2017
Cornell Guide for Integrated Field Crop Management

Cornell University
Cooperative Extension

These guidelines are not a substitute for pesticide labeling. Always read and understand the product label before using any pesticide.

2 GENERAL INFORMATION FOR CROP PRODUCTION *(continued)*

3 CORN GUIDELINES *(continued)*

4 FORAGE CROPS GUIDELINES *(continued)*

6 SOYBEAN GUIDELINES *(continued)*

1 Pesticide Information

1.1 Pesticide Classification and Certification

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) created two classifications of pesticides – general-use and restricted-use. **General-use pesticides** may be purchased and used by anyone. **Restricted-use pesticides can** only be purchased by a certified applicator. Restricted-use pesticides must be also be used by a certified applicator or someone under their supervision.

The same federal law that classifies pesticides divided applicators into two groups: private and commercial. **Private applicators** use or supervise the use of pesticides to produce agricultural commodities or forest crops on land owned or rented by the private applicator or their employer. A farmer must be certified as a private applicator in order to purchase and use restricted-use pesticides on agricultural commodities. (No certification is needed if a farmer does not use restricted-use pesticides.)

A **commercial applicator** uses or supervises the use of pesticides for any purpose or on any property not covered by the private applicator classification. In New York, a commercial applicator must be certified to purchase or use any pesticide whether it is general- or restricted-use.

More information about pesticide certification and classification is available from your Cornell Cooperative Extension office (cce.cornell.edu/learnAbout/Pages/Local_Offices.aspx), regional NYSDEC pesticide specialist (www.dec.ny.gov/about/558.html), the Pesticide Applicator Training Manuals (store.cornell.edu/c-876-manuals.aspx), or the Pesticide Management Education Program (PMEP) at Cornell University (psep.cce.cornell.edu).

1.2 Use Pesticides Safely

Using pesticides imparts a great responsibility on the user to be a good steward of their health and that of others. Keep in mind that there is more to “pesticide use” than the application. Pesticide use includes mixing, loading, transporting, storing, or handling pesticides after the manufacturer’s seal is broken; cleaning pesticide application equipment; and preparation of a container for disposal. All of these activities require thoughtful planning and preparation. They are also regulated by state and federal laws and regulations intended to protect the user, the community, and the environment from any adverse effects pesticides may cause.

1.2.1 Plan Ahead

Many safety precautions should be taken *before* you actually begin using pesticides. Too many pesticide applicators are dangerously and needlessly exposed to pesticides while they are preparing to apply them. Most pesticide accidents can be prevented with informed and careful practices. **Always read the label on the pesticide container before you begin to use the pesticide.** Make sure you understand and can follow all directions and precautions on the label. Be prepared to handle an emergency exposure or spill. Know the first aid procedures for the pesticides you use.

1.2.2 Move Pesticides Safely

Carelessness in transporting pesticides can result in broken containers, spills, and contamination of people and the environment. Once pesticides are in your possession, you are responsible for safely transporting them. Accidents can occur even when transporting materials a short distance. You are responsible for a pesticide accident so take every effort to transport pesticides safely. Be prepared for an emergency.

1.2.3 Personal Protective Equipment and Engineering Controls

Personal protective equipment needs depend on the pesticide being handled. **Required personal protective equipment (PPE) are listed on pesticide labels.** These requirements are based on the pesticide’s toxicity, route(s) of exposure, and formulation. Label PPE requirements are the minimum that must be worn during the pesticide’s use. Pesticide users can always wear more protection than the label requires.

The choice of protective equipment depends on the activity, environment, and handler. The type and duration of the activity, where pesticides are being used, and exposure of the handler influences the equipment you should use. Mixing/loading procedures often require extra precautions. Studies show you are at a greater risk of accidental poisoning when handling pesticide concentrates. Pouring concentrated pesticide from one container to another is the most hazardous activity. More information on personal protective equipment can be found online at umes.edu/NC170/Default.aspx?id= 7184.

Engineering controls are devices that help prevent accidents and reduce a pesticide user’s exposure. One example is a closed mixing/loading system that reduces the risk of exposure when dispensing concentrated pesticides. More information on engineering controls can be found online at umes.edu/NC170/Default.aspx?id=7196.

1.2.4 Avoid Drift, Runoff, and Spills

Pesticides that move out of the target area can injure people, damage crops, and harm the environment. Choose weather conditions, pesticides, application equipment, pressure, droplet size, formulations, and adjuvants that

2 General Information for Crop Production

2.1 Introduction

This publication includes the most up-to-date information on growing field crops in New York, drawn from Cornell research, extension demonstrations, and on-farm experience. It has been designed as a practical guide for farmers, for merchants who provide sales and services to producers, and for others who advise them. Our aim is to supply the best information available to help those who make management decisions. We do not consider this a cookbook but rather a source of practical information to use in the development of sound planning and good management.

In any statewide publication, we must deal with a spectrum of crop environments; information and guidelines must cover general farm situations. Though we have tried to make these as specific as possible for various conditions in New York, each farmer must determine how these varieties and practices will work on his or her farm. The information in this publication should be considered general rules. Additional information is available in the publication **Cornell Field Crops and Soils Handbook**, revised in 1987 and available through Cornell Cooperative Extension offices or directly from the Section of Soil and Crop Sciences at Cornell, 607-255-2177. For further information on any topic in this booklet, you may contact your local Cornell Cooperative Extension office or write to the Section of Soil and Crop Sciences Extension Office, 237 Emerson Hall, Cornell University, Ithaca, NY 14853.

2.2 New York State Climate

2.2.1 Growing Degree Days for Corn and Soybeans

Crop plants require heat from their atmospheric environment to develop, grow, and mature. The effect of this heat is cumulative as the growing plant progresses through its life cycle.

Temperature is an indirect measure of the heat available in the atmosphere. Heat sufficient to cause growth and development in a plant is indicated when the daily mean temperature warms to a certain level, called the base or threshold temperature. Below (cooler than) this level there is essentially no growth. Different species of crop plants have different base temperatures. Corn and soybeans have a base temperature of 50°F.

The growing degree day—sometimes called a heat unit—has become a useful indirect measure of the heat available for growth and development of corn and soybeans. In the 86/50 method it is assumed that for corn and soybeans, growth increases linearly from 50°F to 86°F, at which peak growth occurs, and growth remains at peak for temperatures above 86°F. The maximum temperature for the day is set at an upper limit of 86°F, and the minimum temperature is set at the lower limit of 50º F. On each day of the growing season the crop receives a number of growing degree days equal to the number of degrees that the daily adjusted mean temperature is higher (warmer) than the 50°F base temperature. Growing degree days are then accumulated each day as the crop progresses toward maturity.

To calculate the daily growing degree days for your farm, first, determine the adjusted mean air temperature for each 24-hour day during the growing season. For a day with a high temperature of 60ºF and a low of 40ºF, for example, the low temperature would be set at the lower limit of 50ºF. The adjusted mean temperature for the day would be 55ºF. Subtracting 50ºF, the base temperature for corn and soybeans, from the mean temperature gives 5 growing degree days for that day. If, on the other hand, the high temperature for a given day is 90ºF and the low is 66ºF, the high temperature would be set at the upper limit of 86ºF. The adjusted mean temperature for the day would be 76ºF. Subtracting 50ºF, the base temperature for corn and soybeans, from the mean temperature gives 26 growing degree days for that day. On any day that the adjusted mean temperature is 50ºF or colder, the number of growing degree days is recorded as zero.

Records are kept for each day of the growing season, from the first frost-free day in the spring through the last frost-free day in the fall. By adding together the growing degree days supplied each day, the accumulated total for the frost-free growing season is determined.

The distribution of average accumulative growing degree days in New York State is presented in Figure 2.2.1. These data, applying to the freeze-free season, were determined from temperature records kept by numerous weather stations around the state during a 30-year period ending in 1980.

2.2.1.1 How to Use Growing Degree Days

Early corn hybrids and short-season soybean varieties need fewer growing degree days than late corn hybrids and long-season soybean varieties to grow and mature.

Use the map (Figure 2.2.l) to determine the growing degree days available for corn and soybean growth in your locality. You can then choose corn hybrids and soybean varieties suited to your vicinity from the groups listed in sections 3.2: Corn-Hybrid Selection and 6.1: Soybean Varieties. You may need to make adjustments to fit local differences in elevation or frost susceptibility.

2.12.1 Lime Rate Table

In 2009, after careful evaluation, the Cornell Nutrient Analysis Laboratory (CNAL) changed chemistry used to determine a lime recommendation from exchangeable acidity to the modified Mehlich buffer. This switch simultaneously eliminated a chemical waste stream and increased laboratory efficiency.

To increase the soil pH to the desired levels, use the modified Mehlich buffer pH listed on the soil test report and the lime guidelines from Tables 2.12.2 and 2.12.3. The process of determining a lime recommendation involves five simple steps:

Step 1: Determine the desired and minimum rotation pH:
A rotation is defined as a 6-year crop sequence (3 years past, 3 years ahead). The desired pH for common field crops grown in New York State is shown in Table 2.12.1. The crop with the highest desired pH will determine the desired/target pH for the entire rotation. For example, for a three year corn and three year alfalfa/grass rotation, the crop with the highest desired pH is alfalfa/grass and, as a result, the desired pH for the rotation is 7.0.

Step 2: Determine if lime is needed:
No lime is recommended if the soil pH is above the desired pH. No lime is recommended if the soil pH is below the desired pH but above the minimum pH as applications would not be economical (but test the soil again in 2-3 years). If the soil pH is lower than the minimum rotation pH, go to step 3.

Step 3: Determine the lime rate:
If the soil pH is less than the minimum rotation pH, the recommended lime rate can be read from Table 2.12.2 using the soil's buffer pH and the desired rotation pH (note: soil pH will tell you if lime is needed; buffer pH tells you how much is needed). For example, if the buffer pH is 5.5 and desired rotation pH is 6.5, 4.5 tons/acre lime is recommended. Lime rates in Table 2.12.2 assume liming material with 100% Effective Neutralizing Value (ENV) and actual lime rates need to be converted in accordance with step 5.

Step 4: Adjust rates for tillage depth.
The recommendations listed in Table 2.12.2 assume a 6 to 7 inch tillage depth. For an 8-inch tillage depth, multiply the rates listed in Table 2.12.2 by 1.33. For a 10+ inch tillage depth, multiply the rate listed in Table 2.12.2 by 1.67.

Step 5: Adjust rates for lime source characteristics (%ENV).
The recommendations listed in Table 2.12.2 are on a 100% ENV basis. To adjust for specific materials, divide the recommended lime rate by the percent ENV reported for the lime source. For example, if the recommended lime rate is 4.5 tons/acre and the lime source available is 75% ENV, 4.5 / 0.75 = 6 tons of this liming material should be applied per acre. This is explained in more detail in Agronomy Fact Sheet #7 (Liming Materials).

Table 2.12.1. Minimum and desired pH for common field crops in New York State.

Crops	Cornell Crop Codes	Desired pH	Minimum pH
Alfalfa, Alfalfa/grass, Alfalfa/trefoil	ABE, ABT, AGE, AGT, ALE, ALT	7.0	6.7
Soybeans	SOY	7.0	6.7
Birdsfoot trefoil	BCE, BCT, BGE, BGT, BSE, BST, BTE, BTT	6.5	6.4
Barley	BSP, BSS	6.5	6.4
Wheat	WHT	6.5	6.4
Triticale	TRP	6.5	6.4
Sunflower	SUN	6.5	6.4
Buckwheat	BUK	6.2	6.0
Clover	CGE, CGT, CLE, CLT, CSE, CST	6.2	6.0
Corn	COS, COG	6.2	6.0
Crownvetch	CVE, CVT	6.2	6.0
Grass	GIE, GIT, GRE, GRT	6.2	6.0
Pasture	PGE, PGT, PIE, PIT, PLE, PLT, PNE, PNT	6.2	6.0
Rye	RYC, RYS	6.2	6.0
Millet	MIL	6.2	6.0
Oats	OAS, OAT	6.2	6.0
Sorghum, sorghum sudangrass	SOF, FOG, SSH, SUD	6.2	6.0
Wheat with legume	WHS	6.2	6.0

Table 2.12.2. Lime recommendations for soil with a pH less than the minimum pH for the rotation.

Modified Mehlich Buffer pH	Desired rotation pH (minimum pH)			
	7.0 (6.7)	6.8 (6.6)	6.5 (6.4)	6.2 (6.0)
	tons/acre (100%ENV)			
5.0	11.0	10.0	8.5	6.5
5.1	10.0	9.0	7.5	6.0
5.2	9.0	8.0	7.0	5.5
5.3	8.0	7.5	6.0	5.0

Table continues on next page.

3 Corn Guidelines

High-yielding corn requires moderately well-drained or well-drained soil with a pH above 6.0 as well as timely and skillful management practices. Management practices to consider carefully include planting techniques, hybrid selection, fertilization, and control of insects, weeds, and diseases. Correct management of all these practices is essential for maximum economic yield.

3.1 Planting Techniques

Early planting usually, but not always, results in maximum corn yields. Under central and western New York conditions, corn planted in late April or early May typically out yields either grain or silage corn planted after mid-May (Figure 3.1.1). Early-planted corn also matures earlier, resulting in lower moisture and grain drying costs at harvest, and lodges less. A general guideline for the best time to begin planting corn is about 10 days before the average date of the last 32°F temperature in the spring. If soil conditions are too wet at this time, wait until soil conditions improve. Corn planted in late May under dry soil conditions will consistently out yield corn planted in late April under wet soil conditions. Conversely, if it is warm and dry any time after April 15th in central/western NY, corn growers should be ready to begin planting. Modern corn hybrids tolerate cold soil conditions and seed treatments protect corn from soil pest problems under extended emergence time due to cold soil temperatures. Planting depths of about 1.5 inches for silty clay or clay loam soils and 1.75 to 2.0 inches for silt loam and gravelly loam soils are recommended for April or early May-planted corn. Planting depths of about 1.75 to 2.0 inches for silty clay or clay loam soils and 2.0 to 2.5 inches for silt loam and gravelly loam soils are recommended for most planting dates in May. If soil conditions are dry in the top 2 inches in late May and early June, corn can be safely planted to a depth of 3 inches on silt loam and gravelly loam soils.

To achieve the full yield potential of an early planting date, full-season hybrids (hybrids that match the growing degree days in a region) are necessary (Figure 3.1.1). After the first or second week of May, however, the yield advantage of full-season vs. medium-season hybrids decreases when planted for grain. Furthermore, full-season hybrids may not mature, resulting in low test weight, and/or will have high grain moisture at harvest, if planted after the second week of May. Therefore, for grain production, full-season hybrids should be planted only in late April or during the first 2 weeks of May. For silage production, full-season hybrids can be planted until about May 20. Growers should not plant more than 30% of their crop to full-season hybrids. The majority of corn acreage (~60%) should be planted to medium-season hybrids (100 and 200 growing degree days less than the growing degree days in a region for silage and grain, respectively). If planting must be delayed until early June, early-season hybrids (300-400 growing degree days less than the growing degree days in a region for silage and grain, respectively) are recommended.

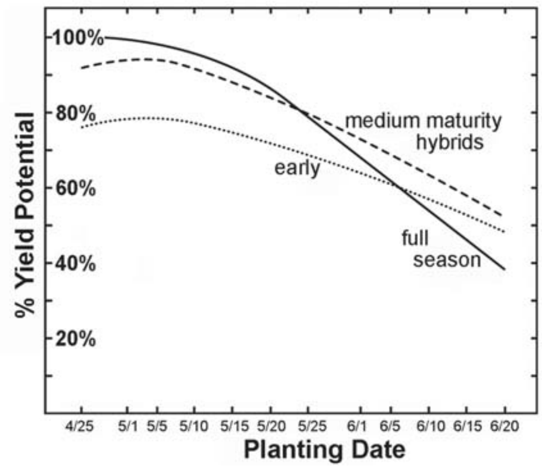


Figure 3.1.1. Effect of planting date on grain yields.

The optimal corn population depends on soil type, hybrid selection, and crop use. For many New York soils (well-to moderately well-drained to somewhat poorly drained silt or clay loams), numerous Cornell experiments have shown that modern hybrids still require a harvest population of only 26,000 to 28,000 plants per acre for maximum economic grain yields (Table 3.1.1). Droughty soils, however, cannot support high populations, and plant populations should be adjusted downward (Table 3.1.1). Likewise, hybrids differ in their response to plant populations, so hybrid selection should influence whether the harvest population is at the high or low end of the recommended range for each particular soil condition (Table 3.1.1). Also, most hybrids require higher harvest populations for silage than for grain production, about 5,000 more plants per acre (Table 3.1.1).

Planting date, tillage practices, pest problems, planter performance, and hybrid selection influence actual corn populations obtained in the field. To compensate for potential problems, it should be assumed that only 90 percent of the kernels planted actually emerge and survive to become harvestable plants in the fall. To obtain 27,000 plants per acre at harvest on a moderately well-drained silt-loam soil, the planting rate should be about 30,000 plants per acre (27,000 divided by 0.90). In some situations such as a no-till situation or an April planting date, it should be assumed that only 85 percent of the kernels will emerge and survive. The planting rate in these situations on a moderately well-drained silt-loam soil should be about 31,765 plants per acre (27,000 divided by 0.85).

is low, the product may be labeled only for supplementary disease control on seed previously treated with a fungicide.

3.5.2 Selection of Disease-Resistant Varieties

Resistance to several diseases common to New York State is often incorporated in modern hybrids. Because no hybrid is resistant to all diseases and the importance and prevalence of diseases vary over time and location, it is important to keep up to date on what diseases are currently causing problems in your area. Even a moderate level of resistance is enough to prevent losses to certain diseases; other diseases warrant the highest level of resistance available. Hybrids can also be selected for tolerance - the ability to produce acceptable yields even though symptoms develop. Your seed dealer can help you select hybrids that have appropriate levels of resistance or tolerance to specific diseases.

All New York hybrids should possess good standability. Strong stalk rind characteristics may be as important as, or more important than, resistance to internal stalk-rotting organisms, although hybrids do vary in stalk-rot resistance. Gibberella stalk rot is endemic in New York and harvest losses occur annually, especially in fields that are otherwise stressed. Anthracnose stalk rot can be severe in certain seasons, especially in fields heavily infested with European corn borer.

Although heavy losses are rare, leaf blight epidemics are potentially devastating if they develop during or before the first four weeks after pollination. In addition to directly reducing grain yields, leaf blights can predispose corn plants to stalk rots. Resistance to debris-associated diseases, such as anthracnose leaf blight, eyespot, and gray leaf spot, is most important for hybrids being sown into or near infested corn debris, as in no-till corn production.

Two leaf diseases (northern leaf blight and northern leaf spot) can threaten corn yields even at a considerable distance from infested corn debris. This is because the spores of the causal fungi can be dispersed long distances by high air currents.

Traditionally, hybrid resistance to foliar fungal diseases has been based on single genes that condition strong resistance to the predominant fungal races. The hybrids are susceptible, however, to new races of these highly variable fungi, which occasionally appear. Corn hybrids are now available with partial resistance effective against all races of a pathogen. These hybrids avoid serious losses by slowing down the rate of epidemic development within the crop.

Diseases such as common smut and common rust are relatively minor problems today because most modern field corn hybrids have been selected for resistance to them. They could become severe again, however, if we don’t continue to grow resistant hybrids.

3.5.3 Sound Crop Management

Management decisions throughout the season can affect the prevalence of corn diseases. Attention to the following is important:

Cropping sequence. Because many diseases of corn are perpetuated by contaminated crop debris, the practice of continuously planting corn on the same land is discouraged. This applies particularly to reduced-tillage culture. Debris-borne diseases that can build up in systems of corn monoculture include northern leaf blight, northern leaf spot, eyespot, gray leaf spot, and anthracnose.

Selection of planting site. Avoiding poorly drained soils can help reduce stand losses caused by seed rots and seedling blights. Likewise, if a farmer has a choice, it is good policy not to plant corn in low-lying, shaded fields with poor air drainage and constantly high relative humidity. These conditions allow serious development of leaf diseases.

Seedbed preparation. Important considerations include thorough incorporation of previous crop debris, especially if corn follows corn and diseases have been serious. Correct soil pH (6.0 or above) and fertilizing according to soil test results will help plants withstand several diseases such as stalk rot, common smut, and leaf blights. Balanced fertility is the key; in particular, avoid too much nitrogen and too little potassium.

Date of planting. From the standpoint of disease control, early planting is recommended unless soils are excessively cold and wet. Grain that is thoroughly mature at harvest is least likely to become moldy.

Plant population. Dense stands can increase stalk rot, particularly if nitrogen fertilization is excessive. Where fields have a history of stalk rot, it may be advisable to reduce plant populations from those of previous years.

Varietal maturity. The tendency in New York is to select early-maturing hybrids. Provided they are harvested promptly after maturity and are not allowed to stand until late fall, early hybrids alleviate ear rots associated with immature grain and early frost. But remember that stalk rot will be more severe if mature corn is allowed to stand for too long in the field.

3.5.4 Foliar Fungicide Application

A rather new practice in the Northeast is the application of foliar fungicides at late vegetative stages through kernel blister stage (R2) to control foliar fungal diseases, in particular gray leaf spot and northern leaf blight, on the upper leaves during grain filling. The primary fungicides being applied in New York are products that combine a strobilurin and a triazole fungicide. The cost of product plus application is currently in the range of $35 to $45 per acre. There are no firm disease thresholds to guide fungicide

Table 3.7.3. Chemical weed control in corn.

Weed Situation	Amount of Product(s) per Acre	Remarks and Limitations
Conventional corn hybrids		
PRE Programs Annual grass and broadleaf weeds	2.3 qt. *†Harness Xtra **or** 2.3 qt. *†Keystone LA NXT	**GROUP 5 and 15 HERBICIDES•** Apply preemergence or early postemergence. If used postemergence, apply prior to the 2-leaf grass stage and before corn is 11 in. tall. *†Harness Xtra and *†Keystone LA NXT, and other acetochlor products are **not** for use in Nassau and Suffolk Counties. See label for special groundwater protection requirements.
	10-18 fl oz *†Verdict	**GROUP 14 and 15 HERBICIDES•** Apply prior to crop emergence. Application after emergence will cause crop injury. A postemergence treatment may be required for full-season weed control. Note that rates vary depending on soil texture. *†Verdict is **not** for use in Nassau and Suffolk Counties.
	1.5 qt. *†Bicep Lite II Magnum **or** 1.5 qt. *†Cinch ATZ Lite	**GROUP 5 and 15 HERBICIDES• Apply preemergence** or early postemergence to corn up to 5 in. tall. A lower rate of *†Bicep Lite II Magnum **or** *†Cinch ATZ Lite should be used on sandy and/or low organic matter soils. *†Bicep Lite II Magnum **and** *†Cinch ATZ Lite are **not** for use in Nassau and Suffolk Counties.
	1.5 qt. *†Bicep Lite II Magnum **or** 1.5 qt. *†Cinch ATZ Lite + 1 qt. *†Princep 4L	**GROUP 5 and 15 HERBICIDES•** Preemergence only. Use with heavy infestations of crabgrass or fall panicum. *Atrazine and (or) *†Princep carryover may injure triazine-sensitive rotational crops. *†Bicep Lite II Magnum **and** *†Cinch ATZ Lite are **not** for use in Nassau and Suffolk Counties.
	2.7-3.25 qt. *†Lumax EZ	**GROUP 5, 15 and 27 HERBICIDES• Apply preemergence** or early postemergence before corn reaches 5 in. in height. Use the lower rate if soil organic matter content is less than 3 percent and the higher rate if soil organic matter content is 3 percent or greater. The addition of 1 pt./A of *atrazine will improve common ragweed control. *†Lumax EZ is **not** for use in Nassau and Suffolk Counties.
	3.0-3.5 qt. *†Lexar EZ	**GROUP 5, 15, AND 27 HERBICIDES• Apply preemergence** or early postemergence before corn reaches 12 in. in height. Use 3 qt./A if soil organic matter is less than 3% and 3.5 qt./A if soil organic matter is 3% or greater. *†Lexar EZ provides twice as much *atrazine/A as *†Lumax EZ (see Table 3.7.6 for the amount of *atrazine at labeled rates of each product). This additional *atrazine should improve common ragweed control. *†Lexar EZ is **not** for use in Nassau and Suffolk Counties.
	3 pt. Prowl H2O **or** 3.6 pt. Prowl 3.3 EC + 1 qt. *†Atrazine 4L[1]	**GROUP 3 and 5 HERBICIDES•** Apply preemergence. Prowl should not be applied preplant incorporated for corn. Plant corn at least 1 1/2 in. deep in fields with adequate seedbed preparation to provide good coverage of the corn seed. Good choice if velvetleaf or triazine-resistant lambsquarters are problems.
POST Programs Emerged annual grass and broadleaf weeds	1.5 oz. Steadfast Q + 4 fl. oz. Banvel **or** 4 fl. oz. Clarity **or** 4 fl. oz. DiFlexx	**GROUP 2 and 4 HERBICIDES•** Apply early postemergence with crop oil concentrate **or** nonionic surfactant **and** ammonium nitrogen fertilizer to hybrids with a relative maturity (RM) rating of 77 days or more. For best results, apply when annual weeds are 1-2 in. tall and before corn is 12 in. tall. A good choice if foxtails or fall panicum and annual broadleaf weeds have emerged. Not very effective against crabgrass. Rotational interval is 10 months or longer (depending on soil pH) for alfalfa, clovers, and several other crops. Do **not** apply Steadfast Q if corn was treated with Counter 15G (any application method).

Table continues on next page.

4 Forage Crops Guidelines

4.1 Forage Varieties

4.1.1 Alfalfa

Often called the queen of the forages, alfalfa tops all other perennial forage crops as a producer of homegrown feed. High-yielding and versatile, alfalfa serves well for hay, silage, green chop, and pasture. It produces high-protein and palatable feed, which livestock like and do well on. Alfalfa also fills an important role in crop rotations, improving soil structure and building soil fertility for future grass and grain crops.

Alfalfa is a deep-rooted, drought-tolerant crop that does best on deep, well-drained soils. Alfalfa also needs a well-limed soil; it gives top performance on soils with pH levels of 6.5 or higher. It does poorly on acidic soils, and soil acidity is often noted as the major limiting factor on alfalfa growth in New York. Acidic soils must be limed to a pH of 6.5 or higher to maintain high-yielding alfalfa stands.

On well-drained soils, alfalfa can produce high yields for many years, but it will yield poorly and die soon on poorly drained soils. Tile and other drainage aids can improve the soil's ability to grow good alfalfa. Trefoil and red clover offer better choices for good production on sites with poor or spotty drainage patterns.

Alfalfa seedlings need phosphorus and potassium at planting time. Older stands need topdressing to maintain high yields. An ample fertility program provides nutrients for recovery after harvest, good winter survival, and high yields. Phosphorus and potassium are musts, but nitrogen rarely, if ever, pays on alfalfa because nitrogen-fixing bacteria in root nodules can provide enough nitrogen for top yields. For details on fertilizer suggestions, see Table 4.6.1.

Insect pests cause sporadic damage in alfalfa, varying with season and locality. Potato leafhopper feeding can lower second-cut yields in some years. The alfalfa weevil and blotch leaf miner, formerly serious, are now largely controlled through introduced insect parasites and predators. The alfalfa snout beetle can cause severe damage in the several counties where it occurs. Check control guidelines in the section "Management of Insects in Forage Crops (section 4.10)."

New York alfalfa trials test yield of new varieties (Table 4.1.1). Modern alfalfa varieties have been bred for resistance to one or more of five diseases that can thin alfalfa stands in New York. These diseases include **bacterial wilt**, caused by bacteria present in most New York alfalfa soils; **Verticillium wilt**, a soilborne disease that can kill susceptible plants in their second or third year; **Phytophthora** root rot, caused by a soilborne water mold often found in wet areas of fields; **anthracnose**, found in warmer areas of the state, particularly the Hudson Valley; and **Fusarium wilt**, common in New York soils and may occur but is not documented as a widespread problem in New York. Phytophthora hits hardest in the seedling year, and the other diseases affect mature stands in their second and third years of production.

Check Table 4.1.3 for variety reactions to these specific diseases as well as for yield and fall dormancy data. Choose varieties that are listed as R (resistant) or HR (highly resistant) for diseases found in your area. Both Aphanomyces root rot and pea aphid occur here but the value of varietal resistance may not be established for these and some other pests.

Several varieties have been developed at Cornell for specific adaptation to New York State conditions. These include ReGen, Ezra, N-R-Gee, Seedway 9558 SBR (selected for resistance to alfalfa snout beetle) and SW315LH (selected for resistance to potato leafhoppers).

Improved feeding value has been a goal of alfalfa breeders for years. Several recent varieties have been released with claims of improved feeding quality. Our tests show that minor differences in feeding quality do exist. However, effects on milk production have yet to be established. Timely cutting and leaf-saving harvest practices are far more important in affecting forage quality than leaf or plant type. Choose varieties with strong disease resistance and high yield potential that are well adapted to your farm and needs. Optimal yield and forage quality is at the one-tenth bloom stage.

New leafhopper-resistant varieties are available that have improved resistance and agronomic characteristics (see Table 4.1.2). Resistance comes from fine hairs on stems and leaves, and results in significantly lower numbers of hoppers in resistant alfalfa stands compared to conventional alfalfa. Resistant varieties will surpass other strains when leafhopper pressure is heavy. Spraying in the seeding year may still pay under heavy hopper pressure.

4.1.2 Birdsfoot Trefoil

Birdsfoot trefoil is a long-lived legume with high yield potential on slightly acidic soils with drainage less than the best for alfalfa. Trefoil also does well as perennial forage on hard-to-plow meadows and pastures. Trefoil is bloat free, and no case of bloat has ever been recorded in animals grazing on trefoil. On fields where drainage is a problem, trefoil can out yield alfalfa and outlive red clover by many years. Birdsfoot trefoil should be planted with a perennial forage grass and at harvest time, leave 5 to 6 inches of stubble to allow for regrowth of the trefoil. Birdsfoot trefoil varieties that are being tested in Cornell yield trials are listed in Table 4.1.4.

PARDEE birdsfoot trefoil is a vigorous, upright, hay-type variety. It resists the Fusarium wilt disease that often kills trefoil in New York meadows and pastures. Pardee flowers

Table 4.1.1. Yields of alfalfa cultivars in trials planted in New York State each year from 2012 to 2014.

T/A = tons per acre dry matter *LSD(.05)* = least statistically significant difference. To claim statistically significant yield differences between two cultivars, the yield difference must be equal to or greater than the LSD. *Oneida VR, 5312, and Vernal* are cultivars planted in every alfalfa trial. Results are expressed as yields that are percentages of the average yield of the three check cultivars in each trial..

Ithaca, Tompkins County, Sown May 2012

Cultivars	2015 Total	3-Yr Total Season	% of Cks.
	- tons per acre dry matter -		
55V50	6.06	19.42	135
MAGNITUDE	5.95	18.11	126
GEMSTONE	5.92	17.90	124
MARINER IV	5.47	17.89	124
REGEN	5.32	17.62	122
EZRA	5.35	17.22	120
LEGACY 449APH2	5.32	17.20	119
MASKA	5.28	17.15	119
BRADOR	4.71	15.80	110
N-R-GEE	4.73	15.68	109
55H94	4.60	15.44	107
5312	4.22	14.88	103
ONEIDA VR	4.06	14.40	100
VERNAL	3.86	13.94	97
Mean	*5.40*	*17.42*	*Ck. Mean*
5% LSD	*0.34*	*0.76*	*14.41*
CV (%)	*5.1*	*3.5*	
Alfalfa Entered as Experimental in Ithaca 2012			
PERSIST III	6.27	19.47	135
DSC02-T*	5.94	19.41	135
MAGNUM 7-WET*	6.02	19.32	134
CRAVE*	5.92	19.04	132
DSC04-BR*	5.98	18.92	131
DSC01-T*	5.93	18.89	131
DSC03-BR*	6.00	18.88	131
PGI 529*	6.09	18.58	129
DSC06-M*	5.83	18.57	129
505004*	5.77	18.46	128
DSC05-BR*	5.49	18.23	127
FG 48A177*	6.03	17.93	124
MAGNUM 7*	5.58	17.83	124
Seedway 9558 SBR*	5.09	16.91	117

Chazy, Clinton County, Sown June 2012

Winterkilled in 2015
Not harvested in 2015

Cultivars	2014 Total	2-Yr Total Season	% of Cks.
	- tons per acre dry matter -		
55V50	5.74	11.51	111
PHIRST EXTRA	5.42	11.35	110
PERSIST II	5.56	11.25	109
PGI 557	5.54	11.24	109
ARCHER III	5.52	11.21	108
WL 354HQ	5.49	11.15	108
PROLIFIC II	5.46	11.15	108

Table continued in next column.

Chazy, Clinton County, Sown June 2012 *(continued)*

Winterkilled in 2015
Not harvested in 2015

Cultivars	2014 Tota	2-Yr Total Season	% of Cks.
	- tons per acre dry matter -		
REBOUND 6.0	5.51	11.00	106
GUNNER	5.47	10.99	106
PGI 215	5.32	10.89	105
DG 4210	5.30	10.83	105
VERNAL	5.14	10.44	101
ONEIDA VR	5.01	10.42	101
5312	4.87	10.18	98
Mean	*5.38*	*10.97*	*Ck. Mean*
5% LSD	*0.53*	*0.88*	*10.35*
CV (%)	*7.8*	*6.4*	
Alfalfa Entered as Experimental in Chazy 2012			
msSunstra-B12*	5.87	12.32	119
HYBRIFORCE 3400*	5.73	12.12	117
SENECA*	5.79	12.01	116
5010*	5.34	10.67	103
Seedway 9558 SBR*	5.14	10.60	102
FG 45A119*	5.33	10.56	102

Cobleskill, Schoharie County, Sown June 2012

Cultivars	2015 Total	3-Yr Total Season	% of Cks.
	- tons per acre dry matter -		
MARINER IV	6.31	20.36	117
55V50	6.35	20.00	115
MASKA	6.37	19.78	113
GEMSTONE	6.44	19.75	113
MAGNITUDE	6.26	19.43	111
BRADOR	5.99	19.08	109
REGEN	5.87	18.94	109
EZRA	5.83	18.90	108
N-R-GEE	5.92	18.41	106
55H94	5.95	18.33	105
5312	5.82	18.30	105
ONEIDA VR	5.67	17.79	102
VERNAL	5.28	16.23	93
Mean	*6.19*	*19.45*	*Ck. Mean*
5% LSD	*0.45*	*1.02*	*17.44*
CV (%)	*5.8*	*4.1*	

5 Small Grain Crops Guidelines

Small grains, which include winter and spring wheat, winter and spring barley, oats, and rye, play an important role in crop rotations on many New York farms. Under good soil conditions and management practices, small grains can produce profitable yields of grain for the cash market or farm feeding. Equally important is the value of the straw crop.

Oats and rye tolerate acid or poorly drained soils better than wheat or barley does. Nevertheless, maximum yields of both crops are attained on moderately well-drained or well-drained soils with a pH above 5.8. For maximum wheat production, wheat must be cropped on moderately well-drained or well-drained soils with a pH above 6.0. Barley requires well-drained soils with a pH above 6.3, the same as needed for alfalfa production.

5.1 Planting Techniques

5.1.1 Winter Grains

Winter wheat should be planted with a grain drill to a depth of 1 to 1-1/2 inches during the couple of weeks after the Hessian fly-free date. The optimal planting is thus from mid-September until early October in most regions of winter wheat production. Depending upon the fall or winter conditions, wheat can be successfully planted until early November but at a lower yield potential. Soft white winter wheat has a broad optimum seeding rate range and rates of about 120 pounds or 2 bushels per acre usually result in the highest grain and straw yields. If planting is delayed beyond early October, the optimal rate is 150 pounds or 2-1/2 bushels per acre. Soft red winter wheat also has a broad optimum seeding rate range and rates between 1,000,000 and 1,300,000 seeds per acre result in highest grain yields when planted in September and about 1,500,000 seeds/acre for highest straw yields. If planting is delayed after mid-October, soft red winter wheat should be seeded at rates of 1,500,000 seeds for acre if just for grain and 1,800,000 seeds/acre if the straw is also harvested.

Barley is less hardy than wheat and is not susceptible to Hessian fly. Winter barley can thus be planted a few days earlier than wheat, that is, from September 10 to September 20. Because barley is very susceptible to barley yellow dwarf virus, planting before this time is strongly discouraged. It is best to sow the seed with a grain drill at a depth of 1 to 1-1/2 inches. Seeding rates should be in the 96 to 120 pounds per acre or 2- to 2-1/2-bushel range.

Rye is the hardiest of all winter grains and thus can be successfully established with an early to mid-October planting date. For seed production, rye should be sown with a grain drill at a depth of 1 to 1-1/2 inches. The seeding rate should be in the 110 pounds or 2-bushel range.

5.1.2 Spring Grains

Spring grains should be sown as early in the spring as possible. In central New York, a yield decrease of about 1 bushel per acre per day can be expected in oats and barley for each day the crop is planted after April 15. With spring wheat, a yield loss of about 1/2 bushel per acre per day can be expected if planting occurs after April 15. All spring grains should be sown with a grain drill to a depth of 1 to 1-1/2 inches. The optimal seeding rate for oats is 96 pounds or 3 bushels per acre, whereas spring barley and spring wheat do best at 2 bushels per acre. If oats or barley is to be used in forage seeding, seeding rates should be reduced by 50 percent.

See the *Cornell Field Crops and Soils Handbook* for more detailed planting information.

5.2 Variety Selection

5.2.1 Winter Wheat

Wheat is an important cash crop in central and western New York. Most New York wheat is classified as soft red winter wheat, but some soft white winter wheat is also grown. Millers use the soft wheats to produce high-quality, low-protein flours for use in pastries, crackers, cookies, and breakfast cereals. Soft red wheats are inherently more resistant to pre-harvest sprouting than soft white wheats.

Winter wheat varieties are tested every year in Cornell trials, and results of multiyear evaluations are shown for soft white wheat varieties from Cornell's breeding program in Table 5.2.1 and for both Cornell and commercial soft red wheat varieties in Table 5.2.2. Please note the following points when using the winter wheat variety evaluation tables. Varieties are in order from those that have been tested the longest to those most recently entered into the testing program. For each trait, the number of years of data used to assess that trait are noted at the top of the table. The more years of evaluation, the more precise the data will be. The **table includes only varieties that have been tested for at least two years in Cornell trials**. All the winter wheat varieties reported in these tables are good options for New York growers. Their yields are good and they all have acceptable milling and baking quality, test weight, and lodging resistance.

5.2.1.1 Soft White Winter Wheat

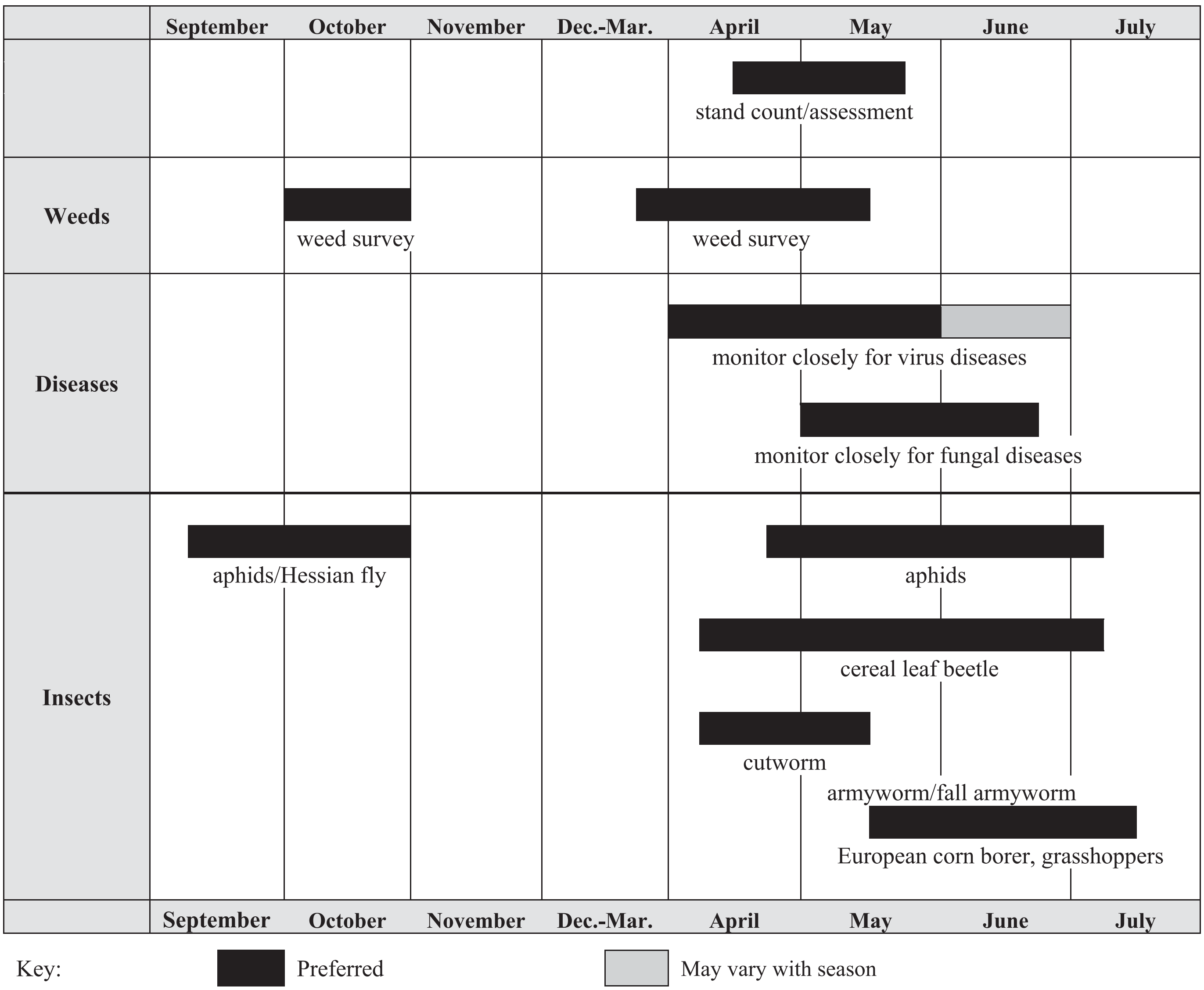
Only varieties developed by Cornell University's soft white wheat breeding program are evaluated in Cornell trials at present. Results of variety evaluations are reported in Table 5.2.1. Special traits of some of these varieties are noted below, but recall that **all the varieties listed in the Table are good options for New York growers**.

CALEDONIA is a top yielder with excellent standability. It has attractive, light-colored straw and resistance to soilborne and spindle streak mosaic viruses.

Table 5.6.1. Winter wheat pests and crop monitoring activities.

Routine	Occasional
Stem extension (jointing to boot stage)	
Leaf spots (Septoria nodorum blotch, tan spot, powdery mildew, leaf rust), cereal leaf beetles, watch for “occasional” pests/problems	Herbicide injury, hail, frost/freeze, drought, armyworm, aphids, cutworms, fall armyworm, grasshoppers
Flowering to Grain Ripening	
Root and crown rots, cutworms, armyworm, Fusarium head blight / scab, viruses, bunt, smut, leaf spots (powdery mildew, Stagonospora nodorum blotch, Tan spot, leaf rust), cereal leaf beetles, watch for “occasional” pests/problems	Wind, excessive nitrogen, lodging, nutrient deficiency, stripe rust, armyworm, stalk borer, European corn borer, fall armyworm, wheat stem sawfly, grasshoppers, white grub, wireworm, flea beetles

Figure 5.6.1. Winter wheat IPM scouting calendar.



8 Appendix

8.1 Trade and Common Names of Field Crop Pesticides

Table 8.1.1 Fungicides.

Trade Name[1]	EPA Registration Number	Common Name
Absolute 500 SC	264-849	tebuconazole + trifloxystrobin
Affiance SC	10163-332	tetraconazole + azoxystrobin
Aframe Plus 2.2 SE	100-1324	propiconazole + azoxystrobin
Allegiance FL	264-935	metalaxyl
Alto 100 SL	100-1226	cyproconazole
*†Aproach SC	352-840	picoxystrobin
*†Aproach Prima 2.34 SC	352-883	cyproconazole + picoxystrobin
Apron XL	100-799	mefenoxam
Avaris 200 SC	100-1178-5905	azoxystrobin + propiconazole
Caramba 0.75 SL	7969-246	metconazole
Domark 230 ME	80289-7	tetraconazole
Endura 0.7 DF	7969-197	boscalid
*Evito 480 SC	66330-64	fuoxystrobin
Fitness	34704-1031	propiconazole
Headline AMP	7969-291	pyraclostrobin + metconazole
Headline EC	7969-186	pyroclostrobin
Headline SC	7969-289	pyraclostrobin
*†Priaxor 4.17 SC	7969-311	pyraclostrobin + fluxapyroxad
Proline 480 SC	264-825	prothioconazole
PropiMax 3.6 EC	62719-346	propiconazole
Prosaro 421 SC	264-862	prothioconazole + tebuconazole
Quadris Flowable	100-1098	azoxystrobin
Quadris Top	100-1313	azoxystrobin + difenconazole
Quilt	100-1178	azoxystrobin + propiconazole
Quilt Xcel	100-1324	azoxystrobin + propiconazole
Stratego YLD	264-1093	trifloxystrobin + prothioconazole
Tilt 3.6E	100-617	propiconazole
†Topguard	67760-75	flutriafol
Topsin M 70 WP	73545-11-70506	thiophanate-methyl
TwinLine 1.75 EC	7969-247	pyraclostrobin +metconazole

*Restricted-use pesticide

†Not for use on Long Island, NY

[1]Trade names are given for convenience only. No endorsement of products is intended nor is criticism of unnamed products implied.

Table 8.1.2. Insecticides.

Trade Name[1]	EPA Registration Number	Common Name
*Ambush	5481-502	🐝permethrin
*Asana XL	352-515	🐝esfenvalerate
*Baythroid XL	264-840	🐝beta-cyfluthrin
*Counter	5481-545	terbufos
*Diazinon	Multiple	🐝diazinon
Dimethoate	Multiple	🐝dimethoate