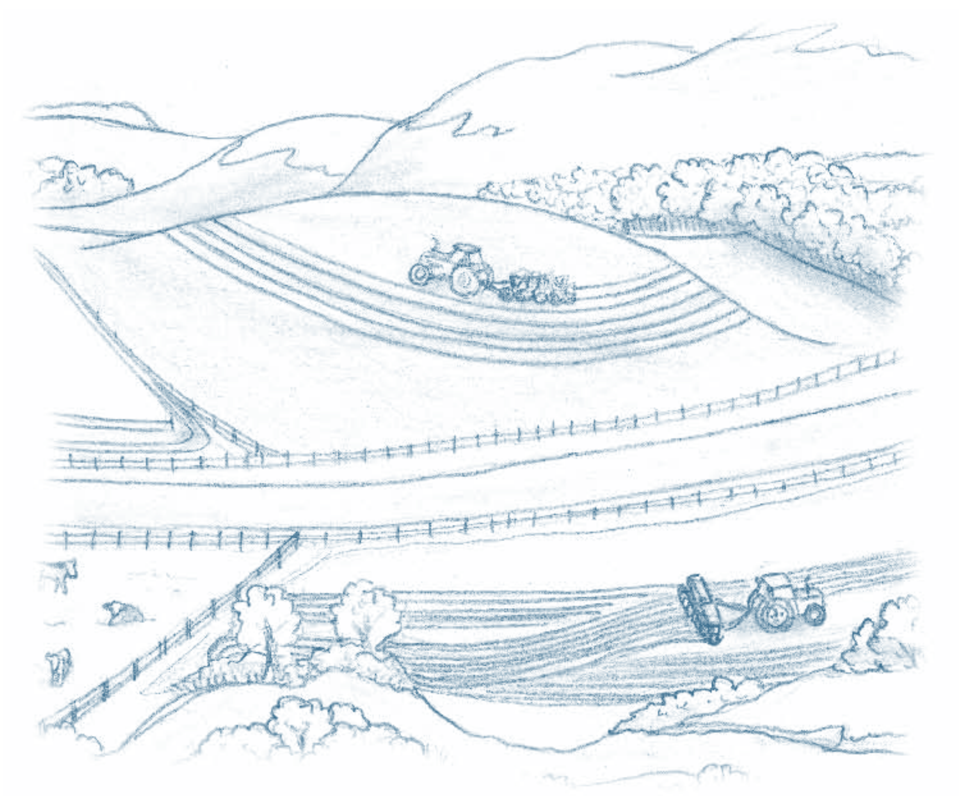
Chapter 8.2

Cropping Practices to Reduce Nutrient Losses in Runoff



learning objectives

- List four practices of managing manure application that can reduce nutrient losses in runoff and briefly explain how these practices reduce the loss of runoff.
- List two cropping practices to deal with slope concerns on sites at risk for erosion or nutrient losses in runoff.
- List at least five cropping practices that can be used to provide ground cover on sites at risk for erosion or nutrient losses in runoff and briefly explain how they reduce risk.

more info

This chapter is meant to provide an overview of the erosion control benefits of selected practices. For more details about these practices consult the suggested references for each topic, contact Alberta's Ag-Info Centre, or contact a qualified consultant or service provider.

Important Terms

Table 8.2.1 Key Terms and Definitions

Term	Definition
Contour	Following the lay of the land perpendicular to direction of the slope.
Crop Biomass	The total plant matter produced by the crop (i.e., straw, roots and seed).
Direct Seeding	In this cropping system, no tillage operations are completed prior to the seeding of the crop. Generally, the crop is seeded directly into the stubble of the previous crop.
Percolates	The movement and filtering of fluids through porous materials (i.e., soil).
Reduced Tillage	In this cropping system, tillage operations are minimized leaving most of the plant residue on the soil surface. The primary tillage operation is seeding. The amount of soil disturbance varies with the equipment used. Reduced tillage systems replace most weed control tillage operations with herbicide applications.
Terraces	A leveled section of a hilly cultivated area designed as a method of soil conservation to slow or prevent the rapid runoff of surface water.
Zero Tillage or No-Tillage	This is a conservation cropping system in which the only operation that disturbs the soil is seeding and any simultaneous fertilizer application. While the amount of soil disturbance varies with the equipment used, in most practical situations only 10 to 30 % of the soil is disturbed.

This chapter will focus on management practices that are designed to prevent nutrient losses in runoff, primarily through addressing ground cover and slope. The practices discussed in this chapter generally do not require additional, specialized equipment and are cost-effective in contrast to installing more intensive runoff control measures, which are discussed in Chapter 8.3.

Manure application and no-tillage situations can increase the occurrence of nutrients on or near the soil surface and subsequently increase the amount of potential dissolved nutrients in water. Management practices that take into account the characteristics of runoff can be adopted to minimize the potential nutrient loss due to runoff. Practices that are effective at reducing nutrient losses from a field either reduce the source of nutrients on or close to the soil surface or reduce the flow of runoff.

Practices designed to reduce water erosion and nutrient losses from runoff generally fall into:

- Practices that manage the application of manure
- Practices that attempt to disrupt the continuity of a slope
- Practices that maintain or enhance ground cover
- Practices that reduce soil compaction

Practices that Manage the Application of Manure

Avoid Applying Manure on Snow-covered or Frozen Ground

Manure spread on snow-covered or frozen ground is in direct contact with snowmelt runoff water increasing the risk of nutrient transport. Higher levels of nutrients have been measured in runoff from land where manure was winter-applied as compared to non-manured land. Eliminating or minimizing winter application of manure reduces the chance of nutrient loss during runoff.

To eliminate the need for winter application, producers may have to increase their manure storage capacity. Adequate storage is required to contain the manure produced during the winter months and allow for application at more appropriate times. This may require the construction of larger and more costly manure holding facilities than presently used by some producers. Alternatively, a small group of producers may work together to construct and share a larger storage facility. This approach reduces the costs associated for individual farms while providing the benefit of an increase in storage capacity.

Apply Manure to Meet Crop Nutrient Requirements

Crops require approximately three to seven times the amount of N than they do P. As a result, applications of manure, which may have a 2:1 or even a 1:1 ratio of N to P can result in the over-application of P. The over applying of P above crop need results in the build-up in the soil. Applying fertilizer and manure at rates that meet crop nutrient requirements will reduce the risk of nutrient build-up in the soil. By reducing the concentration of nutrients on or near the soil surface, the amount of nutrients available for transport in runoff water will be reduced.

A significant implication to applying manure based on P requirements is the affect on land requirements and transportation costs. Since crops use significantly less P than N, a larger land base maybe required for manure application based on P requirements compared to N requirements. Operators may need to purchase more land, rent additional land or build partnerships with surrounding landholders to secure the land-base required for a P-based manure application program. An expanded land base may also result in increased transportation costs if manure has to be hauled greater distances. Other manure management strategies such as composting or generating bio-fuels may offer alternatives to transportation.

A NMP may be adopted that calculates manure application rates based on multi-year crop P demands matching P uptake to crop removal in a rotation over three to five years. Operations may need to improve their MMP and feeding strategies to either reduce the opportunity of N loss from the manure or increase the amount of P retained in the animal to maintain a higher N to P ratio. Manure with a higher N to P ratio provides a better nutrient balance for crops, making it easier to manage and reduces the risk of P accumulation.

Time Manure Application to Maximize Crop Uptake

Apply manure just prior to seeding or as close as possible to the time of active crop growth. Nutrients from the manure application can be used and taken up by the crop reducing the opportunity for loss from the system. The crop canopy will also provide protection from erosion and loss by rainfall and volatilization. Application on unfrozen surfaces increases the opportunity for the movement of dissolved nutrients into the soil through water infiltration. In addition, there is a greater opportunity for spring applied nutrients to be absorbed by the soil compared to late fall manure applications reducing the risk to surface runoff losses. Avoid application without incorporation of manure in the late fall as this increases the risk of nutrient loss during spring snowmelt.

The challenge to early season manure application is time, conflict with spring seeding and the risk of soil compaction if soils are wet. Custom applicators may be used to manage time constraints. Field and crop selection are important considerations when managing seeding and manure application. Select crops that will be seeded

later in the season such as warm season crops, silage or fall cereals. Manure may also be applied to forage and pasture crops or injected between forage cuts. This increases the opportunity for manure application when the soil is drier reducing the risk of soil compaction while providing nutrients when needed the most. If manure must be applied in late summer or fall, select fields that are a low risk for snowmelt water runoff to reach surface bodies of water.

Incorporate or Inject Manure

The incorporation or injection of manure can reduce the exposure of manure to surface runoff events reducing the opportunity for dissolved nutrients to be carried from manured fields to adjacent bodies of surface water. In Alberta, manure must be incorporated within 48 hours of application unless it is applied to forage, reduced tillage systems or on frozen or snow covered ground (Chapter 4.4).

While incorporation does not fit well with perennial crops, direct seeding or no-tillage farming operations, the low disturbance liquid manure injection technologies have been shown to work well with these systems. Injection technologies allow for the direct placement of liquid manure into standing forages or stubble fields with minimal disturbance.

Alternatively, high disturbance tillage can be used to incorporate surface applied liquid or solid manure. Although tillage can be an effective means to incorporate manure, the negative consequences associated with tillage include reducing the amount of protective crop cover residue and the breaking up soil structure. The result can reduce the snow trapping ability of the field and lead to a greater risk of soil loss to erosion by water and wind. However, some of the negative effects will be offset by manure application since organic matter in manure can protect the soil surface from erosion, promote water infiltration and improve soil structure.

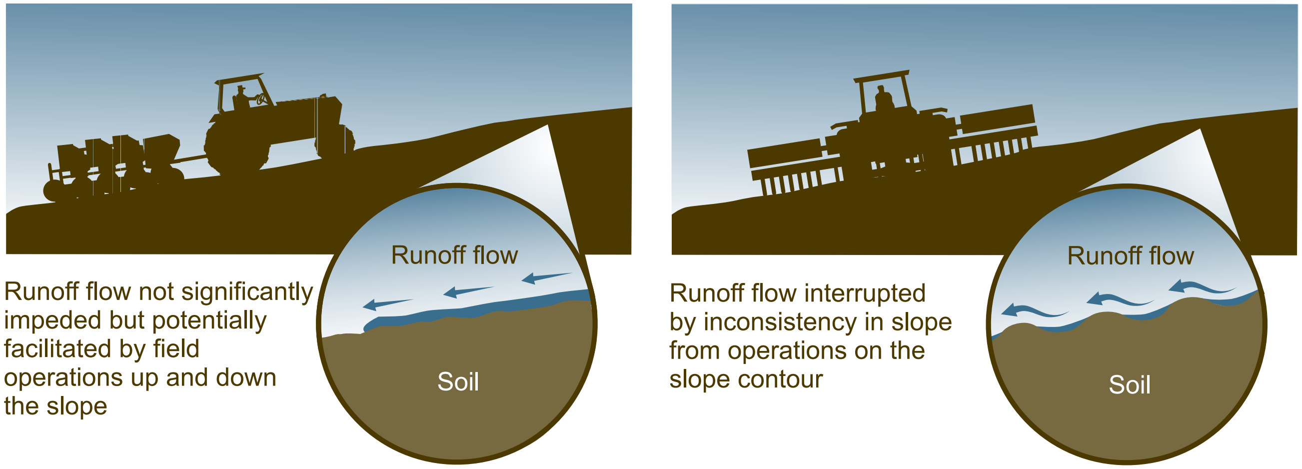
Practices to Deal with Slope

The primary way to control runoff on problem slopes is to disrupt slope uniformity using practices such as farming on the contour or maintaining permanent ground cover. These practices generally work best on slight to moderate slopes (e.g., < 6 or 7 %) that are relatively uniform. For sites where runoff flow patterns are more concentrated, a combination of practices described in this chapter with more intensive constructed erosion control measures described in Chapter 8.3 may be required.

Farm on the Contour

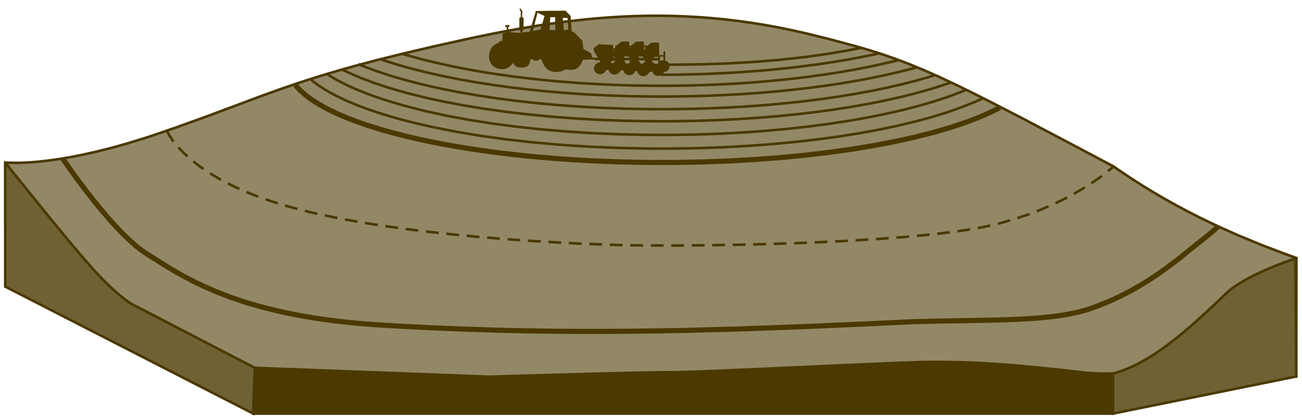
Farming on the contour refers to performing field operations across the slope along the shape (or contour) of the land. This results in a series of small ridges and furrows that act as micro-terraces or obstacles to water attempting to flow down the slope. Field operations on the contour can be done to direct water flow toward an outlet such as a grassed waterway thereby providing additional runoff control and soil protection (Figure 8.2.1).

Generally, contour farming dramatically reduces erosion on gentle slopes but is less effective on steeper slopes. The presence of ground cover (e.g., standing crop residue) increases the effectiveness of contouring.



Source: Hirschi et al., 1997

Figure 8.2.1 Slope Disruption Resulting from Farming on the Contour



Source: Hirschi et al., 1997

Figure 8.2.2 Example of Farming on the Contour

sidebar

The effectiveness of farming on the contour on its own diminishes as slope length increases and the amount of residue or ground cover present decreases.

more info

To get more information about farming on the contour, consult the following online document:

USDA-NRCS. 2000. Contour farming. National Conservation Practice Standard #330. Electronic Field Office Technical Guide. United Stated Department of Agriculture – Natural Resource Conservation Service. ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice-standards/standards/330.pdf

more info

For recommended minimum levels of crop residue to minimize erosion (based on slope grade and length for various cropping systems and soil types), see the following online document from AF.

AF. 2005. A method for developing best management practices to prevent water erosion on farmland using WEPP. CAESA Soil Quality CSQ Research Factsheet 11. www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag5804

tip

For crop residue to retain snow-catching effectiveness it is important that any fall soil disturbances minimize stubble knockdown and keep most of the crop residue on the surface.

Practices to Maintain or Enhance Ground Cover

One of the best ways to reduce erosion is to protect the soil surface with a cover of growing plants or crop residue. Surface cover cushions the impact of raindrops so soil particles are not as easily dislodged and moved. It also slows the flow of runoff giving the soil time to absorb more water thereby reducing the total volume of runoff and risk of erosion and nutrient loss.

Crop residues and roots stabilize soil aggregates, enhance infiltration and add to soil organic matter, which increases soil water holding capacity. Ground cover also provides insulation to the soil buffering against changes in soil temperature. This has important implications for runoff resulting from snowmelt (see Chapter 8.1).

Tillage Systems

Under conventional tillage management, there are several negative impacts including reduced soil moisture reserves, increased wind and water erosion risk, disruption of soil structure, accelerated organic matter decomposition, and depending on the implement used, compaction of sub-surface soil layers.

Conservation tillage systems have been promoted in western Canada for several decades. Conservation tillage is a general term that refers to several systems including zero tillage (zero-till), direct seeding and reduced tillage. All of these systems increase the amount of crop residue left on the soil surface and all have the same goal: to minimize erosion risk and conserve soil moisture.

Minimizing the Negative Impacts of Tillage

- Avoid fall tillage so ground cover is retained to trap snow and prevent soil erosion during the fall, winter and spring.
- Replace deep tillage with shallow tillage to minimize disturbance of soil.
- Reduce the number of tillage passes.
- Reduce tillage speed.
- Use implements that bury less crop residue (Table 8.2.2).
- Where possible, run tillage and seeding operations across the slope (as opposed to up and down the slope) to prevent runoff from eroding channels down the slope.
- Avoid field operations when the soil is wet.

Table 8.2.2 Residue Left by Various Tillage Implements

Tillage Implement	% Residue Left After One Pass	% Residue Left After 4 Passes
Wide-Blade Cultivator	90	60 - 65
Chisel Plow with Low-Crown Shovel	85	40 - 45
Chisel Plow with Normal Shovels	80	35 - 40
Chisel Plow with Normal Shovels Plus Mounted Harrows	60	10 - 15
Heavy Tandem or Offset Disc	35 - 65	5 - 15
Moldboard Plow	0 - 10	0

Source: AF

Fallow Systems

» Negative Impacts of Fallow

- Fallow systems result in decreased organic matter levels with time since little plant residues are returned to the soil during fallow years.
- Tillage raises soil temperatures and increases aeration and mixing of the soil, which increases the rate of decomposition of soil organic matter and crop residues compared to a soil with a growing crop. Declining soil organic matter content degrades the physical structure or tilth of the soil. Poorer soil structure results in less infiltration of precipitation into the soil resulting in increased runoff, further increasing the likelihood of soil and nutrient losses.
- Lack of plant residues on the surface as a result of repeated tillage operations leave the soil vulnerable to water (and wind) erosion.
- All fallow systems increase the risk of nutrients being lost from the soil through volatilization and leaching.
- Loss of crop available nutrients. As organic matter and crop residues decompose, soil microorganisms mineralize organic forms of crop nutrients to crop-available forms. Normally, these mineralized nutrients would be taken up by growing crops but in fallowed fields they remain in the soil and may be lost either through leaching or gaseous emissions.
- Impact on groundwater recharge. Crop plants are large consumers of soil moisture and play an important role in regulating soil moisture conditions. Under fallow conditions, more precipitation percolates down through the subsoil and enters the groundwater. This can transport water-soluble crop nutrients (e.g., nitrate) to groundwater sources and impact groundwater quality. Downward movement of water can also move salts to groundwater discharge areas causing groundwater levels to rise in these discharge areas and potentially increase salinity.

Conservation Fallow

Conservation fallow maintains plant residues on the soil surface, which helps to reduce soil erosion while still providing weed control and soil moisture conservation benefits. With no tillage, stubble and other residues from the preceding crop are left undisturbed, erect and anchored, as are the remains of the dead weeds. This practice protects the soil from wind and water erosion and increases snow catching. The shade provided by the residues keeps the soil surface cooler and together with less tillage-induced aeration of the soil reduces evaporation.

At the end of summer fallow period, typically 60 to 80% of the protecting stubble remains. Losses during this period are due to the normal decomposition from ultra-violet radiation, chemical oxidation and microbial activity.

Winter Cereal Production or Cover Crops

Another strategy for maintaining ground cover during periods of high runoff risk from snowmelt is to include winter cereals in crop rotations or selectively planted in vulnerable areas. Winter cereals begin growing and using nutrients in the fall reducing the opportunity for the loss of applied nutrients (i.e., manure or fertilizer) later in the season. Even though winter cereals do not grow much during the winter, the crop prevents free flow of snowmelt water in the spring and the roots anchor soil particles. This reduces the risk of erosion and sediment-bound nutrient losses in the spring. Later in the season, winter cereals provide ground cover that buffers raindrop impact during rainfall events helping to preserve soil structure and reduce the risk of soil erosion.

Fall rye has the best winter hardiness and produces the most soil cover followed by winter triticale and then

more info

AF has over 30 publications relating to direct seeding and reducing tillage, including:

- **1996. Soil quality and moisture conservation benefits of direct seeding. Agdex 570-6.**
- **1999. Direct seeding systems: terms, definitions and explanations. Agdex 570-7.**
- **2006. Making the move to direct seeding. Agdex 570-5.**

Another excellent resource is Reduced Tillage LINKAGES (www.reducedtillage.ca), which has a network of specialists throughout Alberta that can provide advice on issues relating to reduced tillage production systems.

The Prairie Farm Rehabilitation Administration (PFRA) with AAFC also has information relating to reduced tillage in the following online documents:

- **Brandt, S. 2006. Tillage practices that reduce soil erosion. www.agr.gc.ca/pfra/soil/tillage_e.htm**
- **PFRA. 2006. Economics of zero till. www.agr.gc.ca/pfra/soil/ swork1.htm**

more info

For more information on the benefits of conservation fallow is available in the following online document, accessible through Ropin' the Web.

- **AF. 1993. Summer fallow and soil conservation. Agdex 570-3.**

The PFRA with AAFC also has information relating to the economics of conservation fallow in the following online document:

- **PFRA. 2006. Economics of conservation fallow. www.agr.gc.ca/ pfra/soil/swork3.htm**

winter wheat. Winter cereals for water erosion control should be planted as early as possible to maximize growth and soil cover before the dormant period. They can then be terminated in spring with herbicide and planted to spring crops or left and harvested as a winter crop. Spring cereals planted in late summer or early fall will also provide good winter cover and may substitute for winter cereals in some situations.

Green Manures

Green manuring is the practice of growing and terminating a short-term crop, which can include cereals, oilseeds and legumes, part way through the growing season. A green manure crop is grown to provide short-term ground cover during the growing season reducing the risk of erosion and runoff.

Traditionally, green manuring was used prior to the availability of nitrogen fertilizers to boost soil fertility. Legumes such as peas, lentils, or clovers, which "fix" atmospheric nitrogen are the preferred options for manuring because the residues from these crops have a high concentration of nitrogen that is readily released for subsequent crops.

The traditional practice is to bury crop biomass, which returns most of the fixed nitrogen and plant material to the soil. To provide protection from surface erosion, however, some crop residue must be left on the soil surface. This can be accomplished by either desiccating the crop using herbicides or by haying the crop.

Perennial Forages in Crop Rotations

Including perennial forages in long-term crop rotations is perhaps one of the most effective ways to minimize soil and nutrient losses from runoff. Perennial forages can be grown on poorer soils or on sites where slope is a serious constraint. This allows these areas to remain productive while minimizing erosion.

They provide dense ground cover, which protects the soil from erosion through buffering against raindrop impact filtering soil from runoff and slowing the speed of runoff thereby altering its erosive potential. In addition, the fibrous roots hold the soil in place.

Forages improve soil structure improving the ability for water to infiltrate into the soil and reduce runoff and erosion. Soil structure is improved through contributions to the soil organic matter pool as well as through the root structure of forages which tends to be finer than annual crops and creates a large number of small channels in the soil.

Conservation crop rotations designed to address erosion concerns typically alternate forages with cereals and oilseeds or legumes. Including legumes in the rotation will also boost soil nitrogen levels and improve soil fertility. Legumes can return about 60% of the plant material and nitrogen to the field. Perennial forage crops that are hayed can be added to the crop rotation to mine surplus nutrients such as phosphorus and potassium reducing the risk associated with nutrient build-up in the soil.

Forages can be successfully established by direct seeding. Forage stands can be terminated using herbicides and then an annual crop can be direct seeded into the field minimizing the exposure or bare ground and reducing the negative affects of tillage operations of increasing the risk of erosion and nutrient loss.

Retaining Crop Residues

Crop residues include straw, chaff and roots. Crop type and yield influence the amount of crop residue produced (Table 8.2.3). Leaving or returning crop residue to the land can help reduce runoff related soil and nutrient loss.

Table 8.2.3 Typical Amounts of Straw and Chaff Produced per Bushel of Grain

Crop	Soil Zone	Pounds of Straw Per Bushel of Grain*	Pounds of Chaff Per Bushel of Grain**
	Brown	50	
HRS Wheat	Dark Brown	65	20-25
	Black, Gray	80	
	Brown	40	
CPS Wheat	Dark Brown	50	20-25
	Black, Gray	60	
	Brown	30	
Barley	Dark Brown	35	5-10
	Black, Gray	45	
	Brown	30	
Oats	Dark Brown	35	5-10
	Black, Gray	45	
	Brown	40	
Canola	Dark Brown	50	15-20
	Black, Gray	60	
	Brown	40	
Peas	Dark Brown	50	20-25
	Black, Gray	60	

* Amount of harvestable straw, assuming about 80% recovery in cereals, and 50% in peas and canola, with 5 to 10 cm (2 to 4 inch) stubble left.
** Amount of harvestable chaff, assuming little or no weed chaff.

Adapted from: Hartman, M. 1999. Estimating the Value of Crop Residues. AF, Agdex 519-25

Standing stubble increases snow catch and has more benefit than loose, surface residue for wind erosion control. Surface residue that is well anchored with some standing stubble is also very effective for water erosion control, maintenance of good soil structure, increasing infiltration rates and preventing soil drying. Retaining straw and chaff on the surface of a field offers many benefits including increased snow catch, infiltration, reduced evaporation, increased soil organic matter, improved soil structure and plant nutrient cycling, reduced erosion risk and reduction of some weed species.

more info

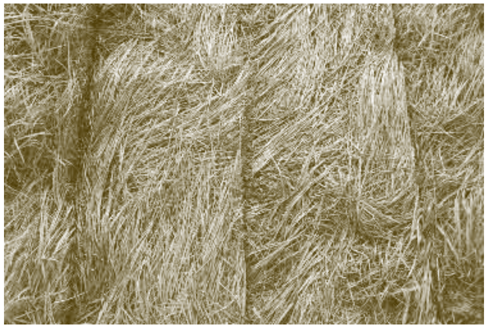
AF has several publications relating to winter cereal production, including:

- **AF. 1998. Direct seeded winter wheat. Agdex 112/22-1.**
- **AF. 1999. Winter wheat in the Parkland area of Alberta. Agdex 112/11-1.**
- **AF. 2001. Winter cereals for pasture. Agdex 133/20-1.**

These can be ordered from the Publications Office (1-800-292-5697) or viewed on Ropin' the Web.

Another resource is the online winter cereal production manual maintained by the University of Saskatchewan at: www.usask.ca/agriculture/plantsci/winter_cereals/index.php

Ducks Unlimited also has some information available on winter cereal production available at www.wintercereals.ca.



Practices that Reduce Soil Compaction

As was discussed in the previous chapter, soil structure influences infiltration of water into the soil and the extent and severity of runoff. Traffic from heavy field equipment, especially when soils are moist, compresses the soil structure compacting and sealing the soil surface and preventing water infiltration. Water from precipitation then has a greater tendency to accumulate on the soil surface setting the stage for runoff events resulting in soil and nutrient loss.

Tips for Preventing Soil Compaction

- Avoid wheel traffic on soils that are too wet
- Use wide, dual tires or tracks
- Maintain minimal tractor tire inflation pressure for an acceptable tire lifespan
- Avoid heavy, oversized equipment that exceeds job requirements
- Combine or eliminate field operations to minimize number of passes on the field
- Minimize tillage on soils in the spring
- Keep openers and shovels sharp
- Adopt practices that build soil organic matter and improve structure
- Vary the depth of primary tillage operations from year to year
- Use track-type tractors or tractors with four-wheel drive or mechanical front-wheel drive instead of two-wheel drive
- Vary directions of field operations

Additional Resources

More information on green manuring is available in the following document from Ropin' the Web:

- AF. 1993. Legume green manuring. Agdex 123/20-2.

Other valuable online resources with information on green manure include:

- McGill University. Not Dated. The basics of green manuring. EAP Publication 51. http://eap.mcgill.ca/Publications/EAP51.htm
- National Sustainable Agriculture Information Service. 2003. Overview of cover crops and green manures. http://attra.ncat.org/attra-pub/covercrop.html
- Sustainable Agriculture Network. 1998. Managing cover crops profitably. 214 pg. www.sare.org/publications/covercrops/covercrops.pdf
- University of California (Davis). 2006. Cover crop database. Sustainable Agriculture Research and Education Program. www.sarep.ucdavis.edu/ ccrop/search_ccrop.html

AF has several publications relating to forage production, including:

- 2005. Perennial forage establishment in Alberta. 120/22-3.
- 2006. Varieties of perennial hay and pasture crops for Alberta.Agdex 120/32.
- 2006. Applying manure on perennial forage. Agdex 538/120-2.
- 1999. Removing forages from the rotation in a direct seeding system. Agdex 519-17.
- 1999. Residue management for successful direct seeding. Agdex 570-4.

- 1999. Estimating the value of crop residues. Agdex 519-25.
- 1999. Handling difficult crop residue conditions in direct seeding systems. Agdex 519-2.

The Alberta Forage Manual (Agdex 120/20-4) is available from the Publications Office for a price of $10.00.

These publications and others can be ordered from the Publications Office (toll free in Canada 1-800-292-5697), or can be downloaded from the publications page on www.ropintheweb.com.

PFRA with AAFC also has information relating to crop residue management in the following online document:

- PFRA. 2006. Managing crop residues on the prairies. www.agr.gc.ca/pfra/land/residue_e.htm

More information on soil compaction is available in the following online documents:

- DeJong-Hughes, J., Moncrief, J. F., Voorhees, W. B. and Swan. J. B. 2001. Soil compaction: causes, effects and controls. University of Minnesota Extension Service. www.extension.umn.edu/distribution/cropsystems/DC3115.html
- Manitoba Agriculture, Food and Rural Initiatives. Soil management guide: soil compaction. www.gov.mb.ca/agriculture/soilwater/soil/ fbe01s10.html
- Petersen, M., Ayers, P. and Westfall D. 2006. Managing soil compaction. Colorado State University Cooperative Extension Service. www.ext.colostate.edu/PUBS/crops/00519.html
- Kok, H., Taylor, R.K., Lamond, R.E. and Kessen, S. 1996. Soil compaction: problems and solutions. Kansas State University Cooperative Extension Service. www.oznet.ksu.edu/library/CRPSL2/AF115.pdf

summary

- Manure spread on snow-covered or frozen ground is in direct contact with snowmelt runoff water, increasing the risk of nutrient transport.
- Appling fertilizer and manure at rates that meet crop nutrient requirements will reduce the risk of nutrient build-up in the soil and potential for transport.
- Apply manure just prior to seeding and active crop growth, so that plants take up nutrients and reduce the opportunity for nutrient loss.
- The incorporation of manure can reduce its exposure to surface runoff events.
- Conducting field operations across the slope (on the contour) produces micro channels that intercept and slow the flow of runoff down the slope.
- Permanent cover can be grown on sloped land to help hold the soil in place and promote water infiltration, reducing soil and nutrient losses.
- Conservation tillage and conservation fallow systems increase the amount of crop residue left on the surface soil surface, minimizing erosion risk and conserving soil moisture.
- Winter cereals use nutrients in the fall, their roots anchor soil particles, provide ground cover and reduce the opportunity for erosion nutrient losses.
- A green manure crop is grown to provide short-term ground cover during the growing season, reducing the risk of erosion and runoff.
- Minimizing traffic from heavy field equipment can prevent the compaction of soils and maintain water infiltration, reducing the risk of erosion losses.