Winter crops

Minimising the loss of nutrients and sediment to waterways

WORKING FOR OPIHI WATER

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This fact sheet on winter crops has been developed under the Working for Opihi WaterProject. It covers critical source areas, key messages, good management practices (plan, establish, graze) and gives a farmer case study example.

WHAT IS A CRITICAL SOURCE AREA?

Critical source areas are those parts of the landscape, such as swales and gullies, where overland flow and seepage converges to form small channels of running water, which may then flow to streams and rivers. (Figure 1).

KEY MESSAGES

- Plan – paddock selection, fertiliser, feeding management
- Preventing sediment and nutrient loss is far more efficient and cost effective than fixing problems.
- Research has shown that grazed winter forage crops contribute significantly to the risk of phosphorus (P), sediment and faecal losses to water. Critical source areas (CSAs) such as gullies and swales are a particularly important part of the landscape involved in the transport of these contaminants to water.
- Strategic grazing and careful management of CSAs can reduce losses of sediment and phosphorus (P) by 80-90%. The reduction is achieved by minimising stock movements and thus soil treading damage in the CSA. This means any rainfall and runoff that occurs is more likely to infiltrate the soil, minimising the amount of runoff and losses of sediment and P.
- Practices to reduce N leaching:
  - Urine N leaching can be reduced through appropriate paddock selection, crop selection, grazing time and grazing regime.
  - Fertiliser N leaching can be reduced through the use of crop calculators to gauge need and achieve precision application to ensure appropriate application and timing.
  - Winter fallow N leaching can be reduced through the use of a cover crop or late harvests.
  - Mineral N leaching can be reduced through the use of minimal tillage.
  - Follow forage crops with cereal or Maize type crops

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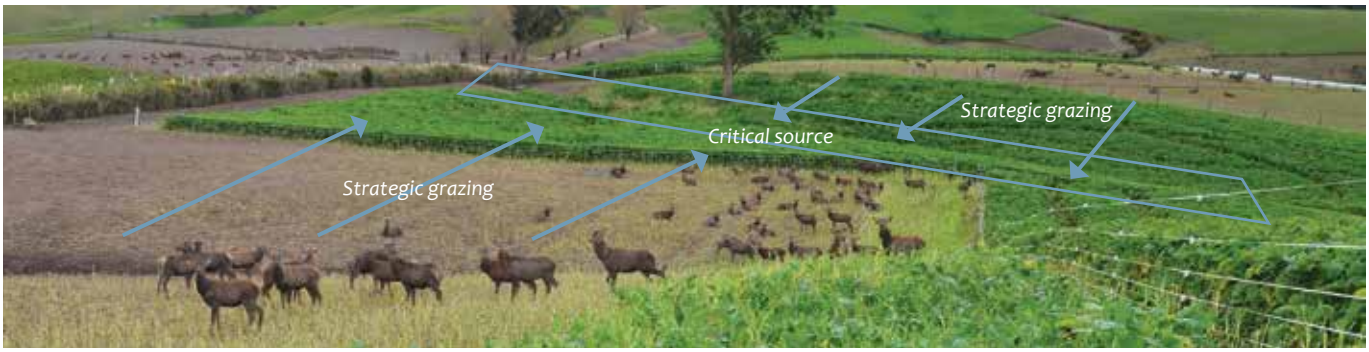

Figure 1: Critical source area and strategic grazing

GOOD MANAGEMENT PRACTICES FOR WINTER CROPS THAT WILL HELP REDUCE NUTRIENT LOSS AND IMPROVE RETURNS

Plan

a. Where possible choose paddocks away from waterways to plant winter crops.

b. Buffer zones and/or riparian strips are used between cultivated soils and waterways to keep stock at least 3 metres (m) away from waterways.

c. Steeper ground should be avoided, but if used will require a wider pasture buffer zone of 10 to 15 metres. Identify temporary streams or natural drainage channels or swales in the paddocks that will drain water when it rains heavily; leave a 3m strip either side uncultivated and fence them off during grazing.

d. Plant deep rooted crops such as maize to utilise or 'mop up' nutrients from high fertility soils, e.g. in soils cultivated after long term pasture or soils that have had regular effluent applications or have been heavily grazed.

e. Fodder beet requires a pH of 6.0 and good soil fertility to get high yields, soil test at least 6 months before sowing so that lime and fertiliser can be added if required.

f. Manage crop rotations to maintain soil organic matter levels. The Organic Matter (OM) in the soil is a source of many plant nutrients, particularly nitrogen. OM also plays a major role in determining soil physical characteristics such as structure, moisture retention and water infiltration. Some of the soil organic matter in winter feed crop rotations is derived from the breakdown of old roots. This can be a slow process.

g. Test the soil before preparing a crop nutrient budget for available N (AMN test) and/or mineralisable N (Deep N test). The AMN test is a measure of Nitrogen mineralised under specific laboratory conditions. The actual amount of nitrogen that will be mineralised in the field depends on soil temperature and moisture. The deep N test measures the nitrate-N and ammonium-N levels at the time of sampling.

h. Test the nutrient content of manure, slurry, compost or effluent before application, they can vary greatly. The release of N from organic sources can be difficult to predict. Usually the mineral forms of N are immediately available to the crop, whereas the organic forms are released slowly through microbial activity.

i. Prepare a pre-season nutrient budget for each crop, taking into consideration a realistic crop yield (use your long term average yield as a guide) and likely soil supply of N (from soil tests) and amount of residue from the previous crop. Your fertiliser consultant or farm advisor will prepare pre-season crop budgets for you if required. Often these budgets show the potential to reduce fertiliser inputs or the potential to improve crop yields by matching crop uptake with nutrient inputs.

Leave a buffer around wet areas

Avoid steep paddocks prone to runoff

Establish

a. If you are cultivating sloping ground, work across the slope face rather than up and down the slope. If the rows are oriented up and down the slope, restrict their length to 200m. Use contour drains to break the rows up.

b. Minimise the number of passes over the paddock by using direct drilling or minimum tillage. This is particularly important if your paddocks are sloping or your soils are light and easily eroded by the wind. There may be times when you need to increase cultivation intensity or bring out the plough to deal with soil constraints and weed and pest issues.

c. Do not apply fertiliser close to a waterway or wetland. Leave a riparian margin or buffer of at least 1-2m on flat land and 5m or more on sloping land.

d. Manage irrigation to avoid ponding, run off and leaching. If water is draining below the depth of the crop roots it will take nitrates with it.

e. Consider soil and weather conditions before fertiliser is applied, when the risk of run-off, volatilization (gaseous losses) and leaching is low. Nitrogen fertiliser should not be applied when the ground is saturated. Nitrogen should not be applied when the 10cm soil temperature at 9am is less than 6 degrees Celsius.

Graze

a. If there is a waterway, break-feed so the area nearest the waterways is fed off last, as this provides a wider buffer for filtering runoff and retaining nutrients within the paddock than if grazing beside the waterway first.

b. Crop is utilised more efficiently when long narrow breaks are offered rather than wide breaks.

c. Back fence stock off land that has already been grazed.

d. Reduce wastage due to trampling by moving the fence once or twice a day rather than offering a few days feed at a time.

e. Fence off a narrow access strip along the length of paddock to access gateways. Adjust feed intake to weather conditions. In cold, wet conditions, feed demand is higher and utilisation is lower. Underfed stock wandering in search of feed adds to the potential soil loss through physical damage and sediment entering waterways

f. Place supplementary feed such as baleage into the paddock at start of winter when soils are not wet. Keep well back from waterways to avoid stock congregating near them.

g. Provide transportable troughs for stock drinking water, ensuring cows have access to water at all times while on crops. This helps to minimise soil compaction from stock traffic walking back to a trough at the other end of the paddock from the feeding face.

Graze area close to waterway last

MANAGING WINTER FEED WHILE MINIMISING THE LOSS OF NUTRIENTS AND SEDIMENT – A LOCAL EXAMPLE

Chad Steetskamp's 13.5 Ha runoff near Fairlie, on first appearances is a simple block to manage. It is dryland, and has free draining Balmoral silt loam soils and is flat. It is mostly in kale. The crop was struggling in the drought and Chad thought he would be lucky to get 2 -3 tonnes DM/ha out of it. However with good autumn rains by May it looked like it should yield 6 -8 tonnes DM/ha. In a good year it will yield much more than this.

This property has a small swale that runs through the centre of the property. Potentially this small waterway could carry sediment and nutrients, from the property, down through the Opihi catchment. Chad's management of his kale greatly reduces this risk. Between the kale and the swale there is buffer of long grass and trees that help trap sediment and phosphorus before it gets to the swale. The cows graze the areas furthest away from the waterway first, this means that the remaining kale also helps to trap any sediment and run-off.

From 1 January 2017, the Orari- Opihi-Pareora (OOPs) Zone will have nitrogen (N) caps as part of the Canterbury Water Management Plan. The challenge for managing this run-off block is that it has free draining soils, which are low risk for pugging, but are very vulnerable to nitrogen leaching. With a high winter stocking rate there is high winter leaching. The nitrates are rapidly lost to the extremely gravelly subsoil and from there get into the ground water and waterways further down the catchment. This leaching of N to water is increased when kale and other crops are grazed in June/July and then the ground is left fallow for a number of months, with no crop or pasture to take up the nitrates.

Using Overseer® different crop management systems can be modelled to predict the amount of N loss to water. The N loss to water wintering cows on kale over a Balmoral soil can be above 140kg N/ha/yr if the ground is left fallow for 3 months. Following the kale with a whole-crop cereal silage crop, before putting the block back into winter crop, can greatly reduce the N in the soil and therefore the N leaching. With this system Overseer® can model the N loss to water and would show a reduction from more than 140 to 80 kg N/ha/yr. However, sowing the winter crop a month later maybe risky as this is a dryland block.

REFERENCES

Dairy NZ – Land Management on Canterbury dairy farms

DairyNZ – Reducing surface run off on grazed forage crop paddocks by strategic grazing management

Foundation of Arable Research Farm Environment Plan