RUTGERS COOPERATIVE EXTENSION AT THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION

PLANT & PEST ADVISORY

ORGANIC FARMING EDITION $1.50 DECEMBER 18, 2003

INSIDE

Biology of Weeds

John Meade, Ph.D., Retired Specialist in Weed Science

Weeds, identified as "plants growing where not wanted", are classified by their life cycle:

1. Annual weeds: those growing for one season and surviving by producing seeds.

Examples: velvet leaf and barnyard grass

2. Biennials: those germinating in one year, making a large taproot, and flowering the following year.

Examples: wild carrot (Queen Anne's lace) and dock.

3. Perennials: plants living more than two years.

Examples: mugwort and Canada thistle.

Problems

Annuals: These plants produce a large number of seeds. The average is around 25,000 per plant but some produce up to 250,000. So, even if only a small number are viable, there are still enough to assure continuation of the line. There is also a factor of seed dormancy. Not all of the seeds produced in any one year germinate the next year. Some will germinate in the second year, some in the third year, and some will lie dormant for up to 25 years or more. This makes prevention of weed seed production very important. Otherwise we try to prevent the germination of these seeds with herbicides or prevent them from becoming established by very early cultivation or hoeing. When a seed germinates, the root is the first structure out and becomes anchored. By the time you see the top growth, the plant is usually firmly in place. The longer you wait to remove it, the more difficult it becomes. Early removal is easiest and most efficient.

Biennials: Relatively easy to control. The plant can be disturbed enough the first year by cultivation or mowing to prevent its appearance the second year.

Perennials: These plants, in addition to producing seeds, also produce vegetative reproductive parts. These include rhizomes (underground stems), stolons (above ground, horizontal stems), bulbs, tubers, nutlets and taproots. These organs store food and overwinter to send up new plants the next year. Or, if the top growth is removed by clipping or pulling, the underground parts will regenerate new plants that season. Control of these plants through conventional methods is achieved by treating the foliage with systemic herbicides which penetrate the plant and kill both the above and underground portions.. Continued removal, tillage and/or flaming of the top growth of perennials will force the plant to deplete its root reserves and eventually kill it. ❑

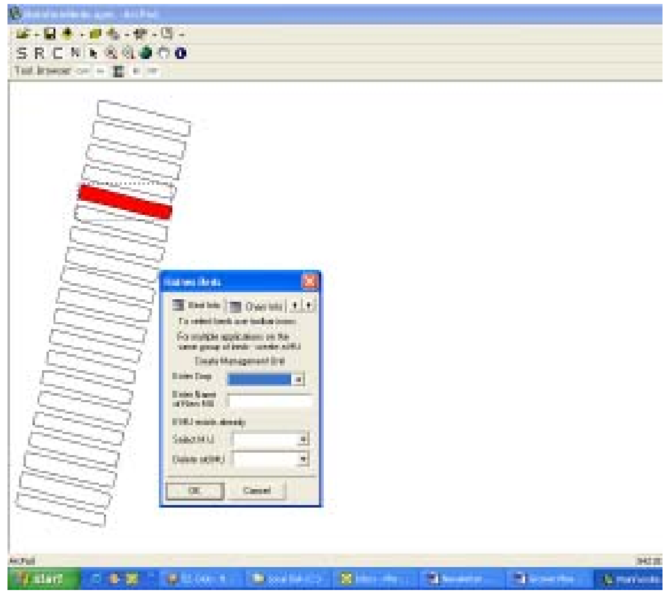
Precision Ag for NJ Farms Project Holds Grower Meeting

Aaron Starr, Program Associate for the RCE/ NJDA Precision Ag Study

On November 20, 2003 we held a meeting at the Rutgers Marucci Center for Blueberry and Cranberry Research and Extension in Chatsworth for the participants of the precision agriculture grant. This is part of the Rutgers Cooperative Extension/New Jersey Department of Agriculture 2-year pilot study, deploying mobile GIS/GPS on New Jersey farms that we have previously reported on. The attendees included project leaders from Rutgers Cooperative Extension and the New Jersey Department of Agriculture and 11 farmers participating in the project. The purposes of the meeting were to introduce precision farming concepts useful for a wide range of specialty crops, keep the participants informed of the progress we are making, and collect feedback on their experiences so far and suggestions for improvements to the system. Additionally, we demonstrated our mobile handheld computer application to enter, store, and retrieve farming information linked to specific sites within fields.

Presentations were given by members of the project team. Peter Oudemans, Specialist in Plant Pathology, talked about the study and GIS in broad terms, discussing GPS technology, aerial imagery and sophisticated analysis that can be done using the technology. Aaron Starr, Program Associate to the project, gave a talk on data, including the information that's available and the layers that can be created from the data collected. He also presented a diverse list of freely available web sites where farmers can obtain precision ag information, including aerial imagery. Marilyn Hughes, the programmer, talked about use of the application she created for farmers, which includes pesticide and chemical applications, fertilizer and nutrient management, field histories, farm maps with accurate field sizes, a farmer's notes section, and irrigation record keeping. The application has become quite sophisticated, thanks to Marilyn's tireless efforts, but its' main feature is still ease of use. The grant was written specifically to find a way to keep accurate, thorough records of farm activities while using a minimum amount of the user's time and attention. Therefore, the interface uses only drop-down boxes; no typing is required for basic data collection. Yet the system has the ability to record customized notes through handwriting recognition or an on-screen keyboard.

We then collected feedback from the participants and talked about future enhancements. Particularly, we talked about how to record irrigation information in a manner that makes it easier for the farmer to comply with DEP regulations. Opinions differ on how to best track usage since water can travel a complex path on its way to a field and there are several ways to calculate usage. Also, growers are presented with the decision of recording use daily or monthly. The law only requires monthly totals, but it is the opinion of the members of the study that recording on a daily basis is ultimately more useful because over time it will give the farmer more thorough records and allow for more accurate correlations between the activities performed during a season and the yield.



The application developed for the Rutgers/NJ Department of Agriculture Precision Agriculture study captures data on critical farm activities with the touch of a pen- no typing needed

One of the suggestions was that we provide a Spanish version of record keeping applications.

In addition to vegetable and fruit farmers, we have a dairy farmer participating in the study. This has presented a unique challenge for data collection. Farmers applying manure are under pressure to adopt Nutrient Management Plans and our application can make it easier for a farmer to do so.

Another farmer noted that they do not spray entire fields at once and would like to be able to track partial applications, time of application, and simple duplication of past applications for different fields or dates. We are looking into this and will try our best to incorporate these functions into future versions of the program.

Participants have voiced a range of goals from simple tracking of pesticides and fertilizers to helping to document the 3-year transition from conventional to organic farming, to total farm tracking. While many challenges lay ahead, we are encouraged by our progress and the feedback we have been receiving. For further information on this project, contact Jack Rabin, Associate Director for Farm Services, NJAES at rabin@aesop.rutgers.edu or 732-932-5000 ext. 610. ❑

Preparing Plants for Growth in Greenhouses or Hotbeds

Reprinted from the 2004 Commercial Vegetable Production Recommendations for New Jersey, Rutgers Cooperative Extension/NJAES.

Note: If any of the following materials are not suitable for organic production, substitute substances with equally effective approved materials.

These recommendations apply to plants grown under controlled conditions in greenhouses or hotbeds. A transplant is affected by such factors as temperature, fertilization, water, and spacing. A good transplant is grown under the best possible conditions.

Table A-1 presents optimum and minimum temperatures for seed germination and plant growing, the time and spacing (area) required to produce a desirable transplant, and number of plants per square foot.

Table A-1. Optimum and Minimum Temperatures and Planting Recommendations

Crop	°F Opt. Day	°F Min. Night	Weeks to Grow	Sq In per Plant	Plants per Sq Ft
Broccoli	65-70	60	6-7	3	48
Cabbage	65	60	6-7	3	48
Cauliflower	65-70	60	6-8	3	48
Celery	65-70	60	9-12	3	48
Cucumber[1]	70-75	65	2-3	4	36
Eggplants	70-85	65	7-9	6-9	24
Endive, Escarole	70-75	70	5-7	2	72
Lettuce	60-65	40	5-6	1	144
Melons[1]	70-75	65	2-3	6	24
Onions	65-70	60	9-12		
Peppers	70-75	60	8-9	4-6	36
Summer squash[1]	70-75	65	2-3	4	36
Sweet potatoes	75-85	in bed	4-5		
Tomatoes	65-75	60	5-6	6-9	24

[1] Seed directly in container; do not transplant prior to setting in the field.

Plant-Growing Mix. A good, lightweight, disease-free, plant-growing material can be made from a mixture of peat and vermiculite. The formula for a very simple mix is given in Table A-2, but a preferred formulation is shown in Table A-3 (on page 4). If plants are to be grown in mix longer than 8 weeks, use the formula in Table A-3.

Table A-2. Simple Plant-Growing Mix

Materials	Cubic Yard (22 Bushels)	2 Bushels
Shredded sphagnum peat moss	11 bu	1 bu (10 gal)
No. 2, 3, or 4 domestic or African vermiculite[1] or horticultural grade (dust-screened)	11 bu	1 bu (10 gal)
Pulverized limestone use *dolomitic* lime for mixes made with *domestic* vermiculite	10 lb	1 lb (1¼ cups)
or use *calcitic* lime mixes made with *African* vermiculite	6 lb	9 oz (3/4 cup)
Superphosphate (20% P_2O_5) or	2½ lb	4 oz (½ cup)
Triple superphosphate (46% P_2O_5)	1¼ lb	2 oz (¼ cup)
Fertilizer (5-10-10)	5 lb	8 oz (1 cup)

[1] Vermiculite should be pea-sized and relatively free of fines and dust. Final mix should have a pH of 6.0-6.5.

Notes. Good results for growing lettuce and cabbage transplants have been obtained by diluting this mix with an equal part of sand.

This mix will only get the seedlings up. Supplemental fertilizing will be needed to grow plants to transplant size. About 3 weeks after seeding, begin liquid fertilizing the plants with a soluble fertilizer, such as a 20-20-20, at the rate of 2-3 teaspoons per gallon of water. This rate should be applied at least weekly. More frequent applications may be desirable.

Regardless of which formula is chosen, unless good mixing procedures are used, the results will be less than optimal. For best mixing, use a horizontal-type paddle mixer that folds or blends the additives, such as lime and fertilizer, evenly throughout the mix. With tilted or other types of mixers, the additives tend to segregate or separate out, resulting in erratic performance of the mix.

Good procedures to follow when preparing a mix are:

1. *Use a respirator to prevent inhalation of dust when mixing peat, vermiculite and additives.*
2. For small quantities of mix preparation—1 cubic yard or less—place 4 to 5 inches of vermiculite in the bottom of a 5-gallon pail. Add all the additives (lime, fertilizer, micronutrient, etc.) to the vermiculite in the pail and mix thoroughly.
3. Fluff the recommended amount of peat. Start mixer and begin blending the peat.
4. While blending, add water according to the dampness of the peat. You will need approximately 1 gallon of water per bushel of peat in the mix.
5. While blending, slowly pour the additives, which you have already mixed thoroughly with a small amount of vermiculite, into the mixer and blend for 3 to 5 minutes.

SEE PLANT GROWING ON PAGE 4

PLANT GROWING FROM PAGE 3

6. Add the recommended amount of vermiculite and blend for 1 minute. Soon after mixing, use the mix for growing your plants. It is not a good practice to stock-pile the mix in large piles for long periods of time.

Remember, the success of using the mix and obtaining excellent plants is very dependent upon good mixing procedures. Also, read all labels of the ingredients used, and heed all warnings that may be marked on the labels or bags.

Commercial Plant Growing Mixes. A number of commercial media formulations are available for growing transplants. Most of these mixes will produce high quality transplants when used with good management practices. However, these mixes can vary greatly in composition, particle size, pH, aeration, nutrient content, and water-holding capacity. Avoid formulations having fine particles which may hold excessive water and have poor aeration. *Have media formulations tested by your state soil test laboratory to determine the pH and nutrient levels in the media before planting.*

If plants are yellow, growing slowly, or stunted due to high pH (7.0 or higher) in the growing medium, drench seedlings in trays with a solution containing 1 to 1.5 pounds iron sulfate ($FeSO_4$) per 100 gallons of water. Rinse seedlings after drenching.

Treatment of Flats and Trays. Flats used in the production of transplants should be new to avoid damping-off and other disease problems. If flats and trays are to be reused, they should be thoroughly cleaned after use and completely submerged in a household bleach solution for at least 5 minutes. Use 5 gallons of 5.25 percent sodium hypochlorite (Clorox, Purex, etc.) for each 100 gallons of solution. Permit flats to dry completely prior to use. One or more of the following methods of disinfecting should be used:

Chlorine bleach. Wash flats and trays with soapy water, then dip in a chlorine bleach solution several times. Use 5 gallons of 5.25 percent sodium hypochlorite for each 100 gallons of solution. Cover treated flats and trays with a tarp to keep them wet overnight. Wash flats and trays with clean water or a Q-salt to eliminate the chlorine. It is important that the bleach solution remains below pH 6.8 and that new solutions be made up every 2 hours or whenever it becomes dirty. Organic matter will remove the active ingredients quickly.

Fumigants. Pre-wet flats and trays; place in long, short stacks; and cover with an air tight plastic seal. Apply methyl bromide with 1 percent chloropicrin (3 pounds per 1,000 cubic feet) within the sealed area. Pay attention to all labeled precautions and temperature requirements.

Q-salts (Quaternary ammonium chloride salts). Compounds such as Greenshield, Physan and Prevent can be applied in the final wash of flats and trays during the chlorine treatment. Additionally, they can be used to wash exposed surfaces (benches, frames, etc.) in greenhouses.

Plant Containers. Individual plant-growing containers should be used for vine crops and early market crops of tomatoes, peppers, and eggplant. Various types of fiber or plastic pots or cubes are available for this purpose. If plastic pots are reused, treat as described for flats.

Seed Germination. Seed that is sown in flats to be "pricked out" at a later date should be germinated in straight vermiculite (horticul-

SEE TREATMENT ON PAGE 5

Table A-3. Preferred Plant-Growing Mix

Materials	Cubic Yard (22 Bushels)	2 Bushels
Shredded sphagnum peat moss	11 bu	1 bu (10 gal)
No. 2, 3, or 4 domestic vermiculite[1] or horticultural grade (dust-screened)	11 bu	1 bu (10 gal)
or		
African vermiculite[1]	11 bu	1 bu (10 gal)
Pulverized limestone		
use *dolomitic* lime for mixes made with *domestic* vermiculite	10 lb	1 lb (1¼ cups)
or		
use *calcitic* lime mixes made with *African* vermiculite	6 lb	9 oz (3/4 cup)
Superphosphate (20% P_2O_5) or	2½ lb	4 oz (½ cup)
Triple superphosphate (46% P_2O_5)	1¼ lb	2 oz (¼ cup)
Sulfate or muriate of potash (50%-60% K_2O)	½ lb	1 oz (2 tbs)
Osmocote[2] (18-6-12)		
Tomatoes	4 lb	6 oz (3/4 cup)
Eggplants	8 lb	12 oz (1½ cups)
Peppers	8 lb	12 oz (1½ cups)
Micronutrient mix	Use according to mfgr.'s recommendations	
Wetting agent (such as Aqua-Gro granular)	1½ pt	1 oz (4 tbs)

[1] Vermiculite should be approximately pea-sized and relatively free of fines and dust. Final mix should have a pH of 6.0-6.5.

[2] Osmocote is a slow-release fertilizer. Use a formula that will release nutrients over a period of 8 to 9 months. Therefore, mixes should be made just prior to seeding. Plants grown in mixes containing Osmocote must be carefully watered and the temperature carefully controlled prior to field planting. Reduced rates are suggested to control plant height when using small cells.

Treatment from page 4

tural grade, coarse sand size) or a plant growing mix. However, it is recommended that no fertilizer be included in the mix or the vermiculite until the seed leaves (cotyledons) are fully expanded and the true leaves are beginning to unfold. Fertilization should be in the liquid form and at one-half the rate for any of the ratios listed below. Seedlings can be held for 3 to 4 weeks if fertilization is withheld until 3 to 4 days before "pricking out." Seed that is sown in pots or other containers and will not be "pricked out" later can be germinated in a mix that contains fertilizer.

To get earlier, more uniform emergence, germinate and grow seedlings on benches or in a floor-heated greenhouse. If floor heat or benches are not available, seed the trays, water, and stack them off the floor during germination. **Caution**: be sure to unstack trays before seedlings emerge.

Plant Growing Facilities. Good plant-growing facilities (greenhouses) provide maximum light to the seedling crop through clean glazing in good repair. They also have soil-heating capabilities, either on the benches or on the floor, and provide good heating and ventilation systems for effective environmental control. Providing proper soil temperatures ensures uniformity of crop throughout the greenhouse by moderating normal temperature variations experienced with hot air heating systems. Soil heating and growing the crops on the floor provide for a significant energy savings because the greenhouse does not have to be operated 10°F higher than the required soil temperatures for good germination and seedling growth. Hot air heating units are best located in sheds or a headhouse outside the growing area to minimize the chance for aerial pollution adversely affecting the seedlings. Units located inside the greenhouse must be vented and have an outside fresh-air intake to provide combustion air to the heater. The heating and ventilation thermostats must have a wide difference in temperature setting to insure that the exhaust fans do not operate when the heating units are running. Improperly designed ventilation systems that draw in exhaust gases from the heaters can cause yellowing, stunting, and death of the seedlings. Ventilation units must be adequate in size, providing 1.2 to 1.4 sq ft of opening for each 1,000 cubic feet per minute (cfm) fan capacity. Seedlings should not be grown or held in areas where pesticides are stored.

Liquid Feeding. The following materials dissolved in 5 gallons of water and used over an area of 20 square feet are recommended for use on the transplants if needed:

20-20-20—1-2 oz/5 gal water
15-15-15—2 oz/5 gal water
15-30-15—2 oz/5 gal water

Rinse leaves after liquid feeding. Fertilizers used for liquid feeding should be 100 percent water soluble.

When using starter solutions for field transplanting, follow manufacturer's recommendation. **Caution**. High rates of starter solution can become concentrated and burn transplant roots when the soil becomes dry.

Watering. Keep mix moist but not continually wet. Water less in cloudy weather. Watering in the morning allows plant surfaces to dry before night and reduces the possibility of disease.

Hardening. Reducing the amount of water used, lowering temperatures, and limiting fertilizers cause a check in growth (hardening) to prepare plants for field setting. When hardening vine crops, tomatoes, peppers, or eggplants, do not lower temperature more than 5°F (3°C) below the recommended minimum growing temperatures. Low temperature causes chilling that can injure plants and delay regrowth after transplanting. Do not harden endive or escarole by lowering the temperature because low temperature increases early bolting. Avoid overhardening or underhardening. ❑

Grant Awarded for Organic Control of Flea Beetle in Eggplant and Brassicas

The Organic Farming Research Foundation has awarded researchers at the New Jersey Agricultural Experiment Station $7,200 to conduct efficacy studies of insecticides for the control of flea beetles on organically-grown eggplant and brassicas. The grant was awarded to Olga Wickerhauser, NJAES Sustainable Agriculture Coordinator and Principal Investigator on the project, George Hamilton, Extension Specialist in Entomology, and Martha Maletta, Horticultural Consultant in Hunterdon County. Cooperators include the New Jersey chapter of the Northeast Organic Farming Association (NOFA-NJ). The research will be conducted at the Snyder Research & Extension Farm in Pittstown, NJ, as well as on a local organic farm. This project was developed in response to needs expressed by New Jersey organic farmers. The study will begin this spring and will be conducted for one growing season. ❑

Lettuce, Endive and Escarole IPM Field Guide

Wesley Kline, Cumberland County Agricultural Agent, RCE and Shirley Kline, Horticultural Consultant

Reprinted from Integrated Crop & Pest Management Field Guides & Database, Rutgers Cooperative Extension, 2000. For the entire manual or individual crop field guides, contact Rutgers Cooperative Extension of Cumberland County, Extension Education Center, 291 Morton Ave., Millville, NJ or call 856-451-2800.

Pre-planting Decisions:

1. Practice a minimum of 3 year crop rotation for control of most diseases; 4-5 year rotation for drop.
2. Do not produce lettuce transplants with ornamental bedding plants, particularly Impatiens, to avoid tomato spotted wilt virus.
3. Lime and fertilize according to soil test recommendations.
4. Use the information obtained from last year's scouting to select control options for those weeds. Match preplant incorporated and preemergence herbi cide rates to soil type and percent organic matter.
5. Plant on raised beds, select fields with good soil and air drainage and avoid fields with a history of bottom rot or drop.

Spring Seeded Lettuce, Endive or Escarole

Scout 30 plants/field for fields up to 10 acres; add an additional 10 plants for each additional 10 acres.

Pest	Damaging Stage	Monitored Stage	Sampling: Method	Sampling: Frequency	Threshold	Notes
Cutworms	larval	larval	Scout for missing or cut off plants next to weedy field edges, ditches, roads, woods, or in low lying areas of the field. Sift through soil to a depth of 3 in. for larva within a 1.5 in. radius of damaged plants.		No threshold, but most growers are concerned if >3% of stand is affected.	Most common in spring in low damp spots, trashy areas and areas with grassy weeds nearby. Cutworm larvae hide during the day.
Aster Leaf-hopper	adult nymph	adult nymph	Use 5-10 yellow sticky cards/acre for detection of first leafhopper activity. Replace weekly. Thereafter, use standard 15″ sweep net, 25 sweeps in each quadrant of the field.	Weekly	Thresholds dependent upon aster yellows infectivity of the leafhoppers.**Head Lettuce:** AYI = 20-25**Leaf Lettuce:** AYI = 30-35	**Aster Yellows Index (AYI**) = % infectivity x (number of leafhoppers/100 sweeps)Aster leafhoppers transmit the viral disease, aster yellows.
AphidsGreen Peach Aphid GPA) Potato Aphid	all	all	Check along field edges. Since aphids tend to be clumped, check 25 plants per quadrant of a field.	**Seedling:** 2x/week **Est'd. Plants:** weekly	**Seedlings:** > 1 aphid/ plant.**Est'd. Plants:** > 2 or resample in 3 days if any plants rated > 4 aphids/ plant.**7-10 days prior to harvest** = 1% infestation	Overuse of pyrethroids kill predators/ parasites that help keep aphid populations under control. Aphids are known to vector several viral diseases. If heavy rains are forecast or natural enemies are abundant, infestations that slightly exceed thresholds may be tolerated for a few days.

CONTINUED ON PAGE 7

Continued from page 6

Pest	Damaging Stage	Monitored Stage	Sampling: Method	Sampling: Frequency	Threshold	Notes
Tarnished Plant Bug (TPB)	adult nymph	adult nymph	Sample 5 plants in > 6 random locations, checking the center of each plant, especially for fast moving nymphs.	Weekly	No threshold established.	TPB tend to come up from the inner part of the plant when disturbed. Adults may fly short distances.

Disease	Sampling – what to look for	Frequency	Threshold	Notes
Downy Mildew	Look for symptomatic plants when environmental conditions are favorable for disease while scouting for other pests. Look for light green to yellow angular spots on upper leaf surfaces, white fluffy growth on lower sides of these spots.	Weekly when environmental conditions are favorable for disease.	presence of disease.	Most damaging on early spring or late fall crops. Environmental conditions favorable for disease development: high humidity, night temperatures 40-50°F, day temperatures 54-68°F, cloudy skies, film of moisture on leaves for 5-7 hours.
Bottom Rot (BR)	Look for wilted plants with dark brown discolor-ation particularly near the midrib, radiating out on under side of older leaves.	weekly	presence of disease	No mycelium will be seen with BR. Controls are different for BR than drop making accurate identification of disease important.
Drop	Scout for wilted plants, with outer leaves dropping to the ground while scouting for other pests. Look for white mycelium with black sclerotia on bottom of plant. Eventually entire plant collapses, especially near harvest.	weekly	presence of disease	Rogue and remove infected plants to reduce inoculum in field. Fungus has a wide host range and sclerotia live for many years in the soil. Soil fumigation reduces inoculum.
Nematodes	Scan field for uneven or poor growth. Check for galls or swelling on roots. Map these areas.	Threshold depends on species found.		Obtain soil & plant samples of affected areas. Keep samples out of direct sunlight, preferably in a cooler. Submit to lab for analysis.

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