After the third prebud cutting of this treatment in mid July the stand was allowed to regrow throughout the fall. This regrowth period given for restoration of root reserves and alfalfa plant vigor was not enough to overcome the effects of the repeated early cutting. This had severely thinned the stand. The reduced first cut yield in 1982 resulted because there were fewer shoots produced.

ALFALFA CUTTING MANAGEMENT FOR INSECT PEST CONTROL

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The harvesting process has a pronounced effect on the insects in alfalfa fields, either by removing the insects (including their eggs) with the forage or by destroying the major source of food for those remaining. The physical environment of the alfalfa field is changed, and generally becomes much hotter and drier. Also, the cutting practice abruptly changes the vegetative cycle, and plants that varied from a late bud to a past blossom stage become stubble, which sprouts and initiates a new cycle of vegetative growth. These changes in the environment of an alfalfa field at cutting will cause insects to leave, seek shelter or die.

The three pests of most importance in Massachusetts alfalfa are: Alfalfa Blotch Leafminer, Potato Leafhopper, and Alfalfa Weevil. Cutting management can provide effective control for each of these pests.

Alfalfa Blotch Leafminer

The adult leafminer is a small black fly (1/8 inch long) which is active on the growing tips of alfafa. Females feed by puncturing leaflets, resulting in "pinholes" (Fig. 1a). Eggs deposited in leaf tissue, hatch into maggots, which usually develop parallel to the midrib (Fig. 1b) and then expand into the comma-shaped "blotch mine" (Fig. 1c). Finally, the maggot chews its way out of the mined leaflet and drops to the soil to pupate, leaving behind an empty blotch mine (Fig. 1d). At summer temperatures maggots take 10-12 days to develop; new adults emerge from pupae after approximately 18 days.

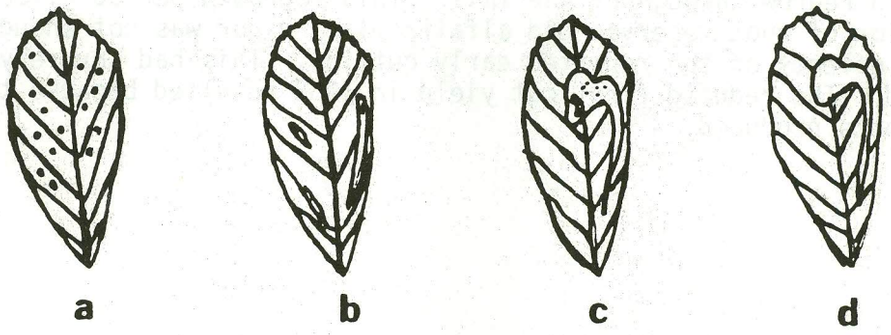

Figure 1. Leafminer damage on alfalfa: (a) pinholes, (b) linear mines, (c) a blotch mine with maggot, and (d) an empty blotch mine.

Several leafminer generations occur per season, beginning in early May when overwintered adults emerge. One generation occurs during each alfalfa growth when the crop is harvested three times at 10% bloom. Since flies are short-lived, distinct gaps occur between infestations. The second generation is often the largest producing up to 150 flies per single sweep of an insect net; 50% or more of the leaflets may be damaged.

Damage results from both pinholing and leafmining. A completed mine occupes 25% of the leaflet. Mined leaflets often drop prematurely, both in the field and during harvest operations. In addition, the loss of leaf surface may reduce photosynthesis and plant growth. Economic injury occurs when 25-30% of the leaflets are mined.

Only the soil-inhabiting pupae are able to survive the interval between harvest and crop regrowth. The number of empty blotch mines at harvest determines leafminer numbers during the next regrowth. Thus, if you notice an abundance of blotch mines per stem at harvest, you can anticipate a severe infestation at the following harvest. When alfalfa is harvested three times at 10% bloom, ideal conditions are provided for leafminer survival because the pupae are in the soil and survive between harvest and regrowth. This results in elevated injury levels during the first two cuttings (Fig. 2a). In contrast, a pre-bloom first harvest may be used to prevent maggots from leaving mines to pupate in the soil. This virtually eliminates damage throughout the growing season (Fig. 2b). For best control, first cutting should be made when linear mines (Fig. 1b) first appear. Depending on spring weather conditions, this early harvest would occur 5-15 days prior to 10% alfalfa bloom. Many growers commonly conduct pre-bloom harvests in which a pre-bloom first harvest was followed by two 10% bloom harvests.

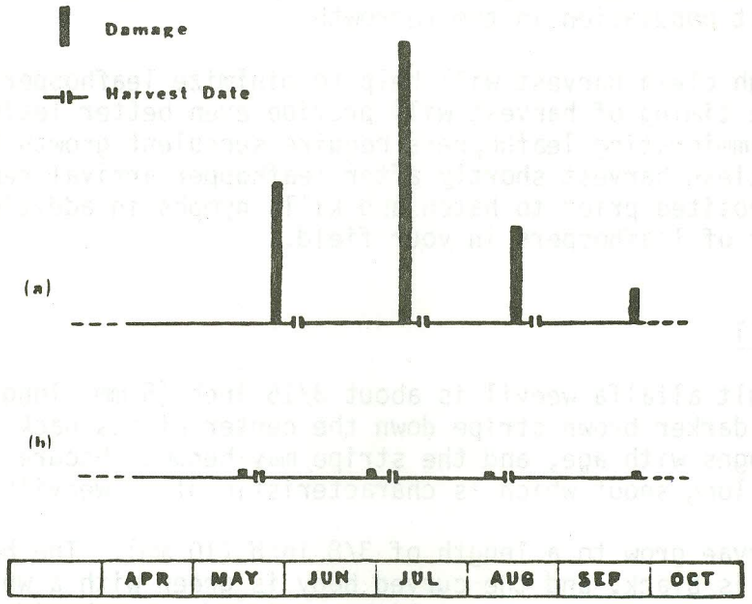

Figure 2. Leafminer control by altering harvest schedule:
(a) damage at each harvest under a 10% bloom harvest schedule,
(b) pre-bloom first harvest followed by 10% bloom second and third harvest.

Potato Leafhopper

The adult is a green, wedge-shaped insect about 1/8 inch (3 mm) long. The nymphs closely resemble adults; however, they are smaller, yellow, and wingless. Both adults and nymphs are very active; they can move sideways and backwards as rapidly as forwards when they are disturbed. Adults often fly when disturbed.

Potato leafhopper adults are carried northward by the spring winds from the Gulf Coast states where they overwinter. Their arrival in Massachusetts is determined by weather systems. Thus they may arrive in mid-June one year and mid-July another. Eggs are laid by the immigrating gravid females into the stems and the larger leaf veins; in midsummer they hatch in six to nine days. Nymphs develop into adults in about 2 weeks.

Both adults and nymphs have piercing-sucking mouthparts, Initial feeding damage is characterized by a wedge-shaped yellow area formed on the leaf tip and known as "hopper burn". Heavy feeding can cause the entire leaf to turn yellow, and heavily infested fields take on a yellow color.

The adults migrate from alfalfa fields at harvest. Nymphal survival is dependent on the nymph's ability to locate succulent alfalfa left at harvest. Clean harvest practices can reduce population levels by causing a higher mortality of both eggs and nymphs. When an alfalfa field is poorly

cut at harvest, the surviving leafhopper population can contribute to an increased pest population in the regrowth.

Although clean harvest will help to minimize leafhopper survival on regrowth, the timing of harvest will provide even better leafhopper control. Because the immigrating leafhoppers require succulent growth for feeding and egg-laying, clean harvest shortly after leafhopper arrival removes most eggs they have deposited prior to hatch and kills nymphs in addition to preventing establishment of leafhoppers in your field.

Alfalfa Weevil

The adult alfalfa weevil is about 3/16 inch (5 mm) long. It is light brown with a darker brown stripe down the center of its back. The body coloring changes with age, and the stripe may become obscure. The adult beetle has a long snout which is characteristic of a "weevil".

The larvae grow to a length of 3/8 inch (10 mm). The head of a mature larva is black, and the curved body is green with a white stripe down the center of the back and a light stripe down each side.

Alfalfa weevil is not a common pest in Massachusetts at this time because of its suppression by natural enemies introduced through a program of rearing and release by the USDA and cooperating institutions. However, when it is abundant early harvest at first cutting removes shelter for the developing larvae and they die from exposure and starvation. In heavy outbreaks, when 30% of the terminals are ragged, cut when the larvae begin to feed in the open (the small stages hide in the terminals).

In summary, an early first cutting can eliminate leafminers for the rest of the growing season if cutting is timed to coincide with the initial appearance of blotch mines. For leafhoppers clean harvesting a few days after they arrive (this year it was the week of July 7-14) removes eggs, kills nymphs and forces out adults. The advantage of alfalfa pest control through cutting management is that the practice protects beneficial insects, including the parasites of the leafminer and alfalfa weevil. It also eliminates the cost of pesticidal control, as well as the potential for chemical residues and the "days-to-harvest" requirements.