United States Department of Agriculture
Natural Resources Conservation Service

# Plant Materials Program

## Big Flats Plant Materials Center: Progress Report of Activities, 2012

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**T**he Big Flats Plant Materials Center (PMC) is one of 27 plant materials centers operated by the United States Department of Agriculture, Natural Resources Conservation Service. Areas served by the center include the Northeast, from Maine to northern West Virginia. The center is located in the Finger Lakes region of Central New York State.

**I**t is our mission to develop plant materials and state-of-the-art plant science technology for the conservation of natural resources and meet the objectives of environmental programs. We focus on using native plants to solve conservation problems and protect ecosystems. Six major objectives addressed are:

- Cropland Erosion, Water Quality, Soil Health
- Native Plants for Conservation Systems
- Biofuels/Agroforestry
- Protecting and Improving Water Quality
- Wildlife Habitat Improvement
- Critical Area Stabilization
- Improving Air Quality

**T**his is a brief summary of 2012 activities at the center. For additional information on the projects, please contact us at the center. Visit our Plant Materials Program Website at http://Plant-Materials.nrcs.usda.gov to view Plant Fact Sheets on conservation plants; information on how to obtain conservation plants; publications and technology development from PMC's across the United States; new improved plant uses and technology, and links to websites with additional or supporting information.

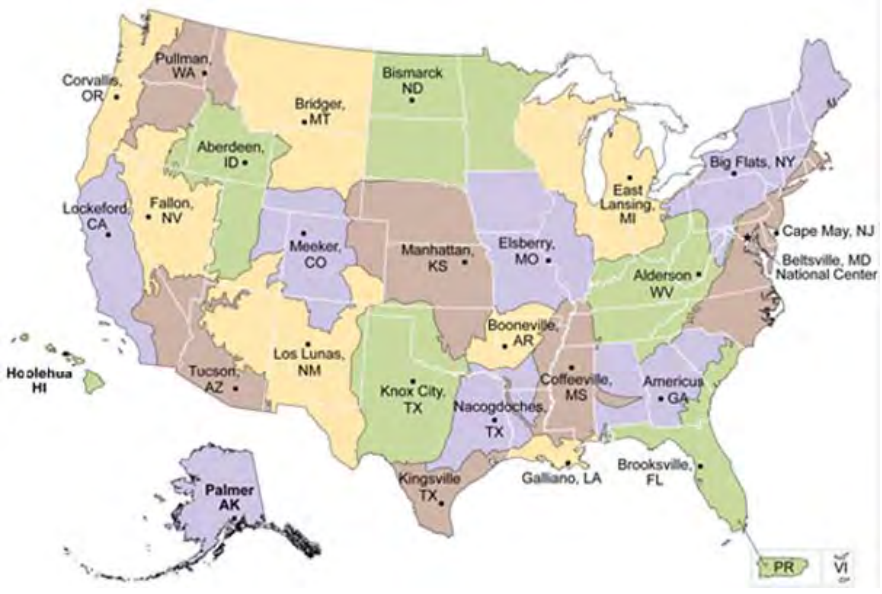
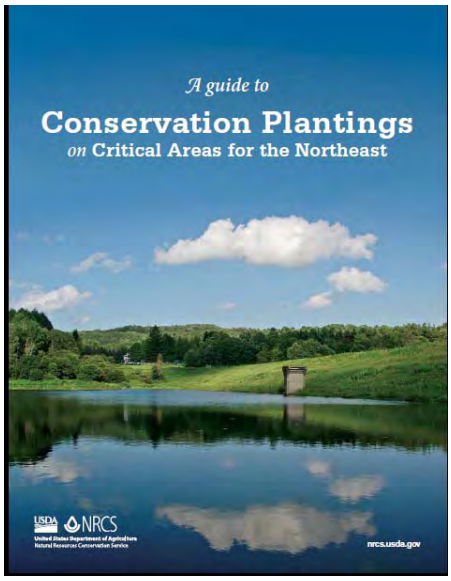



**Figure 1: Locations of Plant Materials Center in the US.**

## Recent Publications from the Big Flats Plant Materials Center

(see our website for pdf versions of these documents. Click Here.)

- *Native Wildflower Seeding Rate Calculator for Conservation Plantings*. Shawnna Clark.
- *Pollinator Friendly Plants for the Northeast US*. (PDF; 3,389K) Shawnna Clark. 2012. 60p.
- *Establishment Guide for Willow Biomass for BCAP Program*. (PDF; 183K) Paul Salon, Tim Volk, Mike Fournier. 2012. 6p.
- *Ease of Establishment and Persistence of Native Wildflowers after 4 years*. (PDF; 105K) Shawnna Clark. 2012.
- *Field Studies for Establishing Native Wildflowers to Increase Pollinator Habitat*. Shawnna Clark. 2012.
- *Germination Requirements of Native Wildflowers.* (PDF; 106K) Shawnna Clark. 2012.
- *Diverse Cover Crop Mixes for good soil health*. (PDF; 59K) Paul Salon. 2012. 9p.
- *A Guide to: Conservation Plantings on Critical Areas for the Northeast.* (PDF; 6 MB) Paul Salon and Chris Miller. 2012. 148p.



## Cover Crop Demonstration Plots

There are many benefits to the utilization of cover crops, such as reducing soil erosion, improving water quality and soil tilth, alleviating soil compaction, recycling of nutrients, providing nitrogen, weed suppression, early spring forage, and food and habitat for wildlife. All of these benefits rely on the planning of the cover crop system. 180 different species of cover crops and several mixes were seeded throughout various dates from June to October 2012. Data on planting dates, percent cover, and above ground biomass were recorded throughout the season, and will be looked at again in the spring of 2012. The proceeding pictures show a nice representation of the different seeding dates and growth stage and the differences when seeded alone or together with another cover crop.


**Figure 3. Triticale and Austrian Winter Pea seeded together on September 1, 2012. Picture was taken December 12, 2012.**


**Figure 2. Triticale and Austrian Winter Pea seeded together on September 15, 2012. Picture was taken December 12, 2012**


**Figure 4. Austrian Winter Pea seeded alone on September 1, 2012. Picture was taken December 12, 2012.**

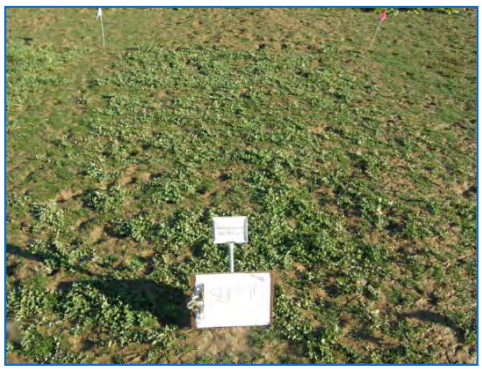


**Figure 5. Austrian Winter Pea seeded alone on September 15, 2012. Picture taken December 12, 2012.**

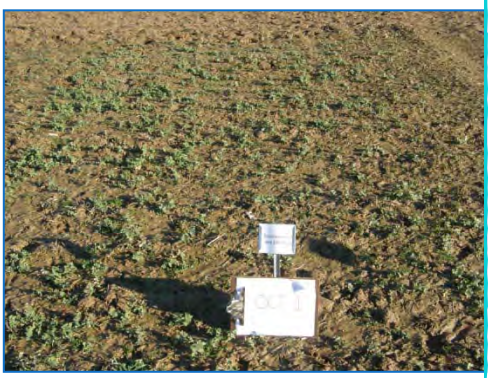


**Figure 6. Austrian Winter Pea seeded alone on October 1, 2012. Picture was taken December 12, 2012.**

**Figure 7. Triticale was seeded on September 1, 2012. Picture was taken December 12, 2012.**

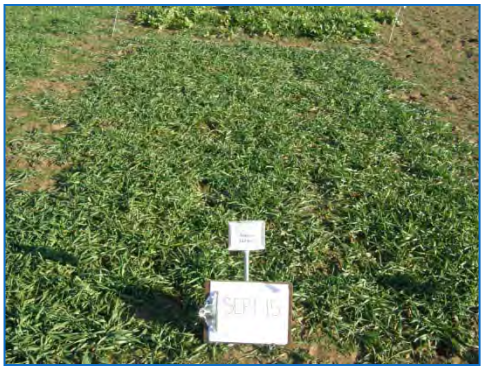


**Figure 8. Triticale seeded on September 15, 2012. Picture was taken December 12, 2012.**

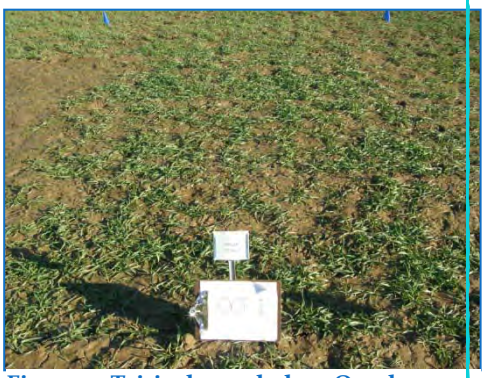


**Figure 9. Triticale seeded on October 1, 2012. Picture was taken on December 12, 2012.**

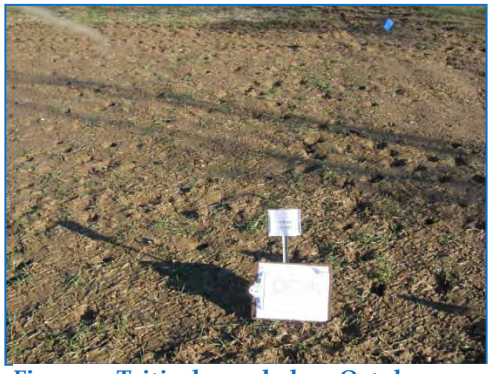


**Figure 4. Triticale seeded on October 15, 2012. Picture was taken December 12, 2012.**

## Optimizing Cover Crop Mixtures for Nitrogen Supply and Cost-Effectiveness

Legume cover crops are a proven tool for supplying nitrogen to a subsequent cash crop. In the Northeast US, the fallow period between a small grain harvest in mid-summer and a cash crop planting the next spring provides a sufficiently large time period in the late summer and fall to plant a fast growing, winter-killed legume cover crop. Charlie White, of Penn State University's Crop and Soil Sciences, put in experimental plots, in July of 2012, at the Plant Materials Center, to test the various plant densities of a winter-killed legume (fava bean), a winter-hardy legume (red clover), and a winter-hardy grass (triticale) in monoculture, biculture, and triculture cover crop plantings at different planting rates. Cover crop biomass, nitrogen content, nitrogen fixation, and seed costs will be measured along with subsequent cash crop yield response and soil inorganic N pools near the time of maximum cash crop demand as indicators of the performance of each cover crop treatment.

In Charlie's preliminary research, they have found that fava bean cover crops planted between late July and early August in central PA produced between 150 and 290 kg N/ha in above ground biomass prior to winterkill. The following spring, after winterkill of the fava beans, there is an additional period of time with suitable temperatures and solar radiation for growth of a winter hardy cover crop species.

The following hypotheses are being tested in PA and at the PMC:

1. A legume cover crop mixture containing species adapted to different temporal growth periods will have a higher biomass and nitrogen accumulation than monoculture stands.

2. That nitrogen mineralizing from winterkilled legume (fava bean) residues will suppress nitrogen fixation by the companion winter hardy legume species (red clover).
3. There is an optimum density of grass which will increase the total N fixation and N availability of a 3-species mixture containing a winter killed legume (fava bean), a winter hardy legume (red clover), and a winter hardy grass (triticale).
4. Cover crop mixtures where components vary across planting rates and density gradients will have different abilities to supply nitrogen to the next cash crop.
5. There will be differences in economic returns and that the mixtures which optimize economic returns may not be the same mixtures that optimize other ecological functions measured in this study, such as N fixation or N supply to a subsequent crop, due to the differences in seed cost among species and mixtures.

In the spring of 2013, biomass of cover crops will be obtained, the covers will be burndown, and corn will be seeded in early May. Nitrogen will be applied to the corn in control plots, in mid-may, and in mid-June the soil will be sampled for inorganic N. Once corn is harvested in October, biomass yields of the corn will be obtained.

Figure 11. 2012 Participants of the annual cover crop tour viewed Charlie White's plots. In the foreground, fava bean mixtures can be seen.

## Diverse Cover Crop Mix Trials

The use of a diverse cover crop mixture that contains two or more plants is often more effective than a monoculture planting. Cover crop mixtures adapt to variation in soils, increase biomass production, provide broader spectrum of weed control, have better winter survival and ground cover and attract a range of beneficial insects. Nutrients can be immobilized or produced depending on existing soil conditions and plants used. Mixes can be a grass/legume, multiple cultivars of a single species, or a mix containing plants with different growth patterns. When developing mixes there are multiple factors to consider to ensure compatibility. Select species which have similar heights and use corresponding shade tolerant species, different root characteristics, synchrony in flowering or maturity for proper C:N ratios, as well as species that fill niches in the ecosystem resulting in continuous cover from summer to the following spring.

Managed correctly, cover crops add carbon to the soil, and diverse cover crops species mixes add different carbon compounds to the soil via root exudates. Different plants leak different root exudates in order to attract particular segments of soil biology that help the plants thrive. With a field full of diverse plants attracting diverse organisms, the field can begin to accumulate all the needed components of a healthy and fully functioning soil system. A soil system like this grows exceptional crops on less fertilizer and sequesters soil carbon. Planting multi-species cover crop mixtures may be a viable solution for increasing the ecological stability and resilience of cover crop communities, which can contribute to

higher and more consistent productivity. Production benefits of multi-species plant communities include the potential for increased resource-use efficiency and crop yields.

In 2011, two diverse summer cover crop mixes were developed and seeded with a Tye drill, on June 15th and 16th and were compared to red clover and sorghum sudangrass seeded alone, as well as a control plot. Aboveground biomass samples were taken in the fall of 2011, as well as in the spring of 2012. On June 22, 2012, a late start, field corn was seeded into the roller crimped, cover crop fields.

Also in 2011, fall cover crop mixtures were seeded on August 22, 2011 and followed the same procedures as mentioned above. October 25, 2012 marked the fall harvest of the field corn, where yields of corn are currently being measured, and yield will be compared to the cover crop treatment that was applied the previous spring. Please contact us for updated results to this study.

**Figure 12. Summer seeded cover crop mix, in December 2011. This plot was then seeded with corn in June 2012.**

**Figure 13. Seeded in August 2011, these fall seeded cover crops were still green in December 2011. This plot was also seeded with corn in June 2012. Biomass samples were taken in May 2012 of the cover crops, as well as the corn in Oct 2012.**

# Native Plants for Conservation Systems

## Selecting Native Forbs for Pollinator Conservation

The New Farm Bill of 2008 emphasizes the development and conservation of native habitat for managed and native pollinators. In May and August of 2012 we seeded 40 species and mixes in the field, replicated 4 times. We choose the selected species and seeding dates based on the successes over the past 3 years. All plots are still being evaluated for percent cover, heights, vigor, flowering date and abundance (seeds per square foot). We also have large plots at ¾ and ½ acres, and are looking at these for ease of establishment and maintenance. We have been looking at Poast grass herbicide, and Stinger broadleaf herbicide, for potential use in establishing these natives successfully. Note the Stinger herbicide is a highly selective herbicide, and will stunt and/or kill desired species. Please consult with the local extension personnel before applying any herbicides to your field. Mowing was also utilized at various dates throughout the growing season to keep annual and perennial weeds down before going to seed, with good results! All other seeding dates, June, August and October 2009, July 2010, May and August 2011, and the new seedings will be continually monitored over the next few years.

**Figure 14: Pollinator Fields planted in June 2009. In early May 2012, with abnormally high spring temps, Lupine was in full bloom.**

**Figure 15: Pollinator planting plots seeded in Aug 2009, picture taken in August 2012.**

### Northeast Native Seed Initiative

There is a growing need in the Northeastern States for seed of local ecotypes of native plants, suitable for habitat restoration. The Northeast Native Seed Initative was formed with cooperators from US Forest Service in the Green Mountains, and the White Mountains National Forests, USDA-NRCS, State Departments of Transportation in NY, VT, NH, and ME, New England Wild Flower Society, state foresters, cooperative extensions, natural heritage programs, and interested NGO/citizens. With little or no native seed available, in the commercial market, the goal of this intitative is to collect seed of selected native species from across the region and grow out in increase blocks. Once harvested, this seed will be provided seed companies for commercial seed production. For the initial collection, 5 grasses (Canada and Virginia Wildrye, fowl bluegrass, upland bentgrass, little bluestem), 1 sedge (nodding sedge), and 5 forbs (common milkweed, boneset, NE aster, blue vervain, flat-topped white aster) were selected by the group. Collections were made in 2009, 2010, and 2011 and 2012. A hundred new accessions were collected this fall and will be added to the existing field in late spring 2013.

## Biofuels/Agroforestry

### Switchgrass Smut Study with Cornell University

Switchgrass Smut is a fungal disease caused by *Tilletia maclaganii* and results in stunting, premature flowering, and seeds that are replaced by fungal sori. *Tilletia maclaganii* is a systemic pathogen that can perennially reduce the yield of biomass from an established field and can cause almost total loss of seed production in a heavily infected field. Because of the devastating effects on its host, *T. maclaganii* is seen as a threat to the establishment of switchgrass as a productive biofeedstock crop. Dr. Gary Bergstrom and Christine Layton of Cornell University have set up test plots, in 2009 and 2010, on the center looking at different seed treatments and fungicides that may potentially help in eliminating this stand-depleting fungus. In 2010, a switchgrass variety trial was established, to see if any of these showed resistance to smut infection. Varieties from various sources being tested are Kanlow, Bomaster, Shawnee, Shelter, Blackwell, Cave-in-Rock, Hightide, Carthage, some hybrids and 'Atlantic' Coastal Panicgrass. So far, all varieties are quite susceptible to the smut disease. In 2011 and 2012, Christine collected seed from these plots and will see if any varieties are showing resistance to this disease, and establish additional plots.

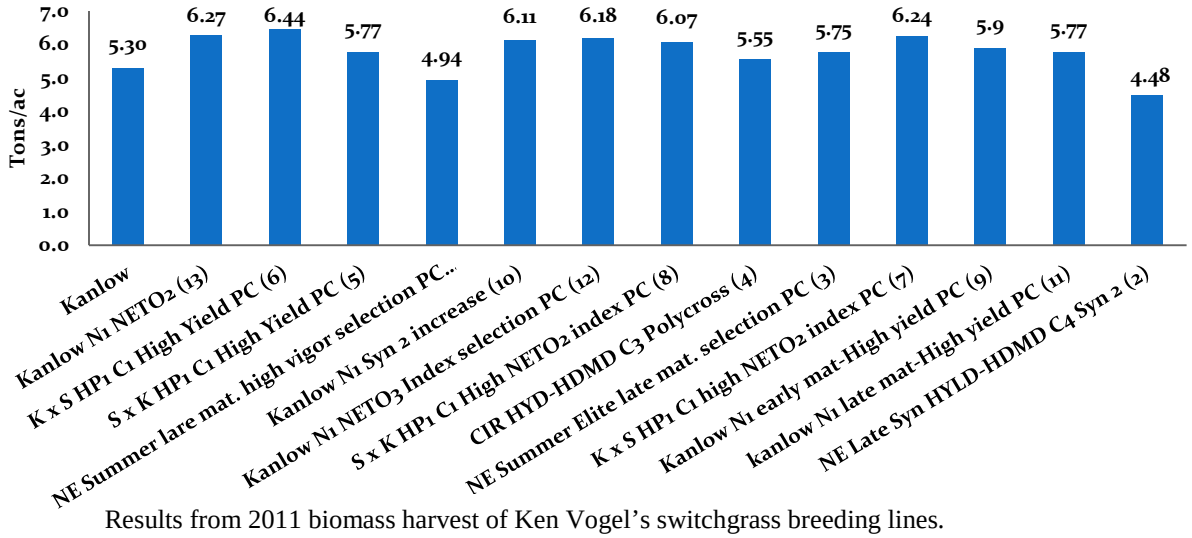
### Tall Wheatgrass Time of Cutting Study

We evaluated two varieties of tall wheatgrass, 'Alkar' and 'Szarvasi-1', with 5 cutting dates cuttings and 1 recut date with two seeding rates of 20 and 40 N lb/ac. See below for conclusion to date:

- Tall wheatgrass may be harvested as a biomass crop in the Northeast with a single harvest in late July to early August maximizing single cut yields of up to 4.5 t/ac with improved chemical composition over early cutting dates.
- Chemical compositional analysis indicates a substantial reduction in K, Cl, and ash from later cutting with low nitrogen and sulfur levels.
- There was no significant difference between the 20 and 40 lb/ac seeding rate in tall wheatgrass cultivars.
- Intermediate wheatgrass 905190 shows promise as a biomass crop only if cut with a 2 cut system due to potential lodging problems but could have issues with chemical components due to early cutting.
- Ranking between the tall wheatgrass varied between 2008 and 2009 indicating more years of data collection are warranted to access performance over time.
- Future cultivar evaluations of tall wheatgrass should be conducted as a single late cutting.

## Evaluation of Ken Vogel's and Mike Casler's Switchgrass Breeding Lines

Conventional plant breeding and molecular genetics techniques provide opportunities for improving switchgrass for bioenergy. Current switchgrass research is focusing on breeding and genetics to improve biomass yields for energy production as well as ecosystem uses. A potential mechanism for increasing biomass yield is by producing hybrids based on the upland and lowland ecotypes. Current research by Mike Casler, USDA-ARS in Wisconsin, and Ken Vogel, USDA-ARS Nebraska, indicate hybrid cultivars can increase biomass yield by more than 40% compared to the parental lines. Switchgrass species have 2 distinct ecotypes, lowland and upland. Lowland ecotypes, i.e. 'Kanlow' are found in riparian areas and wetlands whereas, upland ecotypes, such as 'Cave-in-Rock', occur in drier areas that are not subject to inundation.,. Most switchgrass cultivars that were previously developed for pastures were upland types because they generally have smaller stems and generally more leaves. The lowland ecotypes, because of their higher yield potential, are more suitable for biomass energy production. It is possible to produce hybrid cultivars of lowland and upland parents which could result in additional yield improvements. In 2009, we seeded 13 different breeding lines, from Ken Vogel. In 2010 and 2011, biomass yields were calculated and ranged from 3.2 T/A-5.06 T/A. In 2009, hybrids of upland and lowland types, from Mike Casler were seeded and compared with 'Timber', 'Bomaster', and 'Kanlow' cultivars of switchgrass. 2011 was the first year for biomass yields, and will be analyzed this winter.




Results from 2011 biomass harvest of Ken Vogel's switchgrass breeding lines.

### Big Bluestem and Switchgrass Breeding Project for Biofuels with Cornell University

**Figure 16: Over 4000 native switchgrass and big bluestem plants are being evaluated for their potential use as a Biofeedstock source or wildlife and roadside plantings.**

**S**witchgrass and big bluestem have a lot of genetic diversity within native populations. It is important to collect, evaluate and store this germplasm. An effort was made to collect Northeast native switchgrass and big bluestem to develop breeding lines which originated in the Northeast. Approximately 80 collections each of switchgrass and big bluestem were made from 10 states. The seedlings were planted at both the Big Flats PMC and Cornell University. The collections were grown out to establish breeding evaluation blocks of 3,000 individual plants at both locations. Collections that were received late in 2008, were added in 2009 to the existing plot. Evaluations of flowering dates and growth form, heights, vigor, disease, stem and leaf abundance, and leaf widths were continued in 2011. Plants are now being selected based on potential use for biofuel and wildlife plantings, and will be moved to seed increase blocks and advanced evaluation in 2013.

# Critical Area Stabilization/Improved Forages/Streambank Stabilization

## Critical Area Seeding Mix Study

Critical area stabilization plantings are utilized to stabilize areas that are highly susceptible to erosion. These areas include very steep or long slopes, highly erodible soils, droughty or excessively wet soils, and slopes adjacent to waterways or wetlands. On June 28, 2011, 20 mixes of warm and cool season grass species were seeded. Later in the season, on August 22, 2011, 30 mixes of native and non-native cool season grasses, some containing legumes and wildflowers were seeded. The cool season grasses may be seeded almost year-round, except during the typical midsummer dry period, where warm season grasses need to be seeded in spring or early summer. All plots are being evaluated for percent cover, competition with weeds, ease of establishment, overall vigor and species compatibility, to further improve seeding recommendations.

On May 24th , 2012 a seeding rate demo planting was conducted with some native and introduced cool season grasses for the workshop. There was a mixture study replicated 3 times with 20 treatments of warm and cool season native grasses, and a planting of cool season grass mixtures with 3 replications and 8 treatments. There was also 3 replications of a mix of reed canary grass and 'Garrison' creeping foxtail to evaluate the competition between those 2 species. That was done to compare the degree of invasiveness of 'Garrison' creeping foxtail compared to reed canarygrass. This was for observations only. These plots were viewed and current findings were presented at the 2012 Critical Area Seeding and Planting Workshop (see below for more details).

## Soil Bioengineering Time of Cutting Study

The use of willow for soil bioengineering continues to be a component in most stream bank stabilization projects. With increase in and severity of hurricanes in the Northeast in the past couple of years there has been an increase in use and questions concerning the timing of planting of willows for soil bioengineering. The use of additional engineering practices such as barbs, vanes and weirs has also increased the potential success and use of willow plantings as well. Although it has been recommended to plant only dormant stock there has been no published data in the Northeast quantifying the effectiveness of non dormant plantings. A study was conducted with 'Streamco' purple osier willow (*Salix purpurea*) and 'Geenbank' Sandbar willow (*Salix exigua*). The study compared dormant harvested cuttings, stakes and fascines cut on March 15th and April 1st and stored in moist refrigerated cooler with plantings that were harvested and planted outside of the dormant season. Planting dates were: April 20th, May 14th June 4th, July 6th, September 11th and December 4th 2012. For some dates a soaking treatment was conducted to evaluate the effect of soaking on the cuttings and stakes. There are two factors at work, one is the physiology of the non dormant planting stock at harvest and the other is the warmer and drier soil and weather conditions when planting later in the season.

Data was collected on percent survival and number of stems per planting stock. Observations to date has supported the use of dormant planting stock and that extended refrigerated moist storage has had no detrimental effect on planting stock establishment. Non dormant stakes of 'Streamco' willow did almost as well on all planting dates especially on April 20th and May 14th but produced less stems per stake with less vigor as the season progressed. There was an extended drought and it was decided to irrigate for the July 6th planting date. There was a difference in survival, growth and vigor between species with purple osier willow clearly outperforming the sandbar willow when planted on the non dormant dates. Stakes performed better than cuttings for both species and the irrigation on July 6th improved growth and survival compared to the June 4th planting date indicating that summer plantings would benefit from irrigation. The soaking treatment had mixed and minor differences in this study. See Results Below:

| Planting Date | Dormant harvest[1] | | Non-dormant harvest[2] | |
|---|---|---|---|---|
| | % Survival | stems/stake | % Survival | stems/stake |
| May 14th | | | | |
| Purple osier willow | 93.3 | 5.8 | 96.7 | 5.7 |
| Sandbar willow | 100.0 | 3.5 | 90.0 | 5.7 |
| June 4st | | | | |
| Purple osier willow | 100.0 | 8.1 | 77.0 | 4.9 |
| Sandbar willow | 90.0 | 6.3 | 3.3 | 0.7 |
| July 6th(3) | | | | |
| Purple osier willow | 83.3 | 6.5 | 96.7 | 6.1 |
| Sandbar willow | 93.3 | 4.7 | 0.0 | 0.0 |

[1] Dormant harvest data is the average of the March 15th and April 1st harvest treatments.
[2] Non-dormant harvest dates were May 10th, May 31st and June 29th for respective planting dates

[3] This date received irrigation.

## Native Willow Collection

Interest has arisen for propagating native species of shrub willow for restoration plantings in riparian areas, streambanks, and wetlands as well as for living snow fences and odor barriers. Willows are used because they can grow quickly, stabilize soils and withstand flooding, improve water quality, and provide shade and cover for stream life. Four willow collection identification workshops were held to train NRCS and Cooperating agencies on how to identify and collect willows for use in streambank erosion control, in 2010. Willows were also obtained from SUNY ESF.

The species of interest are Bebb's willow, pussy willow, silky willow, shining willow and heart-leaved willow (Salix bebbiana, S. discolor, S. sericea, S. lucida, and S. eriocephala). A total of 122 collections, from VT, NH, PA, and NY, were obtained and were grown in a nursery bed at the PMC. In July 2010, these collections were planted in three replications for evaluation. In 2011 and 2012, we evaluated each plant for survival, vigor, disease, and heights.

We had to erect fencing to put up around the willow planting, due to very heavy browse from deer and other small mammals. In 2012, an additional fence needed to be added on top of the existing fence, since deer were jumping over the 7 foot fence. After evaluating this year, some very promising species have survived initial deer pressure and insect damage.

The species that overall have low disease and insect damage, compete well with weed pressure and are vigorous is Salix sericea or silky willow. There are select accessions in each genus that are showing great potential and each surviving plant will be further evaluated in 2013.

## Wildlife Food and Cover/Agroforestry

### RPM Trees Study

The "Root Production Method" (RPM) is a proprietary process for producing trees. The RPM process includes air pruning of seedlings grown in well aerated soil medium to encourage a dense fibrous root system that promotes rapid growth of the plant. Other nurseries which use similar size nursery stock, 2 gallon containers, and other air root pruning methods are available. Planting tree seedlings in agroforestry practices can be a problem with weed competition, wildlife browsing and possible flooding and wet soils. The question has been asked whether larger container trees should be used instead of smaller nursery cone-tainer seedlings. Smaller seedlings require tree tubes for deer protection requiring additional maintenance while larger planting stock costs more but may have increased survival and may not require the tree tubes This study was initiated in the fall of 2006 where five species of hardwoods – Pine Oak, Red Oak, Swamp White Oak, Sugar Maple and Shadbush Serviceberry – were compared to three types of nursery stock: RPM trees, one-year-old cone-tainer seedlings and two-year old 1 gallon seedlings. These trees were evaluated for a number of years to monitor the rate of growth and performance. Also, a field evaluation planting was established in the spring of 2007 on a Wetland Reserve Program site in Madison County, NY, to evaluate RPM hardwood trees of wetland species. Their performance will be compared to regular nursery seedlings. Evaluations performed in 2012 as well as past years, are showing that although, RPM trees were taller at planting date, 1-yr old and 2-yr old trees were almost as tall after 4 years, but not larger in caliper width than the RPM trees. Long-term success of tree plantings and economic benefit, for restoration and conservation practices, are the main objectives and will be looked at over the next few years.

**Figure 17: Photo of plot with RPM trees, 1-year old bareroot cuttings and 2- year old nursery stock.**

**Figure 18: Photo of tree seedlings at initial planting date in 2006. Left tree shows RPM, middle 2-year old nursery stock, and far right is 1-year bareroot cutting.**

## Vegetative Buffers/Windbreaks for Improved Air Quality on Concentrated Animal Operations

**W**hat can be done to minimize the conflict between residential landowners living near a concentrated animal operation? There are problems with odors, flies, noise, dust and normal agricultural activities. There is information from the Midwest that needs to be adapted to the east where space is limited. A group of cooperators (including NRCS in PA, Penn State University Poultry Science and Horticulture departments, PA Bureau of Forestry, Cooperative Extension, Wenger Feed, Big Flats and the National PMC and farmers), was organized to establish windbreak demonstration sites to evaluate potential benefits for windbreaks and air quality. More than 20 demonstration sites have been planted on poultry, dairy and swine operations. In 2010 a site at Hillendale Farm, Gettysburg, PA, was established. Many species of trees, shrubs, and grasses, such as Northwind Switchgrass, Streamco purpleosier willow, Red Maple, Northern White Cedar, Miscanthus, and Valley Forge Elm, were planted in front of large exhaust fans Studies at Penn State University are being conducted to evaluate the effect of trees to absorb ammonia, dust and other pollutants. Fast growing species, such as 'Streamco' purple osier willow and 'Spike' hybrid poplar are being studied to establish visual screens in two to four years, while also acting as an air filter and a living snow fence. Windbreaks may have the ability to reduce odor concentrations and this cooperative group will be monitoring the plantings to determine their effectiveness. In 2011, another field evaluation site was planted at Flintrock Farm, in Lancaster PA. A variety of grasses, trees, and shrubs for their potential use as windbreaks for odor control were planted in different configurations by exhaust fans to test their performance.

**Figure 19: Large Fans release odors and particulate matter from inside the barn.**

**Figure 20. Many species were planted in front of large exhaust fans. and will be evaluated over the next few years.**

## Native Grass Studies at Cornell University Arnot Research Forest

**T**hree studies were started at the Cornell University Arnot Research and Training Forest in cooperation with Cornell University, Dept. of Natural Resources in 2006. The first is a Native Cool Season Grass Mix study to determine optimum seeding rates of the mixes and evaluate their establishment. The grasses were: bentgrass, fringed bromegrass, fowl bluegrass, intermediate wheatgrass, red fescue and rough bentgrass. At this site, some of the species initially established in the first year but within a year, reverted back to original field conditions. Second is a Native Cool Season/Warm Season Grasses Mix study. The warm season grass mix that was seeded consisted of big bluestem, indiangrass, switchgrass, and deertongue with the cool season grasses consisting of Virginia wildrye, Canada wildrye, Riparian wildrye and intermediate wheatgrass. Initially both warm and cool season grasses established well but after 4 years is now a solid warm season grass stand. The third study at the site is a switchgrass variety trial for biofuels. At this 1900' elevation, 'Kanlow' switchgrass and 'Atlantic' coastal panicgrass had 80% winterkill while 'Cave-in-Rock', 'Cartage', and 'Shelter' switchgrasses had significantly less winterkill, with nice stands. A 2.6 acre section of the field was seeded with a warm season grass mix of 'Niagara' big bluestem, Indiangrass, 'Tioga' deertongue, and 'Shelter' switchgrass. Evaluation of this field, in 2012, showed an excellent, solid stand of the warm, season grasses. The original field had extensive goldenrod that has not re-invaded this planting after 5 years.

**Figure 21: Cool Season grass mix at Arnot Forest.**

**Figure 22: Different Plots of Cool season grasses.**

## Seed and Plant Production

Plant materials of released conservation plants and new plants under development were grown and processed at the Plant Materials Center. Any seed grower or nursery business interested in producing any of our plant releases should contact us directly at the center. Any landowners that need information on conservation uses of these varieties or local sources of plant materials can contact their local NRCS office. Seed that was harvested in 2011 was, 'Aroostook' Rye, Canada and Virginia Wildrye, Canada Bluejoint, Sideoats grama, 'Niagara' Big Bluestem, New England collections of Little Bluestem, Big bluestem, and Indiangrass, 'Tioga' deertongue, 'Copper' Chinquapin, Bur oak, Albany Pine Bush's' bush clover, lupine, and butterfly milkweed, blue false indigo, intermediate wheatgrass. There were visitors this year to the PMC to learn about our seed cleaning operations. We had 2 people from the Albany Pine Bush Preserve Commission bring seed they collected and learn about the processes and equipment required to successfully clean seed for future use at their site. We also trained a SCA person from the Cuyahoga Valley National Park, in Ohio, on our seed cleaning equipment and processes. He had some challenging seed to clean such as big bluestem, various goldenrod and aster species, spotted joe-pyeweed and boneset. These species with their very fluffy seed heads, required several steps. They will use their seed for restoration and plantings in the national park in 2013.

# Tours/Workshops/Meetings

## Cover Crop Workshop 2012

On November 15, 2012, over 110 participants joined us for our 4th annual cover crop workshop and tour. Ray Archuleta started us off with his very powerful slake and rainfall infiltration simulation. These demonstrations show the differences in conventionally tilled soils and 40-year no-till soils. The no-tilled soils did not fall apart when submerged in water, due to the hydrophobic biological glue, glomalin, that is produced by arbusuclar mycorrhizal fungi, found on plant roots. These glues stabilize aggregates, which will reduce wind and water erosion, increase water infiltration, increase water retention near roots, improve nutrient cycling, increase soil carbon, and improve root penetration by reducing compaction and ultimately improve soil health.

*****Listed below are the other presenters that rounded out the day-long event*:**

- **Paul Salon** *USDA-NRCS, Plant Materials Specialist.* Tour of Cover Crop Demonstration Plots, which included a time of seeding demo, with over 180 plots
- **Charlie White** *Penn State University, Extension Specialist*; Cover Crop Combinations of Fava Bean, Red Clover and Triticale.
- **Bianca Moebius-Clune** *Cornell University Department of Crop and Soil Sciences, Extension Associate;* From Soil Health Testing to Soil Health Management Planning – Opportunities for Collaboration.
- **Aaron Ristow** *Agriculture Coordinator, Upper Susquehanna Coalition (USC)*; Cover Cropping within the Chesapeake Bay TMDL Framework.
- **Ray Archuletta** *East National Technology Center, Conservation Agronomist*; Soil Quality, Health, Biology and Cover Crops. Reduction of Chemical Inputs through Soil Health, Nutrient cycling and balancing C:N ratios.
- **Quirine Ketterings** *Cornell University Dept. of Animal Science, Associate Professor, Nutrient Management Spear Program*; Winter-Forage Small Grains to Boost Feed Supply: From Cover Crop to Double Crop.
- **Klaas *Martens*** *Organic Grain and Cover Crop Seed Producer* Penn Yan, NY; On Farm Cover Crop Research and Development.

## Biofeedstock Tour and Demonstrations

**T**he Big Flats PMC conducted its annual Biofeedstock Field Day on August 10, 2012 for approximately 100 people. The tour allowed attendees to observe research and demonstration plots of many warm and cool season grasses including herbicide treatments, seeding techniques, time of seeding and cutting studies, breeding nursery, cultivar and seed treatment studies, plant pathology studies as well as seed production fields. Establishment and management of hybrid willows were discussed and observed as well as demonstrations of a mobile pelletizer and a powdered biomass burner.

***Presentations were given by:***

- **Paul Salon-**USDA-NRCS Plant Materials Specialist, biomass projects at the Big Flats PMC, including a summary of a bioenergy grass cultivar study, in cooperation with Cornell University.
- **Dean Tiessen -** New Energy Farms, Miscanthus Production and Management
- **Larry Smart-** Cornell Horticulture/Plant Breeding Departments, willow breeding project
- **Christine Layton -** Cornell Dept. of Plant Pathology and Plant-Microbe Biology; Biology and Management of Switchgrass Smut.
- **Paul Lawson -** Small Pellet Mill Demonstration, Lawson Mills Biomass Solutions
- **Kim McNight-** Powdered Biomass Burner, Summerhill Biomass Systems
- **Tom Voigt -** University of Illinois- Crop Science Dept. Midwest biomass energy perspective and Miscanthus production research and the invasive species issue.
- **Jerry Cherney-** Cornell Crops and Soils Science Dept. Chemical composition and management of grasses in regards to combustion and emission.
- **Denise Costich-** USDA-ARS. Molecular and phenotypic markers for switchgrass breeding and development.
- **Tom Richard-** Director of Penn. State Institutes of Energy and the Environment. Cellulosic ethanol research and commercialization update.

Figure 23. Lawson Mills mobile pelletizer.

Figure 24. Larry Smart, from Cornell University, stands in front of his hybrid willows. After being harvested earlier this year, some varieties are already 8 to 9 feet tall.

## New York Pollinator Conservation Planning Short Course

The 2008 Farm Bill makes pollinators and their habitat a conservation priority for USDA. On September 13, 2012 60 participants attended this day-long short course and provided conservationists, land managers, farm educators, and agricultural professionals with the latest science-based approaches to increasing crop security and reversing the trend of pollinator decline, especially in heavily managed agricultural landscapes. Below lists the days speakers:

- **Jolie Goldenetz Dollar** – Pollinator Habitat Restoration Specialist, The Xerces Society for Invertebrate Conservation – Protection, establishment, and management of pollinator habitat.
- **Mia Park** – Bryan Danforth Lab, Cornell University - The role and importance of native bees in apple pollination.
- **Dave Biddinger Lab**, Pennsylvania State University – Integrating pollinator habitat in farm and orchard systems.
- **Alan Taylor** – Professor of Seed Science and Technology, New York State Agriculture Experiment Station, Cornell University – Seed science and technology of non-crop plants to attract pollinator species.
- **Shawnna Clark** – Natural Resources Specialist, Big Flats Plant Materials Center – Tour of pollinator habitat test plots at PMC and lessons learned.
- **Paul Salon** – Plant Materials Specialist, USDA-NRCS – Specifics on pollinator habitat establishment.

There was also an afternoon tour of Big Flats Plant Materials Center pollinator enhancement wildflower projects: Time of seeding study with 4 dates and 60 species, weed control study, pollinator garden, and warm season grass plantings.

## Critical Area Seeding and Planting Workshop

On September 18, 2012, over 60 participants visited the PMC for a day long workshop on critical area seedings and planting for erosion control. Below lists the presenters and their topics:

- **Pete Hanrahan -** CPESC, NE IECA Chapter President, Erosion Control & Geoproduct Manager, E.J. Prescott, Inc. Gardiner, Maine Advances in Jobsite Sediment Control Technology.
- **Joe Koziell -** Regional Sales Manager, North American Green, Evansville, Indiana. Hydro Seeding and Mulching Specifications for Effective Erosion Control & Turf Establishment.
- **Pauline Burnes** - CPESC, CSWQ, Regional Landscape Architect, Region 6 NY-DOT**.** Seeding the Slippery Slopes of the Southern Tier – Critical Area Seeding on Highway Projects, Case Studies will focus on the SR 15 reconstruction project (future I-99), 6 miles of a new four lane highway under construction south of Corning.
- **Jessica Verrigni** - Director of Chemung County Storm Water Coalition, and Jimmie Joe Carl, CPSEC, Technician for the Coalition. Stabilization of Multi-family Residential Site in Chemung, County, and Lessons Learned. Stabilization and revegetation of disturbed soils has been challenging due to soil characteristics, weather, rainfall, and construction operations.
- **Jimmie Joe Carl and Mark Watts** - CPESC, Manager of the Chemung Co. SWCD. Practical Application of Soil Bioengineering Techniques for Stream Stabilization.

- **Paul Salon**- USDA-NRCS, Plant Materials Specialist. Tour of critical area seed mix demonstrations of warm and cool season native and introduced species, time of cutting and planting shrub willows for soil bioengineering applications, and cover crop demonstration plots.
- **Shawnna Clark**- USDA NRCS PMC, Natural Resources Specialist. Wildflower and forb establishment study lessons learned (over 60 species and mixes).
- **Steve Sprecher**-USDA NRCS Resource Soil Scientist**.** Soil Considerations for Critical Area Restoration.

## Working Trees in Agricultural Landscapes: An Introduction to Agroforestry

On November 16th, 60 people attended our tour on Agroforestry, in cooperation with Brett Chedzoy, Cornell Cooperative Extension. This inaugural agroforestry event at the PMC featured NRCS soil health advocate Ray Archuleta. Some of Ray's key messages throughout the day was: "Farm in the image of Nature"; "Feed the soil"; and "Nature hates monocultures". The five agroforestry systems discussed throughout the day certainly showed how the thoughtful combination of trees, crops and sometimes even livestock can go a long ways towards making our agricultural production more sustainable. Information covered included:

- An Overview of Five Agroforestry Systems for the Northeast: Alley Cropping, Forest Riparian Buffers, Windbreaks, Silvopasturing and Forest Farming
- The Ecological and Economical Benefits of
- Field Tour included examples of windbreaks, living snow fence, willows for soil bioengineering, hybrid willows for bioenergy, shrub willow time of cutting and planting study. Establishment method demonstration: nursery stock options, site preparation methods, post-planting vegetation and pest control, native willow evaluation, species and cultivars of interest.

**We would like to thank the following people for presenting and speaking at this workshop:
**Dan Dostie**, State Resource Conservationist – USDA NRCS Pennsylvania, **Dr. Ken Mudge**, Associate Professor of Horticulture – Cornell University, **Ray Archuleta**, Conservation Agronomist - USDA-NRCS National Technology Center-East, **Dr. Larry Smart** – Cornell University, **Dr. Peter Smallidge** – Cornell University Cooperative Extension, and **Dave Roberts** – USDA NRCS.

## Other Tours and Public Outreach Conducted in 2012

In 2012, many groups and organizations, from a variety of disciplines, contacted us for a tour of our facilities, field projects, and equipment. See below:

- **February 22, 2012**- Volunteers from NY's NRCS and FSA State office, potted over 1000 plants of many wildflowers, grasses, and shrubs for a restoration project at Kirk Park in Syracuse, NY.
- **June 13, 2012-**Cornell University Bioenergy and Bioproduct Education Program participants visited and toured our facilities and research plots.
- **July 11, 2012-** Participants in the Boyce Thompson Institute Biofuel 'Train the Trainer' Program, spent the day viewing our field plots dealing with biofuel research as well as a tour of all of the facilities here at the PMC.
- **November 5, 2012-** Several students from Alfred State College's Sustainable Vegetable Production class, toured our facilities and equipment as well some our research on cover crops and pollinators and their importance to vegetable farming

## People's Garden Initiative

People's Gardens vary in size and type, but all are required to have three components in common. They must benefit the community, in some cases by creating recreational spaces and in others by providing a harvest for a local food bank or shelter. They must be collaborative - that is, the garden must be created and maintained by a partnership of local individuals, groups, or organizations. And third, they should incorporate sustainable practices. The gardens might use compost or mulch made by participants. They might contain native plants or encourage beneficial insects. They also might exemplify water conservation, for instance, capturing rain in a barrel to water the garden.

****PA People's Gardens****

Over the past few years the PMC has provided technical assistance for many People's Garden plantings. This past spring, we supplied more than 2000 native wildflowers to 24 NRCS service centers in PA, which in turn planted over 50 People's Gardens throughout the State. We also supplied another 1000 wildflowers to a stream restoration site, in conjunction with NRCS NY state office staff and local schools, in the Syracuse area.

Currently, we are working with the Philadelphia Orchard Project (POP), in supplying 40-50 plants to 5-6 sites in the inner city of Philadelphia as well as providing technical support on which plants will work well in urban environments, seed harvesting and storage, and establishment. We look forward to continue working with them in 2013.

**** 'Abraham Lincoln' tomatoes supplied to Erwin Child and Family Center, in Painted Post NY****


In 2012, People's Gardens around the world grew 'Abraham Lincoln' tomatoes to celebrate the 150th Anniversary of our founding. 'Abraham Lincoln' is an heirloom variety of tomato introduced in 1923. It is one of the great tomato classics, excellent for making tomato juice, ketchup and slicing.

In late spring 2012, we supplied the Erwin Child and Family Center, in Painted Post NY, a dozen of these special tomatoes plants and other vegetables as well, to plant in their existing garden. We received great feedback from the director of this center, Colleen Coro, and suggested they become a People's Garden, to highlight and receive recognition for all of their outstanding work. I received the following letter from the center which explains their reasoning behind establishing a garden for the kids as well as their families, in this community

"The Pathway's Kids Garden at the Erwin Child and Family Center in Painted Post, New York shares in the hopes of Michelle Obama that our garden's story and the stories of gardens across America will inspire families, schools, and communities to try their own hand at gardening and enjoy all the gifts of the health, discovery, and connection a garden can bring. Our early childhood program believes learning should excite each child. Our garden is a collaborative effort between two Pathways programs: Kids' Adventure Club which is a school age program and Erwin Child and Family Center which provides care to children ages 6 weeks through third grade.

We kicked off the 2012 growing season with a Garden Party, where we observed a variety of seeds, tasted the fruit or vegetable the seed would produce in our garden, painting a rain barrel to incorporate sustainable practices in our garden, digging our garden dirt, planting seeds in cups to grow our seedlings that would later be transplanted to the garden, and exploring with bugs. This event encouraged the excitement for all the children about our garden.

A survey was sent to all of our families to gather information and interest in our garden adventure with their children. This survey led us to a very special opportunity. We were given Abraham Lincoln Heirloom tomato seedlings by the USDA and were able to register with the People's Garden initiative spreading across America. In addition to researching the history of our historic seedlings, the children filled the garden with pepper plants, basil, corn, beans, zucchini, Heirloom 'Abraham Lincoln' tomatoes, pumpkins, bird gourds, carrots, radishes, turnips, potatoes, lettuce, cucumbers, and egg plant. Our garden was visited by the big horn tomato worm and several ground hogs! While awaiting the harvest of our 'Abraham Lincoln' tomatoes, we had a large companion crop of basil that the children harvested and made into pesto for everyone to experience. The children learned that a seed became a plant which was then harvested to become food during our center wide cooking project. We are excited to report that the children enjoyed our 'Abraham Lincoln' heirloom tomato harvest. Some children loved to eat green tomatoes and the red tomatoes disappeared fast from our garden, into the mouths of the children!

Our garden produced a very special harvest of turnips. Two school age boys harvested turnips with mobile infants. They took the turnip harvest and made a meal of mashed turnips and potatoes with turnip Greens. These boys then fed the infant class a taste of a garden harvest and wrote a story to share with the families about how the babies reacted and interacted in the experience.

The People's Garden Initiative is a successful mission accomplished in our garden, and shows how working together in gardens, large and small, we have begun to grow a healthier nation!" –Colleen Coro

*Our "Coolest Day Ever" Children Quotes from the Garden*

*"Are these tomatoes magical? They are magic. My Mom told me. And if you eat them they're magic. Some make you small. Some make you tall. And some make you medium size. And if you close your eyes and eat one you'll see Abraham Lincoln." said by Jadea from the school age program at the Erwin Child and Family Center.*

*"I got to eat peppers. They're good and green. I pick weeds to help the plants. A lot of times I pick around the corn. We have a garden so we can provide here." Gavin*

*"I weed baby weeds. I do it because it's fun and gets your hands dirty. We do it so the plants will grow instead of the weeds. We have a garden so we can eat vegetables. They're healthy for you." Preston*

*"Me and Preston went round the garden to pick turnips. Picked a really big one. We washed them cooked them, smashed, then we ate them. I fed baby Jackson and he spit it back out. He ate it, too." Lucas*

*"It's so fun to weed. It's really hot out. I learned a lot. Sometimes it's like you really have to go to the bathroom and you go inside and forgot and don't go until you get home that night. That's how much fun we have." Abby*

## Pictures from 2012 planting and harvest at the Erwin Child and Family Center.

## Permanent Exhibit at the NYS Fairground in Syracuse

NRCS New York developed a permanent exhibit site at the New York State Fairgrounds in Syracuse, NY. The Big Flats PMC staff was recruited to construct the site in 2005. In 2011,the fence between NRCS and NYSDEC exhibit was removed. The PMC mulched before the fair and new forbs planted. A plot map and a plant identification book were available for thousands of viewers as they walked through the area, which promotes conservation of our natural resources. In another area of the fair, plants were given to officials for a rain garden exhibit. Rain gardens allow rainwater runoff from impervious surfaces like roofs, driveways, parking lots, and compacted lawn areas, the opportunity to be absorbed. This reduces rain runoff by allowing stormwater to soak into the ground, when normally it would flow into storm drains and surface waters, which can cause erosion, pollution, and flooding.

**Figure 25: NRCS display at the New York State Fairgrounds.**

## Empire Farms Days

Empire Farm Days occurs every year in Seneca Falls, NY. The site covers over 200 acres of working farm fields, at the Rodman Lott & Sons Farm and is the Northeast's largest outdoor agricultural show. Six hundred or more exhibitors are in attendance each year. For three days in August, tens of thousands of farmers gather here to view the event. The Plant Materials Center maintains a demonstration plot every year, which showcases many warm and cool season grasses, shrubs for restoration work and some newly planted pollinator beneficial plant.

**Figure 26: Empire Farm Days, PMC site, front entrance.**

**Figure 27: Empire Farm Days, PMC site**