegetable trials. (Graham Johnson)