SCAS Teaching Series No. T95-1
Department of Soil, Crop and Atmospheric Sciences
Cornell University, Ithaca, NY 14853 USA
June 1995

THE AGRONOMY OF DAIRY FARMING IN NEW YORK STATE

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SUMMARY

This document provides a brief description of the climate, soils, history, and crop production practices in common use on New York dairy farms. It includes a map of the agricultural regions of New York State and an overview of the common crop rotation systems currently being practiced. This is a revision of Agronomy Mimeo 88-5.

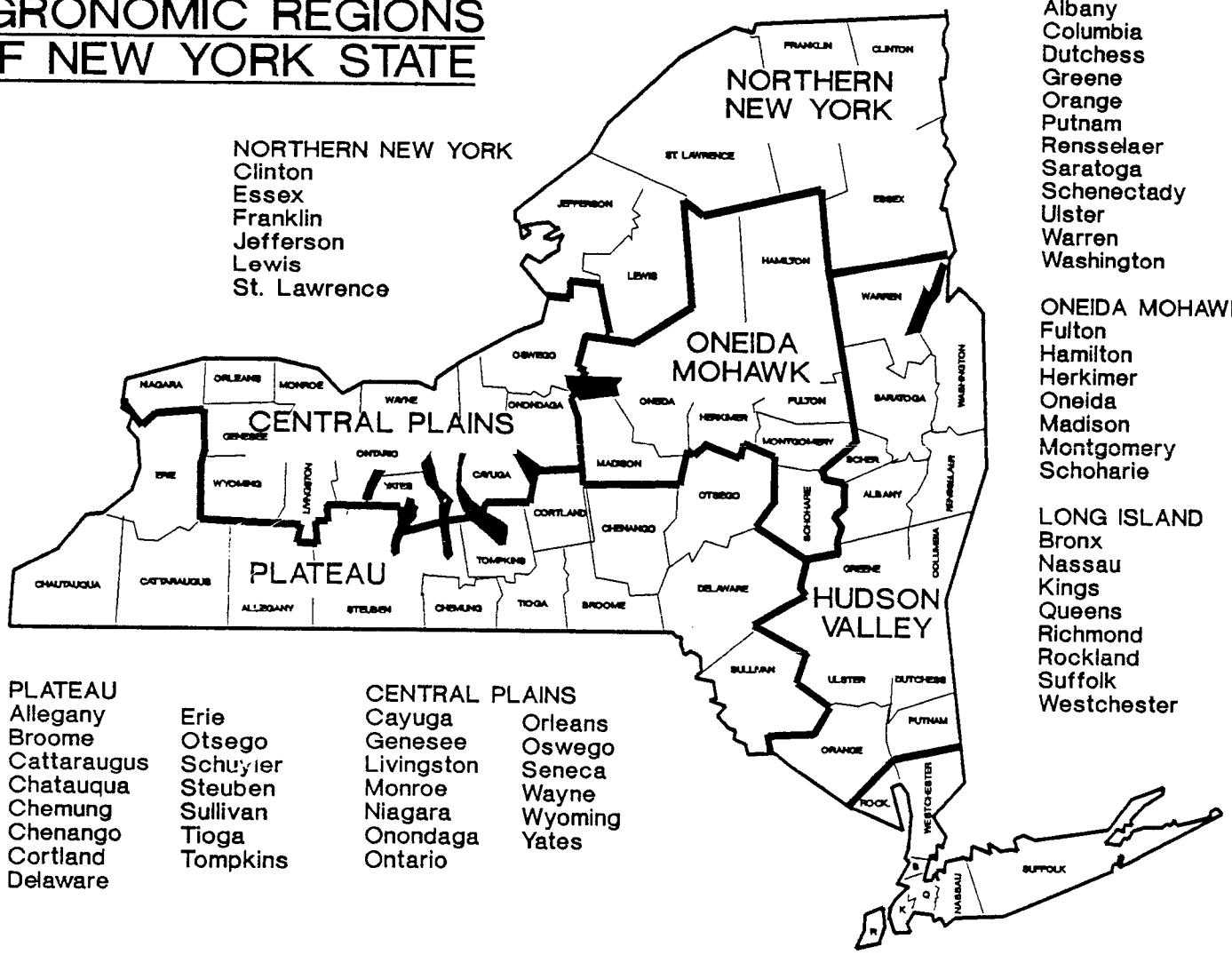
Dairy farming is the largest agricultural industry in New York State, providing over 50% of New York's agricultural income. In 1995, the state had about 11,000 dairy farms with almost 730,000 milking cows, making New York the third largest dairy state in America. The industry was supported by about 600,000 acres (245,000 ha) of corn silage, 550,000 acres (225,000 ha) of corn grain, 225,000 acres (90,000 ha) of small grains, 1,800,000 acres (730,000 ha) of perennial haycrops, including 700,000 acres (285,000 ha) of alfalfa and alfalfa mixtures, and about 750,000 acres (300,000 ha) of pastures. Total dairy farm assets were about $13 billion with on-farm milk sales of about $1.4 billion.

Natural resources and history. Dairy farming in New York State is fairly typical of the region surrounding the Great Lakes of North America, sometimes called the "dairy belt." The agriculture across the dairy belt is mixed, with fruit, vegetable, and cash crop production being locally important. Nevertheless, the dominant cropping systems support a dairy industry through the production of corn for silage and grain and alfalfa and perennial grasses for hay and haycrop silage. Other crops on New York dairy farms include wheat, oats, barley, soybeans, forage mixtures based on red clover, and pastures and hayfields based on perennial grasses. Historically, this region supported an almost unbroken temperate deciduous forest, and the corn and alfalfa cropping systems of the region have developed in the last 125 years.

New York State has 61 counties grouped into six agronomic regions (Figure 1). The growing season of New York State varies from 100 to 200 frost-free days between April and October. The sizable variation is associated with a substantial range in elevation, with the lower altitudes of the Central Plains and Long Island regions having the longest seasons. Precipitation is fairly uniform through the year with 14 to more than 20 inches (350 to more than 500 mm) of rainfall during the growing season in most years. Evapotranspiration often exceeds rainfall in July and August, and this, coupled with low water holding capacities of many soils, make soil water availability the limiting factor of production on many farms. The warmest month of the year is usually July, but mean maximum temperatures (80 to 86°F, 27 to 30°C) are somewhat lower than in the major corn producing areas immediately to the south and west so short-season corn hybrids are needed. The coldest month is usually January with mean minimum temperatures of 5 to 14°F (-10 to -15°C). Snow cover is common in the winter and the climate is generally too severe for modern varieties of winter oats, but not for winter wheat.

The soils have developed from a variety of parent materials but almost all show the effects of glaciation (Cline 1970). Many of the soils are rocky and shallow to fragipans or firm layers that restrict root development. Low native soil pH is common, except for the "Lime Belt" of the Central Plains where glacial action mixed limestone through the soil. About one fourth of the soils have drainage limitations, and many have been limed to raise the pH and artificially drained to improve agricultural production. Soil limitations are of major

AGRONOMIC REGIONS OF NEW YORK STATE



NORTHERN NEW YORK
Clinton
Essex
Franklin
Jefferson
Lewis
St. Lawrence

HUDSON VALLEY
Albany
Columbia
Dutchess
Greene
Orange
Putnam
Rensselaer
Saratoga
Schenectady
Ulster
Warren
Washington

ONEIDA MOHAWK
Fulton
Hamilton
Herkimer
Oneida
Madison
Montgomery
Schoharie

LONG ISLAND
Bronx
Nassau
Kings
Queens
Richmond
Rockland
Suffolk
Westchester

PLATEAU
Allegany
Broome
Cattaraugus
Chatauqua
Chemung
Chenango
Cortland
Delaware
Erie
Otsego
Schuyler
Steuben
Sullivan
Tioga
Tompkins

CENTRAL PLAINS
Cayuga
Genesee
Livingston
Monroe
Niagara
Onondaga
Ontario
Orleans
Oswego
Seneca
Wayne
Wyoming
Yates

Figure 1. The counties and agronomic regions of New York State. (The map was prepared by Prof. Emeritus Reeshan Feuer, Dept. of Soil, Crop and Atmospheric Sciences, Cornell Univ.)

importance in selecting cropping systems for particular farms.

Agricultural soils regularly freeze in the winter, usually to less than 20 inches (500 mm) of depth. Frost action in soil can cause severe stresses to perennial legumes like alfalfa. During spring thawing, a water table is suspended above deeper frozen soil until ice in the soil profile has completely melted. The resulting wet conditions at the soil surface in early spring delay field operations on many farms. Much of the land is sloping and subject to accelerated erosion under annual crops. Where soil limitations, including severe erosion, restrict production, much land has been allowed to revert to forest through ecological succession. Most of the hillsides of the Plateau region (Figure 1) are no longer farmed.

Forest was cleared from the land after European settlement, first to allow subsistence crop production and then to support an export trade, which was mainly wheat processed as whiskey. Wheat production without pest control, soil conservation, or soil fertilization was only a temporary enterprise. Pests introduced from Europe such as the Hessian fly were particularly serious problems for the pioneer wheat growers of this area. When monoculture wheat production was no longer profitable, many farmers simply moved further west to clear new land. On the fields left behind, European forages like Kentucky bluegrass and white clover naturalized and pastures became established to feed sheep and cattle in the summer (Colby 1974). Eventually, timothy, redtop, and red clover stands became the base of a hay industry associated with the large population of horses in cities and the general demand for winter livestock feed.

About 1880, three important changes fostered the development of the modern forage/dairy industry of the region. First, the demand for milk in the growing cities around the Great Lakes and on the Atlantic coast exceeded the supply from the milk producing areas immediately around the cities. Second, refrigerated transport of milk into the cities was initiated as a means of meeting the demand for milk; and third, the technology for producing corn silage made winter milk production possible in face of a year-round demand for milk. The protein demands of the producing dairy cow were first met with white clover pastures and red clover hays, but the selection of adapted alfalfa varieties gave this "new" legume increasing importance after the 1930's (Colby 1974). Regional demand for milk continues to drive the dairy industry in the zone around the Great Lakes. As dairy herds have increased in size, year-round feeding of conserved forages to housed livestock has become more common. This practice maximizes production per animal in a system where animal numbers are usually limited by available winter housing.

Crop production practices. The main crops of the forage/dairy farms of New York usually include corn and alfalfa (Cherney et al. 1994, Cox and Klausner, 1988). Corn is grown for both on farm use and as a cash crop. Alfalfa may be sown in monoculture or with a perennial grass such as timothy or smooth brome. It is harvested as both hay and silage,

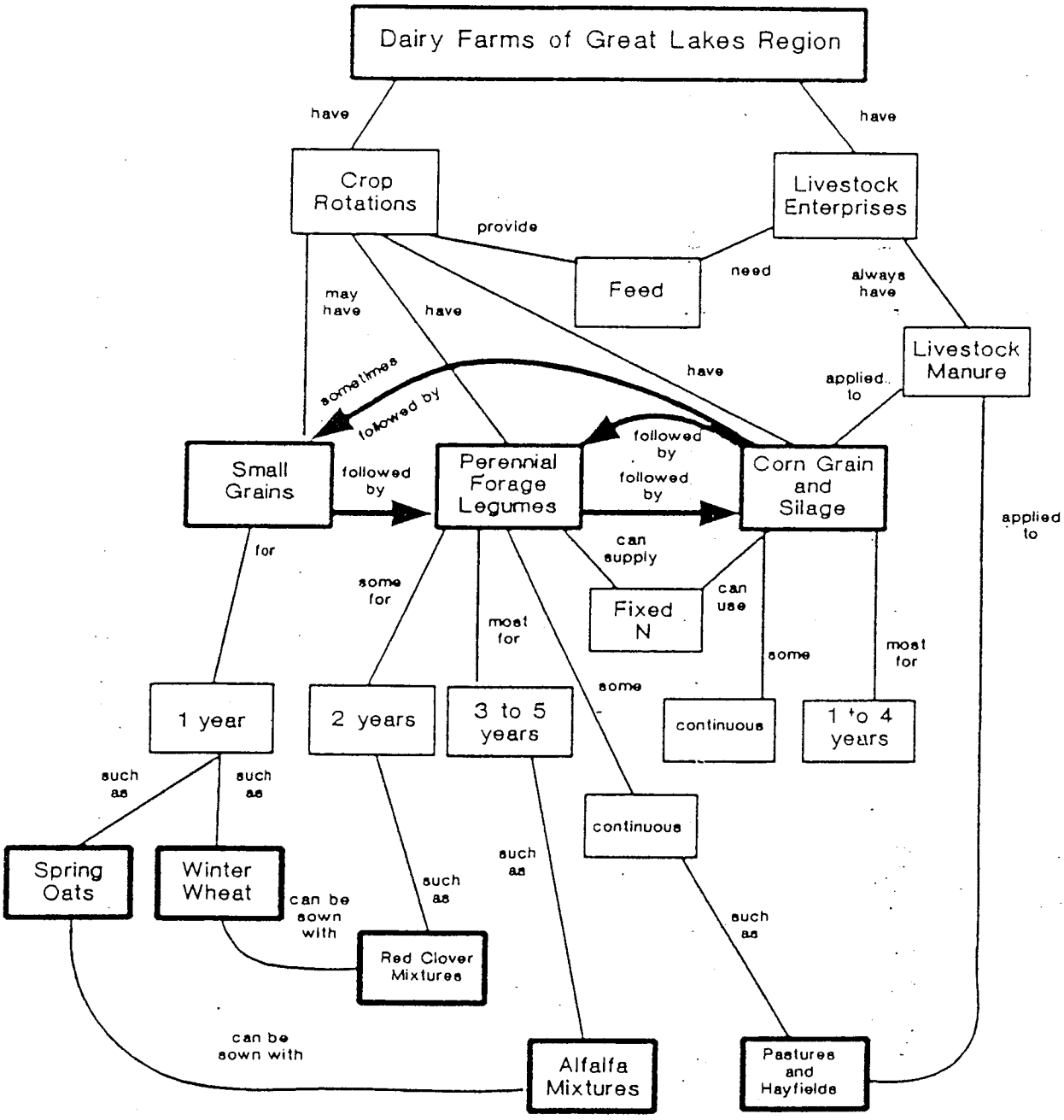


Figure 2. This concept map shows the crop rotation system in common use on the dairy farms of New York State. The main linkages between crops and livestock as well as the sequence and duration of the primary crops are illustrated. This figure comes from Fick and Power (1992).

with two to four harvests being made each year depending on length of the growing season and age of the stand. Although alfalfa replaced red clover as the primary legume of the region, red clover is still grown on wetter soils and where shorter rotations to corn are needed. Red clover is treated as a biennial, whereas alfalfa is a perennial, typically left in the rotation for 3 to 6 years (Figure 2). Longer lived perennial grasses, such as improved cultivars of reed canarygrass, are sometimes grown without legumes. If harvested early enough, they can provide high quality hay crops and good places to spread livestock manure.

The cropping system usually involves crop rotation. Alfalfa and other perennial forages are typically sown in the spring (April and May), either with a "companion crop" of spring oats or with the use of herbicides. After 3 to 6 years, depending upon the condition of the perennial forage stand, corn is usually planted after plowing down of the perennial sod in May when soil temperatures exceed 50°F (10°C). Alfalfa or a perennial forage mixture is again seeded after 3 or 4 years of corn production. If alfalfa is seeded with oats, the oat crop may be harvested about July 1 for hay or silage, after which alfalfa may be harvested 6 to 8 weeks later. If the oats are harvested later for grain, the alfalfa often does not grow enough for another harvest in the establishment year. Alfalfa established with herbicides may produce two or three crops in the establishment year if soil moisture is adequate.

Red clover may be established like alfalfa, but it has greater seedling vigor and it can be "frost seeded" into a stand of winter wheat. Winter wheat usually follows a spring grain crop or an early harvest of corn silage. Planting is usually in mid to late September, which is early enough to allow good autumn establishment but late enough to prevent damage by the Hessian fly or barley yellow dwarf virus. Red clover seed can then be broadcast onto the wheat field in March while the soil is still frozen (Figure 2).

Wheat, oats, spring barley, or soybean may be grown as cash crops or incorporated into the dairy ration. Whole-plant oat hay or silage has a high phosphorus content especially needed by dry dairy cows. The grain of wheat or spring barley can effectively meet some of the protein demand of the milking dairy cow, as well as providing significant amounts of energy needed for good milk production. Corn and alfalfa balance the nutritional demands of the dairy cow for energy, protein, and fiber. Purchased feeds often include corn grain and soybean meal when energy and protein demands cannot be met by crops produced on the farm. Recently, some dairy farms have purchased a soybean roaster to process the soybeans on farm for feeding to their cows, thereby eliminating the need to purchase soybean meal.

Most dairy farms in the Great Lakes region also have pastures and grass-based hayfields. Pastures are normally grazed by dry cows and growing livestock, but they are becoming an important source of summer feed for milking cows on some farms, especially if short duration rotational grazing is

practiced. Pastures and hayfields also provide places to spread livestock manure at times of the year when corn fields cannot receive manure applications. Spreading manure on alfalfa or red clover stands is becoming more common, but it may promote the growth of weeds.

Primary tillage usually precedes each seeding operation and involves plowing or chiseling plus a couple of secondary disking or harrowing operations to break up soil clods and to firm the seedbed. Currently, most stands of perennials are plowed under before corn planting, although some stands are killed in the fall with herbicide. About 65% of the corn in the state is planted on plowed land, 35% is chiseled, and 5% is "no-tilled." Particularly on wetter, heavier soils common in the Great Lakes region, elimination of plowing has been associated with reduced corn yields and increased problems in pest management. On the other hand, reduced tillage can help conserve soil water and improve establishment of forages in summer seedings that follow harvests of oats or wheat as hay or silage. Present general recommendations are to plow each field at least once in every crop rotation.

The cropping calendar. Cultural practices in New York State begin in the spring with spreading of manure on corn fields and seedbed preparation for oats as soon as the soil can be worked. Fertilizer may be broadcast and incorporated into the soil as the seedbed is prepared or banded with the drilled seed as it is planted in April or early May in most years. Lime is normally applied in the late fall or early winter to fields that require adjustment of the soil pH before planting legumes. By early to mid-May, soils are often warm enough to begin planting corn, which will normally receive some starter fertilizer. Most herbicides for corn are usually applied shortly after the crop has emerged. If the corn is not following alfalfa or on a heavily manured field, nitrogen is usually sidedressed in June. The use of the "pre-sidedress nitrogen test" (PSNT) just before sidedressing time can identify fields that do not require additional nitrogen fertilizer.

In early June, mid-July, and late August, alfalfa is ready to harvest in the three-cut climatic zones, which are most common in the State. If four harvests are made, late May, late June, late July, and late August are the usual times. In high elevation, short growing season areas, only two harvests may be possible with cuts taken from mid to late June and early to mid August. Red clover may be harvested like alfalfa, but it usually is cut with the two-cut schedule. Winter wheat is harvested in July, and if oats are grown for grain, the harvest is usually made in August. Corn silage harvest begins early to mid-September and is followed by corn grain harvest in late October and November in even the best harvesting seasons. Winter wheat is normally sown in September following oat or corn silage harvest.

Manure may be spread and plowed down in the autumn on soils not subject to winter erosion. Fall is also the recommended time for soil testing. Depending on the amount of storage for livestock manure, it must be spread throughout the year on the land that is

available at the time. Given the daily demands of livestock on the dairy farm, the work schedule is very full and the farmer is always challenged to complete crop management practices in a timely fashion.

If you are interested in more details about the climate, soils, and cropping systems of New York State, you should refer to some of the publications listed on the back page. The *Cornell Field Crops and Soils Handbook* (Cox and Klausner, 1988) covers all aspects of agronomy applied to the region, and recommended practices are updated annually in *Cornell Recommends for Integrated Field Crop Management.*

SCIENTIFIC NAMES

(of plant and pests species mentioned in this article)

Alfalfa (lucerne): *Medicago sativa* L.
Barley: *Hordeum vulgare* L.
Corn (maize): *Zea mays* L.
Kentucky bluegrass: *Poa pratensis* L
Oats: *Avena sativa* L
Red clover: *Trifolium pratense* L.
Redtop: *Agrostis gigantea* Roth
Reed canarygrass: *Phalaris arundinacea* L.
Smooth brome: *Bromus inermis* Leyss.
Soybean: *Glycine max* (L.) Merr.
Timothy: *Phleum pratense* L.
Wheat: *Triticum aestivum* L.
White clover: *Trifolium repens* L.

Hessian fly: *Mayeliola destructor* (Say)

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