Developing Educational Resources for Pest-Control Alternatives

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Environmental Studies Senior Seminar
Spring 2006

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Introduction

The spring 2006 Environmental Studies Senior Seminar focused on pest-control issues and alternatives. In the first half of the semester, we took an in-depth look at the role of pesticides in agriculture and our society as a whole. Over the course of the semester, we realized that something has to be done to educate the public about the implications of pesticide use. While pesticides may appear to be a quick and easy solution to controlling organisms that compete for our food, every citizen should understand how pesticides interact with the environment and affect populations in unforeseen ways. There are alternative methods of growing food that are not as reliant on pesticides as is conventional agriculture, yet not all farmers are familiar with these more ecosystem-friendly methods. Therefore, we worked with the Northeastern Organic Farming Association of VT (NOFA-VT) to create fact sheets about these alternative less pesticide-dependent methods of agriculture that will be available to the public through the NOFA-VT website.

It should come as no surprise that we have competitors for our food. In any natural ecosystem, different organisms compete for resources every day. Yet, when insects and other organisms appear in agricultural fields in order to consume the food we are harvesting, we call these organisms pests and do everything we can to wage a war against them. Pesticides are chemical compounds that are sprayed on crops to reduce the damage done by insects or competing plant species (Winston, 1997). Many pesticides disrupt the endocrine system of insects, resulting in death, while others interfere with the nervous system. As human populations increase at an exponential rate, farmers search for ways to decrease damage to crops and increase productivity and yield. Pesticides clearly have the potential to decrease the damage done to the
crops, yet the most commonly prescribed pest control treatment, chemical pesticides, can also be
damaging to our health and the environment around us (Winston, 1997).

When deciding whether or not to spray chemical pesticides into the environment around
us, it is important to look back at the history of pesticides and learn from some of the mistakes
we made in the past. The onset of the modern era of synthetic organic pesticides came during
WWII when a Swiss chemist, Paul Mueller, showed that DDT is highly toxic to many insects
even when applied in very low doses. The development of DDT as a pesticide, which acts upon
the nervous system by interrupting the transmission of nervous signals, was hailed as one of the
most promising inventions of the century for which a Nobel prize was given (Winston, 1997).

DDT was seen as an amazing success and people around the world were excited for these
miraculous chemicals that had the potential to revolutionize agriculture. Scientists quickly found
out that DDT and other insecticides also had the potential to assist in disease control. The use of
pesticides in controlling disease-carrying insects met with great success around the world and
saved millions of lives.

The advent of synthetic pesticides did, in fact, revolutionize agriculture, as farmers began
to focus on the complete eradication of pests rather than just controlling them to minimize crop
damage. Many farmers turned from more traditional, non-chemical methods of controlling pests
such as “rotating crops, removing diseased plants, encouraging natural enemies, draining
standing water, and selection of resistant varieties” (Winston, 1997) because the chemical
pesticides were much less time-intensive, they were less expensive, and also, in the short-term,
were more effective. Many farmers adopted the practice of spraying chemical pesticides on their
crops before gathering enough evidence to prove that pesticides they were using were not
destructive to human health and the productivity of the ecosystem. Eager farmers saw these
pesticides as the answer to producing wholesome, nutritious food at a low price while increasing industrial and agricultural profits. It was not until 1962 that Rachel Carson published *Silent Spring*, through which she attempted to educate the world about how harmful DDT is to all organisms in the environment. Carson presented strong evidence that DDT kills fish, birds, plants, and other organisms in addition to being a threat to human health (Gottlieb and Warren, 2003).

The effects of pesticides on the environment are significant; they have the potential to change the species composition and disrupt ecological functioning. One of the main problems is the destruction of non-target species. Although a farmer may only want to kill one species of insect when spraying pesticides on the fields, many other organisms may also be harmed. Depending on environmental conditions, different pesticides can break down in many different ways. The degradates of some pesticides are actually more harmful than the pesticide that was originally sprayed (Moore, 2002). Pesticides are ubiquitous in all habitats because they can be highly mobile and can travel great distances through the air and as droplets suspended in fog, rain, and water. They have negative impacts on a variety of organisms, from soil-dwelling microorganisms to beneficial insects and vertebrates (Winston, 1997). Surface and underground water sources are also susceptible to pollution from pesticides. Because some substances can travel quickly through water, runoff from agricultural fields can go straight into rivers and lakes, making fish and other aquatic vertebrates particularly vulnerable.

Birds are especially affected by pesticides because they eat grain that has been exposed to these chemicals in addition to eating exposed fish. It has been estimated that 672 million birds around the world are affected by pesticides each year and about 10% of these birds die (Pimentel, 1999). Because harmful toxins are often stored in the fatty tissue of fish, they are passed on to
the predator that consumes the fish. The pesticides often travel up through the food chain, accumulating in predator species through a process called bioaccumulation. Colburn (1996) explained that many of the synthetic chemicals that are released in the environment can disrupt the endocrine system of a variety of animals. In addition, these chemicals decrease fertility in birds, fish, and mammals, decrease hatching success in fish, birds, and turtles, and increase birth deformities in birds, fish, and mammals.

Some of the non-target species affected by pesticides may be beneficials. All organisms within an ecosystem are necessary for ecosystem functioning, although to varying degrees and often in ways that are not well understood (Winston, 1997). Many pesticides will kill pollinating bees in addition to the insects that are feeding on the crops. Without these insects, the plants are less likely to be pollinated and productivity is minimized. In addition, predators and parasites that normally control pests in the natural environment can also face same neurological damage that the pests themselves would face when exposed to pesticides. The predators that prey on pests suffer when entire populations of pests are wiped out by pesticides. Even if the predators are not affected directly, they will die off when their food source disappears (Winston, 1997).

In addition, pesticides pose a problem of inducing resistance. When pesticides are introduced to the environment, there are always a few individuals that have randomly mutated and are resistant to the harmful effects of pesticides. These are the insects that survive to reproduce, passing their genes onto the next generation. The pesticide-resistant offspring will not face any intraspecific competition, and it is likely they will flourish and pass on their genes again. Because insects reproduce quickly, have high fecundity, and have the potential to quickly adapt to a changing environment, an increasing number of individuals will be unaffected by the
pesticides in each generation (Winston, 1997). The pest situation is thus exacerbated and, farmers are forced to use more pesticides to kill the pests as resistance continues to rise.

Humans often forget that they are organisms interacting in the environment and are also affected by the harmful pesticides that they release into the environment. Our bodies are “inherently porous and tightly linked to the surrounding world” (Nash, 2004), and we are unavoidably exposed to pesticides through food, water, air, workplaces, and living environments every day (Moore, 2002). Pesticides can be ingested, inhaled, or absorbed through the skin; therefore, farmers working directly with pesticides face a disproportionate amount of effects. The Environmental Protection Agency has estimated that 300,000 of the 2.5 million farmworkers in the US are poisoned to some degree each year (Claren, 2003). People seemingly removed from pesticide exposure are also affected. Because pesticides can travel long distances by air, many people are exposed to pesticides every year. In addition, humans consume pesticides that have bioaccumulated in the fish and birds we eat. Newborn babies are exposed to extremely high concentrations of toxins because breast feeding mothers are at the top of the food chain. In addition, children often face a disproportionate negative effects from pesticides because they are closer to the ground, are more likely to put pesticide dust in their mouths, their bodies and organs are still developing so they do not process poisons as well as adults, they face more exposure because they eat and drink more per pound of body mass, and they have a greater surface area in contact with the environment (Moore, 2002).

The lengthy list of known and suspected health problems associated with pesticides is growing steadily as new scientific discoveries are made each year. Pesticides are known to cause acute effects that often go undiagnosed or unreported, including blurry vision, dizziness, fatigue, diarrhea, nausea, vomiting, and abdominal pain (Moore, 2002). Exposure is also known to
increase the severity of existing illnesses and medical conditions, such as asthma and respiratory disease. Chronic pesticide exposure among humans is linked to neurological effects, reproductive and developmental illness, disruption of the endocrine system, immune dysfunction, mood disorders, and various forms of cancer (Winston 1997, Moore 2002). Some pesticides kill pests by acting like hormones and mimicking natural estrogen, thus creating infertility in the insects. The pesticides can mimic the natural estrogen in humans as well, which causes infertility and can be destructive to the developing organs of a fetus, often resulting in a variety of birth defects (Colburn, 1996).

In addition to affecting physiological systems, pesticides enable farmers to create large monocultures. With pesticides, farmers can grow larger areas of the same valuable crop every year; yet these monocultures are unsustainable in the long-term. Although monoculture agriculture is often more productive in the short run, using pesticides on monocultures reduces the long-term viability of the entire land. Monoculture practicing and chemical-intensive agriculture are much more susceptible to “soil erosion, crop damage, and other water-caused losses than those farms that practiced more conservation-oriented forms of agriculture such as polyculture, crop rotation, biological pest control, water conservation, terracing, strip cultivation, and agroforestry” (Clay 2004, 45). These integrated pest management (IPM) techniques, if used in site- and crop-appropriate combinations, are much more likely to support the biodiversity and the integrity of the land. IPM is a continuum that ranges from low to high; the range is determined by the extent to which ecological and biological methods of pest control replace chemical pesticides. Organic farming, a form of agriculture that relies on ecosystem management and minimizes synthetic agricultural inputs, is also known to promote and enhance the health of the ecosystem. Organic strategies might be considered an end-member on the IPM
spectrum, representing holistic strategies to minimize control and damage to the ecosystem. When farmers use a “minimal level of control that will maintain a pest below an economic damage threshold” (Winston 1997, 163), rather that simply attempting to eradicate entire species of pests, they minimize the damage to non-target organisms and to the ecosystem as a whole.

Some pesticides are approved for organic use. These pesticides are derived from naturally occurring substances such as nicotine. The pesticides used by organic farmers are subject to the same regulations as conventional pesticides, and organic pesticides are not completely harmless. Another organic-approved alternative to using high doses of chemical pesticides to control pests is to use pheromones from insects that attract the opposite sex from the same species from vast distances. Farmers can minimize the amount of pesticides they spray on their field by monitoring insects after attracting them by pheromones. Pheromones can also be used through the “attract-and-kill” technique, drawing insects to a trap where they will be exposed to pesticides in a container. Lastly, pheromones can be released into the air, where they disrupt the mating rituals of the insects, impeding their ability to reproduce (Winston, 1997). These pheromones are much less destructive to the environment because they only attract specific species, they do not affect non-targets, they can be very effective in extremely low doses, they attract hundreds of insects from great distances, and they are easy to market because they have few, if any, side effects (Winston, 1997). Although pheromone management is expensive and hard to perfect, it has a lot of potential in agriculture.

Despite the evidence showing the negative implications of pesticides and the success of different alternatives, pesticide use in the US has nearly tripled from 215 million pounds in 1964 to 588 million pounds in 1997 (Kimbrell, 2002). Regardless of the widespread regulation that exists today, the use of pesticides around the world is greater than 5 million metric tons per year.
There is an understanding of the potential for biologically based strategies to manage pests in many academic circles, yet most farmers are still relying heavily on synthetic pesticides (Winston, 1997). This lack of alternative pest management strategies around the world has many causes. Winston (1997, 16) asserts that the “pursuit and adoption of biologically based methods of pest control have been hampered by our commitment to pesticides, our psychological attitude toward pests, short-term economic concerns, the complexity of nonchemical management techniques, and a lack of comprehension about our impact on the rest of nature.” Farmers calculate the costs and benefits of using different pest control alternatives on the short-term scale, without taking the effects on the environment into consideration. If they are just focusing on immediate returns, pesticide-supported monocultures are the best way to go, because they are cheaper, less time-intensive, and easier to develop. Integrated pest management strategies are not simple. A farmer who chooses to minimize pesticide use and turn to alternative strategies must be committed to becoming an expert on the entire ecological system. The farmer must go through intensive training to be successful with an IPM or organic strategy and must be willing to increase costs in the short-term (Winston, 1997).

Consumers also contribute to lack of more conservation-oriented farming techniques because of their demand for perfection. Many of the pests that are targeted with chemical pesticides only cause surface blemishes, without threatening taste, creating health threats, or endangering the food supply. Many of the non-chemical, biologically based strategies to control crops are enough to control any significant damage done to crops, yet “not at the level required by the pestaphobic public” (Winston, 1997). Although specialists understand implications of spraying millions of pounds of chemical pesticides on our crops every year, the dialogue does
not extend to the public. Most people do not have any idea of the extent of pesticide use in our society, and many are enjoying the luxury of their uncertainty (Moore, 2002).

Most researchers understand that pesticides can be helpful in agriculture to some extent; yet, they also understand the need to minimize the amount of pesticides that we are releasing into the ecosystems around us. When Rachel Carson educated the public about the dangers of DDT, she did not suggest that we end the use of pesticides, but rather that we need to understand how pesticides are used and how they effect the environment. The harmful effects of pesticides to farmers’ health can be minimized if the pesticides are handled properly and are applied correctly. Winston (1997, 174) explained that,

By more realistically defining what is a pest, and choosing to deal only with organisms that truly cause us harm, by deciding to manage rather than eradicate, and acting against pests only when the danger they present becomes economically or medically significant, and by choosing methods that are the least damaging to our own health and to the environment, even if they appear more costly, we can reverse the trend toward ever more toxic and ineffective methods of pest management.

The most important aspect of safe pesticide use is education. Consumers should be educated about the implications of their demand for perfect produce and their phobia of pests. If farmers understand how to use integrated pest management in order to use small doses of pesticides more efficiently, the negative effects on the natural ecosystems would decline drastically. Farmers should have access to abundant information about the pests in their region, different pest management strategies that have worked in the past, and the implications of spraying pesticides on their fields every year.

The Northeastern Organic Farming Association of Vermont (NOFA-VT) recognizes this need for education about pest-control alternatives. NOFA-VT is a non-profit organization of consumers, gardeners, and diversified farmers who are interested in “promoting an economically
viable and ecologically sound Vermont food system for the benefit of current and future
generations” (NOFA-VT). NOFA-VT uses education and member participation to strengthen
the agriculture sector in Vermont. NOFA-VT recognizes that there are insufficient resources for
farmers to learn about the different alternatives to pesticides, and if these resources do exist, they
are not easily accessible. With this in mind, NOFA-VT asked the Middlebury College
Environmental Studies senior seminar to create a series of web-based fact sheets to explain pest-
control alternatives applicable to commercial production of apples, strawberries, and lettuce in
Vermont. We were also asked to create a fact sheet about applicator safety and regulations
because it is important for all farmers, including organic farmers, to understand the importance
of using caution when applying any pesticide. NOFA-VT wants to make it easier for
conventional farmers who might be interested in converting to organic farming to go online and
find resources to learn about the environmental impacts of pesticides and potential alternatives to
the conventional system.

Similar fact sheets exist for different states throughout the country, yet Vermont has its
own unique climate, soil, pests, and smaller-scale agricultural system. According to NOFA-VT,
the most pesticide-reliant commercial crops in the U.S. are apples and strawberries, and both
crops are grown in the Champlain Valley of Vermont. There was a need for developing web-
based educational resources specifically for Vermont farmers on the variety of available controls
for common apple, strawberries, and small vegetable farm pests for crops such as lettuce.
Focusing on these crops also allowed us to present a range of challenges and issues. For
example, while lettuce can be grown organically fairly easily, it is very difficult to grow
strawberries without some sort of pesticide spray. Our goal was to create a series of web-based
fact sheets so that farmers could have information about these different crops, the pests and
pesticides traditionally associated with them, and the alternatives to traditional pesticide use. These VT-specific fact sheets will be accessible to farmers through the NOFA-VT website.

Methods

Our first contact was our community partner, Enid Wonacott, at NOFA-VT. She gave us suggestions on where to look to find pertinent information and which farmers to contact, in addition to giving us perspective on this project. Talking to farmers helped further identify what was important to put on the fact sheets and what was common knowledge and, therefore, unnecessary to include.

We conducted significant online research about applicator safety, current trends of pesticide use in Vermont, conventional versus organic pesticides, and other organizations like NOFA-VT, that distribute information to farmers. Background research came from a variety of resources including peer-reviewed journals, such as the Annual Review of Entomology, state and government websites, such as the Environmental Protection Agency website, and university extension organizations, such as the University of Vermont Agricultural Extension site. Our research helped us to evaluate what information was already available and where gaps might exist that our fact sheets could fill.

In addition to background research, we contacted local farmers. Among them was Vern Grubinger of the University of Vermont Agricultural Extension services, who directed us to extension fact sheets relevant to our topic. Nick Cowles of Shelburne Orchards provided a general perspective on farming, both organic and conventional. We also spoke with Will Stevens of Golden Russet Farm, David Merchant, the president of the Small Fruit and Vegetable Growers Association, Merrill Legare who is a strawberry and vegetable farmer who started growing organic strawberries and then switched to conventional, and Eugenie Doyle, an organic
strawberry grower, who was extremely helpful in giving us a greater understanding of the
difficulties and benefits of growing organic strawberries in Vermont.

After interviewing farmers, we used relevant background research, existing fact sheets,
and farmers’ priorities to produce the four guides. The guides are fact sheets that take everything
a step further by providing links to, and descriptions of, websites with more extensive
information about the topic and its related issues. The fact sheets are for strawberry production,
lettuce production, apple production, and for pesticide applicator safety/regulations. Each fact
sheet includes an introduction and information about pests and remedies or regulations in the
case of the applicator safety guides.

The most important feature of our fact sheets is that they provide information about
several different aspects of our topics all in one place. The fact sheets list the best resources and
offer a comprehensive view on the production of fruit and vegetables in our area and the
pesticide regulations that apply to all farmers, including organic farmers. Because farmers are
often short on time, we strived to create an efficient product that was highly accessible and easy
to navigate so that it could be readily and quickly understood.

The primary means of distribution for our fact sheets will be via the NOFA-VT website.
Due to the fact that many of the resources in our guides are available exclusively on the internet,
the website will be the best place for farmers to access and utilize our materials. If, however, a
farmer is without internet access, NOFA-VT will send the fact sheets to anyone needing them in
a hardcopy format. In addition to printing out and mailing the actual fact sheets, NOFA-VT has
also indicated a willingness to print out materials from the links that we cite on the actual fact
sheets to provide farmers with easy access to that information. Finally, we have also included
addresses or phone numbers for many of the listed resources and organizations.
Results

We learned many important things throughout the research and conception of our fact sheets as it was a great opportunity to be introduced to the details of organic farming in Vermont on the whole, and then to delve further into the issues that directly affect production of lettuce, strawberries, and apples. Our group saw the difficulties of growing in Vermont due to its short growing season and high humidity, but more importantly saw how farmers can succeed in this environment. Research revealed that diligence, hard work, precise timing, and creative planning could overcome Vermont’s seemingly difficult growing conditions and allow plants to thrive.

For an organic grower, to be personally successful is one thing; for an organic grower in this area to be commercial successful is surely another. Complex marketing strategies are needed for organic farmers to compete in a market where anything but perfect is considered unsellable. With lettuce, strawberries, and apples, organic pest management methods can leave produce with blemishes that are typically unattractive to customers, even if they do not affect the taste or nutrient value of the plant. Organic apple farmers, for instance, such as Cowles of Shelburne Orchards can be left with only a small percentage of crop sellable as raw produce. The majority of the crop, and some years all of the crop, must be turned into a value-added product such as Cowles’ pies or Ginger Jack beverage. Even then, the demand for Ginger Jack is not as high as the demand for apples, and it is assumed that many will not be willing to pay the high price for organic pie over a storebrand pie. While there seem to be options for value-added apple products and strawberry jams, what to do with lettuce? Clearly, there are numerous challenges for the organic grower in Vermont, and even if produce can be grown, there is the additional challenge of selling it, which must be overcome with creativity and innovative planning to eliminate pests.
When dealing with the physical and aesthetic challenges of growing fruits and vegetables in Vermont, we learned that some of the pests affect multiple crops while others specialize. The biggest threats to a successful strawberry crop are the tarnished plant bug and the strawberry clipper, as well as grey mold disease. Apple crops are affected most significantly by the plum curculio insect, codling moth and other moths, and the apple maggot fly. Diseases are also common in apple crops, and the most severe problems for local farmers include the fungi known as apple scab, powdery mildew, and cedar apple rust (see Appendix 1 and 2 for our apple and strawberry fact sheets). Lettuce crops are in jeopardy of damage caused by slugs, the same tarnished plant bug that affects strawberries, and the flea beetle, as well as fungal diseases similar to those that affect strawberry and apple crops. Lettuce is actually fairly easy to grow organically in Vermont because of the short amount of time that the plants are in the ground, but it is a difficult crop to grow well as it is susceptible to frequent blemishes (see Appendix 3 for our lettuce fact sheet). Through our research, we learned that farmers are able to deal with the problems presented by these pests by employing numerous methods and integrated management strategies. Methods range from keeping soil nutrient concentrations high, managing moisture levels in the fields, and applying sprays of organic-approved pesticides to rotating crops, starting plants in greenhouses, and completing checks of the crop for damage frequently in an effort to catch problems before they become uncontrollable.

In addition to learning a great deal about the challenges and benefits of growing organic produce in Vermont, we were surprised to learn about the regulations that apply to organic farmers. While consumers may assume that the organic label means produce is pesticide free, organic farmers do use pesticides, albeit generally different ones than those used on conventional produce. Applicators of pesticides, both organic and conventional, need to follow a strict
protocol to protect themselves from the potential harms of the substances they are using. Organic farmers, therefore, need to be conscious of how rules and regulations apply to their farms and be safe when they are using organic pesticides as part of their pest management routine (see Appendix 4 and 5 for our applicator safety and rules/ regulations fact sheets).

**Further Research/ Recommendations**

While creating our fact sheets, we learned a great deal about organic agriculture and pesticides use, yet many questions remain. Many of the ideas that we had brainstormed at the beginning of our project remain as areas that would be valuable to investigate in the future. We had hoped to take this project into the classroom at local schools. Many of the principles of organic farming and characteristics of pesticides would be beneficial for students to learn about, especially now, when people are trying to become more and more aware of what they are eating. Our group learned a great deal while creating our fact sheets, and we feel that a consumer-based fact sheet is needed so that other consumers can learn about these issues as well. Our fact sheets can be used as a template to create additional fact sheets (see Appendix 6 for our template).

Suggested topics for the consumer fact sheet include: what organic means, what organic pesticides are, and what methods farmers use to grow organic food. Distribution sites could be at schools, municipal buildings, grocery stores or local markets, and even restaurants.

In addition, ways to get the information on the current fact sheets that we created out to as many farmers as possible should be investigated to get the maximum utility from our work. Due to the limitations of the internet, paper copies of the four fact sheets in an easy to read format, even if it is a shortened version, would be appropriate to have at distribution sites, such as local farm stores like Agway, or perhaps even at larger stores where pesticides are distributed.
Mailings of the fact sheets along with the NOFA-VT directory or even to just a targeted group of farmers would also improve the scope of our project’s impact.

Conclusions

As Rachel Carson asserts in *Silent Spring*, agriculture cannot exist today without the support of some form of pesticide; however, there is potential to minimize the use of these pesticides by replacing them with non-synthetic, biological controls. Completion of this project confirms both the effectiveness and feasibility of these controls in Vermont. Vermont is unique in its potential to support these alternative methods because of the structure of its agricultural system; it consists mainly of small, privately owned farms rather than large-scale conventional farms. For this reason it is easier for the farmers to become familiar with the functioning of the ecosystem in order to cultivate sustainable practices. Although it is not necessarily easy to switch from pesticide-dependent conventional farming to using integrated pest management strategies, our research has shown us that farmers are knowledgeable about alternatives and many have been successful in implementing these alternative strategies. The market for organic farming and other alternative farming methods is growing, and it will continue to grow as farmers and consumers become more educated about the implications of pesticides use. There can never be enough education, so this project was one step in the right direction toward informing the public about pesticide use and the alternatives to conventional, pesticide-dependent farming.
Sources


Appendix 1:

A guide to resources for organic apple growers in Vermont

Successfully growing organic apples in Vermont is a challenge—it requires diligence and careful attention to your orchard—but it is a worthwhile challenge, one that some growers in Vermont have tackled successfully. If you are an organic apple farmer, are trying to become one, or if you are just curious about organic apple production, this factsheet may be helpful for you; it includes a brief summary of issues associated with organic apple production. For more detail, see the information links provided.

Considering the orchard holistically

In order to produce a crop of apples, it is important that all aspects of the orchard be healthy and in balance. This is especially crucial for organic orchards, as you cannot fall back on chemical fertilizers and pesticides to help production in the face of overall orchard health issues. If you are planting an orchard, selection of disease- and pest-resistant apple varieties can save you from problems in the future. Also, when planting, consider how the site of the orchard can have a profound effect on the crop. Lowland areas and other fog-collecting sites should be avoided, as cool air sits in these pockets making trees planted in this area more likely to lose fruits to freezing. The increased moisture makes apples more susceptible to fungal diseases, as well. Ideally, trees are planted on the slopes just above these foggy areas where they are protected from cold temperatures by the warm air displaced by the fog, or the ‘inversion layer’. In order to have successful, vigorous trees, high quality soil is necessary. If nutrients and water are readily available, the tree will be healthier and under less stress, and therefore, less likely to be infected by disease. Healthy soil is full of mycorrhizal fungi, which live symbiotically with tree roots and effectively increase the nutrient and water uptake area available to the roots tenfold, increasing the trees ability to thrive. The development of these beneficial fungi can be encouraged with an application of mycorrhizal gel to roots before planting the tree.

Tree health can also be improved by organically enriching soil nutrient levels. Organic compost is an excellent way to improve the soil nutrients and organic matter content. Cover cropping with nitrogen-fixing legumes will increase nitrogen in the soil, providing greater supplies of this often-limiting nutrient to your orchard. An added benefit of covercropping is that flowers of these plants (and others) attract honeybees, whose pollination services will likely improve fruit production.

This is just the beginning of ways you can help your orchard’s productivity organically. For a more complete description of the holistic approach to apple growing, see these wonderful resources:

  This is an excellent, comprehensive book written with Vermont orchards in mind!
- ‘Organic Matters: Considerations in Organic Apple Production’

A guide to major pests and diseases affecting apples in Vermont

Check out the University of Vermont Apple program website for complete information about pests, diseases, and more at http://orchard.uvm.edu/uvmapple/pest/index.html

- Insect pests:

  Plum Curculio: After overwintering at bases in hardwood trees or in brush and leaf piles elsewhere, this pest moves to edges near the orchard in the spring mating. It then comes into the orchard to lay eggs in apples when nighttime temperatures stay above 70°F, on a ‘curculio night’. Treatment: Until recently, there were few options for organic treatment of this pest. Indeed, this is the pest that pushed many would-be organic growers to spray Imidan and take IPM status instead. (This pesticide is toxic to honeybees—a side effect worth considering as they are the primary pollinators of blossoms.) However, kaolin clay has been successful in prevention
of a curculio problem if fruitlets are thoroughly covered in the clay for the duration of curculio threat. SurroundWP™ is a brand name of the product. See this link for information provided by ATTRA concerning kaolin clay use on apples: http://attra.ncat.org/attra-pub/kaolin-clay-apples.html

For more information about plum curculio: http://orchard.uvm.edu/uvmapple/pest/BacktoBasics/Arthropods.htm#PlumCurculio

Codling moth (and other moths): There are many species of moth pests affecting apples, including codling moth, oriental fruit moth, and various leaf rollers. **Treatment:** Although the various moth species affect apples at different times during the growing season, they can all be treated with *Bacillus thuringensis* (Bt), a bacteria toxic to moths and other insects. Bt should be mixed with fish oil to slow its breakdown and to increase its adherence to trees. For codling moth, spray 15 days after the start of petal fall, and every five days thereafter.

For more information about codling moth: http://orchard.uvm.edu/uvmapple/pest/BacktoBasics/Arthropods.htm#CodlingMoth

**Apple maggot fly:** These flies lay their eggs in young fruits, where they hatch and mature. At the start of winter they move into the soil from fallen fruit. **Prevention:** Remove fallen fruit from tree bases to reduce their numbers in the soil, and therefore, next year’s crop. **Treatment:** Trap flies with red sphere traps. These sticky traps are made to resemble apples. Hang 6 traps on each average-size tree by three weeks past petal fall.

For more information about apple maggot: http://orchard.uvm.edu/uvmapple/pest/BacktoBasics/Arthropods.htm#AppleMaggotFly

**Diseases**

**Apple scab:** This fungus causes khaki green spots during its early stages, which thicken and darken with time. It often causes infected leaves to fall from the tree, decreasing its ability to produce fruit. Infected fruits may also fall from the tree. It develops during spring, facilitated by mild temperatures and high humidity. **Prevention:** Choose a variety that is resistant to apple scab if you are planting new trees. Spores of scab overwinter in apple leaves, so fall removal of leaf litter will reduce spring infection. Limestone and compost over leaves can inhibit reproduction as well. **Treatment:** Spray with sulfur, an organic fungicide.


**Powdery mildew:** This disease, also a fungus, covers leaves with a thin, chalky-white layer. It is facilitated by warm days and cool nights, even in low-humidity conditions. Spores overwinter in infected buds. If flowers are infected with the fungus, they usually wither and die. Fruitlets infected after blooming will result in mature apples that are blemished in a net-like pattern, called ‘russetting’. It may stunt the growth of infected tissues. **Prevention:** If you are just beginning your orchard, select varieties that are resistant to powdery mildew. Selection of a site with good air circulation can prevent the fungus from being a problem. **Treatment:** Spray with sulfur, an organic fungicide.

For more information about powdery mildew: http://orchard.uvm.edu/uvmapple/Pest/BacktoBasics/Diseases.htm#PowderyMildew http://ohioline.osu.edu/hyg-fact/3000/3001.html
Cedar apple rust: Caused by fungi of the genus *Gymnosporangium*, this disease causes rust colored spots on fruit and leaves. Highly infected leaves often fall from the tree. Germination of spores necessitates at least six continuous hours of moisture, so wet conditions facilitate its development. **Prevention:** Select disease resistant varieties of apples. Destroy infected trees to prevent spread of the disease to the adjacent trees. **Treatment:** Sulfur: spray at pink bud stage and three weeks after petal fall.

For more information about cedar apple rust:
http://orchard.uvm.edu/uvmapple/pest/BacktoBasics/Diseases.htm#CedarAppleRust
http://counties.cce.cornell.edu/suffolk/grownet/tree-disease/cdaprust.htm

More information on organic apple production in New England

The links below contain useful information about organic apple growing.

- **The University of Vermont Apple Program Integrated Pest Management (IPM).** This website has great links to a wealth of information concerning all aspects of apple production in Vermont. Although the website is for IPM apples, it is an incredible resource for organic growers as well. http://orchard.uvm.edu/uvmapple/pest/index.html For information about timing of pest treatment, see this easy-to-use chart. http://orchard.uvm.edu/uvmapple/pest/2004IPMQuickSummaryForMonitoring.PDF
- **“Elements of IPM for Apples”, New York State Integrated Pest Management Program.** This website has a checklist-style guide to IPM apple growing in New York State. It also has useful links to other sources. http://www.nysipm.cornell.edu/elements/apple/default.asp
- **ATTR A - The National Sustainable Agriculture Information Service** is a great resource for organic and IPM farmers of all types. www.attra.org
  Links specific to apple production include:
  For free paper copies of any ATTRA publications, contact: ATTRA - National Sustainable Agriculture Information Service P.O. Box 3657 Fayetteville, AR 72702 1-800-346-9140
- **“Proceedings of the 3rd National Organic Tree Fruit Research Symposium”.** See this for information about current research on organic apple production. Topics and researchers are listed, along with summary information of their findings. http://organic.tfrec.wsu.edu/OrganicIFP/ OrganicFruitProduction/PROCEED_FINAL.pdf
- **The Red Tomato** is a non-profit marketing group that created the ‘eco-apple’ label. See this site to learn more about a Vermont apple farmer working with the Red Tomato. http://www.redtomato.org/profile_sunrise.html
- **“A future for organic apple growing in the Northeast” by Laura Sayre,** http://www.newfarm.org/features/0504/apples/orchard.shtml
Organic strawberries are both challenging and rewarding to grow in Vermont. This crop can be difficult to grow because strawberries must be replanted on a regular, and frequent basis, inevitably sustain some level of crop damage due to pests, and require a great deal of time and energy in weed control. However, despite these obstacles, there are many rewards for the organic strawberry grower, including a large and unsaturated market and high customer satisfaction. In addition, because organic strawberries are in high demand, organic farmers can charge more for their fruit to offset their increased labor costs.

There are many resources available for those who wish to learn more about how to manage this crop organically. This factsheet contains information and links highlighting the major problems encountered with strawberry production in Vermont, and existing resources to assist farmers with these issues. The first part of this factsheet introduces some of the major pests and diseases that Vermont farmers encounter with strawberries and some links to information about these specific topics. The second section of this factsheet contains links to more general, but very useful, publications and websites concerning organic strawberry production. Although it may be difficult to grow strawberries organically, it certain is possible! If you encounter a problem you cannot solve, seek out an experienced grower and ask for advice. Northeast Organic Farming Association of Vermont (NOFA-VT) and the University of Vermont Extension office are both good sources to start with. You can find a listing of all of Vermont’s organic strawberry growers on the NOFA-VT website. Finally, remember to check with the Vermont Organic Farmers (VOF) listing of approved organic pesticides and treatments before using any product on your strawberry crop.

A guide to the major pests and disease affecting strawberries
in Vermont

- **Weeds**
  Weeds are a major problem for strawberry growers, as they are for many crops. There are, however, many ways to control this problem without synthetic herbicides. Because you cannot use synthetic herbicides in organic production, mechanical and hand cultivation (weeding) is imperative for the organic strawberry grower. As it is difficult to grow organic strawberries without intensive labor, it is important to only plant as big of a crop as you have people to weed it. As a result, most organic strawberry operations in Vermont are fairly small, usually less than 20 acres.

  Site preparation and crop rotation are also important for managing problem weeds in strawberry crops. With strawberries, a good cover crop rotation is to plant two crops of buckwheat in your field for at least a year prior to planting strawberries. The fall before planting strawberries, plant a cover crop of oats. The oats will die over the winter and in the spring are easy to incorporate into the soil, creating a good seedbed for strawberries. Another cover crop rotation option is to plant a combination of legumes and because legumes help to re-nitrify the soil and rye has been shown to suppress weeds through natural chemical secretions. Rye, however, remains lush throughout winter and thus takes longer to break down when tilled into the soil. Use of cover crops is a good management practice because they eliminate many perennial weeds by competing with them for space and resources. In Vermont, most strawberry farmers protect over-wintering plants with straw mulch. In the spring this mulch can be raked into rows between plants to aid in weed suppression.

  Corn gluten has also been shown to inhibit germination of some weeds, and provides a good fertilizer for strawberries. Gluten, however, is expensive and not proven to be completely successful. Another allowed organic treatment that can be applied to weeds is vinegar. Mixed with citrus oil and a little bit of liquid soap, this treatment is effective at killing weeds. It is important not to apply vinegar to the
strawberry plants directly, however, as it will kill them as well. In addition, because the mixture must be 15% acetic acid, it is highly toxic and full protection measures must be used. Using vinegar as an herbicide is not proven efficient for large-scale commercial strawberry farms because it is difficult to apply the mixture to weeds without spraying the strawberry plants as well. For home garden use, however, this method may be an effective tool for controlling weeds.

- **Insect Pests**
  - **Tarnished Plant Bug (TPB)**

  *Characteristics and Life Cycle*
  
  Adults hibernate under litter and rocks but breed in grasses. Eggs are laid on the midrib of strawberry leaves or are inserted into plant stems. The nymphs, which hatch 10 days after eggs are laid, cause the most damage to strawberry plants because they puncture terminal shoots and inject poison beneath the bud, causing the plant to wilt or die. In addition, this insect damages fruit by feeding on the seeds or vascular tissue surrounding seeds, preventing normal development, causing the strawberry to “button.” You can avoid or reduce TPB pressures by only planting early or mid-season strawberry varieties. These varieties allow you to harvest the bulk of your strawberry crop before a second onslaught of TPB nymphs.

  For more information, see the Pennsylvania State Entomology Department factsheet on the tarnished plant bug: [http://www.ento.psu.edu/extension/factsheets/tarnished_plant_bug.htm](http://www.ento.psu.edu/extension/factsheets/tarnished_plant_bug.htm)

  *Management Options*

  To discourage TPB breeding, keep the ground cover well clipped for 5-10 yards around the crop and remove or destroy hibernation habitats, such as plant debris or tall grasses. At first bloom, survey for TPB by tapping 30 or more flower clusters from different parts of the field into a white pan and counting the number of bugs. Spray with a low dose of approved organic pesticide if there is more than 1 nymph per 4 flower clusters or infestation is greater than 10%. Do not plan on managing TPB solely through organic-approved pesticides, however. The effectiveness of these sprays is questionable and they have not had much success in Vermont. Research done in California has demonstrated the effectiveness of using trap crops such as alfalfa, radish, and sweet alyssum to control TPB, although this has not been tried in Vermont. Some farmers in Vermont have reported that nearby hay fields work well as alternate habitat for TPB. If you have a hay field, you can lure TPB away from your strawberries by not mowing your fields until after strawberry harvest. In addition, a beneficial fungus, *Beauveria bassiana*, appears to have some effect in reducing TPB populations. Likewise, certain varieties of parasitic wasp may serve as an effective biological control for TPB, but it is not yet known how effective this control method is in Vermont. Crop rotation is extremely important in strawberry cultivation to control pests, disease, and weeds. Three years is the maximum amount that any one field should be in production to minimize these problems.

  For more information, refer to:

  - Virginia Tech factsheet on managing TPB: [http://www.ento.vt.edu/Fruitfiles/StrwLygus.html](http://www.ento.vt.edu/Fruitfiles/StrwLygus.html)
**Strawberry Clipper**  
*Characteristics and Life Cycle*

This insect is a problem for strawberry producers because the females oviposit into unopened buds and then sever the bud from the pedicle to prevent it from developing into fruit. Adults over-winter in wooded areas bordering fields, emerge in the spring and migrate onto strawberry plants. Recent research indicates that overall yield is affected little by clippers because plants compensate for damaged buds by producing larger fruit.

For more information about the strawberry clipper, refer to:


**Management Options**

To minimize invasion by adult clippers plant strawberry crops away from habitats in which they over-winter. Immediately after harvest, plow old beds and remove mulch and other debris to remove adult habitat. Although this debris is important for maintaining fertile soils, it encourages strawberry clipper beetles to over-winter in your fields. It is important to strike a balance between eliminating pest habitat, thereby reducing the need to spray pesticides, and maintaining soil fertility and good weed control.

Check for clipped plants as soon as buds are visible, removing and destroying any you encounter. Research by several organizations has shown that, in strawberries, the acceptable economic threshold is 1 clipped bud per 2 feet of row. If clipping is present, it is recommended that you spray with an organic-approved insecticide at early bud stage and 10 days later. If the field has a history of clipper problems, you may want to do a preventative spray. In this case, try to only spray the rows closest to edges or near woodlots to minimize pesticide use. Remember, because clippers may not actually cause as much damage as was previously thought, spraying may not be necessary at all. Early-fruiting varieties are more susceptible to damage than are late-fruiting ones. In addition, some varieties, such as Seneca, tolerate clippers better than others.

For more information, see the New York State Integrated Pest Management Program factsheet on the strawberry clipper: [http://nysipm.cornell.edu/factsheets/berries/strawberry_clipper.pdf](http://nysipm.cornell.edu/factsheets/berries/strawberry_clipper.pdf)

- **Grey Mold**

*Characteristics and Associated Problems*

Grey mold is a strawberry disease caused by the fungus *Botrytis cinera*. Like all fungi, *Botrytis* is carried by spores that can infect any part of a strawberry plant. The presence of small, soggy looking areas covered in fuzzy grey spore masses is indicative of a *Botrytis* infection.

See the Cornell University Plant Clinic grey mold factsheet for more information: [http://plantclinic.cornell.edu/FactSheets/botrytis/botrytis_blight.htm](http://plantclinic.cornell.edu/FactSheets/botrytis/botrytis_blight.htm)

**Management Options**

Keeping air circulating between plants and planting strawberries in well-drained soils are two of the most important ways to minimize *Botrytis* infection. Thin your plants regularly and harvest fruit quickly to avoid letting rotten berries sit in the field. In addition, do not plant strawberries in fields that previously grew a solanaceous crop, as these crops may have introduced pathogens into the soil. It is helpful to plant strawberries on raised beds with good air circulation and light penetration because fungi and other plant diseases do best in cool wet conditions. Crops should be inspected on a regular basis, and those that are infected should be isolated and destroyed. Immediately remove any infected material from the field, taking care to not let infected clippings
come in contact with healthy plants. At the end of each season remove and destroy plant debris so that spores cannot over-winter in the field. In addition, organic mulches, sulfur, copper, compost tea, milk, and baking soda treatments all help control soil-borne pathogens. In Canada, farmers have had a great deal of success using the beneficial fungus *Glicladium roseum* as a biological control for grey mold. *Glicladium* spores are placed outside of a honeybee hive and are delivered to strawberry plants when the bees pollinate them.

To avoid diseases in your strawberry crops, it is always important to purchase your plants from a reputable nursery that can guarantee they are disease-free.

For more information see these links:
- University of Vermont Extension factsheet on using compost tea to suppress grey mold and other plant diseases: [http://www.uvm.edu/vtvegandberry/factsheets/composttea.html](http://www.uvm.edu/vtvegandberry/factsheets/composttea.html)
- University of Illinois Extension publication on grey mold in strawberries: [http://www.aces.uiuc.edu/ipm/fruits/rpds/704/704.html](http://www.aces.uiuc.edu/ipm/fruits/rpds/704/704.html)

**More information on organic strawberry production in New England**

Refer to these links for factsheets and websites designed to answer your questions about growing organic strawberries. The information contained in this factsheet came primarily from these sources, and they provide a more detail on the issues discussed above.

- **Detailed National Sustainable Agriculture Information Service (ATTRA) publication addressing organic and IPM strawberry farming.** This is one of the most helpful guides you will find for organic and IPM strawberry management. ATTRA can also be reached via telephone at 800-346-9140 between 8am and 8pm Eastern Time. [http://attra.ncat.org/attra-pub/strawberry.html](http://attra.ncat.org/attra-pub/strawberry.html)
- The UVM Extension “Vegetable and Berry Page” contains links to many fact sheets and publications concerning organic and IPM strawberry production. Vern Grubinger is an excellent resource, and you can call his office directly at 802-257-7967, ext. 13. [http://www.uvm.edu/vtvegandberry/](http://www.uvm.edu/vtvegandberry/)
- Learn to avoid soil-borne diseases at this ATTRA website: [http://www.attra.org/attra-pub/PDF/soilborne.pdf](http://www.attra.org/attra-pub/PDF/soilborne.pdf)
- The Vermont Extension Integrated Pest Management website deals with fruits and berries. While not designed specifically for organic growers, this website has a great deal of helpful information about strawberry production. [http://pss.uvm.edu/ipm/vegberry.html](http://pss.uvm.edu/ipm/vegberry.html)
- Marvin Pritts at Cornell University has done a great deal of research on organic and IPM strawberry production. [http://www.hort.cornell.edu/department/faculty/pritts/organicres.html](http://www.hort.cornell.edu/department/faculty/pritts/organicres.html)
- For a quick rundown of the many elements in IPM strawberry production see the New York State Integrated Pest Management Program IPM strawberry worksheet. [http://nysipm.cornell.edu/elements/strawb.asp](http://nysipm.cornell.edu/elements/strawb.asp)
- Maine has a similar climate to Vermont, and you might just have a problem that has been encountered by somebody in the Maine Organic Farmers and Gardener’s Association. [http://www.mofga.org/tech.html](http://www.mofga.org/tech.html)

Special thanks to Eugenie Doyle from The Last Resort, Monkton VT for her assistance and insight into strawberry growing in VT.
Appendix 3:

A guide to resources for organic lettuce growers in Vermont

Compared to other vegetables, lettuce is one of the easiest crops to grow organically in Vermont. While there are still some problems associated with growing organic lettuce, few pests hinder the actual growth process. The crop’s short growing time is largely responsible for its lack of pests, and thus is a great crop for farmers attempting to transition to organic farming. This fact sheet outlines the general problems associated with organic lettuce growth and production, and then provides links to websites with additional information about and/or solutions to these problems. Generally speaking, the most common type of pest management for lettuce is an organized system of crop rotation and good soil fertility. Shortening the lettuce’s duration in the ground is also a useful way to keep pests from lettuce.

A guide to the major pests and disease affecting lettuce in Vermont

- **Slugs**
  
  **Background Information**
  Slugs are one of the greatest problems associated with growing organic lettuce. They are normally a problem in the earliest part of the season and are more prone to be present in heavier soil. Because slugs are more of a problem the longer the lettuce is in the ground, the simplest solution is to minimize the duration of time in the ground. This can be done by beginning the season in a greenhouse, and then transferring the plants outside. Because mulch and permanent ground cover create a hospitable environment for slugs, tilling also helps reduce their numbers.

  For more information see:
  - [Organic AgInfo.](http://www.organicaginfo.org/record.cfm?pk_doc_id=3285&doc_num=1)

- **Insect Pests**
  
  **Background Information**
  The two main problematic insect types are aphids and thrips. Other specific problem insects include cutworms and risac conius; however, two specific ones in Vermont include the tarnished plant bug and the flea beetle, which are discussed in detail below.

  **Tarnished Plant Bug and Flea Beetle**
  In Vermont, the tarnished plant bug and flea beetle don’t actually hinder the growth, but feed off the chemicals in the lettuce, stripping the plant of its colors. Flea beetles are particularly a problem in specialty lettuce such as arugula. There are organic chemical sprays that provide a microclimate cover over the plant that is less hospitable to the insects.

  For more information see:
  - [Appropriate Technology Transfer for Rural Areas (ATTRA): Specialty Lettuce and Greens.](http://www.ATTRACenter.org) This publication examines the problems associated with mesclun lettuce types, disease, insect,
and weed pests, propagation, crop scheduling, harvesting, and post-harvest handling. There is also a link to a pdf file entitled “Flea Beetle: Organic Control Options” written by George Kuepper. Any ATTRA publications can be obtained by contacting their office or their website: http://attra.ncat.org/attra-pub/lettuce.html

**Maine Organic Farmers and Gardeners Association**
This website has information on the scientific background of a tarnished plant bug and the specific damages done to lettuce. It also provides some information of organic control. http://www.mofga.org/pest030816.html

**Flea Beetles Management**
This article is by Vern Grubinger, of the University of Vermont Extension. His specialty is fruit and vegetable production, and his contact information is listed on this webpage in the “other resources” category. http://www.uvm.edu/vtvegandberry/factsheets/fleabeetle.html

**Disease**

*Background Information*

While there may be less insects affecting lettuce, there are a variety of diseases that can occur, primarily limited to rotting, viruses, or fungi. These include soft rot, bottom rot, downy mildew (in picture), drop, grey mold, root knot, tip burn, big vein, mosaic, and aster yellows. Lettuce grown in cold environments, such as Vermont, is less prone to these diseases, though they can still occur.

For more information see:

- **Cornell University: Northeast Organic Network (NEON)**
  This website focuses on the lettuce problems in New York state, but it is still very pertinent to Vermont growers. http://www.neon.cornell.edu/training/resources.html

- **Resource Guide for Organic Insect and Disease Management**
  Visit this website on lettuce, for an example of information provided in the guide. This publication is promoted on Cornell's website, and serves as a comprehensive guide for crop management. It has specific information on lettuce, including insect and crop management. It can be downloaded as a pdf file or ordered: http://www.nysaes.cornell.edu/pp/resourceguide/cmp/lettuce.php#i3

**Weeds**

*Background Information*

Different types of crop rotation provide a good alternative to synthetic herbicides for weed control in lettuce growth. Alternating the type of crop grown season to season maintains diversity within the soil, hindering weed growth. Flame weeding, as described below, is another organic option.

For more information see: **ATTRA: Flame weeding for vegetable crops**

- Yes the practicality of flame weeding. It is a non-chemical weed que, and is common in organic vegetable growing.

http://attra.ncat.org/attra-pub/flameweedveg.html

- **NEON Crop Rotation Manuals and Spreadsheets**
  A subset of the Cornell University’s organic farming program, this website has information on planning crop rotation, according to field size or crop.
  http://www.neon.cornell.edu/croprotation/index.html
More information on organic lettuce production in New England

- **Resource Guide to Organic and Sustainable Vegetable Production**
  A resource guide of educational materials that supports the needs of organic and sustainable vegetable farmers. Farmers making a transition to sustainable farming need information on a wide variety of topics (e.g., legumes as a source of nitrogen, cover crops, compost, non-chemical weed control, biointensive IPM, etc.). This Guide provides a summary of some of the best in-print and on-line sources around.


- **University of Vermont Extension**
  Vern Grubinger has created an extensive database for websites pertaining to organic and sustainable vegetable growth in the region, and particularly in Vermont. He has a database of websites for both organic farming in general, lettuce production, and many other agriculture topics. [http://www.uvm.edu/vtvegandberry/](http://www.uvm.edu/vtvegandberry/)
  - One of his more specific links: **University of Vermont Extension: New England Vegetable Management Guide: Lettuce, Endive, and Escarole.**
    This website provides a good overview of the different types of lettuce grown throughout New England. It provides an extensive database for types of management for all problems, including insects and slugs. Be aware that not all management options on this website are organic approved.
    [http://www.nevegetable.org/index.cfm?objectid=D5B32555-8C7F-4CFE-51B18853E620AF2C](http://www.nevegetable.org/index.cfm?objectid=D5B32555-8C7F-4CFE-51B18853E620AF2C)

- **New England Vegetable Management Guide: General Information**
  This website is useful because it explains various aspects of agriculture needed to best understand the subsequent pages. While this isn’t as useful for someone who is more comfortable in organic vegetable production, it would be very useful for someone attempting to make the switch to this type of agriculture.
  [http://www.nevegetable.org/index.cfm?objectid=B2766D0D-8C7F-4CFE-5632BD5B754C58D7](http://www.nevegetable.org/index.cfm?objectid=B2766D0D-8C7F-4CFE-5632BD5B754C58D7)

- **University of California at Davis: Agriculture and National Resources**
  Although geographically and climatologically distal to Vermont, California has established itself as one of the country’s leading organic and sustainable growth production areas. This website outlines basic insect pests to lettuce, the damage, symptoms, field evaluations, and IPM management. [http://www.ipm.ucdavis.edu/PMG/selectnewpest.lettuce.html](http://www.ipm.ucdavis.edu/PMG/selectnewpest.lettuce.html)

- **Organic AgInfo**
  This website contains a database for organic farm methodology throughout the country. Using search options either by crop or region, there are reports to various tests that have been conducted attempting different types of organic control.
  [http://www.organicaginfo.org/get_region.cfm](http://www.organicaginfo.org/get_region.cfm)

- **Organic Agriculture at Cornell University**
  This website provides a link to their resource guide publication listed earlier. It is another source for various research summaries and findings on different organic farming issues.

- **University of New England: Sustainable Weed Management in Organic Herb and Vegetable Production**
  This website provides more research findings on organic weed control throughout New England.
• Some physical addresses of resources
  o University of Vermont Extension
    11 University Way
    Brattleboro, VT 05301
    Phone: (802) 257-7967 ext.13
  o Gemma Osborne (Cornell University)
    NYSAES
    630 W. North Street
    Geneva, NY 14456
    Phone: (315) 787-2248
  o Northeast Organic Network (Cornell University)
    Department of Horticulture
    121 Plant Science Building
    Cornell University
    Ithaca, NY 14853
    Phone: (607) 255-1780
  o ATTRA
    PO Box 3657
    Fayetteville, Arkansas 72702
    Phone: (800) 346-9840
Appendix 4:

A guide to resources on rules and regulations for farmers in Vermont

There are many rules and regulations involved in the application of pesticides for both organic and non-organic farmers. Many organic farmers do not realize that they fall into the same licensed pesticide applicator requirements as all farmers do, regardless of their organic certification. This guide includes links for information on rules and regulations for organic and non-organic farming. These links provide information about these requirements, approved pesticide products, and Vermont agriculture laws.

**Rules and regulation links for all organic and non-organic pesticide use in Vermont:**

- For laws, regulations, forms and applications, visit the Vermont Agency of Agriculture, Food and Markets web page. This page provides downloadable forms and applications on topics such as the Registration of Pesticides form and the Acceptable Agriculture Practice regulations. They are all Vermont specific: [http://www.vermontagriculture.com/regulations.htm](http://www.vermontagriculture.com/regulations.htm)

- If you have specific questions about Vermont agriculture statutes, visit the following link and check Title 6, which lays out Vermont’s Agriculture laws as of 2005 Vermont Legislature. Chapter 83 (under Title 6) concentrates on the Control of Pesticides: [http://www.leg.state.vt.us/statutes/statutes2.htm](http://www.leg.state.vt.us/statutes/statutes2.htm)

- All fertilizers and pesticides must be registered with the Plant Industry Division at the Agency of Agriculture. If you are applying pesticides, it must be done in a manner consistent with federal and state laws. For contact information on the Plant Division visit [www.vermontagriculture.com/pid.htm](http://www.vermontagriculture.com/pid.htm) or call (802)-828-2431

**Pesticide rules specifically for organic farmers:**

- For the National List of Allowed and Prohibited Substances in organic farming, visit The National Organic Program page. These guidelines were developed to ensure that organic products consistently meet national standards. This site lists information on the information on the evaluation criteria for substances, and a list of synthetic and non-synthetic substances that may be used in organic crop production: [http://www.ams.usda.gov/nop/NOP/standards/ListReg.html](http://www.ams.usda.gov/nop/NOP/standards/ListReg.html)


- NOFA-VT: Pesticides for both organic and non-organic farming must be approved. For organic farmers active ingredients must be either non-synthetic or accepted synthetic. Make sure you check the Brand Name Product List for organic crop production on the National Organic Program site listed above, or visit [www.nofavt.org](http://www.nofavt.org) or contact NOFA-VT at (802) 434-4122.

- Any food item grown or processed in Vermont that meets the USDA National Organic Standards can be organically certified. If you have been thinking about becoming a Certified Organic grower visit: [http://www.nofavt.org/programs/organic-certification.php](http://www.nofavt.org/programs/organic-certification.php)
General Rules and Regulations resources


- Did you know it became mandatory to report new hires in Vermont as of 1998? See the ‘New hire’ link: https://uiclaims.det.state.vt.us/empServices/ fax (802)-828-4286


If you have any questions about your own use of pesticides call NOFA-VT at (802) 434-4122
Be sure you are following Vermont’s rules and regulations with pesticides and farming standards!
Appendix 5:

**A guide to resources on organic pesticide applicator safety and requirements**

**Applicator Safety:** The best way to avoid pests is by tackling the problem with basic non-chemical strategies. If you are a certified organic farmer, your pesticide choices are limited and you should attempt to use crop-specific strategies described elsewhere. Because there are instances where (organic) pesticides must be used, proper safety precautions and requirements must be taken. This fact sheet is an outline of available applicator safety information, as well as application requirements. Remember, pesticides are highly toxic and dangerous substances, regardless of their EPA approval or organic certification. Always read the label on the pesticide package and follow instructions. Be sure to wear an applicator’s mask, rain coat and pants, long-sleeve shirt, gloves as well as eye and ear protection whenever you apply pesticides, and wash your hands immediately. The following links provide information on how to safely handle and apply pesticides while meeting applicator requirements.

**In Case of Emergency:** Take the right action! If the symptoms include
- unconsciousness
- trouble breathing or
- convulsions

Call 911

If the symptoms do not include these things contact the Poison Control Center at (800) 222-1222.

**Minimizing Pesticide Use**
- The best way to eliminate pests is to limit their habitat. Non-chemical pest control strategies, like removing sources of water to destroy their breeding ground, are a safe way to avoid having to use pesticides. To see some basic, non-chemical pest control strategies, and tips on how to properly store chemicals: [http://www.epa.gov/pesticides/factsheets/pest_tli.htm](http://www.epa.gov/pesticides/factsheets/pest_tli.htm)
- For tips on pest management strategies, visit the Purdue University Extension link. This site offers information on how to prevent pests by practicing management techniques, such as plant selection, planting dates, crop rotation, and sanitation. [http://www.btny.purdue.edu/Pubs/PPP/PPP34.html](http://www.btny.purdue.edu/Pubs/PPP/PPP34.html)
- For a Citizens Guide to Pest Control, and more information about non-pesticide control standards visit: [http://www.epa.gov/pesticides/factsheets/health_fs.htm](http://www.epa.gov/pesticides/factsheets/health_fs.htm)

**Pesticide Safety:**
- Pesticides are very dangerous substances, particularly to children. The EPA Health and Safety site evaluates the health risks of pesticides. This page offers links to other sites dealing with human health issues such as protecting children, pets and workers, and information about how to use pesticides safely: [http://www.epa.gov/pesticides/health/index.htm](http://www.epa.gov/pesticides/health/index.htm)
- Workers are exposed to pesticides through many associated activities, including exposure during the mixing and loading equipment process, the actual application, or by entering an area where pesticides have been recently applied (pickers). The EPA provides a site dedicated to worker safety and training standards. [http://www.epa.gov/pesticides/health/worker.htm](http://www.epa.gov/pesticides/health/worker.htm)

- The Worker Protection Standard is a federal regulation designed to protect humans who may be exposed to pesticides. It contains requirements for:
  - Pesticide safety training
  - Notification of pesticide applications
  - Use of protective equipment
  - Restricted entry to areas recently applied
  - Decontamination supplies and
  - Emergency medical assistance

- The EPA has attempted to raise public awareness about the sale of illegal pesticides. These pesticides can be much more toxic because they do not abide by the EPA standards. To identify some common “counterfeit” products, and learn how to avoid coming into contact with them visit: [http://www.epa.gov/pesticides/health/illegalproducts/index.htm](http://www.epa.gov/pesticides/health/illegalproducts/index.htm)

- To find a list of all EPA approved pesticides, and fact sheets on newly accepted ingredients, visit the following site. It allows you to check out each pesticide by name, find its function, its chemical make-up, and learn how to safely apply it. [http://www.epa.gov/opprd001/factsheets/](http://www.epa.gov/opprd001/factsheets/)

- For more information on pesticides contact the National Pesticide Information Center at (800) 858-7378
Appendix 6: Fact Sheet Template

A guide to resources for organic ___________ growers in Vermont

Introduction text to be added here.

Introduction/purpose text to be continued here.

Top pests and diseases encountered in ___________ production

- First pest (can have a picture below left if available)
  
  Details of the first pest

  How to manage the second pest – management options

  o Description/title of link with more information
    http://www.websiteaddressofthelink

  o Description/title of link with more information
    http://www.websiteaddressofthelink

- Second pest (can have picture below left if available)

  Details of the second pest

  How to manage the second pest – management options

  o Description/title of link with more information
    http://www.websiteaddressofthelink

  o Description/title of link with more information
    http://www.websiteaddressofthelink

- Third Pest (can have picture below left if available)

  Details of the third pest

  How to manage the second pest – management options

  o Description/title of link with more information
    http://www.websiteaddressofthelink

  o Description/title of link with more information
    http://www.websiteaddressofthelink
• Fourth Pest (can have picture below left if available)
  Details of the fourth pest
  How to manage the second pest – management options
  
  o Description/title of link with more information
    http://www.websiteaddressofthelink
  
  o Description/title of link with more information
    http://www.websiteaddressofthelink

More information on organic _______ production in ___(Vt/NE?)_______

Refer to these links to fact-sheets and websites designed to answer your questions about growing organic _______. The information on this factsheet came primarily from these sources, and they provide a more detail on the issues discussed above.

• Description/title of link with more information
  http://www.websiteaddressofthelink
• Description/title of link with more information
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  phone number
  e-mail

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