

# MEASURE AND MANAGE

## **Alfalfa Forage Stand Management**

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### **1: Forage Diseases**

Forage Diseases can be broken down into 3 main categories.

#### **Leaf and Stem Diseases, Crown and Root Rots and Vascular Wilt Diseases**

- The severity of these disease complexes depends on weather, soil type and crop management. Control options are few within the season the best defenses are field observations, management practices and select future varieties with desired traits.

#### **Leaf and Stem Diseases**

The main leaf and stem Diseases are:

##### **Anthracnose**

- The Anthracnose Disease is most prevalent in Southern Ontario and develops rapidly under warm moist conditions. The symptoms show as sunken, diamond or oval shaped lesions on the stems. The lesions develop a straw coloured center with a dark borders. These lesions can join together and girdle the stem. In the centers of the lesions tiny black specks or pycnida form which are the spore bodies ready to release their spores and infect more plants. This disease can move down to the crowns.
- The symptoms of crown infection are fewer stems, and black or dark blue colour on the crown, plant death is the usual result of crown infection. This disease moves from the top of a alfalfa plant to the crowns a top to bottom problem and one of the keys to identification.
- Leaf Symptoms are sudden wilting, yellow to white colour with scattered dead plants. However one very distinct feature is the shepherds hook at the top of the plants a cane shape often confused with frost damage or rhizoctonia disease.
- This disease is often worse in 2<sup>nd</sup> year stands. Once the disease has progressed to the crowns little can be done there are no treatments only management options. Reduce as much wheel traffic in the field as possible in early spring. Avoid spreading fertilizers or

manure in the spring in order to prevent damage to the crowns by wheel traffic.

- For future stand establishment select varieties with resistant traits.

### **Spring Black Stem**

- This disease is most active in cool wet springs. The symptoms on leaves are small circular Tar spots with irregular borders on the lower leaves of the plants.
- The stems show dark brown spots and the leaves turn yellow and drop. The spots can join together and girdle the stem resulting in the death of shoots.
- Crown Symptoms ..... death.
- Management in season is to harvest early before leaf drop, which captures more quality but also limits the spread of the disease. This disease is active in the seeding year and throughout the life of a stand. Choose varieties with tolerance.

### **Common Leaf Spot**

- This disease affects leaves only. Small, circular, brown to black spots which stay as separate spots and rarely join together. Older lesions have raised centers, which contain the fruiting bodies full of spores. The leaves are chlorotic and often drop at this point most of the protein is in the leaves therefore quality suffers. This disease favours warm moist conditions, over-winters in plant debris and starts on the lower leaves and moves upwards. The disease is reduced by warmer drier conditions. Resistance varieties are the only solution long term. In season observe and cut early. This disease can be active from seeding year throughout the entire life of the stand. This disease affects stand vigour and yield over time.

### **Downey Mildew**

- This disease is of lesser importance and is rarely a problem. It develops in cool humid conditions in new seedlings that are thick with a closed canopy. Yellowing of leaves with a downward curl. The underside of leaves have a gray colour. Cut early to avoid further leaf loss. Harvesting removes the dead tissue and opens up the stand and increases air circulation. This disease is most prevalent in the seeding year and is rare in later years of the stand.

### **Lepto Leaf Spot**

- This disease is most active in cool rainy periods. The leaves show pepper spots early which then enlarge to form eyespots with tan centers and a yellow halo. Harvest early to avoid further loss of quality. Usually not a persistent disease.

### **Mosaic Virus**

- This is not serious economic problem. Symptoms are light green to yellow mottling colour of leaves. Malformed leaves and leaves stay attached. Spread by aphids.

### **Crown and Root Rots**

#### **Aphanomyces Root Rot**

- This disease is most prevalent in fine textured or poorly drained soils that stay wet for long periods. This is mostly a seedling disease. Symptoms are yellow cotyledons. Roots are often dead and gray coloured with watersoaked lesions and stunted seedlings. Regrowth is very slow. Resistant variety selection as well as choosing sites with good soil structure and drainage are the only management options for stand longevity.

#### **Phytophthora Root Rots**

- This disease is again most prevalent in wet soils. Moderate to high temperatures increase the likely-hood of infection. Infections occur as seedlings emerge, risk declines as stand ages. Lower leaves yellow and may turn a reddish brown. Seedlings are stunted and plants wilt. Older plants have a less root mass and regrow at a slower rate.
- Root symptoms have water soaked lesions, become black and rotted, the tap root is unable to take up water and wilting results and ultimately plants die. The leaves however stay attached and is one distinguishing characteristics of this disease.
- The management opportunities are to choose well drained sites, free of soil compaction, soil test and keep fertility from becoming a limiting factor, fertilizers encourage lateral root growth, avoid stresses such as leaf feeding insects as they predispose plants to become susceptible to infection, choose resistant varieties, use seed treatments ( metalaxyl). Generally reduce controllable stresses.

#### **Sclerotinia Crown and Stem Rot**

- This disease is encouraged by cool wet weather. Thin seedling stands are evident with scattered dead plants or small circular dead patches of a few plants.
- At the base of the stems a white mycelia is produced which ends up as sclerotia ( looks like mouse droppings). Which in turn fall to the ground and germinate into apothecia (looks like little mushrooms) which release spores and cause further spread of infection.
- This disease can infect at any time and usually results in thinning of the stand allowing entry of weeds into the stand and lower feed quality.

### **Winter Crown Rot Snow Mould**

- This disease complex can develop after a deep snow cover arrives when the temperature is around 0 degrees C. The fungus is temperature tolerant and continues to develop at -2 to -3 degrees C. Young plants are rotted at or just below the crown at the tap root area. This greatly weakens the plants in the spring large dead areas are evident with advancing edges and crown heaving.

### **Crown Rot**

- This is a complex of diseases that affect the crown, the center of the crown is destroyed by the fungi leaving a characteristic V shaped groove. This is a progressive disease and works away over the years at destroying plants.

## **Vascular Wilt Diseases**

### **Bacterial Wilt**

- The leaves take on a yellow- green cast, plants are stunted, spindly stems, and distorted leaves. Slicing open a cross section of the stem reveals a yellow-brown ring in the vascular system which indicates the plugging up of conducting tissue resulting in the destruction of the plants ability to move water and nutrients.
- Infections enter via wounds or insect feeding, nematodes, mechanical harvest damage, or winter injury. The symptoms are slow to develop and may not show until 2<sup>nd</sup> or 3<sup>rd</sup> years. The fungus survives in the soil, seed, and plant residue.
- Management consists of crop rotation, resistant cultivars, well drained soils, sanitize harvest equipment, harvest infected fields first, Do not cut when foliage is wet avoids spreading to rest of the field.

### **Fusarium Wilt**

- This is a vascular disease which results in the gradual thinning of the stand, leaves are yellow to bleached colour with a red cast. Wilting of plants on one side may be observed, most often plants die singly or in scattered patches there is no stunting of plant height.
- A transect of the stem shows a red streaking of the stele, or the entire vascular bundle may show a reddish brown discoloration.
- Resistant varieties are the only prevention.

### **Verticillium Wilt**

- This disease can reduce stands by 50% it is most severe with advancing age of the stand. The fungus enters via roots or cut stems. It is spread from older to younger plants by harvest equipment, insects or manure spreading. This disease causes destruction of the vascular system and reduces the plant's ability to move water and nutrients hence causes wilting. Initially only a few

stems show symptoms, leaves become orange- brown and bleached. Leaves curl inward and plants are stunted, stems often stay green. Diseased plants are randomly scattered around the field. Verticillium can survive on broad leaf weeds.

Management:

- Use resistant varieties. Cut healthy stands first then clean equipment. Control weeds and rotate fields usually the disease is not persistent so a <2 year rotation is sufficient.

## **Alfalfa Disease Management**

### **Variety Selection**

- This is the most critical management step. Observe your present fields for diseases and select the traits you need. Yield, winter hardiness, resistance. Select for resistance for Phytophthora on heavy soils, Verticillium, Bacteria Wilt, Anthracnose and Aphanomyces. We need to protect the seedlings and stand longevity this can only be done by resistant varieties.

### **Seed Treatments**

- Seed treatments do provide some protection for phytophthora and pythium by using Apron Seed Treatments.

### **Site Selection**

- Select well drained fields or improve fields by tiling. This eliminates stresses and provides a more ideal root environment to battle root rots.

### **Stress Relief**

- Minimize stresses, provide good fertility levels, correct pH and insect control.
- Limit traffic, especially in the seeding year. Avoid crown damage, reduce entry wounds and reduce soil compaction. Avoid manure applications until 2<sup>nd</sup> or 3<sup>rd</sup> years.

### **Harvest Timing**

- Timely harvest, reduces leaf losses from leaf diseases as well as insects, increases protein content of feed.

### **Crop Rotation**

- Crop rotations, provide a break in the disease cycles. Forages in rotation enhance the yields of other crops, corn can yield an additional 30-40 bushels per acre after alfalfa versus continuous corn.

## 2. Alfalfa Pests

### Forage Insects

#### Alfalfa Weevil

- Alfalfa Weevil is a small Beetle with chewing mouth-parts that feeds on alfalfa leaves. The loss of leaf area is a concern because it is a loss of protein, yield, and stresses plants predisposing them to disease infection. Sprays are seldom needed there is a natural parasite that controls them. However the parasite in 2000 arrived late and the weevil populations grew unchecked. The most effective control is to simply cut early. Cold winters usually control the population. The cool spring delayed the development of the parasitic larvae and put them out of synch with the weevil (maybe). If spray control is necessary Imidan or Guthion insecticides do the job.

#### Potato Leafhopper

- The Potato leafhopper migrates in from the south each year. It has piercing and sucking mouth-parts. The feeding symptoms are a V shaped burn on the tip of alfalfa leaves. The saliva causes the phloem to plug up and nutrients accumulate in the leaves causing a burn or salt damage to occur. Obviously the loss of leaf means loss of feed quality and yield. New seedlings are most susceptible. Crop scouting is necessary to determine threshold damage levels. Sweep nets are used to gather samples and the counts and plant height determine timing of controls.

| Stem Height(inches) | Leafhoppers per sweep net |
|---------------------|---------------------------|
| 3                   | 0.2 adults                |
| 6                   | 0.5 adults                |
| 8-11                | 1.0 adults and nymphs     |
| 12-14               | 2.0 adults and nymphs     |

- Insecticide is Cygon/ Lagon ( dimethoate)
- Resistant varieties help in the control. Hairy leaf surfaces interfere with feeding ability.
- One characteristic as the name implies is the hopping action of the adult as you approach them.

#### Alfalfa Blotch Leafminer

- This seldom a problem it is usually controlled by a parasite introduced in the 1960's.

- The adult is a fly and larva is a maggot which does the feeding damage. The larva feeds between the leaf surface producing a transparent area in the leaves. Once again loss of leaf content means loss of quality and quantity.

#### **Alfalfa Snout Beetle**

- This is a localized pest present in Prescott County and New York State. This beetle can't fly it can only walk therefore is not widespread. Currently hay grown in these areas is under quarantine. The beetle attacks the crowns and is very devastating. Crop rotation is the main control.

### **European Skipper**

- European skipper is a pest of timothy. The adult is a butterfly and the caterpillars that do the damage (chew the leaf blades) are green in colour. Usually not a large problem skippers can be controlled by the insecticide Dipel.
- Controlling pest that destroy leaf area is vital. Loss of leaves means loss of protein, yield and plant vigour. Loss of leaf area lowers photosynthesis and weakens plants leaving them susceptible to plant disease infection.
- Disease infection results in reduced stand longevity and increase feed costs by virtue of lower yield and or poor quality. Lower yields may mean additional purchased feed to make up for shortages as well as increased seed cost because of short stand life and more frequent reseeding.

## **3: Forage Fertility Management**

### **Soil Testing**

- The first step in managing soil fertility is to take a proper soil sample. There is simply no other way to assess fertility and the need for soil amendments. No one can see or feel the soils' ability to provide a balanced level of plant available nutrients or to measure deleterious effects of harmful elements (pH). It is better to plan ahead, then try to take remedial action after the fact.
- Soil testing is indispensable for those growers following Best Management Practices (BMP). Nutrient Management Planning requires the test in order to show Due Diligence in fertilizer and manure applications. When used along with other management information such as field characteristics (drainage etc.) more informed decisions can be made on efficient use of all resources in the farming enterprise.
- We can have confidence in our soil- testing program however it must be realized it is a tool.
- Just like tools of a mechanic they assist and enhance the skills of the person using them. Soil tests are the same, they are information sources, when interpreted properly with common sense the process can yield profitable outcomes.

### **Taking Proper Soil Samples**

- It is vital to collect a sample that is truly representative of the conditions that are to be measured.

- There are some things we can do to assure a representative sample. Take enough cores at least 1 every 2 acres and collect cores in a clean plastic pail represent no more than 25 acres per sample. Collect and mix the cores in the pail then transfer to a proper laboratory supplied sampling container. Avoid using pails from the milk house they may be contaminated by phosphorus based cleaners, as well avoid galvanized pails especially when testing for micronutrients in particular zinc.
- Divide up fields according to management practices, avoid mixing areas that have received manure or fertilizers from those that have not mixing the areas will cause sample results that characterizes neither properly.
- Cover the intended area thoroughly soils are highly variable sampling only a small area could give very misleading information. A sandy knoll could have a pH of 4.9 indicating a need for lime whereas the rest of the field could have a pH of 7.0 and not need lime. If it is not your intention to manage small areas then do a thorough sampling job. On the other hand if you are trouble-shooting production problem areas then by all means sample as separate entities. Click on or Precision Ag Web section for details on site-specific management techniques and services.
- The Ontario Soil Fertility Hand Book Pub 611 is an excellent source of more detailed soil sampling instructions. A copy can be obtained by contacting OMAFRA locally or phoning 1-888-466-2372. Or at [www.gov.on.ca/omafra](http://www.gov.on.ca/omafra).

#### **What Tests are usually Run in The Lab?**

- The basic test analyzes pH, BpH, P K and Mg this is the bare minimum of information necessary to create a fertilizer and lime recommendation. As you see in the lab services directory there are complete tests available to test for calcium, organic matter, CEC, micronutrients and for forages in particular boron.
- Complete test packages measure more of the essential nutrients and leave very little to chance. Depending on your level of risk acceptance, you can choose a basic inexpensive test and assume all other tests are optimum or you can choose a more complete test. By checking the levels of all secondary and micronutrients you can satisfying your risk assessment by measuring and then managing with knowledge based decisions. Soil testing removes the guess-work.

#### **Lime Recommendations**

- The pH of the soil is the most important test on the soil report. A legume such as alfalfa grows best with pH in a range of 7.0 to 8.2. If the soil pH falls below 6.5 we run a buffer pH (BpH). This is on the report and is a test used to measure the need for limestone. Limestone is used to raise the pH to the appropriate level. The best way to explain the relationship of pH and BpH is to draw the analogy of viewing a soil sample as a cup. A low pH of 5.6 is indicating there is acid present in the cup (intensity) the BpH is used to measure the level of acid in the cup (quantity).
- Once we now the quantity we know how much limestone to recommend. The table in 296 is used to make the lime recommendation. To use the table we need to know the target pH (where you would like to raise the pH to) and the BpH to determine the rate.
- There are 2 types of lime calcitic and dolomitic. Calcitic lime is calcium based lime and contains 38-40 % calcium, dolomitic is both calcium and

magnesium based lime usually 20-21% calcium and up to 13% magnesium. When the magnesium soil test falls below 100 ppm choose dolomitic lime it will raise the pH and supply necessary magnesium .

- The additional piece of information on limestone is to know the quality of the product. The Agricultural Index is a measurement that takes into account particle size and neutralizing value. The chart in pub 296 assumes an Ag- Index of 75, you adjust your rate of application based on the Ag- Index of the product you are applying. (Example) if the BpH indicates you need 2 tonnes per ha. of 75 Ag –index lime. The product you are using has an Ag- index of 25 you must adjust the rate to 6 tonnes in order to have the same neutralizing power as 2 tonnes of Ag- index 75 lime. The opposite is also true with a higher index lime you can lower the rate proportionate to the increase in the index.
- The reported levels of P and K and Mg are usually rated as being deficient, low, medium, high, very high or excessive. The values on a soil report should be viewed as an index of a soils’ ability to supply that nutrient to meet desired agronomic performance of a chosen crop. The lower the value the poorer the soils ability to supply that nutrient in an amount and at a rate sufficient to meet the needs. The higher the value the greater the soils ability to supply that nutrient.
- The implications are the lower the value the greater the need for additional fertility and the higher the value the less likely we see an economic response to additional fertility.
- In an Alfalfa crop as long as the P test is less than 40 ppm and potassium less than 250 ppm we will print recommendations. When the soil tests exceed these values the recommendations are zero. The management options are to stop applying fertility and draw down the levels and continue to monitor fertility levels with regular soil sampling. Or to apply nutrients at a rate equal to crop removal and prevent the drop in soil tests and at the same time avoid building levels of P and K to excessive levels. Soil testing once every 3-5 years to track the trends of P and K provides the management information necessary to do Nutrient Management Planning.

### Crop Removal

- Forages and Alfalfa in particular have large appetites for nutrients. Whenever the whole plant is harvested large quantities of phosphorous and potassium are removed from the soil. In the case of legumes two thirds of the nitrogen is fixed in plants by the symbiotic relationship of rhizobia infection (nodules) on alfalfa roots. These nodules convert atmosphere N into plant available amines. The remaining third of the Nitrogen is taken up from the soil as Nitrate Nitrogen by the root system. To maintain stand vigour and resist disease attack the fertility must to be managed effectively.
- In order to manage fertility an appreciation for the quantities of nutrients removed is necessary.

| Crop      | lbs. per(dry) ton harvested |      |     |    |    |
|-----------|-----------------------------|------|-----|----|----|
|           | N                           | P2O5 | K2O | Mg | Ca |
| Alfalfa   | 60                          | 13   | 57  | 5  | 30 |
| Mixed Hay | 44                          | 12   | 46  | 4  | 20 |

|             |    |    |    |   |   |
|-------------|----|----|----|---|---|
| Corn Silage | 25 | 11 | 23 | 2 | 4 |
|-------------|----|----|----|---|---|

- Example: A 5 ton/ ac (dry) of alfalfa would take up and remove 300 lbs. of N, 65 lbs. of P<sub>2</sub>O<sub>5</sub>, and 285 lbs. of K<sub>2</sub>O. The Nitrogen would be mostly supplied by N fixation of the nodules however the P and K are removed from the soil root zone. Depending on soil fertility levels it may be necessary to replace them with an annual application of fertilizer.
- The amount of fertilizer needed is determined as follows.
- The likely source of P would be 0-46-0 or MAP 12-52-0 and Potassium by 0-0-60 Muriate of Potash.
- Using 0-46-0 which is 46% P<sub>2</sub>O<sub>5</sub> we need 65 lbs so divide 65 by 0.46 = 141 lbs
- Muriate of Potash is 60% K<sub>2</sub>O we need 285 lbs. so divide 285 by 0.60 = 475 lbs.
- The total application rate per acre is 141+ 475 = 616 lbs of a blend consisting of triple and potash. Some fertilizer blenders carry only MAP this is also an excellent source of P with a little N, which may be beneficial in promoting P uptake on low P soils.
- The guarantee of this blend would be 0-10-46.
- One metric tonne would consist of 220 kg of triple and 780 kg of Muriate of Potash.
- Manure from livestock operations is an another source of fertility that must be managed. This author, suggest not applying manure to 1<sup>st</sup> year stands of alfalfa. New stands need a period to grow and establish deep roots. Avoiding as much wheel traffic as possible in the 1<sup>st</sup> year lessens compaction and injury wounds on crowns these actions help to resist disease establishment in the second and later years by reducing early stresses. As the stand ages and grass takes over then manure can be used more effectively.

### Manure as Fertilizer

- A liquid dairy manure although highly variable farm to farm may contain 13 lbs of N, 5 lbs. of P<sub>2</sub>O<sub>5</sub> and 23 lbs of K<sub>2</sub>O per 1000 gallons. It is recommended to test manure from your own operations and use those values. To match the removal of potash in the previous example would require an application of 13,000 gallons per acre (best applied twice at 6500 gallons each time). This rate also supplies 65 lbs of P<sub>2</sub>O<sub>5</sub> and 169 of N. With the exception of the nitrogen this rate matches the P and K needs of this yield level. This is one on the minor draw- backs of manure, it is not a balanced package of nutrients. Nonetheless it is every bit as good as fertilizer in supplying the essential nutrients of P and K. This kind of consideration for the nutrient content of manure is vital for proper due diligence of overall nutrient management of a farm enterprise. Soil testing, manure testing and planning the nutrient needs are the basics of a BMP for maximizing nutrient efficiency and minimizing environmental impact.