

Veggie-e-Gram

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Note: The information provided below on products/pesticide use, is from other states and thus the products may have no current Hawaii registration. Always read the label before making any product/pesticide applications. Due to environmental effects the effectiveness of particular products may also vary across locations.

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## 1. AIM Sweet Corn Herbicide Update (Ohio)-

FMC received a national label for Aim on sweet corn earlier this year. Aim controls emerged weeds and is applied postemergence to the crop, up to the eight collar leaf stage. Weeds should be actively growing and not more than 4 inches high, or 3 inches across. At 1/3 ounce of product per acre, Aim controls lambsquarters (up to 3 inches), morningglories (2-3 leaf stage), eastern black nightshade (up to 4 inches), redroot pigweed (up to 4 inches) and velvetleaf (up to 18 inches). Triazine- resistant biotypes will be controlled. For broad-spectrum weed control Aim must be tank-mixed with other herbicides. Labeled tank-mix partners include atrazine, Permit, and 2, 4-D. Always add Aim to the tank first when mixing the product with other herbicides. A non-ionic surfactant (NIS) must be included in the tank whenever Aim is used, at a rate of 2 pints (80% a.i.NIS.). Adding a crop oil concentrate instead of NIS may provide superior control under dry conditions. Good spray coverage is important. To minimize the chance of crop injury, maintain spray tip height at least 18 inches above the crop and avoid application directly into the whorl of the growing corn plant. While there is no evidence that crop injury will be a major problem with Aim, provided all recommended precautions are followed, FMC has included disclaimer of liability on their product label. This means the grower must accept all responsibility for crop injury, and must determine that the varieties to be treated are tolerant of Aim. By Doug Doohan (Robert J. Precheur, ed., VegNet Newsl. Vol. 8, No. 13. May 17, 2001, Ohio State University Extension Vegetable Crops)

## 2. Bicep II Magnum herbicide on Sweet Corn (Ohio) -

Both products are fully labelled for use on sweet corn. Bicep Lite II Magnum contains 2.67 lbs. of atrazine and 3.33 lbs. of s-metolachlor per gallon. Bicep II Magnum contains 3.1 lbs. of atrazine and 2.4 lbs. of s-metolachlor per gallon. What do these differences mean? For a typical Ohio medium to fine textured soil, with 3% or less organic matter, the label rates for the two products are 1.1 to 1.5 qts./A and 1.6 to 2.1 qts./A, respectively. In other words using Bicep Lite II Magnum, the actual atrazine applied would be 3/4 to 1 lb/ A; safe to most rotational vegetable crops planted

the following year. With Bicep II Magnum the atrazine applied would range from 1 1/4 to 2 lbs./ A; marginally-safe to definitely unsafe for rotational vegetables the following year. (Robert J. Precheur, ed., VegNet Newsl. Vol. 8, No. 13. May 17, 2001, Ohio State University Extension Vegetable Crops)

### **3. PERMIT on sweet corn for yellow nutsedge control -**

Permit (also sold as SEMPRA) which was labelled for use on sweet corn in late 1999, is of great interest to farmers who grow sweet corn, and other vegetables in rotation with sweet corn (consult the label for specific rotational crop guidelines) because of its excellent activity on yellow nutsedge. The supplemental label for sweet corn transfers all responsibility for crop injury to the user. The Permit label, stresses that tolerance of sweet corn cultivars has not been determined and that tolerance might vary between cultivars. Research was conducted at OARDC in 2000 to assess tolerance of 14 fresh-market varieties. Sweet corn varieties included 'Seneca Dancer', 'Temptation', 'Sweet Rhythm', 'Amazingly Sweet', 'Kandy King', 'Immaculata', 'Fortune', 'Confection', 'Bandit', 'Sensor', 'Ice Queen', 'X-tra Tender', 'Candy Corner', and 'Silver King'. Permit was applied at 0, 2/3 and 1 1/3 oz/A on June 28 in a volume of 23 GPA, when sweet corn was 10 inches high on average, and had 5 to 7 collars. Early growth of all varieties was reduced relative to the untreated plots and slight chlorosis was observed on all except 'Ice Queen'. Twenty-one days after application, stunting had generally declined but could still be detected on all varieties. Permit did not affect plant height, rows of kernels, kernels per row, and average number of ears per plant. However, weight of marketable ears and height of ears above the ground were affected by Permit rate. Tolerant varieties at 1 1/3 oz/A were Kandy Corner, Ice Queen, Bandit and Seneca Dancer. Tolerant varieties at 2/3 oz/A were Sweet Rhythm, Sensor and Extra Tender. Tuxedo was used as a guard row variety in this study due to previously demonstrated tolerance. Sensitive varieties were Fortune (most sensitive), Amazingly Sweet, Kandy King, Immaculata, Confection, and Silver King. Excessive rainfall and below average temperatures prior to Permit application may have contributed to reduced crop tolerance in 2000. This research will be repeated in 2001 at OARDC and the study will also be conducted at Purdue University. Growers should

proceed very cautiously with Permit until at least an additional year of research is completed. (Robert J. Precheur, ed., VegNet Newsl. Vol. 8, No. 13. May 17, 2001, Ohio State University Extension Vegetable Crops)

#### **4. 'ZEA-LATER' FOR CORN EARWORM CONTROL (Mass)**

(adapted from article by Ruth Hazzard, UMass Extension)

Corn earworm moths arrive on storm fronts in mid- to late-summer, ready to lay their single, globe-shaped white eggs on corn silks, preferring fresh silk over dried silk. Newly hatched caterpillars move rapidly into the silk channel, enclosed by the top of the husk. They feed very little on the exposed silk, which explains why sprays of Bt are not very effective against this pest. Corn earworm has been a major obstacle to production of organic sweet corn, and conventional control of this pest relies on repeated applications of synthetic insecticides. A new method of control has been developed that uses small quantities of vegetable oil mixed with the biological insecticide Bt (*Bacillus thuringiensis*). The Zea-Later oil applicator, now commercially available, makes this method physically and economically feasible. Research results over several years have shown very good control. The Zea-Later is a hand-held applicator connected by a plastic tube to a 2-liter waist-belt tank. The applicator "gun" has a shell of strong molded plastic, with an internal pumping mechanism. The molded handle fits easily in the hand, and each pull of the "trigger" releases a 0.5 ml dose of oil. Growers and workers who use it are surprised at the lack of hand fatigue, even with several hours of use. The pointed tip is placed on the hollow at the center of the silk ear or pushed slightly into the silk channel, leaving the oil where gravity will pull it all the way into the silk channel. It works best to walk down each row, treating the top ear of each corn plant. One tankful treats about 1/4 acre. Soapy water is used for cleanup.

In the field, corn silks grow to their full length in about 2 days. The best time to apply the oil and Bt mixture is 4 to 6 days after silk growth starts or 2 to 4 days after the silk is full-grown. At this time, most of the pollination has taken place, and the exposed silks are wilting and beginning to turn brown. Earlier applications do not

appear to give better control, but result in a higher rate of poor tip fill. Oil applied later than 6 days after silk initiation can result in poorer control. One application to each block of corn is adequate. It's important to know when corn earworm is active in your area, since its activity may be unpredictable, especially in northern regions, where migratory flights arrive suddenly. Flights can be monitored with the Scentry Heliiothis net trap, baited with Hercon lure tapes for corn earworm, placed at about ear height in freshly silking corn. Trap captures of two moths per week, or more, indicate damaging numbers. Corn or soy vegetable oils are exempt from both federal pesticide labeling and residue tolerance requirement, so they can legally be used on sweet corn. Vegetable oil products with a pesticide label and organic certification include Golden Natural Spray Oil (Stoller Enterprises, Inc), which is soybean oil with an emulsifier. For clarification of any product's regulatory status, contact your state's agriculture department. Mixing Bt with the oil improves control by about 15% over oil used alone. Bt products labeled for sweet corn come in liquid or dry formulations; in either case, it is important to achieve a stable, fine suspension of the Bt crystals in the oil. For dry products, this requires an emulsifier in the oil. Most liquid products will form a suspension, but should be tested to be sure. Regular agitation may be needed.

At first glance, it hardly seems possible that treating every ear could be cost-effective. In fact, the cost is in the same range as conventional methods. The one-time oil treatment usually takes 8 to 10 hours per acre so labor cost ranges from \$60 to 80 per acre. Materials include about 2 gallons of oil (at \$6 per gallon) and 1 pint Bt (\$5 to 7) per acre. For many retail growers, each successive block is typically less than an acre, so it can be treated in one day or less. This can be done in windy conditions, on two successive days if necessary, and does not have to be re-applied after a rainstorm. Some growers would prefer to use a crew of two or three because, as with many repetitive jobs on the farm, it is more pleasant to work in a group and get the job done faster. The Zea-Later is available for \$214 from Johnny's Selected Seeds (207) 437-4395 or [commercial@johnnyseeds.com](mailto:commercial@johnnyseeds.com) (mention of brand name products is for information purposes only, no endorsement is intended) (Vern Grubinger, ed., University of Vermont Extension, VERMONT VEGETABLE AND BERRY NEWS - June 15, 2001)

## 5. PHYTOPHTHORA BLIGHT IN CUCURBIT CROPS

Phytophthora blight continues to be a challenge to manage, with potential to cause total crop loss. Unfortunately it has been increasing in importance in the Northeast region, as well as elsewhere in the United States, as it spreads into new areas and frequently eludes control. Symptoms include crown rot, tip blight, and fruit rot (pictures can be found at <http://vegetablemdonline.ppath.cornell.edu/Home.htm>). Several important points have been learned in our efforts to control this potentially devastating disease: 1. There is no 'silver bullet'. No single management practice will effectively control Phytophthora blight, thus an integrated management program is essential. 2. Management practices should be implemented before Phytophthora blight occurs on a farm because after it has occurred, it is challenging to continue growing susceptible crops without Phytophthora blight reoccurring. 3. Prevention is very important because Phytophthora blight is very difficult to suppress once it starts to develop in a field. 4. It is critically important to avoid having standing water in production fields, including driveways, following rain or irrigation. This was stressed by both growers and researchers who spoke at the Phytophthora Workshop on 27 March 2001. 5. The pathogen (*Phytophthora capsici*) evidently can be easily moved between fields on a farm, based on the more common occurrence of Phytophthora blight in new fields on a farm that already has the disease than on farms where it has not yet occurred. Therefore it is necessary to be scrupulous about cleaning equipment and boots after working in an infested field.

Current recommendations center around preventing the pathogen from being moved into a new field and managing soil moisture to avoid saturated conditions which favor disease onset. It is important to use an integrated program with as many of the following practices as possible.

1. Select fields where Phytophthora blight has never occurred when possible. The fungus that affects cucurbits also causes blight in pepper, fruit rot in eggplant, and buckeye rot in tomato. An effective rotational period has not been identified yet. Two years has been shown to be insufficient, therefore select a field where susceptible crops have not been grown for at least 3 years. Both mating types of the pathogen have been found in fields in New York, Massachusetts, Michigan, and in other states. Therefore it is

possible for the pathogen to produce oospores, which are capable of long-term survival. Rotation will be more successful where only one mating type occurs. Selected fields should be isolated from fields where Phytophthora blight has occurred to avoid the potential of the fungus being moved (in run-off or on farm equipment) from the infested field into the cucurbit crop. Late blight of potato and tomato is caused by a different fungus (*P. infestans*); therefore, previous occurrence of late blight is not a concern in field selection.

2. Select well-drained fields.

3. Make sure water will be able to drain out of the field. Use a land plane to level the field as much as possible. If water does not normally drain out of the field, then make a trench between beds or rows at their ends, make a ditch or waterway across the end of the field for water coming out of the field in the trenches, and continually grade soil at the end to allow water to leave.

4. Physically separate plantings of susceptible crops (cucurbits, pepper, eggplant, and tomato). Plantings should be located such that there is no opportunity for water to move from one planting to another. The pathogen can also be dispersed in rain splash during storms. Therefore it is prudent to consider prevailing wind direction when deciding where to locate multiple plantings of susceptible crops on a farm.

5. When growing small-fruited pumpkins, select varieties producing hard, gourd-like rinds (such as Lil' Ironsides). These have been shown to be substantially less susceptible than varieties with conventional rinds.

6. Minimize hardpans and plowpans by subsoiling or chisel plowing before planting.

7. Do not plant the crop in areas of the field that do not drain well. Plant a cover crop in place of the crop in these areas.

8. Prepare raised dome-shaped beds for summer squash and other bush-type crops. Ideally beds should be a minimum of 9 inches high. Use a bed shaper to provide more lasting beds as opposed to a simple ridge. Use a transplanter that doesn't leave a depression around the base of the plant. Fill in any depressions.

9. Minimize hardpans and plowpans by not driving through wet fields.

10. Clean farm equipment, shoes, etc. of soil between fields.

Movement in soil on equipment and shoes probably is an important means by which Phytophthora has been spread between fields on



farms and may account for the occurrence of Phytophthora blight in fields with no previous history of susceptible crops.

11. Subsoil between rows after planting and before vining to improve drainage. Subsoil again as needed after rain. Good drainage is also important for driveways in fields, as symptoms have been observed first on plants next to the compacted soil of driveways, therefore, subsoiling along the edge of driveways is also needed. It is preferable to plan driveways before seeding leaving ample space, instead of seeding the entire field and then driving over plants.

12. Avoid over irrigating. Normal irrigation practices usually do not encourage Phytophthora blight except when leaks frequently occur. Do not irrigate at night time when temperatures are above 70°F. 13. Do not irrigate from a pond that could contain water that drained from an infested field. Other practices that will improve water management will help control Phytophthora blight. Straw mulch and compost are additional practices that may contribute to control of Phytophthora blight. Research is planned to investigate these.

Mulch could provide a barrier between the pathogen in the soil and the crop. Compost would work by increasing the activity of microbes in the soil, including those that are antagonistic to Phytophthora. Yard-waste compost was not effective when evaluated recently on Long Island; however, the material used had low microbial activity. A brewery-waste compost with high microbial activity is being tested this year.--Margaret Tuttle McGrath, LIHREC, Cornell University (Ruth Hazzard, ed., Vegetable IPM Message, University of Massachusetts, Agroecology Program, MAY 17, 2001, VOLUME 12, NUMBER 2).

## **6. Spider mites on veggies and nightshade as a host**

**Spider mites remain widespread on a number of crops including eggplant, tomato, watermelon and other cucurbits.** A number of growers report applying repeat applications of miticides aimed at spider mites. Damage has been compounded by water stress. Several respondents have indicated that spider mite infestations are most severe where stands of nightshade adjoining plantings. This observation suggests that control of nightshade in unplanted area adjacent to fields will help eliminate this potential source of infestation and may help them reduce possible spider mite problems. On vegetable crops, such as



squash, melons, and watermelons, loss of leaves can have a significant impact on yield and result in sun burning. Often leaves, twigs, and fruit are covered with large amounts of webbing. In at least one instances spider mites have lead to early termination of affected crops (Gene McAvoy, Southwest Florida Pest and Disease Hotline, May 22, 2001)

## 7. Pinworm in tomato and eggplant

**Pinworm populations are building in tomato and eggplant.** Pheromone traps will help give an early warning. When 3 to 5 moths are caught per trap per night, then mating disruption should be initiated. Insecticidal control can be achieved with products such as SpinTor, AgriMec, Proclaim and Avaunt. Thiodan. **Tomato, potato, eggplant, and tropical soda apple (*S. bahamense* L), a solanaceous weed, are the only recorded hosts in Florida.** Thus, the summer break is effective in reducing populations to low levels, except possibly where soda apple is prevalent.

(Gene McAvoy, Southwest Florida Pest and Disease Hotline, May 22, 2001).

## 8. Stinkbugs in tomato

**There have been several reports of stinkbug populations reaching sufficient levels that have justified late season insecticide applications.** The Florida Tomato Scouting Guide sets the economic threshold for southern green stinkbug in tomato is one stinkbug per 6 plants. Stinkbugs may become a greater problem in the future as growers move away from broad-spectrum insecticides to more pest specific bio-rational products.

(Gene McAvoy, Southwest Florida Pest and Disease Hotline, May 22, 2001).

## 9. Resistance management for Azoxystrobin (Quadris)- for management of gummy stem blight in cucurbits

- 1) Reduce disease inoculum with every non-chemical technique available,
- 2) Alternate the use of azoxystrobin with broad spectrum fungicides such as mancozeb or chlorothalonil, and
- 3) Avoide the introduction of resistant strains onto your farm by producing or purchasing disease free plants.

Thanks to Dr Tom Kucharek - Plant Pathologist UF/IFAS

(Gene McAvoy, Southwest Florida Pest and Disease Hotline, May 22, 2001).

## 10. Powdery mildew in cucurbits

Powdery mildew remains widespread on squash and has also been appearing on watermelon over the past few weeks. When powdery mildew occurs on watermelon, it often will not display clear white powdery growth on the leaves as it does on squash and other plant species. The yellowing of leaves is often the first indication that powdery mildew is present. Symptoms may begin as a faint interveinal yellowing on the upper leaf surface of leaves near the crown of a few plants. With the aid of a hand lens, faint white mycelial growth may be seen on the lower side of the leaves. Powdery mildew is capable of producing typical white powdery growth on leaves of watermelon, but in many cases it does not appear that way. Chlorothalonil or Quadris do well in suppressing powdery mildew. To promote good a resistance management strategy, do not use block sprays of Quadris. See caution above. Alternate Quadris with chlorothalonil and other fungicides. The maneb and mancozeb fungicides will also suppress powdery mildew to some extent and they are broad spectrum types which makes them good choices for alternating with Quadris (Gene McAvoy, Southwest Florida Pest and Disease Hotline, May 22, 2001).

## 11. Powdery mildew in pepper

**Powdery mildew is present in scattered locations in older pepper fields.** Powdery mildew is uncommon on pepper in SW Florida. The disease in pepper is caused by the fungi *Leveillula taurica*.

**Leaves with mildew growing on the undersurface may show a patchy yellowish or brownish discoloration on the upper surface.** The edges of infected leaves may roll upwards exposing the white, powdery fungal growth. Diseased leaves drop from the plants and leave the fruit exposed to the sun, which may result in sunburning. Powdery mildew can be severe and can cause heavy yield losses.

**The fungus survives between crop seasons on other crops and on weed species.** The degree of survival depends on environmental conditions. Because of the wide host range of the

fungus, it is difficult to control the amount of inoculum that survives from one season to the next. Thus, simple sanitation methods in and around pepper fields may not provide a sufficient reduction in the primary inoculum to provide disease control. Most pepper cultivars do not possess acceptable levels of resistance to powdery mildew.

**Fungicides can provide satisfactory control and prevent economic loss if applied during the early stages of the epidemic.** Effective control requires spraying with high pressure and high volume for optimum penetration of the crop canopy by the fungicide. Good coverage is necessary for satisfactory control. (Gene McAvoy, Southwest Florida Pest and Disease Hotline, May 22, 2001).

## **12. Fall IPM program in Florida**

**Your Fall IPM Program Should Start Now!**

**As we approach the end of the spring season, it is not too early to start thinking about and even implementing your fall season IPM program.** With all the advances in pest management, new chemistries and space age spray rigs, it is often easy to overlook some of the basics.

**Action taken now will help build a foundation for next year's pest control strategy.** There are a number of cultural practices that a grower should consider when designing an integrated disease control system. Before planting a crop, a vegetable grower can take a number of steps to help control potential pest and disease problems in the coming season. As a general approach, growers should take steps to grow vigorous, high-quality plants using the best farming practices possible.

**One of the most important components in an integrated disease control program is the selection and planting of cultivars that are resistant to pathogens.** The term resistance usually describes the plant host's ability to suppress or retard the activity and progress of pathogenic agent, which results in the absence or reduction of symptoms. It is important to clearly establish a common definition of the term. Growers, researchers,

plant breeders, and seed sellers may have slightly different understandings of the term. The word tolerance, which has a slightly different meaning, is some-times used interchangeably with resistance, resulting in some confusion. By definition, tolerant plants can endure severe disease without suffering significant losses in quality or yield; however, these tolerant plants do not significantly inhibit the pathogen's activity, and disease symptoms may be clearly evident. Resistant plants usually suppress the pathogen in some fashion.

**There are some distinct advantages to planting disease resistant plant cultivars.** Such selections are completely non-disruptive to the environment, and their use may enable growers to reduce and in some cases eliminate the application of chemicals used for pathogen control. The use of cultivars resistant to one disease is compatible with disease management steps taken to control other diseases. A final advantage is that for some host-pathogen systems the stability of the resistance is long lasting and the cultivars can remain resistant for many years.

**There are some disadvantages to the use of resistant cultivars.** The greatest shortcoming is that resistance is not available for all diseases on all crops. For several of the most damaging plant diseases, such as tomato late blight (*Phytophthora infestans*), no acceptable resistant cultivars are yet available. Seed companies and plant breeders rarely invest in efforts to develop resistant cultivars for specialty or minor crops. Another shortcoming of some resistant cultivars is that some selections lack adequate horticultural characteristics in regard to appearance, quality, color, yield, and other important criteria.

**A cultivar that is resistant to one disease may be quite susceptible to another important disease or insect pest.** A final disadvantage to resistance is that, depending on the host-pathogen system, resistance is not long lasting and new strains of the pathogen readily develop, making the crop susceptible once again. Depending on the particular disease involved, the failure of plant resistance can be either a rare or a regular event. In most cases, resistance failure is attributed to the development of new

strains of the target pathogen that overcome the resistance genes of the previously resistant cultivar.

**Despite the challenges of developing resistant cultivars and the setbacks of resistance breakdown, resistant plants remain an important weapon for disease.** Growers are encouraged to actively and thoroughly investigate which resistant cultivars are available and to test to determine which cultivars perform best under their particular growing conditions.

**Before planting crops, a grower should carefully plan out planting and crop rotation strategies to avoid insofar as possible any known problem areas.** A grower can incur significant losses if he or she plants susceptible crops in a field known to be infested with persistent soilborne pathogens. Plant-pathogenic fungi such as *Fusarium* and *Sclerotium*, are true soil inhabitants and will persist in soil for many years, even in the absence of a plant host. Because not all fields are infested with these fungi, growers are advised to select a planting site away from such fields. Soil-borne fungi such as *Phytophthora*, *Pythium*, and *Rhizoctonia* often are much more widespread, so site selection might be less of an option in avoiding these organisms.

**Steps taken prior to and during the planting process can also influence disease.** Attention to crop rotations and crop residue incorporation, can help prevent population buildup in many pest species. The practice of growing the same crop continuously, season after season, on the same piece of ground is an invitation to insect pests and diseases

**Summer weed management can be a challenge.** Growers should check field margins to make sure that pest species are not building up there and migrating out into cropping areas. Many insects over summer on weeds, so efforts to control them can be profitable by reducing their movement into the crops next growing season.

**Weeds are also known reservoirs of a number of viral and bacterial pathogens.** Weeds and volunteers should be removed to prevent the survival and over-summering of pathogens that could

serve as inoculum reservoirs for the next crop. Techniques such as mowing off pepper should not be relied upon as this often results in re-sprouts, which can harbor pests and disease problems over summer.

**The use of cover crops and summer fallowing of fields are also effective tools** in reducing weed populations that can cause problems in the subsequent crop. The role of summer fallow in weed management is often overlooked. Summer fallow keeps new weed seeds from being added to the soil seed-bank. It also reduces the increases in asexual propagated plants such as nutsedges. Yellow nutsedge can put out 70 new tubers (nuts) every two months. Keeping the weeds from propagating will reduce the weed problems encountered during the next cropping season and help reduce insects and diseases that may over summer in weedy fields.

**Chemical fallowing is a twist on the traditional method of fallowing** that depends on disking fields through out the summer period to reduce weed pressure in subsequent crops. One approach uses Roundup to kill weeds during the crop free period.

**Vegetable growers need to provide optimum growing conditions for their crops.** Many plants are able to withstand insect feeding if they are actively growing and are able to compensate for some loss of foliage and root tissues. Soil nutrients can affect crop vigor. There is no substitute for soil testing to determine a fertilization program. Excessively low or high soil pH may induce physiological problems or predispose crops to attack by pests and disease. This past season, I saw several problems that might have been averted by checking and maintaining a favorable soil pH.

**Poor soil preparation can result in stressed and exposed plants and increased damping-off problems due to soil fungi.** Proper preparation of the field and the subsequent raised beds will help reduce problems in areas that are subject to poor drainage, pooling of water, and other conditions that favor pathogens. Soil and bed preparation should result in good soil tilth so that seed or trans-plants are placed in a soil that favors plant

development. Planting depth for seed or transplants should be tailored to enhance seed emergence or transplant establishment.

**The practice of keeping out any materials or objects that are contaminated with pathogens or diseased plants and preventing them from entering the production system is known as exclusion.** For some diseases, seed borne pathogens are a primary means of pathogen dissemination. Growers should purchase seed that has been tested and certified to be below a certain threshold infestation level or that has been treated to reduce pathogen infestation levels. Note that the designation “pathogen-free seed” really is not a valid term because it is not possible to know whether a seed lot is, in its entirety, absolutely free of all pathogens. Seed tests only examine representative samples, but in most cases the tests are accurate enough to give a true picture of the risk of diseases initiated by seedborne pathogens.

**When purchasing transplants, they should be free of as free as possible pathogen contamination (where the pathogen is present on the plant but has not yet caused visible symptoms) and from disease (where symptoms are actually visible).** Sanitation measures are important in greenhouse situations. The removal of dead or dying transplants can help reduce inoculum that could otherwise spread to adjacent transplants. Evidence of poor sanitation may suggest that you look more closely at your choice of transplant producer.

**Soil and water can harbor pathogens as well.** Take care to see that no infested soil or water is introduced into un-infested areas. Pathogens may be found in surface, flood, and runoff waters. Growers who have dredged up soil from ditches and dispersed it onto fields may introduce inoculum of pathogens such as phythophthora. Water draining from fields can carry a number of pathogens, and growers should not recycle or reuse it without carefully considering potential risks and then taking appropriate safety precautions. Soil adhering to tractor equipment and implements can spread soilborne pathogens and weeds from infested fields into clean fields. It is a good idea to reduce the movement of these infested materials as much as possible.



**Incorporation of composts into soils is a fundamental cultural practice in organic production, which can be extended to chemical systems as well.** Composts benefit the soil's fertility and condition in a number of ways, and also undoubtedly benefit disease management in some way. However, research studies and empirical data that clearly document any disease control benefits resulting from field-application of compost are lacking. Despite this lack of information on disease control, composts should benefit soils by increasing soil microflora diversity and populations.

**Soil solarization is the use of plastic tarps placed on the soil surface to increase soil temperatures to a level that kills soilborne pathogens, weeds, and other crop pests.** Soil solarization works best when summer temperatures are uniformly high. These conditions don't always occur in Florida. Soil solarization will not eradicate a pathogen from a field, but it may lower pathogen populations.

**Soil flooding is a related means of creating conditions—in this case, saturated soil over an extended period—that might result in a decline of soil-borne pathogens.**

**Field sanitation is one of the most important tactics in vegetable pest and disease management.** One of the best things that growers can do for themselves and their neighbors is to clean up crop residues promptly after harvest. Sanitation is an important IPM technique that should not be overlooked as an effective, preventative tool against many vegetable pest and disease problems. Sanitation includes any practice that eradicates or reduces the amount of pathogen inoculum, pests, or weed seeds present and thus helps reduce or eliminate subsequent pest and disease problems.

**Prompt crop destruction at the end of the season will immediately end the production of disease inoculum and insects and eliminate the spread of diseases and pests to any other host plants in the vicinity.** Downy and powdery mildew on melons can spread via wind from older, diseased plants to plants in surrounding fields that are still maturing. These diseases are obligate parasites. This means that they can only grow and

multiply on living host tissue. Some plant pathogens, such as the bacterium that causes bacterial spot of tomato and pepper, are unable to survive for extended periods of time outside of the host tissue. Plowing or disking under infected plant debris helps not only by covering up the inoculum but also speeds up the disintegration of plant tissue and kills the pathogen. Good sanitation will help control a number of important vegetable pathogens.

**Soil tillage can destroy insects and expose them to birds and other predators. It can also speed the breakdown of plant residues that harbor insects and plant pathogens.** By either allowing the organic matter in a field to decompose completely before you plant the next crop and /or allowing a fallow period between crops, you can enhance the control of a number of insects and diseases.

**Destruction of tomato vines** will kill off white fly populations and eliminate transmission of the tomato yellow leaf curl virus to subsequent crops and also eliminate inoculum from late blight and other fungal diseases. This is particularly important in the case of TYLCV, as sanitation and whitefly control are the only tools currently available for the management of this disease. A crop-free period is also considered a necessity for the control of a number of other important vegetable pests such as pepper weevil, tomato pinworm, and *Thrips palmi* and is recommended for management of all vegetable pests.

**Crop rotation is an important consideration in disease management.** Rotation employing the inclusion of cover crops, and appropriate use of fallow (host-free) periods can contribute to the reduction of inoculum levels for soil-borne pathogens and the increase of diversity in soil microflora. In contrast, consecutive plantings of the same crop in the same field often lead to increases in soil-borne pathogens. Inadequate rotation can simulate a monoculture effect that might increase foliar diseases. Proper rotation of pest-susceptible main crops with non-susceptible cover crops can keep pest numbers low. The incorporation of a grass species into a rotation is often recommended, as grasses tend to be resistant to most of the insect and disease pests of common cash crops.

**Recent research has shown that certain plants can have a suppressive effect on diseases and nematodes.** For example, after broccoli and other crucifer crops are harvested and the plant residue is plowed into the soil, the decomposition of the broccoli stems and leaves releases natural chemicals that can significantly reduce the number of certain pathogens. This broccoli effect can be an important consideration in crop rotation strategies. Some cover crops (mustards, sudangrass) might also share this beneficial effect and could be considered in the crop rotation scheme. It is important to remember that while rotations with non-susceptible plants and cover crops may help reduce soil-borne pathogen numbers, significant decreases in such populations are likely to take many seasons.

**When devising a crop rotation strategy, a grower should also be aware of which crops and cover crops might increase disease problems.** Sunn hemp might increase soil populations of *Pythium* and *Rhizoctonia* damping-off fungi. Some varieties of cowpea may host of root-knot nematode. There are many factors to consider in regard to planting a crop.

**Cover crops planted prior to the main cash crop can also improve soil fertility and provide a valuable source of organic matter.**

**An integrated approach to pest and disease management will become increasingly important in face of the impending loss of methyl bromide** – whose ease of use and effectiveness in controlling a wide range of problems allowed us to neglect some of these practical common sense pest management techniques.

(Gene McAvoy, Southwest Florida Pest and Disease Hotline, May 22, 2001).

### **13. Actara and Platinum insecticide Registration**

Registration Granted to ACTARA and PLATINUM Insecticides  
C. Welty

Syngenta Crop Protection Inc. (formerly Novartis) announced on 18 May that the Environmental Protection Agency granted registration to several thiamethoxam insecticide products, including Actara and Platinum. These registrations mark the first approval of thiamethoxam for foliar and soil usage in crops. The EPA Previously granted registration to Adage seed treatment, which contains thiamethoxam.

Actara 25WG has been registered as a foliar insecticide for use in cucurbits, fruiting vegetables (tomato, pepper, eggplant), pome fruit, potatoes, and tobacco. Platinum 2SC has been registered as a soil insecticide for use in cucurbits, fruiting vegetables, potatoes, and tobacco. The seed treatment Adage 5FS remains limited to use on wheat, barley, sorghum, and cotton. Thiamethoxam controls aphids, whiteflies, Colorado potato beetle, flea beetles, potato leafhopper, thrips, and tarnished plant bug. In our Ohio tomato insecticide trial last summer, Actara provided excellent control of stink bug. In our Ohio pumpkin trial this summer, we will be testing Platinum for cucumber beetle control.

Thiamethoxam is a neonicotinoid insecticide (similar to imidacloprid, as found in Admire, Provado, and Gaucho) that offers superior control of a broad range of insects at low usage rates. It has an excellent safety profile and has been classified by EPA as an "organophosphate alternative." When Actara is applied as a foliar insecticide, it has rapid translaminar penetration into plant surfaces thus it is locally systemic. When Platinum is applied as a soil insecticide, it has rapid root uptake and is highly systemic within plants. (Robert J. Precheur, ed., VegNet Vol. 8, No. 14. May 23, 2001, Ohio State University Extension Vegetable Crops)

### Actara and Platinum Insecticides Registered for Some Fruits and Vegetables

Syngenta's thiamethoxam insecticides Actara and Platinum have received registrations for use on certain fruits and vegetables. Thiamethoxam is a "neonicotinoid" insecticide ... meaning that it is nearly nicotine-like in its mode of action. Provado and Admire, Bayer's imidacloprid insecticides, are also neonicotinoids. Like imidacloprid, thiamethoxam is systemic, and like many systemic pesticides, it is more soluble in water than most other insecticides currently on the market. The label for these products contains a ground water advisory noting that contamination may occur if it is

used in soils that are permeable, especially in areas where the water table is shallow.

Actara is labeled for foliar application to cucurbits for control of aphids, flea beetles, and whiteflies; to tomatoes, tomatillos, peppers, and eggplant for control of aphids, flea beetles, Colorado potato beetle, white flies, and stink bugs; to potatoes and sweet potatoes for control of Colorado potato beetle and potato leafhopper; and to apples and pears for control of aphids, leafhoppers, leafminers, and plum curculio. Platinum is labeled for soil application at planting time or in irrigation or sidedress treatments to cucurbits, tomatoes, tomatillos, peppers, eggplant, potatoes, and sweet potatoes

for control of the pests mentioned above.

I do not anticipate abundant supplies of these products being available in Illinois this season, and the optimum timing for their application has passed for several of the crop-pest combinations listed above. This winter's educational programs will include reviews of the effectiveness of these insecticides.

Rick Weinzierl (217-333-6651; weinzier@uiuc.edu) (The Illinois Fruit and Vegetable News Volume 7, No. 9 June 6, 2001)

## **14. Potato Growing Tips: Growth and Nutrient management**

### Early to Mid-Season Potato Cultural and Nutrient Management Tips

Determinate potato plants and tubers go through five major developmental phases: sprout development, vegetative growth, tuber initiation, tuber development, and plant senescence and tuber maturation. Conditions during vegetative growth (stage 2) and tuber initiation (stage 3) can have a large impact on crop yield and quality. This publication focuses on two practices, hilling and after planting nitrogen application, often carried out during these stages and that influence the bottom line.

### Potato Plant and Tuber Biology are important in Crop Management

Potato tubers are the enlarged tips of stolons which arise from vegetative stems of potato plants. Stolons which give rise to potentially marketable tubers form only between the seed piece or tuber and the soil surface. Therefore, like some refer to the Kentucky Derby as the "richest two minutes in sports," we can think

of the short distance between a seed piece or tuber and the soil surface as the "profit zone."

A number of factors make it important to manage the "profit zone" carefully. For example, the first stolons develop close to the seed piece and subsequent stolons arise from the stem at points progressively closer to the soil surface. It is also important to keep in mind that stolon length varies within and among varieties. Researchers at the University of Wisconsin-Madison measured stolon lengths of less than one to more than ten inches in eight varieties. Stolon length, while influenced by environmental factors, seems to be under partial genetical control but is unrelated to tuber color or maturity. In addition, potato plants contain four types of roots, three of which may be directly impacted by the condition of the hill. Roots on a potato plant form at the base (main or basal roots), at the junction of the main stem and stolon (stem-stolon junction roots), and from the stolon and tuber. Past studies documented that water taken up by the main roots bypasses the tubers on its way to the foliage. However, water taken up by the junction, and even more so by the stolon and tuber, roots goes primarily to the tubers. Overall, the quantity of water delivered to tubers by these three types of secondary roots may be small. But, it can be a primary carrier for calcium and possibly other soil-applied compounds targeted for delivery to tubers. High levels of calcium, for example, are reported to reduce the potential for internal quality defects such as brown center and hollow heart. Finally, marketable yield is reduced by sunburning or greening which results from inadequate soil coverage. Rainfall, irrigation, or soil disturbance after planting can breakdown the hill. Therefore, while 3-5 inches of soil coverage over the seed may be sufficient at planting, several more inches of coverage in place by the end of tuber initiation (stage 3) are required to maximize marketable yield. Although hill shape and dimensions should be tailored to match soil, market, equipment, row spacing, and other factors, peaked or conical hills are undesirable. Hills with an approximately 14-16 inch wide base and a flat or gently rounded top are best. Potato plants and tubers follow a characteristic sequence of developmental stages and they contain a specific arrangement of roots, stolons, and tubers. Potato plants also tend to take-up nutrients in amounts specific to their developmental stage. Of course, a key to successful nutrient management is to match crop need with supply.

Fortunately, potato growers have several means to gauge crop need and supply nutrients. For the moment, let's focus on assessing crop nitrogen (N) status after planting.

Experienced growers recognize that the appearance or color of the crop is an unreliable indicator of its nitrogen status. In fact, when it comes to nitrogen deficiency, it is often too late to reverse its impact on yield or quality once it becomes noticeable as stunted or yellow plants. Likewise, the negative impacts of excess N are mostly irreversible. This, coupled with the fact that pre-plant nitrogen can be lost if soil moisture remains high after planting, makes it important that crop managers estimate crop nitrogen status using proven methods, in addition to their experience. Petiole sap and tissue nitrate tests were developed to assist in the management of N availability in season. Both methods require sampling of fully developed leaves (usually the fourth or fifth from the top) and calibration of standard values for local production conditions. Petiole sap nitrate tests are rapid and inexpensive while laboratory-based tissue tests often involve more time and expense. However, tissue tests usually report the levels of up to twelve macro- and micronutrients while in-field sap tests are specific to one ion/nutrient (e.g., nitrate-N). Regardless of method (in-field measurement of sap, lab measure of tissue), results from these measures are compared with research-based reference readings available in several Extension publications. For example, North Dakota State University reports that ideal petiole sap nitrate levels are approximately 1250-1800 ppm early in tuber formation, 1000-1400 ppm midway through tuber development, and 500-800 ppm late in tuber bulking. Values at the same stages for dry tissue tests would approximate 17000-24000, 12500-17500, and 7500-10000, respectively. Measured values falling below reference values may indicate that the crop is nitrogen deficient. If needed, additional N can be applied by side-dressing during cultivation and hilling operations, through the irrigation system, or, in limited cases, via foliar sprays. In any case, the goal is to maintain a sufficient (but not excess!) supply of N as going too light or heavy has drastic consequences on yield and quality. The same is true of wide fluctuations in N supply.

The crop's total N requirement is specific to cropping history, soil type, market, variety and maturity, weather, and other factors. Regardless of the total amount to be applied, split applications -



applying a portion pre-plant and the remainder after emergence and, possibly, through tuber bulking - of N are recommended. A rule of thumb is to apply one-half to two-thirds at planting with the remainder applied at and after emergence. Applications made after planting can be adjusted according to prevailing conditions using methods described above. Caution should be used in applying N after hilling as excess N late in the season can delay maturity, reduce tuber quality, and contribute to environmental contamination. In some areas farming non-irrigated, fine-textured soils, one-third to one-half of the total N is applied in one post-planting application at hilling. In other areas farming irrigated, coarse-textured soils, one-half to two-thirds of the N is applied in several applications after planting through a combination of sidedressing and injection into the irrigation water (fertigation or chemigation). By Matt Kleinhenz (Robert J. Precheur, ed., VegNet Vol. 8, No. 14. May 23, 2001, Ohio State University Extension Vegetable Crops)

## 15. Roundup 24(c) Registration on Banana

The Hawaii Department of Agriculture issued a **\*\*revision\*\*** of the 24(c) registration number HI-960005. There is no change of the expiration date, 9/17/01. Here is a summary:

Banana --- Roundup UltraHerbicide (Monsanto; 524-475) --- HI-960005, valid 09/18/96–09/17/2001 --- For use as a “bananacide” in Banana Bunchy Top Virus control programs (to destroy banana plants and mats infected with Banana Bunchy Top Virus) only by injection. REVISED TO INCLUDE: “Do not harvest any fruit or plant materials from treated mats (or units) following injection. Do not allow livestock to consume treated plant materials.”

Disclaimer for 24(c) Labeling List

\*\*\* At the time of application, the applicator must have a copy of the 24(c) labeling in his or her possession. This notice is not a substitute for the 24(c) labeling.

\*\*\* The 24(c) labeling specifies an expiration date and is not valid after this date.

\*\*\* A 24(c) labeling issued for Hawaii is valid only in Hawaii.

\*\*\* The applicator must comply with all instructions and restrictions specified by both the 24(c) labeling and the container label. The instructions and restrictions may discuss any or all of the following: • crop, object, or site that may be treated • application

method • application timing • preparing the crop, object, or site for treatment • wearing protective clothing (for example, a long-sleeve shirt) and personal protective equipment (for example, a respirator) • measuring, mixing, and loading pesticide into application equipment • dosage or dilution of pesticide • setting up, adjusting, and calibrating application equipment • restricting entry by others into a treatment area • cleaning up or securing treated area • notifying other persons of hazards (for example, by training them, warning them, or by posting signs) • storing, locking up, or disposing of the pesticide container • washing up himself or herself after the treatment • making and keeping records. (Charles Nagamine, e-mail, May 23, 2001).

## **16. IPM for "Worms" in cabbage, and other crucifers**

Technically speaking, "worms" is not a very accurate term, but many growers use it to refer to the collection of larvae of the Lepidoptera (butterflies and moths) that attack the foliage and heads of cole crops (cabbage, broccoli, Brussels sprouts, and cauliflower) and crucifer greens (mustard greens, turnip greens, collards, kale, and others). In most instances, the three culprits are the imported cabbage worm, the diamondback moth, and the cabbage looper. The imported cabbage worm overwinters as a pupa within a chrysalis in crop debris, and adults -- the common white cabbage butterflies -- begin flying in early spring. They lay bullet-shaped, ridged yellow eggs (individually, not in masses) on foliage. Larvae are velvet-green, and just over 1 inch long when fully grown; they tend to feed from the edges of the leaf, and large veins are left intact. The chrysalis that encloses the pupa is grayish green to bright green and suspended by threads from the underside of outer leaves. It usually takes 4 to 5 weeks for larvae to mature from the egg to the adult stage.

The diamondback moth is the smallest of these three species. It winters in Illinois as a moth, though its survival can be low in severe winters. Eggs, larvae, and pupae may be introduced on transplants shipped in from southern regions, and northward migration of moths during the season also can extend its range. Flat, yellowish eggs are laid singly or in small groups, often near leaf veins or on stems, but they usually go unnoticed. Larvae initially mine between leaf surfaces, then they feed externally, often consuming all but the

upper or lower epidermis, leaving a "window pane" effect. Fully grown, they are about 3/8 inch long. They pupate within a light silken cocoon on a leaf, and a small moth (1/2-inch wing span) emerges a week or so later. Each generation takes 3 to 4 weeks for growth and development, and there can be as many as 6 generations per year in Illinois. The cabbage looper is the largest and most destructive of the three common Leps (Lepidopteran larvae) that attack cole crops here. This insect does not overwinter (at least not in significant numbers) in most of the Midwest; instead it migrates into the region on weather fronts, usually from June through September. Moths lay dome-shaped, ridged white eggs singly or in small masses on the underside of leaves. Larvae have only 3 pairs of abdominal prolegs (rear fleshy legs without joints) instead of the "normal" 5 pairs of many common Lepidopteran larvae. They grow to a length of 1 1/4 inch or more, and their feeding on leaves and heads can be very heavy. In addition, their frass (insect poop) is a less-than-sought-after contaminant. Each season, 2 to 3 generations of cabbage loopers develop in most of Illinois. The simplest thresholds (and therefore the ones most often used by growers who scout their own fields) for these insects lump all species together, at least for determining the need for control. Growers should examine 10 plants per site in each of 10 sites in a field (more samples = more dependable conclusions), record each as infested (by any of the species) or uninfested, and use the following thresholds:

Threshold for imported cabbage worm, diamondback moth, and cabbage looper: treat if infestations of any/all of the 3 species are found on more than the percentage of plants listed below.

Crop and Stage	% Infested Plants
Broccoli and Cauliflower	
Seedbed	10
Transplant to first flower or first curd	50
First flower or curd to harvest	10
Cabbage	
Seedbed	10
Transplant to cupping	30
Cupping to early head	20
Mature head	10
Collards, Kale, Mustard Greens, and Turnip Greens	

Early in the season, whenever flea beetle or aphid control or thrips control is NOT needed, use Bt (*Bacillus thuringiensis*) applications to control the Lepidopteran "worms" on crucifers. Bt products include Agree, Biobit, Cutlass, Dipel, Javelin, Ketch, MVP, XenTari, and others. These Bt preparations must be eaten to be effective, and they are toxic only to larvae of butterflies and moths. They work well against imported cabbage worm and diamondback moth larvae and are effective enough against young cabbage looper larvae to keep most infestations below economic thresholds at least until heads are present. Relying as much as possible on Bt products early in the season avoids killing natural enemies that help to keep these pests (especially diamondback moth) under control; it also reduces selection for resistance, especially in the diamondback moth, to pyrethroids and a few other insecticides that are valuable for use as cleanup sprays near harvest. Several insecticides are labeled for use against these pests in cole crops (cabbage, broccoli, etc.), but the list of included versus excluded crops gets pretty complex for leafy greens. Check Chapter 6 in the 2001 Illinois Agricultural Pest management Handbook and product labels for specific listings. Also remember ... onion thrips often move into cabbage as surrounding small grain fields dry down. Thrips are difficult to control in cabbage after they move between wrapper leaves. The time to treat is often at cupping or as heads begin to form. Capture, Ammo, and Mustang are among the insecticides that are very effective against thrips in cabbage. Rick Weinzierl (217-333-6651; [weinzier@uiuc.edu](mailto:weinzier@uiuc.edu)) (The Illinois Fruit and Vegetable News, Vol. 7, No. 8 May 23, 2001)

### **17. Folicur Section 18 for rust control in asparagus (Michigan)**

Folicur Registered for Michigan Asparagus, May 29, 2001 - Michigan asparagus growers recently received a Section 18 for the fungicide Folicur as a weapon in controlling rust. The Section 18 went into effect, Friday, May 25. Folicur, manufactured by the Bayer Company, is going through the IR-4 process of being registered. "It was getting to a point of crisis with abandoned fields along with moisture," said Perry DeKryger from the Michigan Asparagus Advisory Board.

Michigan growers did not have a Section 18 for Folicur last year, which caused the problems to escalate, according to DeKryger. He said Mary Hausbeck, professor of botany and plant pathology from Michigan State University, helped make the case to Michigan Congressmen and convinced them the Section 18 was needed. He said the fungicide Folicur is very effective in controlling rust in asparagus. "Abandoned fields put a lot of pressure on new tender seed beds. Folicur is going to be a very good thing for growers to control rust," DeKryger said. Growers will use the product after the harvest is complete and the fields are left to go to fern. DeKryger said growers typically alternate Folicur with Bravo, which is a good product for controlling purple spot. Bravo is in the process of being registered, hopefully by next year, according to DeKryger (Michigan Vegetable Grower News, May 2001).

## **18. PREVENTING FERTILIZER INJURY**

This spring's dry conditions have been excellent for planting but growers need to take special care when it comes to banding their fertilizer. All nitrogen and potassium fertilizers add soluble salts to the soil. These salts are capable of burning tender roots of germinating seeds. Crops that are especially sensitive include snap and dry beans, carrots and onions, while corn, cabbage and lettuce are moderately sensitive. Fertilizer injury occurs most often in dry springs and when fertilizer bands are placed too close to the seed. To prevent injury, keep the amount of N + K<sub>2</sub>O below 80 to 100 pounds per acre in the band. Phosphorus will not cause burning and does not figure into the equation. Make sure the band is placed 2 inches below and two inches to the side of the seed furrow. If you need a higher rate in the band, move the band further from the furrow. Also, using liquid fertilizer is just as hazardous as dry fertilizer. Many growers incorrectly assume that liquid starter is safer due to the extra water applied. However, the amount of water actually added on a per acre basis is miniscule, far below the amount of water necessary to prevent salt injury. In addition to salt injury, materials containing nitrogen may produce an injury due to a high concentration of ammonia. These include fertilizers containing urea, diammonium phosphate (DAP), or anhydrous ammonia. Exceeding 30 pounds of N as urea or DAP (either in combination or alone) in bands at planting may cause seedling injury. If anhydrous

ammonia will be used preplant or as a preemergence source of N for sweet corn, it should be injected as far as possible from the seed. If you realize there was a problem after planting, irrigating as soon as possible is recommended. The water will dilute the fertilizer salt and leach some of it away from the seed. -- Steve Reiners, Associate Professor in Horticultural Sciences, Cornell University, Geneva. (Ruth Hazzard, ed., University of Massachusetts, Vegetable IPM Message, MAY 24, 2001, VOLUME 12, NUMBER 3)

### **19. Monsanto Shelves GM Potato Line**

Monsanto has decided to cease seed production of its six-year-old genetically modified (GM) potato, and will stop selling GM seed to U.S. and Canadian potato farmers after this spring. The NewLeaf potato contains a gene from a microorganism to make a toxin that repels the Colorado potato beetle. Monsanto advertised the potato as a way farmers could greatly reduce their pesticide costs, but NewLeaf never captured more than five percent of the potato-seed market. Last year McDonald's Corporation told its french-fry suppliers to stop using the potato. As a result, J.R. Simplot Company, a major maker of french fries, instructed its farmers to stop growing NewLeaf potatoes. Monsanto is the only U.S. company to have launched a GM version of the tuber. --adapted from Entomological Society of America Newsletter (Ruth Hazzard, ed., University of Massachusetts, Vegetable IPM Message, MAY 24, 2001, VOLUME 12, NUMBER 3)

### **20. Food Safety Guidelines to make juice**

Highlights of FDA Food Safety Efforts: Fruit Juice, Mercury in Fish: The Food and Drug Administration (FDA) issues a comprehensive food safety package: Outlined in this package are strict rules for egg producers and makers of fruit or vegetable juices. The package also discusses consumption limits for pregnant women and women considering pregnancy for fish containing high levels of mercury. [http://www.fda.gov/fdac/features/2001/201\\_safe.html](http://www.fda.gov/fdac/features/2001/201_safe.html) (Ed Net, Food and Drug Administration Newsl. May 24, 2001).

## **21. Economic Impact of Vegetable Industry**

Policy makers are often unaware of the full economic impact of the produce industry on their states. A case in point: An analysis was recently conducted to estimate the full economic impact of the potato industry in Washington State. The farm-gate value of potatoes grown in Washington state in 1996-97 was \$451 million, with a direct employment (fresh and processing industry) of 11,315 workers. However the full impact on the economy was estimated to be over \$3 billion, with a total of 27,600 jobs driven by the potato industry (D. Holland and J.H. Yeo. 2001. The economic impact of potatoes in Washington State. WA Coop. Ext. Serv. XB1039).

## **22. Food Safety Info on the Web**

Finding food safety information from USDA's Food Safety and Inspection Service (FSIS) Web site has never been easier! On this page, educators and health professionals will find FSIS' latest consumer education materials and links to other helpful resources.  
<http://www.fsis.usda.gov/OA/consedu.htm>

University of California Davis FoodSafe Program  
<http://foodsafe.ucdavis.edu/homepage.html>

Iowa State University Extension Food Safety Project  
<http://www.exnet.iastate.edu/Pages/families/fs/homepage.html>

Kansas State University Cooperative Extension Service Food Safety  
<http://www.oznet.ksu.edu/foodsafety/#K-State>

Michigan State University Extension Food Safety Homepage  
<http://foodsafe.fshn.msu.edu/main.html>

North Carolina State University Cooperative Extension Service Food Safety Web site  
<http://www.ces.ncsu.edu/depts/foodsci/agentinfo/index.html>

Penn State University Food Safety Throughout the Food System  
<http://foodsafety.cas.psu.edu/>

Purdue University Dept. of Hospitality and Tourism Management  
Food Safety Toolkit



<http://www.cfs.purdue.edu/RHIT/foodsafety/>

University of Nebraska Lincoln Food Safety Web site

<http://www.foodsafety.unl.edu/foodsafety/index2.htm>

The above Web sites and more can be found at the center's Food Safety index:

<http://www.nal.usda.gov/fnic/foodborne/fbindex/index.htm>

Visit the center's Web site for more food safety information:

<http://www.nal.usda.gov/foodborne>

(Ed Net, Food and Drug Administration Newsl. May 24, 2001).

### **23. Long-life Bananas?**

#### **SINGAPORE SCIENTISTS PRODUCE LONG-LIFE FRUIT WITH MODIFIED GENES**

SINGAPORE - Researchers at Singapore's National University are, according to this story, reported to have developed a system of modifying genes to delay fruit ripening by up to four months. The Straits Times was cited as saying Saturday the researchers have cloned and modified the genes which fruits and plants use to produce ethylene, the gas which causes ripening, . Pua Eng Chong, associate professor of the biological sciences department, was cited as saying fruit with doctored genes produces 90 percent less ethylene, and the flow on effect could mean savings of millions of dollars. Researchers are initially focusing on bananas, a 1.5-billion US dollar a year industry. (June 9, 2001, Agence France Presse English)