FLOOD SEDIMENT

Lower North Island Combined Provincial Federated Farmers Storm Group
SUSTAINABLE FARMING FUND: PROJECT 05/060: Meat and Wool FITT project

In February 2004 180 ml of rain fell in the southern North Island (SNI) over a 36-hour period, leading to the flooding of rivers in the region and inundating an estimated 20,000 ha.

At the time it was found that there was little published information on the recovery of flood affected pasture and what information was available was difficult to source. In addition, no systematic attempt had been made to collate farmers' experience and knowledge on regrassing flooded pastures.

This document combines data collected at the time, information from 200 regrassed paddocks, and the surveyed views of 104 farmers 1-2 years after the event. This summary is designed to be of use for flood affected farmers. It is important to realise that the data in this document is specific to the timing of the 2004 SNI flood and subsequent warm, moist conditions that prevailed after it occurred.

Sediment structure: Flood sediment characteristically lacks structure and organic matter, and comes in varying textures ranging from heavy to light (i.e., from clay to silty loams to sand).

Clay loams are normally flat and feel smooth and silky, and are usually found in ponding areas some distance from the river. The clay loams often pond or retain water for some time and, if deep, can't be cultivated for a considerable time because machinery will bog.

Silt to silty sands are often ruffled in surface texture and slightly gritty to touch. The surface of this medium flood sediment dries fairly quickly but the subsurface remains moist. Sand flood sediment is often rolling, gritty to touch and drains very rapidly. It is usually adjacent to the river and may contain a lot of gravel and flood debris.

As a river floods, the coarser sand material is deposited in the higher reaches of the river and closer to the river bank. This material is poorer quality and less fertile than silty loams, so is less suitable for pasture growth.

Further down a river and further away from the river, more clay loams are deposited. These contain higher nutrient levels and result in better pastures long-term but take longer to dry out.

The immediate fertility of the clay and silt loams will be highly variable and should be tested. Silt and sand can intermingle in layers making mixing a good option. In the farmer survey data, there was a delay in regrassing clay silts but their subsequent pasture establishment was superior to sandy silt.

Silt fertility: The silt washed onto farmland can either be fertile material from upstream farms, or it could be subsoil washed from slips on steeper land. In any case it will contain very little or no organic matter, will probably have very low nitrogen (N) content, and will usually be low in phosphate but high in sulphate. Sands will be the least fertile and clay loams will be more fertile.

Flood sediment pH level is normally quite different to soil. Soil tests can be taken in wet silt as the sample is dried in the laboratory. However, when the soil is wet, less soil is collected per sample so more samples will be required. It can take 3-14 days to get the results back.

Soil tests taken on flood affected pastures from the SNI 2004 floods had a pH of 6.9 (range 5.8-7.8), organic matter 1.6% (0-3.7) and Olsen P of 8 (2-21), mg/kg. There were small differences in the silt from different rivers but these differences have little practical significance. Flood sediment will need potassium and phosphate fertilisers and regular

nitrogen. Efforts should be made to increase organic matter on silt affected paddocks.

Pasture damage: In the SNI 2004 floods, 80% of flooded pastures died. Only a proportion of those under water for less than three days with shallow silt survived. Paddocks recently grazed before the flooding were worse affected.

If a pasture hasn't shown signs of recovery after a week then consider it to be dead. Better quality grasses and clovers will die first leaving plants with rhizomatous spreading habits – couch, browntop and creeping buttercup. Such weeds will cause problems later if left uncontrolled. Ongoing weed control may be needed.

Does the silt smell? When river silts become smelly this indicates that toxins are present as a result of anaerobic organism activity. It is probable that seed germination after sowing directly on smelly silt will be impeded by these toxins. However, recovery of the anaerobic silt following cultivation will be rapid. It is recommended that anaerobic silt be aerated or cultivated.

Plan recovery: Calculate the feed requirements for the upcoming winter and following spring and summer, and plan pasture recovery practices accordingly. There is little point in putting the entire flooded farm into temporary pastures to find that an identical feed pinch exists in the following spring when the pastures have to be renewed again.

Assess each paddock for damage including time under water, density of live pasture remaining after 10 days, and silt type (sandy, clay/silt loam) and depth (<5 cm, 5-20, >25 cm). Using the damage information and future feed requirements, plan the recovery using the estimated times to grazing and expected production recovery of the paddock (see decision tree on back page). Develop a time line for regrassing.

Some paddocks will need immediate action while others will need to dry before cultivation. Back up plans are needed if the contractor is delayed or will only visit once, for example, is there a way to get pasture established using your own machinery or that available from other farmers? However, try to avoid using roller drills to direct drill or direct drills to drill seed on cultivated paddocks.

Flood sediment less than 5 cm: If there is less than 5 cm of silt and the grass has been under the water for less than three days, there is a 50:50 chance that the existing grass will survive and come through the crust.

Existing grass recovers much quicker than sown grass. If there are open parts in the pasture then these can be undersown using perennial grass: clover mixes. If the pasture has died then the options are direct drilling or light cultivation. Light cultivation will break up the barrier between silt and the old pasture which can cause ongoing drainage problems. It will also mix the low fertile, low water holding capacity silt with fertile structured topsoil making the pasture more resilient.

Direct drilling the paddock is cheaper and will reduce the time to first grazing by a month relative to cultivation. However, after 12-18 months, SNI farmers and researchers found the direct drilled paddocks were about 10-15% less productive than cultivated paddocks, but little difference was found by researchers 24 months after flooding. Apply nitrogen fertiliser at about 50 kg N/ha to assist recovery, either as urea (110kg/ha), or as DAP (at 275 kg/ha). Avoid using more than 25 kg N/ha down the spout if sowing seed with a drill.

Flood sediment 5-25 cm: If the pasture has been completely covered by silt it will not survive and will need to be regrassed. Normal cultivation methods will apply at shallower silt levels in this category but heavy deep-cultivating machinery will be required to bring the topsoil to the surface for deeper silt.

Cultivation that mixes topsoil and silt is highly recommended at these silt depths because the silt is infertile, will contain no organic matter or N, and has a poor structure making it prone to pugging. A barrier to water drainage and an anaerobic layer may also occur at the interface between the old pasture and flood silt. It is better in the long term to wait until these paddocks can be cultivated.

Waiting for these silts to dry sufficiently to allow heavy machinery will be a problem. Sandy silts dry quickly but heavy and medium silts dry more slowly. Light machinery can be used to break the surface to speed up the drying process. Level the silt in the paddock to facilitate a more even mixing of topsoil with silt.

Prepare a good seedbed and sow perennial or fescue and clover with a roller drill. Seventy percent of the SNI farmers sowed perennial ryegrass with the remainder sowing Italian (annual) or short-term perennial Italian ryegrass. The Italian ryegrasses performed poorly on the deeper silts in this range.

Apply capital dressings of phosphate and potassium, and regular dressings of nitrogen. Get ongoing soil tests. Try to build up organic matter in the paddock by grazing supplements, and/or topping the paddock

Half the farmers in the SNI floods cultivated to regrass at these silt depths. Direct drilling was the next most common other practise with some oversowing in silt depths greater than 10 cm The first grazing was 2, 3.5 or 6 months for broadcast, direct drilled and cultivated respectively.

At 12 months the farmers assessed the productive value of the paddocks for all methods of sowing at 60-70% of unflooded paddocks, but by 18 months the assessment was 65, 85 and 100% for oversown, direct drill and cultivated respectively. Direct drilling with a roller drill was very ineffective.

Flood sediment more than 25 cm: It is recommended that deep silt is cultivated, when dry enough, with light machinery (including small tractors) to lightly break up the surface, and drill the forage of choice. Half the farmers in the SNI 2004 floods cultivated deep silt, with the others equally split between direct drill and oversowing.

The time to first grazing was six months for direct drilling but 7.5 months for oversowing and cultivation. Deep silts have poor production levels over an extended time period and after 18 months had only returned to 60-70% of their productive capacity. At two years, ground cover was 15% higher on cultivated compared to minimally cultivated paddocks.

Seventy percent of farmers sowed perennial ryegrass with the remainder using annuals and a few Italian perennials. Research has shown good growth from annual crops such as oats, ryecorn and annual ryegrass, but these latter crops will require ongoing fertiliser applications to achieve good production. These crops can be, after winter grazing, mulched to increase organic matter or made into silage in spring.

If ongoing fertiliser is not planned on these deep silts then legumes only should be broadcast. On very sandy areas, use the same seed mix as you normally use on your accretion area.

Broadcasting is not an option for very sandy flood sediment but is an option for clay/silt loams. Oversowing must be done when the silt is still damp and sticky, and must occur quickly when the water has receded. Only use coated seed. Once the silt has caked and cracked it is too late for oversowing. Relying on rewetting the silt after rain to foster germination of oversown seed is unlikely to work.

Oversowing is a more risky sowing method than cultivation or direct drilling, so use higher than normal seeding rates. If the silt is too wet, the seed may rot, and if it is too dry the silt surface will cake and crack and the ryegrass seedlings will struggle to grow primary roots into the “new” soil. Once silt is dry, seed may also blow away and birds become a major problem because they can land on the silt. Oversow with short-term ryegrasses.

Stocking of newly sown areas should begin as soon as possible without pugging. Mulching before subsequent regrassing is a good option for building up organic matter.

Revegetating shingle will be difficult, risky and could be costly. If grazing is required within two years, the sand/shingle needs to removed and stockpiled. It can then be used for races or sold. Alternatively the area can be retired and revegetated using blue lupins or other legumes and, in time, normal regrassing. However, be careful not to build up seed stores of undesirable species if you are intending to regrass at a later date. Farmers had some success revegetating gravely silt with pasture but only use cheap grass seed.

Farmer commentaries:

Flooded again - by Mike Hoggard, farmer

The 2004 flood saw 60 ha flooded but 12 ha of this area in particular was left with 0.5 to 1 m of a sandy and rubble deposit (see photo below).

Top of fence post.

As the area had only a thin 5 cm layer of topsoil, having previously been flooded during Cyclone Bola, it was deemed neither practical nor possible to successfully remove the sand.

The decision was made to crossblade the area with a 27 ton bulldozer, moving first the wood, trees, and rubble to add to an existing bank, then levelling the sand and silt, covering the rubble and leaving a paddock capable of being cultivated. Over the line where we buried the rubble we built a new stock race.

The area was sown down with a mixture of Moata and clover and heavily fertilised. We treated the area as basically a hydroponic area that relied on fertility bought in.

We have since direct drilled in Pacific rye which was recommended as suitable for low fertility and a challenging environment.

The aim is to allow a topsoil to be recreated through stocking and resowing regularly with grasses suitable for these challenging conditions.

What we have found is that grass production decreases each year and requires regular renewal. (In another area we found that the clover flourished, swamping out the permanent grass that was sown.)

During the winter, the dry cows are on this area for 2-3 hours per day while their supplements are fed to encourage a transfer of organic matter.

Dealing with different types of silt - by Mike Webster, farmer

After the Feb 04 floods I've found we were dealing with a number of different types of silts. Close to the Turakina River, which flows through our property, we had a layer of coarse sandy silts very much like being on a beach. Further back from the river in areas where the river had spread out over the flats but away from any real current, we gained what we came to know as "ponding" silt.

The coarser sandier type of silt near the river was 1 m+ deep and covered a very good crop of potatoes. It took a long time to dry out in places and three months later was still unable to support the David Brown 990 in a lot of places. There was at the time a crust of about 18 inches of dry ground on top but if you broke that it was still wet and porridge-like underneath. Because of this we decided to work the ground closer to the river with the sandier types of silt with the 4WD quad.

We towed two plates of tyned or Dutch harrows around to scarify and work up the surface. At one stage we tried three plates of these harrows but found them too hard to pull with the 450cc bike, and the motion of the harrows caused a vibrating action that was too rough on the bike as well.

As soon as that was done we went straight on with the ATV-towed spinner and sowed the seed which in our case was good quality rye clover mix using coated clover seed at 35-40lb/acre (40-45 kg/ha) Immediately after that we used the "Brush Harrow", basically a 4x2 across the back of the bike with kanuka heads tied to it and literally brushed the seed in.

A word of caution here: whilst most spreaders on the market spread fertiliser quite adequately, not all spread grass seed well. In our experience the better types have an agitator closer to the base of the hopper and at least two slots or outlets preferably well apart. The reasoning behind this being on some models or brands the admitter is too far away from the base and there is not enough seed movement causing or allowing seed, especially ryegrass, to bridge and block the slots. In some lights or conditions it is hard to pick up on the fall or throw of seed.

By contrast we were able to get machinery onto the ponded silts. This was because most of it was only 1 ft deep and its plasticine type of texture meant that when it dried out, it would support our 100HP tractor and rotary hoe. This meant that in a lot of areas we were able to blend some of the silt with the ground it had covered.

For the sake of the tyres and rotary hoe, every effort should be made to get any obvious debris out of the ground especially ¼ round posts! We also sowed this area with a spinner but found the brush harrows didn't work as well on this type of soil so we used a light set of chain/grass harrows. Because of this blending action on this country we sowed a permanent pasture type of mix and it still persists today.

Prior to working up the silted country we had it soil tested – both types showed a high pH, no organic matter and Olsen P of 6-8. Following sowing we applied urea at 40 kg/ha. We did this three times and had a good response, applying fertiliser as soon as the plants appeared to be under stress, in our case the ryegrass would go brown at the base. The urea was phased out in favour of crop 15 at the same rate, and all country is now back into a regular topdressing programme. By the autumn of 06 we had a sufficient pasture base to break feed and use as a wintering pad on a main block of 12 ha.

By August 07 the ponding silts had recovered to be ordinary pasture. However, the deeper sandier silts country appears to have run out and recent grazing with cattle has caused tufts of turf to be pulled out. This spring I plan to "skim" plough, lightly disc, resow and roll the area (12 ha). This process I hope will start to build a layer of organic matter and will I hope in time provide a better growing environment.

The older farmers in the valley who have experienced this sort of flood damage work on a 15 year regeneration time frame. As well as grass, some also use lucerne and maize as part of the process – the latter, whilst requiring large amounts of fertiliser, appears to build up valuable organic matter and adds to soil structure when ploughed back in.

It's not a fast process but this sort of silting is salvageable and, in many cases, is just part of a process that has been going on over hundreds of years.

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This information has been compiled by the Manawatu/Rangitikei, Wanganui, Ruapehu and Tararua Combined Federated Farmers Storm Group with funding from the Manawatu Wanganui Regional Disaster Fund, MAF Sustainable Farming Fund, Meat and Wool New Zealand, Farmlands, Dairy Insight and Federated Farmers. Information was provided by farmers from the 2004 storm event, research findings and rural professionals. The full report can be found on http://www.maf.govt.nz/sff and using the search engine put in project number 05/060.

See decision tree over page →

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