UMASS EXTENSION

VEGETABLE IPM MESSAGE

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Crop conditions

As planting continues, there is harvesting, of asparagus, sorrel, cress, chives, fiddleheads and some overwintered crops: parsnips, leeks, and even some greens that survived under the snow. At a farmer's market I visited last Saturday in Ithaca, NY, bins of over-wintered Red Russian kale and large, beautiful leeks were next to young lettuce greens that had been grown in hoop houses.

Frost touched much of the state on Saturday night, May 17, with harsh effects in some places – killing uncovered early tomato or vine crops seedlings – and lesser effects in others, such as burning the tips of corn seedlings. Even row cover did not save some seedlings, especially where the cover was directly touching the plants. This was followed by several days of warm weather which helped raise soil temperatures and move crop growth along, but another spell of cloudy cold and dry weather is slowing us down again. Wherever possible, it may be advisable to hold off on seeding or transplanting crops that need warmth to germinate and grow. See the following article on Transplants.

Cool weather presents problems with transplants

Two days of warm weather, five days of rain and clouds describes the month of May. This has presented a number of problems for growers who use transplants. Early seeding and transplanting so far this year have not given growers the jump on the season that they had been hoping for. In the greenhouse, a number of problems have arisen. Several days of clouds create low light conditions. Transplants tend to etiolate (grow taller) as they "seek" the light. Transplants grown under these conditions tend to have weaker stems and longer stem area between the nodes. Studies done several years ago have shown that if you brush across the tops of the plants with a piece of styrofoam or even your hand on a daily basis, the transplants will not grow as tall. This is especially true for tomatoes. Though this is something to start as soon as the tomatoes emerge from the soil media, there is still some beneficial effect from the brushing even now. I tried it with tomatoes plants in my research greenhouse this year and was pleased with the results. If possible, plant tomatoes and peppers deeper than usual. More roots will form along the stem and transplants are sturdier. Several years ago, Frank Mangan conducted studies on planting depth in peppers. He showed that peppers could be planted up to the first true leaf without any detrimental effect on the plant or on yields. Deeper planting also reduced lodging later in the season.

Another problem under cloudy conditions is that the stomates (the holes in the leaf where carbon dioxide and oxygen exchange) tend to stay closed. Open stomates are what move water and nutrient uptake from the roots to the leaves. Thus, on cloudy days, plants may look yellow even though you are fertilizing them. Usually, this goes away once the sun comes out and translocation occurs at a more rapid rate. This year this has been more of a problem as most days in May have been cloudy. Remember that soils may not be drying out as rapidly under cloudy conditions. Over watering can cause nutrient leaching, increase problems with fungus gnats, and cause damping off and botrytis.

Weather conditions in the field have the same effect on transplants. Air temperatures have averaged in the low 60's and there has been little solar radiation to warm the soil. As in the greenhouse, water and nutrient uptake is virtually non-existent when soil temperatures are below 60 °F. Transplants can actually dry out even if they are sitting in field-capacity soils, especially if there is wind. Cool, cloudy days exacerbate the problem as stomates are only partially open or completely closed. Growth is slow and the transplant basically sits in the ground in the same condition as it was in the greenhouse. This is a good year to plant into plastic mulch to warm the soils.

Transplants that have been under low light in the greenhouse are more light sensitive in the field. Try to plant in the afternoon, with the sun waning, or on cloudy days (not a problem). A clear day can cause sunburn. Symptoms of sunburn include pale, tan or silvery blotches on the leaves which will die back quickly.

If there is enough room in the greenhouse and your transplants are not too big, keep the transplants in the greenhouse as long as you can. Warmer greenhouse temperatures (especially root temperatures) will at least allow growth to continue. Some growers have found that transplants of the same age that are held in the greenhouse until the soil temperatures warm-up will actually blossom and yield before transplants that were set out in the field when soil and air temperatures are low. This is especially true for tomatoes and peppers. However, if the plants are tending to become root bound it may be a benefit to get them into the field. This is a year of a transplant catch-22. This is also a good year to apply a dilute solution of fertilizer to the root ball just prior to planting or into the transplant hole. The plants could use the extra boost to recover from all its potential problems.

-- Anne Carter, Department of Plant and Soil Sciences, University of Massachusetts

NEW INSECTICIDE AVAILABLE FOR ORGANIC GROWERS

Spinosad has been available for several years for conventional growers, and has proved to be an effective option for managing a number of insect pests such as European corn borer in pepper and sweet corn, caterpillars in crucifers, and Colorado potato beetle in potato and eggplant and tomato. The active ingredient has a natural source, derived from a soil actinomycete, produced through a fermentation process, and formulated into a labeled product, Spintor 2SC. When this formulation was denied organic certification because of prohibited inert ingredients that were used to stabilize the product in liquid form, the manufacturer (DowAgrosciences) developed a dry wettable powder formulation (80% active ingredient) which does not contain prohibited inerts. This product, called Entrust, carries the National Organic Program (NOP) approval on its national product label. It has just recently been released and will be available soon from agricultural suppliers in New England who specialize in organic products as well as mainstream suppliers. One supplier that currently has inventory is International Technology Services in Colorado (303-661-9546). Entrust is being sold in one pound pouches and applied at rates of ½ to 3 oz per acre. At approximately $350 per pound it is a big investment, but on a per-acre basis the cost will range from $12 to $66 per application. For smaller plantings you will need an accurate measuring device in order to weigh fractions of an ounce!

The crops listed on the label are the same for Spintor 2SC and Entrust. They include leafy vegetables, all brassicas, sweet corn, fruiting crops, asparagus, potatoes and other tuberous crops. Thrips, leafminers, caterpillars, and leaf-feeding beetles are the groups of pests controlled by this product. Its mode of action is twofold: by contact and by ingestion.

This material will be a welcome addition to the organic growers' toolbox because of its wide range of uses, especially in situations where there are few other alternatives insecticides

and where cultural practices are not always sufficient to prevent damage. For example, there are currently no available *Bt. tenebrionis* insecticides for Colorado potato beetle, because the existing products (Novodor, Colorado Potato Beetle Beeter) have been removed from the 'approved' list. These Bt. products have been a key tool for organic growers for controlling Colorado potato beetle larvae. Entrust is very effective at quite low rates (1 oz/acre), and the especially good news is that it is effective against adults as well as small and large larvae. It will provide an alternative to Bt. sprays for caterpillar pests and a new option for leafminers in leafy greens. As with any product, it is important to avoid overuse, which can lead to resistance. We will be conducting trials at the University of Massachusetts this season to evaluate spinosad products for use against flea beetle in brassicas and striped cucumber beetle in vine crops.

FLEA BEETLE UPDATE

Crucifer-feeding flea beetles (*Phyllotreta cruciferae* and *Phyllotreta striolata*) have emerged from their overwintering sites. Due to the cold weather this spring, emergence occurred later than normal here. While they are often active by the end of March, the first beetles were captured this year on the UMass farm on April 14th. These beetles were found aggregating in large numbers on the leaves of some overwintered turnips. Interestingly, they ignored a plot of overwintered Asian brassicas (Yukina Savoy and Hon Tsai Tai). However, they have been actively feeding in newly planted crucifer seedlings.

Weekly dissections of field-collected beetles indicated that females began producing eggs around the first week in May. The female beetles lay their eggs at the base of the stem of brassicas, and the larva develop in the soil, feeding on root hairs and roots of brassicas. It is possible that the feeding by larvae impacts overall growth and yield of the plants, especially for crops that are in the field for longer periods of time. In our research this summer, we plan to evaluate the impact of larval feeding on the crop, as this has not been well documented. Currently, no management options exist to control immature stages of the flea beetle. We will be evaluating several insecticides that target the adults, larvae, or both stages.

Waxy cole crops such as cabbage and broccoli are more susceptible to flea beetles in the early stages, but tend to be less heavily fed upon as they grow. Non-waxy brassicas such as Asian leafy greens continue to be attractive and very susceptible throughout their growth. There are several options for preventing damage to seedling brassicas. Rotation to a new field at some distance (the farther the better) from previous plantings reduces the numbers, at least temporarily. Floating row covers that are completely sealed around the edges are effective in excluding the beetles. For foliar sprays, one beetle per plants is a conservative threshold; five beetles per plant has been shown to reduce head size and yield in broccoli. Insecticide options include several synthetic pyrethroids (e.g. Asana XL, Ammo, Capture, Warrior), carbamates (e.g. Larvin, Sevin). Organic options include pyrethrin (e.g. Pyganic Crop Protectant), and neem (e.g. Azatin XL, Ecozin 3%, Neemix, etc.). Trials conducted at the CT Agricultural Experiment Station showed that high rates of Pyganic suppressed moderate levels of flea beetles, although we did not find this effective in our experiments at UMass. We have received grower reports of successful suppression at 40 oz/acre with a spreader sticker.

Caryn Andersen and R Hazzard, Dept of Entomology, University of Massachusetts

CUCURBITS: HERBICIDE UPDATE

Strategy (ethalfluralin + clomazone): This label came out during 2002 and the product was extensively throughout New England. Strategy is a premix of Curbit (ethalfluralin) and Command (clomazone). It is intended for preemergence control of annual grasses and many broadleaf weeds in cucumber, melon, pumpkin, summer squash, winter squash, and watermelon. Broadleaf weeds controlled include, common lambsquarters, pigweed, common purslane,

velvetleaf, common ragweed, and Pennsylvania smartweed. This product may be applied to the soil surface after direct seeding on bare ground. It may also be banded between plastic for both direct-seeded and transplanted crops. The formulation of Command contained in this product is the ME (microencapsulated) formulation which does not need to be incorporated. There are many precautions on the label including some replant precautions. For squash and pumpkin, this product will be the treatment of choice since it controls so many weed species. In cucumber and melon, however, Curbit tank-mixed with Alanap (naptalam) may still be a good option since most of the same weeds are controlled but the carryover concerns with clomazone are not present.

Sandea 75WSG (halosulfuron): New label covers cucurbits, tomatoes, fruiting vegetables, asparagus, dry beans, and snap & lima beans. Sandea provides preemergence and postemergence control of many weeds. Most weeds are controlled by either a preemergence or postemergence application; however, common lambsquarters is controlled best by a preemergence application while yellow nutsedge is controlled best by a postemergence application. Postemergence applications require the use of a non-ionic surfactant at a rate of 1 quart per 100 gallons spray mix. Heavy rains following preemergence applications can lead to severe crop injury. There is the potential for crop stunting and a slight maturity delay with the use of Sandea over the top of the crop. Growers should limit their use of Sandea initially to gain experience. Use the correct amount of product per acre. The most common use rate will be ½ ounce per acre. If the directions are not followed, the potential for severe crop injury does exist. A brief summary of use directions follows. Consult the label for complete directions. Consider using Sandea only if current management strategies are not working or as a supplement to existing management strategies to control certain problem weeds. This herbicide may carryover to the following year and can cause severe injury in crucifers, greens, spinach, beets, carrots, onions, and other crops. See the label for details.

Cucumbers: Apply preemergence after seeding and before crop emerges. Can also be applied when a seeded crop has 2-5 true leaves but the potential for crop stunting and yield delay should limit postemergence use to areas where weed pressure is high and yield reductions due to weeds would be unacceptable. Can also be used between plastic mulch with direct-seeded or transplanted cucumbers. In cucumbers, with a shorter life cycle that most other cucurbits, it might make sense to use this product preemergence alone or in addition to Strategy, or Curbit, or Alanap

Pumpkins and Winter Squash: Apply postemergence when the seeded crop has 2 to 5 true leaves. Crop injury and some delay may result. Can also be used preemergence after seeding; however excess rainfall or irrigation may cause unacceptable crop stunting. Can also be used between plastic mulch with direct-seeded or transplanted winter squash and pumpkins. Perhaps the best fit for this product in winter squash and pumpkins is for postemergence control after preemergence use of another product (Curbit, Strategy, Prefar, or Command). Sandea will provide postemergence control of yellow nutsedge, redroot pigweed, velvetleaf, common ragweed, and many other broadleaf weeds

Summer Squash, Muskmelons, and Watermelons: Apply between rows of plastic mulch avoiding contact with the plastic and crop. May also be used in row middles without plastic; any crop contact or use in the crop row will cause injury.

Tomato: Apply either over the top of transplanted tomatoes at least 14 days after transplanting, under plastic mulch, or in row middles. The greatest potential for crop injury occurs when the crop is contacted.

Pepper, Eggplant, Tomatillo: Apply between rows of plastic mulch avoiding contact with the plastic and crop. May also be used in row middles without plastic; any crop contact or use in the crop row will cause injury. If a shielded sprayer is not available, consider applying Sandea to the row middles after the plastic is down but before the crop is transplanted.

Dry Beans, Lima Beans, Snap Beans: Apply preemergence after seeding but before crop emerges. Use lower rates on lighter soils.

Asparagus: May be used during the cutting season after a clear cut or after final harvest. If ferns are present, direct the application to the base of the ferns to avoid injury.

Please read the label entirely regarding application directions and precautions. Accurate measurement and application is essential to minimize crop stunting and delay. A plastic measuring cup should be included with the herbicide container. Results during 2002 in Massachusetts on winter squash, cucumbers, and pumpkins were generally favorable although some severe injury did exist. Crop stunting was common but in most cases, plants recovered with only a slight yield delay.

Gramoxone (paraquat) Formulation Change: Gramoxone Max 3S has replaced Gramoxone Extra for all uses. Label rates are generally lower than the old formulation since Gramoxone Max contains more active ingredient per gallon. As with the old formulation, the use of a non-ionic surfactant is still required. With Gramoxone, always remember that better weed coverage through the use of more water per acre will result in better weed kill.

-Rich Bonanno, Weed Management Specialist

STRIPED CUCUMBER BEETLE CONTROL PART I: USING SYSTEMIC INSECTICIDES

All over the Northeast, striped cucumber beetle is our most serious early-season pest in vine crops. These beetles spend the winter in plant debris on field edges and move rapidly into the field with the emergence of cucurbit crops and the onset of warm days. Densities can be very high, especially in non-rotated fields or close to last year's cucurbit crops. Adult feeding on cotyledons and young leaves can cause stand reduction and delayed plant growth. More importantly, the striped cucumber beetle vectors *Erwinia tracheiphila*, the causal agent of bacterial wilt. This disease overwinters within the beetle and is transmitted by contact of beetle feces with the open wounds in leaf tissue caused by beetle feeding. Bacteria multiply and block the vascular system of the plant, causing vines to wilt. This disease can be effectively managed only by preventing feeding by the beetle. Vine crops vary greatly in their susceptibility to wilt.

Early season infection. Pumpkin plants at the cotyledon and first 1-2 leaf stage are more susceptible to infection with bacterial wilt than older plants, and disease transmission is low after about the 4-leaf stage. Wilt development is strongly influenced by the dose of the pathogen that the plants receive. Typically, only a relatively small proportion (1-10%) of overwintering beetles carry the Erwinia pathogen and are able to infect plants. The higher beetle density during early plant growth, the more severe the incidence of wilt. Beetles that discover a host plant will release an aggregation pheromone that calls others to their spot. Groups of beetles feeding, wounding and defecating on a single plant are more likely to transmit disease, acquire the pathogen, and transmit it to other plants.

Thresholds and foliar controls. Beetle numbers should be kept low, especially before the 5-leaf stage. Crop rotation to a field at a distance from last year's cucurbits reduces beetle numbers significantly and may eliminate the need for controls. Beetle numbers tend to build up when vine crops are planted in the same or nearby fields year after year. Conventional IPM systems have relied on scouting frequently (at least twice per week) and treating after beetles colonize the field. To prevent bacterial wilt, we recommend that beetles should not be allowed to exceed one beetle for every 2 plants in susceptible crops. This is a lower threshold than is needed to prevent significant foliar damage. Less wilt-susceptible crops will tolerate 1 or two beetles per plant without yield losses. Proper timing can be difficult: growers have to be ready to respond quickly in a very busy time of the season, and weather or field conditions can delay sprays. However, foliar sprays remain a viable option and we will discuss those further in next week's article.

One way to inject Admire into the furrow at the seed level is to use an applicator.

Systemic controls. Admire is one of the new class of insecticides, the neo-nicotinoids (also called chloronicotinyls, or nicotine mimics). Another example is Platinum/Actara, with the active ingredient thiamethoxam. We will certainly be seeing more materials from this class in the future, because they have several advantages. They have systemic activity when applied to soil or seed, are taken up through the roots and transported into new leaf tissue where they persist through the critical early plant stages. They also have translaminar effects as a foliar insecticide. Additionally, these materials have a long residual activity and relatively low mammalian toxicity. As with any pesticide, because insects can become resistant when a product is used year after year in the same field, we recommend rotating crops being treated with Admire.

Imidacloprid (Admire 2F) has the potential to improve and simplify early season control of cucumber beetles and thus wilt. It can be applied to soil near the time of seeding or transplanting, enabling the product to be in leaf tissue when an early invasion of beetles occurs. Admire can be applied using banded treatments for direct-seeded crops or a transplant drench in transplanted crops. It can be applied through drip irrigation where crops are grown in a plastic-drip system. It also has good potential as a perimeter treatment. In Massachusetts we have tested several of these methods in pumpkin in 2001 and 2002.

Using Admire in direct seeded crops. Admire 2F can be applied in a narrow band within 2 weeks before planting, as an in-furrow spray or narrow surface band during planting, or as a post-seeding drench. It is important to get Admire into the soil to avoid photochemical breakdown; placing it in the furrow or irrigating it in can accomplish this. One of the most efficient systems for an in-furrow treatment is to attach an injector to the planter for placement at the seed level after the furrow is opened and before the seed drops. This has the advantage of one trip through the field and very precise targeting of material. Where it is applied to the soil surface, it should be watered in with irrigation (or rainfall) to move it to root depth for seedlings. For growers who plant by hand on a two-way grid for cross-cultivation, Admire can be applied in a twelve-inch band at the time that fertilizer is incorporated.

Rates. The label gives a range of 16 - 24 oz per acre or 0.9 to 1.3 oz per 1000 feet of row. Studies have found a rate of 1.0 or 1.1 oz per 1,000 feet to be sufficient for controlling cucumber beetle in the critical early weeks. Given the wide range in row spacing with these crops and the fact that it is a banded application, we recommend calculating rates based on the number of row feet per acre. This reduces the cost at wider row spacing (Admire typically costs about $4.40 per oz). Below is a table of rates for various row spacings. The same

Row spacing (feet)	Row feet per acre	Row feet /1000	Rate/acre at 1.1oz/1000 ft
2	21,780	21.8	24.0
3	14,520	14.5	16.0
4	10,890	10.9	12.0
5	8,712	8.7	9.6
6	7,260	7.3	8.0
7	6,223	6.2	6.8
9	4,840	4.8	5.3

rates can be used for trickle applications.

Using Imidacloprid on transplants: The best time to treat is about 1 day prior to planting in the field. The recommended rate per transplant is very low: 0.02 ml/plant. Accurate measuring of small amounts is very important! A plastic syringe, available from the local drug store medicine section, can help ensure that these small measurements are accurate. Apply in diluted form with enough water to achieve even application and soak the root zone. Methods of application include a Hozon (if you already have one), a Dosatron, or a backpack sprayer followed by watering.

Example. Multiply 0.02 ml per plant times the number of plants in your flat. For example, use 20 ml to treat 1000 transplants. Dilute this amount of Admire in a volume of water sufficient to soak to soil mix evenly. For example, If you use a Dosatron set at 1:200, then calculations would be as follows:

Total Water: 200 X 0.02 ml = 4 ml per plant
X 1000 plants
4000 ml (4 liters, 1.05 gal)

In this example, you would mix 20 ml Admire in 1.05 gal water for 1000 transplants.

To help make other conversions: You can convert ml to oz by dividing by 29.6 (there are 29.6 ml in one fluid oz).

Be careful of phytotoxicity (burning the plants) at higher rates. In Pennsylvania, burning of leaf margins was observed at 0.04 ml/ melon plant at the 2-leaf stage, although these plants did grow out of this in about 2 weeks. The transplant treatment may be sufficient to carry the plants through the early crop stages. Scouting can determine if any foliar applications are needed. Slightly higher rates might be useful on transplants set out in early May, when there will be a delay of several weeks before beetles arrive. However, there is also the risk of phytotoxicity at higher rates. Remember also that the older the plants are when beetles arrive, the less serious is the damage that beetles cause.

This method of application is, obviously, less expensive than a furrow drench. Admire can also be used for Colorado potato beetle or flea beetle control on tomato, pepper and eggplant transplants. Again, be cautious not to use too high a rate, as phytoxicity can result. The suggested rate for tomato transplants is 15 ml - or ½ ounce - per 1000 transplants.

Another way to apply Admire to transplants is through a water wheel planter. Use the same rate of Admire per plant (0.02 ml) and the rate of water per plant that fits your planter (e.g. 8 oz). Multiply by the number of plants and mix the total Admire needed with the total water needed in tank. Make sure your workers wear protective gloves and allow time for uptake (1+ days) into leaves.

Trickle irrigation may be used to apply imidacloprid to direct-seeding or transplanted crops, either on bare ground or under plastic.

Drip application: A drip system can be used for Admire applications to either direct seeded or transplanted crops. Know your system well enough to know how long it will take to inject a given amount of concentrated solution (one bucketful, for example) and to soak the area between emitters. Apply early enough to allow the plant roots and leaves to take up the material before beetles arrive. The system should be

primed with water first, and imidacloprid injected slowly for even distribution. Make sure to use enough water to soak the area between emitters. More emitters provide more even distribution of product.

Calculate the rate of Admire per 100 or 1000 ft of row, at 1.1 oz per 1000 ft of row. Place the total amount in bucket with enough water for 20-30 minutes injection. Charge system with water first to get the soil wet. Turn on the Venturi or other injector, to inject slowly for even distribution (20 or 30 minutes). Then flush lines with clear water and to move product out and down.

In our experiments in Massachusetts, we had poor control with trickle application in the first season, probably because we did not use enough water to soak the entire in-row area and some plants received a low dose. In 2002, trickle applications as well as furrow and transplant applications gave excellent control under high beetle pressure.

Perimeter treatments. Because beetles move into the field from the borders, they feed first on border plants. A trap crop that is preferred compared to the main crop in the center of the field planted in a border of 2-3 rows all around the field, can keep the pest in the border and reduce infestation in the center. For example, a preferred crop such as Turks Turban can be planted around a less-preferred crop such as summer squash, butternut, or pumpkin. It is important to fully surround the field. The trap crop has an even greater impact when treated with effective insecticide.

With or without a preferred crop, perimeter treatments with a systemic such as Admire can have the same effect. Insects feeding on treated plants die rapidly without moving further into the field. In potato, a 3-row barrier treated with insecticide controlled 70% of the colonizing population of Colorado potato beetle (Ferro 1995). In a non-rotated potato field, a 30-foot wide perimeter treatment around a 10-acre field (17% of the field area treated with Admire) controlled Colorado potato beetle for the entire season (Ferro 1997). This approach has the advantage of reducing the cost significantly. It is being tested in vine crops in Connecticut and Ohio.

Non-target effects: Bees are very susceptible to imidacloprid and could be affected by its presence in pollen if it is still at high levels in the plants at the time of flowering. Bees intoxicated by Admire, like beetles, show unusual behaviors such as tremors, staggering, and falling over before dying. This could happen with bees at excessively high rates of Admire and has been reported, but we have never seen this effect at the 1.1 oz/1000 ft rate. The foliar form of imidicloprid (Provado) is not labeled for use in vine crops for this reason.

-Ruth V. Hazzard

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