Flood recovery: silt and slips

1 Tips from farmers

We spoke with farmers who experienced Cyclone Bola (1988), Manawatu floods (2004), Wairoa/Hawkes Bay events (2011 & 2018), and Cyclone Gabrielle (2023). **Here's what they learnt.**

Big picture

- In the immediate aftermath, make sure you, your family and your staff are safe. Gear can be replaced — people can't.
- Once it's safe to get going, make a list and prioritise tasks (e.g., boundary and road fences before internal ones, tracks roughly cleared for access to farm, stock put in stock-proof paddocks).
- Order gear early and don't get stuck procrastinating — not every decision will be perfect, and that's okay.
- Make the most of offers to help - even if it is to just shake debris off fences.
- Volunteers "did a massive job with some of the more mundane/ dirty jobs. If you are organised and take a personal interest, spend a bit of time working with them and having a sausage and beer with them on Friday afternoon, they can power through a lot of debris clearing of fences and the likes ready for a fencing gang to follow through later".
- Team up with neighbors when using a helicopter to improve efficiency — be organised to do multiple jobs (e.g., fencing and waterline materials, seeding, spraying, etc.) across several farms.
- Build a team — your accountant, bank, advisor, contractors, agri manager etc. Use their expertise in each area, this will lighten the load on you.
- Before you start fixing fences think about the long-term use of the land and whether the existing fenceline is still in the right spot. In some hard-hit areas, trees might be a better option than pasture, or it might just be a case of shifting the fenceline to a more appropriate place.
- Time heals — we have been through this before and come out stronger.
- Keep an eye on friends and neighbors, especially the quiet ones, those not accepting help, or not prioritising.

Practical tips and tricks

- Shade cloth works well as a quick, easy temporary fencing repair.
- Retrieve fencing materials before debris dries out — pulling out buried posts with a tractor and chain is far easier while everything is still wet.
- If lambs get scalded feet from silt build-up, running them along the road or another hard surface can help clean the silt out.
- For pivots, first run them around the property dry — it helps find soft spots early and fix them before a full weight pivot causes bigger issues.

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2 Sediment revegetation

Key points

- **Soil test the sediment. Soil testing is valuable to understand what you're working with. Fertility can vary widely between flood events (e.g., pH, K, S), but generally, sediment is low in nitrogen (N), phosphorus (P), and organic matter.**
- **The newly deposited sediment will be very low in N and will remain low in N for a significant time (years), until the organic matter has been built back up.**
- **Organic matter is king. It improves soil structure so soils can breathe, hold water and nutrients, and drives the N cycle. Sediments are always low in organic matter. The more you grow and graze, the more organic matter is returned to the system.**
- **Mix sediment with buried topsoil if possible. Lifting and mixing the buried topsoil adds significant organic matter and fertility, speeding up recovery and soil development.**

Making a plan

Having a written plan can be useful when returning sediment covered land back to productive use. It helps you prioritise tasks and provide a roadmap on what needs to happen over the coming weeks and months.

- ☐ Assess each sediment covered paddock (spreadsheet format often works best).
- ☐ Record silt depth (e.g. 0-5, 5-10, 10-20, >25cm).
- ☐ Texture (sand, silt or clay).
- ☐ Density of pasture after 10 days.
- ☐ Is it smelly (indicates lack of oxygen/production of toxins and need to aerate/cultivate).
- ☐ Add in feed requirement estimates.
- ☐ Use the information to determine urgency of action (e.g. deep wet clay sediment — will need time to drain), which species to use, timing etc. Identify paddocks that will take the least work and cost to return to near full production. Create a plan of what, where, when, and timelines for work. Also have a backup plan, for if you can't get contractors etc.

Organic matter is king

Organic matter is key for soil structure, allowing soils to breathe and water to move through the profile, holding nutrients and driving the nitrogen (N) cycle. Sediments are almost always low in organic matter. While fertility can be corrected relatively quickly, building organic matter takes years. The faster you get something growing, the better. The more growth and grazing, the more organic matter being returned to the system. Establishing roots improves soil structure and can help dry out sediment, which is beneficial if the sediment is planned to be removed.

Because organic matter drives the N cycle, pastures grown on sediment will be N deficient for a long time. Frequent N applications (30–50 kg N/ha every 6–8 weeks) may be needed to keep up growth until the natural N cycle and soil organic matter levels recover. If regular N applications aren't feasible, legumes and their ability to fix N become even more essential.

Soil fertility

Soil fertility in flood sediments varies widely between events because the parent materials differ. Some sediments have been acidic (e.g., Canterbury floods), while others highly alkaline (e.g., Cyclone Gabrielle). Potassium (K) and sulfur (S) levels can also vary significantly. For this reason, always soil test your flood sediment as past soil tests won't reliably predict current conditions.

Typically, though, sediments are consistently low in phosphorus (Olsen P often in single digits) and N. To correct P fertility, consider splitting applications. Test the sediment ASC (anion storage capacity) to gauge its ability to hold P. If the ASC is below 10–15%, split P applications and build fertility gradually.

Sediment texture

Flood sediments can range from light (sandy) to heavy (clayey). Texture will influence how you manage them. Sandy sediments are easier to identify - they feel gritty, contain visible particles, and often have a rolling surface appearance (Figure 1). These drain quickly, however they hold very little water, potentially making them poorly suited for pasture production. If the sediment is very sandy or gravelly, incorporation into buried topsoil (if not too deep) or physical removal may be worthwhile, potentially later used for races/laneways.

Silts and clays have a heavier texture. Clays feel smooth or greasy when rubbed between fingers and tend to stick to your hand. They dry out slowly and often have a sticky surface. Silts and loams feel slightly gritty but heavier and stickier than sands. These moderate to heavy sediments are commonly regrassed and left to develop into deep, productive soils.

Figure 1. Sandy sediment on the left – note the wavy surface. Heavier clay sediment on the right – note the smooth, sticky surface.

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Mixing sediment with buried top soil

Over time, farmers have invested heavily in building the fertility and structure of their topsoil. Experience from previous flood recoveries shows that when sediment was shallow enough to mix with the buried topsoil, outcomes were far better than growing pasture or crops in pure sediment. Bringing up and mixing the buried topsoil adds significant organic matter and fertility, speeding up recovery and soil development.

Mixing past topsoil and sediment can also break up waterlogged, anaerobic vegetation layers that produce ethylene gas, which is toxic to plants. Because ethylene gas can hinder seed germination and growth, aerate or cultivate smelly, waterlogged sediments when conditions allow. However, the ability to mix soil depends on the sediment depth.

Plant species

Annual or Italian ryegrasses are often used as a quick way to re-establish pasture. One advantage is that they allow a wide range of herbicide options, which is useful when weed pressure is high after flooding. Once weeds are under control, the paddock can be returned to permanent pasture. The downside is that annual grasses don't fix N, and flood sediment is typically low in N - so maintaining good growth will require regular N inputs.

Long term legumes are your friend. They supply N through fixation. In areas where running an annual grass for a year, controlling weeds and applying regular N isn't practical, establishing legumes from the start may be the better option. Red and white clover has done well in many cases drilled into deep sediment. This does reduce potential herbicide options, but the benefit is N fixation.

Sediment depth

The depth of the sediment will play a significant role in how they are best managed:

Flood sediment 5-10 cm

If sediment has completely covered the pasture, it will not survive and will need to be regrassed. Normal cultivation methods will apply at these depths. Cultivation is recommended because sediment is relatively infertile, will contain no organic matter or N, and have poor structure making it prone to pugging. A barrier to water drainage may also occur on the interface between the old pasture and flood silt. It is better in the long run to cultivate these depths of sediment, so sediment and underlying topsoil are combined. Sandy sediments will dry quickly and heavy and medium sediments more slowly. The resowing should have a high chance of success as it is normal farm practice. When sowing the whole paddock, it is best to decide whether to sow short-term species, or perennials, as it is not always wise to mix them. Short-term Italian and hybrid ryegrasses will be preferred where feed production in the first winter is crucial, or where weeds are expected to make it difficult to establish a good perennial pasture mix in the current year. Apply regular dressings of N as there will be little or no N cycling in the sediment. Phosphate fertilisers may also be required depending on soil test results.

Flood sediment 10 to 25 cm

In sediment of this depth, there will be deeper and shallower parts in the paddock. By levelling the paddock, it may be possible to bring most of the paddock into the 10-20 cm depth category. Once the sediment has dried, heavy machinery can be used, and deep ploughing (e.g., swamp plough) will help to mix the sediment with the topsoil. If this is successful, then cultivate and sow as normal. If the resulting soil is predominantly flood sediment rather than topsoil, then sow in either short-term ryegrasses or forage oats or other deep-rooted short-term crops and return to permanent pasture the following spring or autumn.

Flood sediment >25cm

There are two options for deep clay/silt loam flood sediment, and these are either oversowing with a helicopter or cultivating the silt and drilling. In either case, be prepared to recultivate in the following spring or autumn due to poor soil structure. If cultivating deep silt wait for the silt to dry sufficiently to support machinery. Use light weight machinery (including small tractors or quads) and lightly break up surface, drill forage oats (annual, good option from farmer experience) or short-term ryegrass and harrow behind. After winter grazing, forage oats can be mulched to aid in organic matter incorporation or made into silage in spring. On very sandy areas use the same seed mix as you normally use on your accretion area.

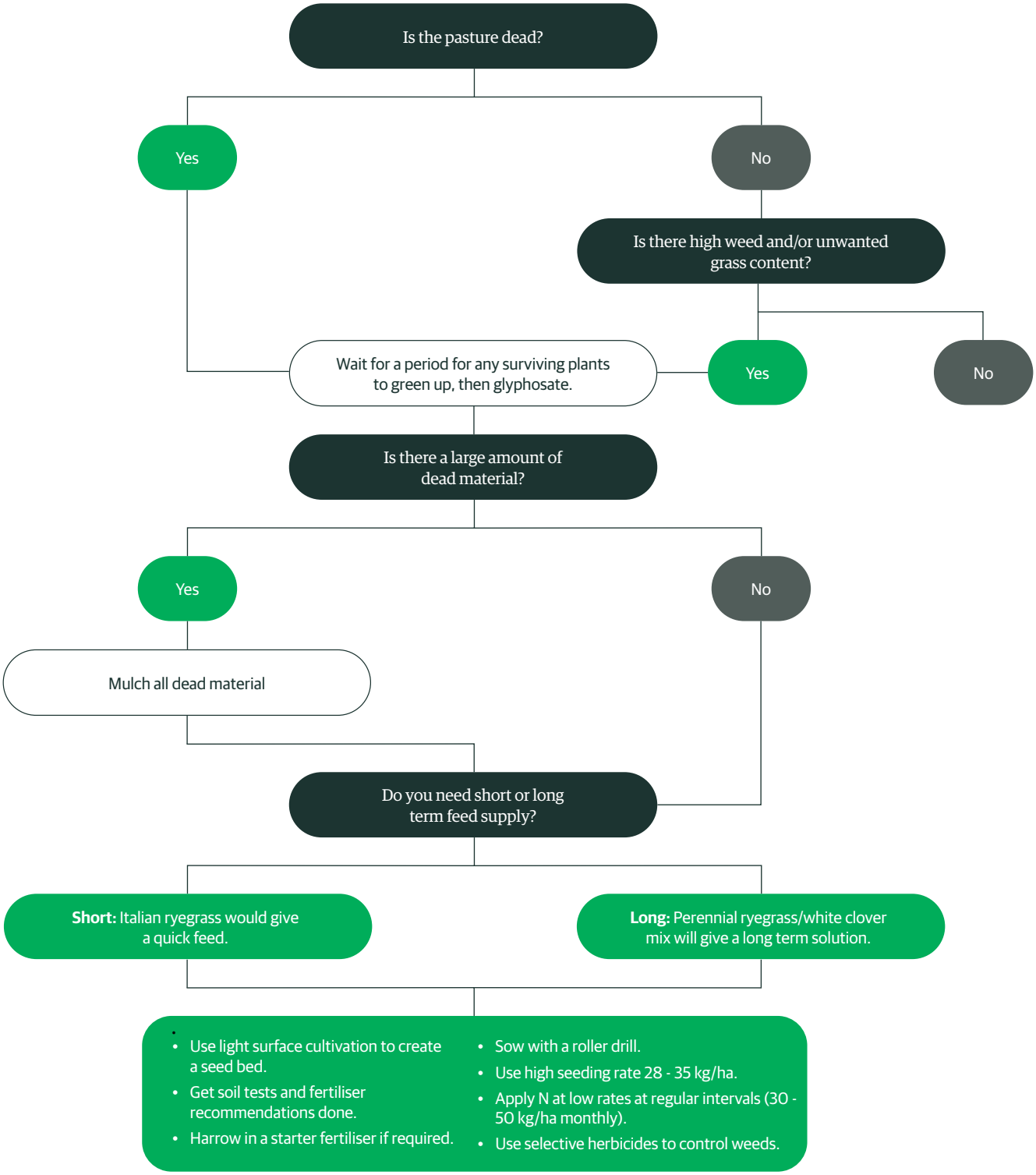
Oversowing is an option some farmers have had success with, and allowed plant growth much earlier than waiting for the sediment to dry out and allow machinery on – this is particularly important for heavy clay sediments, that can take a significant period to dry out - however, it is worth keeping in mind the below learnings:

- Not an option for very sandy flood sediment but is an option for clay/silt loams.
- Timing is important for oversowing. It needs to occur when the silt is still damp and sticky and must occur quickly once water has receded. Once the silt has caked and cracked it is too late for oversowing, dry seed may also blow away and birds become a major problem because they can land on the dry silt. If the silt is too wet, the seed may rot.
- Oversowing is a riskier sowing method than cultivation or direct drilling, so use higher than normal seeding rates.
- Only use coated, rhizobia inoculated, legume seed.
- Relying on rewetting the silt after rain to help germination of oversown seed is not likely to work.

3a Guide to re-grassing flood damaged pastures

Sediment depth

0-3cm | 4-20cm | >20cm



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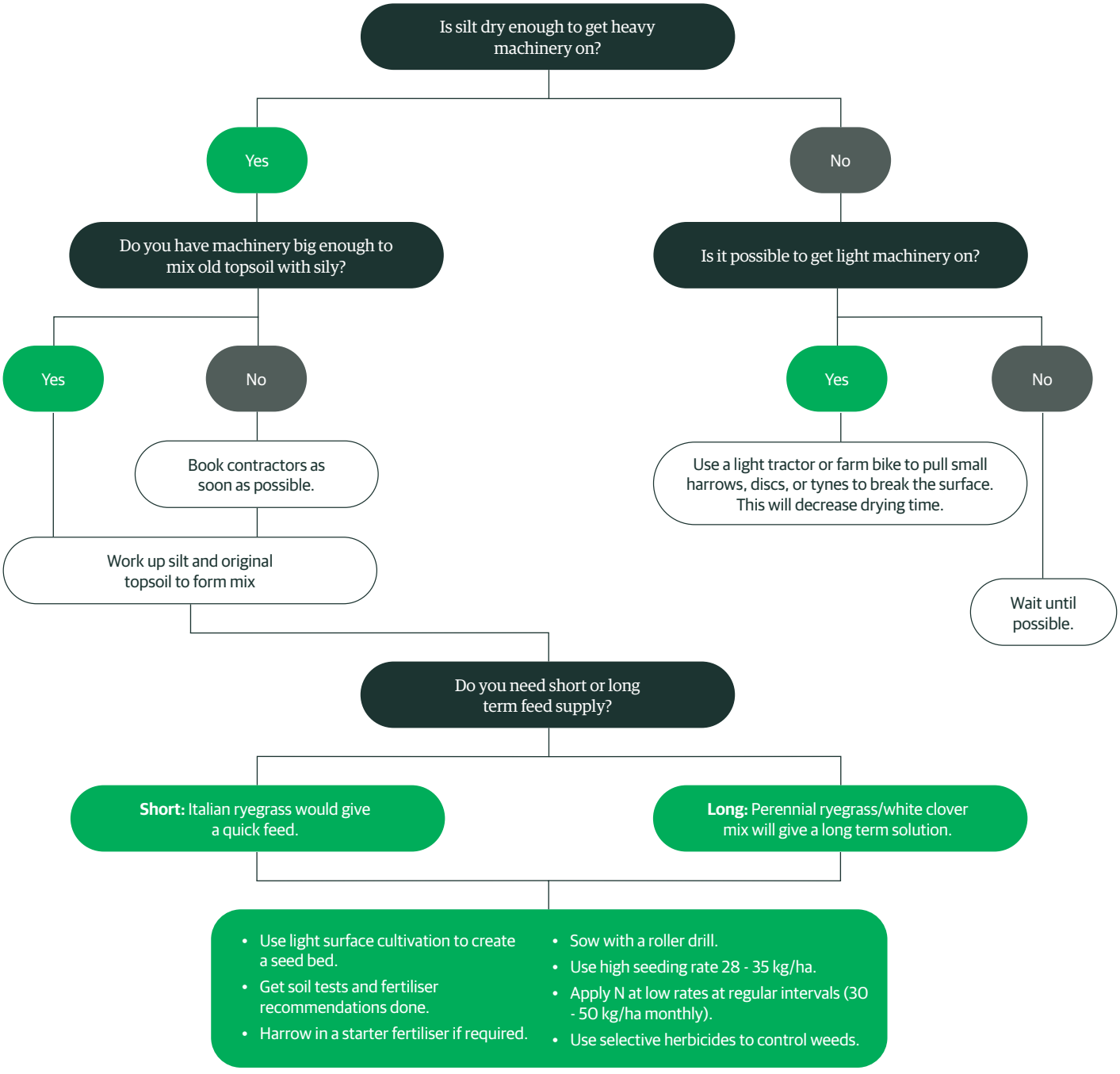
3b Guide to re-grassing flood damaged pastures

Sediment depth

0-3cm | **4-20cm** | >20cm



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3c Guide to re-grassing flood damaged pastures

Sediment depth

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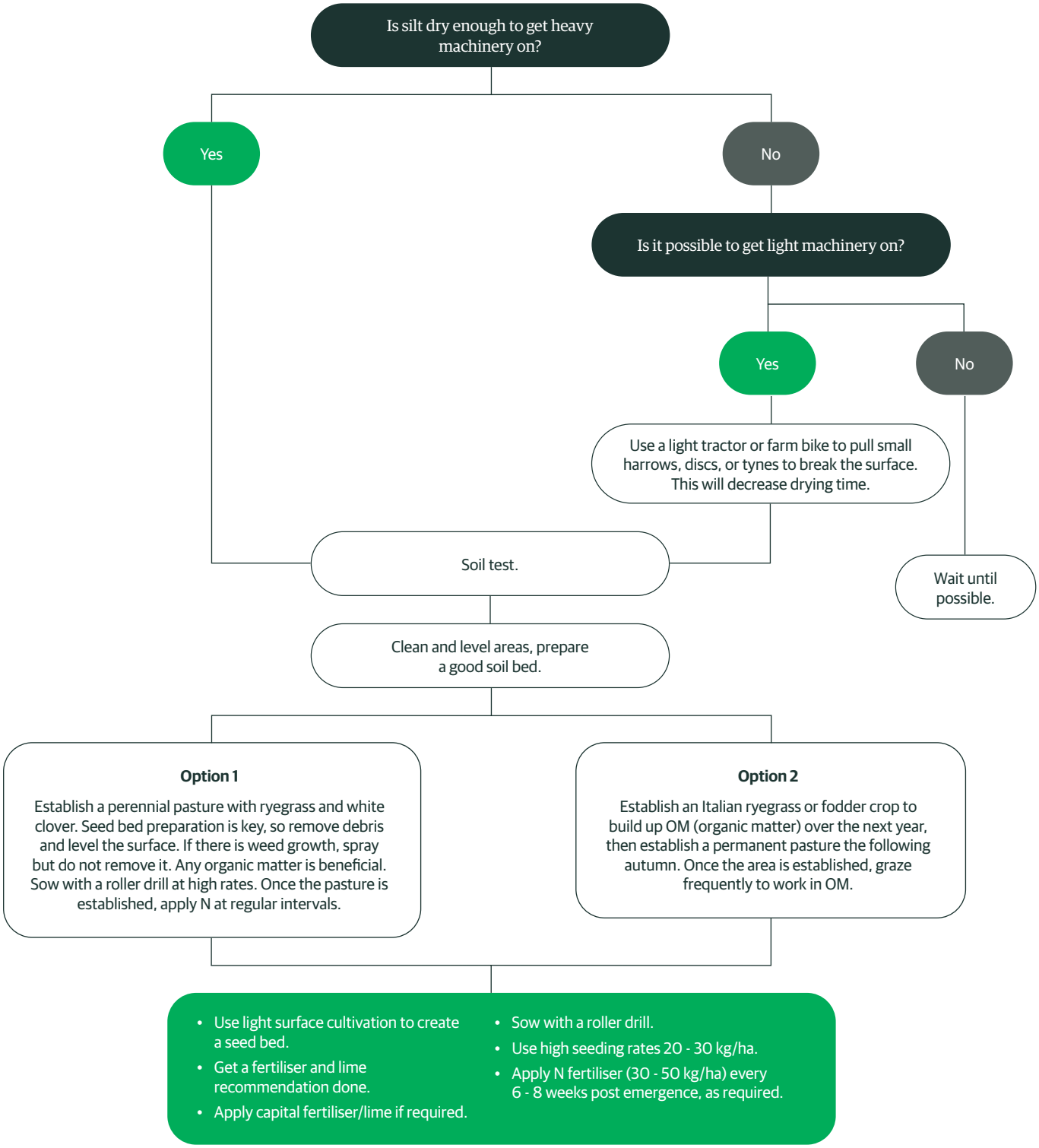

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4 Slip recovery

Key points

- **Slip damage looks worse than it is with respect to loss of dry matter production.**
- **Implement normal "poor" season strategies in response to loss of dry matter production.**
- **Slips are divided into two main areas:**

  ***Faces* — where soil has slipped downslope, leaving very little soil, resulting in poor water holding capacity and low fertility. These areas recover slowly.**

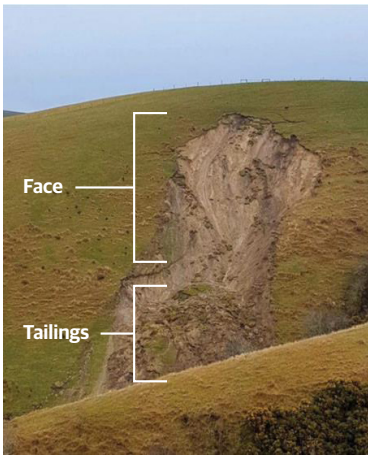
  ***Tailings* — the tumbled mix of soil and buried vegetation below the face, which forms deeper soil and generally recovers relatively quickly.**
- **Regrassing slips is often not economic — in most cases, resources are better prioritised elsewhere on farm (e.g. fences, tracks, stock, and dealing with weeds/thistles later).**
- **In the past, some farmers have regrassed slips for non-economic reasons e.g. reduce visual scaring, maintain capital value of the farm, be proactive, or help reduce runoff.**

Slip impacts on production

Firstly, try to estimate the total slip area and the production loss caused by the slips — this can help with feed budgeting. Modern tools such as satellite imagery and computer based mapping are often freely available after major storms and can help identify and quantify slip affected areas. Because slips are usually located on steeper slopes - which already have lower production and poorer utilisation, compared with gentler country — the overall impact on farm feed supply is often less than first impressions suggest.

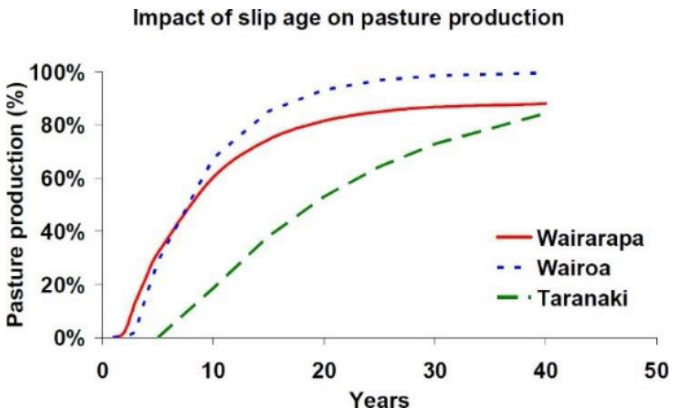
It is important to note that moderate slip damage often only produces the same loss in dry matter as a poor "growth" year. Depending on outcome, farm strategies may include application of nitrogen, culling stock early, bringing forward sale dates of stock, or not mating hoggets, buy in supplements, etc.

In the medium to long term, most production loss comes from the slip faces, as tailings generally recover quickly. After a major storm in the lower North Island in 2004, slip faces had 30% ground cover within two years, while the tailings had almost fully recovered. Therefore, it is appropriate to consider only the slip faces as "lost" dry matter. The faces typically make up only 20–40% of the visible slip area.



Slip faces

The face is where the soil has slipped, leaving shallow soil with low moisture holding capacity, little organic matter, and very low nitrogen levels. These faces are slow to revegetate and present harsh, unstable conditions — sown seed can wash off easily, the shallow soil is prone to drying out, and the limited fertility/water holding capacity makes plant establishment difficult. Over time the slip face will naturally revegetate, initially by legumes and low fertility tolerant pasture species. As time passes the amount of bare ground will gradually disappear. However, it often takes 10 years or more for substantial recovery. Example pasture production recovery rates over time on slip faces are shown below:



Slip tailings

The soil that was lost from the slip is found in the tailings. The tailings are a tumbled mixture of soil and buried vegetation. The tailing debris usually revegetates within 6–12 months due to existing plant material and from dormant seeds already present in the soil. In some cases, tailing areas can be more productive in the long term, as the accumulated topsoil from above leads to improved water holding capacity, and at times, creates a gentler slope.

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Is it worth regrassing slips?

Previous trials and farmer experience show that regrassing slips is generally not economic. The return on investment from the extra production gained is often minimal, and at a time when time and resources are already stretched, those resources are usually better directed elsewhere on the farm. In most cases, it is more effective to focus on returning better country to full production or investing in priorities such as fencing, weed control, silt recovery, and other essential repairs.

Regrassing can improve slip productivity but is often not cost effective. However, some farmers still choose to regrass slips for reasons beyond economics — to tidy up the scars, maintain capital value of the farm, be proactive, or help reduce runoff.

Example of slip tailing revegetation

If you do decide to regrass slips, keep in mind:

- Keep costs low. Be aware that regrassing may be unsuccessful on slip faces due to harsh and unstable conditions. The risk of failure will be higher on steeper slips and those with less soil.
- Make sure the slip has stabilised first.
- Legumes have the greatest chance of establishing in the low nitrogen environment. Use a mix of coated legumes – small leafed white clover, grazing type red clover and Lotus if available/not too expensive. Coated seeds will have better ballistics (spread) for aerial sowing and should include rhizobia to help legumes establish.
- Timing is crucial — conditions need to be moist enough for germination and establishment, and warm enough for clovers to take off (often March to May, or early spring in summer-moist areas). Be aware that heavy rain after sowing can wash seed or seedlings away, while dry spells can dry out establishing plants.
- Often the fertility on slip faces is low. Once some vegetation has recovered, superphosphate fertiliser inputs are likely to benefit production. Fertiliser also makes a good carrier for seed from aircraft.
- Most slips will expose sedimentary subsoil rather than volcanic material, so potassium (K) is usually adequate.
- Spell areas from grazing to allow seedlings to establish. Because of this, regrassing large areas of slip at once often isn't ideal - consider doing some in autumn, some in early spring, or spreading the work over a couple of years to also reduce the risk of failure.
- Nitrogen is often not applied, as it will be of most benefit once grass species become established.

Example of slip recovery over time

Kiwiroa (Waerenga o Kuri) after Cyclone Bola in 1988.

Neighboring ridge, 16 years later, in 2004.

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