NOVA SCOTIA Agriculture and Fisheries
Nova Scotia Agricultural College
HORTICULTURE HNS NOVA SCOTIA
factsheet

Soil Moisture Conservation

Introduction

In Nova Scotia, there is generally sufficient moisture to support plant growth. Although, it may not necessarily be at the right time of the growing season to always achieve maximum yielding and high quality crops. Additional moisture can be provided by supplemental irrigation, but producers can also greatly benefit by conserving soil moisture. This factsheet will therefore provide some fundamental information on practices to reduce water loss through conservation techniques.

Evapotranspiration

The two major water loss passways from cropping systems include **evaporation** and **transpiration**. Evaporation losses occur directly from the soil, while transpiration losses are through plants. A plant can be pictured as a pump, drawing water from the soil and moving it to the leaves where it is lost to the atmosphere through tiny openings called stomata. These two losses are usually combined and referred to as **evapotranspiration** (**ET**). Evapotranspiration values are highest when the soil is near field capacity and the air is warm, dry and moving. The **potential evapotranspiration** (**PET**) is the maximum amount of water that could evaporate and/or transpire when moisture is not limiting. When the PET is high, plants must draw heavily on soil water and transpiration can occur faster than the plants can draw water from the soil which may eventually cause wilting.

Organic Matter

Organic matter is material such as plant residues and animal manure. It influences many of the physical, biological and chemical properties of soil. Some of these properties include structure, water holding capacity, nutrient content, biological activity and aeration. Organic matter that is in a very decomposed stage is called **humus.**

A dark coloured and sticky substance, humus retains water and nutrients extremely well. Soil organic matter generally has a positive relationship on water availability, regardless of the soil texture. Organic matter decreases the bulk density of soil and increases soil aggregation, thus greatly improving structure and water infiltration. Good soil structure allows for plant roots to penetrate more deeply into the soil profile, thus enabling roots to access a greater supply of soil moisture. This helps plants withstand long periods of dry weather and even drought. Subsurface tile drainage systems also promote conditions that maintain good soil structure and increase infiltration of water into the soil.

Intensive crop production often returns little organic matter to the soil. There are several approaches however, to maintaining or improving organic matter content. These include spreading compost or animal manure, reducing tillage, green manuring and practicing good crop rotations.

Solid Manure Spreading Helps to Improve the Soil Organic Matter Content

Spreading Manure or Compost

Animal manure or compost adds nutrients to the soil by decomposing into humus. Compost is organic matter that has been broken down into a stable form under controlled aerobic conditions. Compost also acts as a slow release fertilizer.

Conservation Tillage and Residue Management

Maintaining soil organic matter levels is difficult if the soil is intensively tilled (such as the annual use of a moldboard plow). Reducing tillage means leaving more residue, tilling less often and less invasively than with conventional tillage. No-till is the most extreme version of reduced tillage where the soil is undisturbed prior to planting. To date, no-till has typically been found to be less effective on heavier soils.

Crop residue is defined as the vegetative material left on the field after harvesting, pruning or processing. Crop residues left on the soil surface can conserve moisture by reducing evaporation. Most evaporation from soil occurs when the soil is wet. The presence of crop residues protect the soil from solar energy and acts as a windbreak to reduce evaporation. Residues also aid in moisture retention by reducing water losses due to runoff. As with mulches, crop residues also intercept raindrops, thus reducing soil detachment, dispersion and compaction.

Conservation tillage, a form of residue management, does not bury crop residue but leaves a high percentage of it on or near the soil surface. Minimum and no-till production systems can also be effective in conserving moisture since crop residues are allowed to remain on the soil surface. A crop is seeded into the moist soil directly beneath the residue without destroying the ground cover.

Crop Rotation

Crop rotations between different types of crops (eg. row crops and "soil building" crops such as forages) is a recommended practice, especially for vegetable growers.

Reduced Till Corn is Becoming a Common Management Practice in Nova Scotia

Growing a different crop each year prevents organic matter loss, improves soil structure and reduces the incidence of weeds and pests. Generally, the longer the rotation, the better. Crop rotations can also lead to greater efficiency in soil water utilization. For example, deep rooted crops following shallow crops can take advantage of the extra reserve of deep moisture which was unavailable to the shallow rooted crop.

A cover crop should be established as soon as possible after harvesting short season vegetables. Annual or cereal rye are good cover crops for longer season vegetables because they grow well in cooler weather experienced in autumn and early spring, and are also good at taking up excess fertilizer.

Plowing Down Green Manure

Green Manuring

Green manure is plant material which is grown for the sole purpose of eventually being incorporated into the soil while still lush and fresh. Green manuring adds organic matter to the soil, returns nutrients to the soil and improves soil structure.

In order to be used as a green manure, a plant should have the following characteristics: (i) rapid growth, (ii) grow well under local conditions and (iii) produce a large succulent canopy. Green manures are often legumes or grasses. Examples are sweet clover, alfalfa and rye grass. Legumes provide the additional benefit of nitrogen fixation, the conversion of atmospheric nitrogen into plant available forms.

Mulches

For arable soils, the most effective conservation practices for reducing surface evaporation are those that provide some degree of surface cover for the soil. A cover can be best provided by mulches or by tillage practices that leave plant residues on the soil surface.

A mulch is any material placed on a soil surface for the purpose of reducing evaporation or controlling weeds. Mulches act as barriers to movement of moisture out of the soil. They can be either natural (eg. straw, wood chips, peat) or man-made (eg. transparent or opaque plastic sheeting). Mulches can also enhance soil temperature, depending on the type of mulch being used.

In addition to reducing evaporation, vegetative mulches can reduce the spread of soil borne diseases, reduce weed growth, reduce soil erosion, provide nutrients and organic matter and aid in infiltration. Mulches improve infiltration by protecting the soil surface from the impact of raindrops and eliminating soil crusting. Mulches can however, be expensive and labour intensive to obtain, transport and apply to the soil. Mulching is usually more practical for high value crops such as vegetables and berries.

Specially prepared plastics can also control evaporative loss. Black plastic can also effectively control weeds. These types of mulches are often applied by machinery and there are holes or slits present for plants to grow through. These mulches are commonly used for vegetable and small fruit crops.

Plastic Mulching

Straw Mulching to Prevent Erosion and Aid in Moisture Conservation

The use of plastic mulches have some disadvantages. The formation of a barrier on the surface of the soil decreases ET, but also acts as a barrier to infiltration of additional water from rainfall. There are also problems associated with the removal of plastic mulches at the end of the growing season. It is difficult to completely remove the mulch and detritus can build up after several years, interfering with water movement and cultivation.

Summary

There are a number of conservation methods to reduce excessive soil water loss. Most provide additional advantages such as building soil structure, improving organic matter or weed control. For some producers, soil moisture conservation may be the most efficient and economical way of increasing net returns over the long term.

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