



Down to Earth: Reports from the field

Innovative Small Farmers' Outreach Program (ISFOP): East Central Region

Ten Native Plants for Native Pollinators and Honey Bees

By Dr. Nadia Navarrete-Tindall, Associate Professor and State Specialist—Native Plants

Missouri is home to more than 1200 native plants so if you plan to establish native plants for beautification, pollinators, birds and other wildlife, or even food for yourself, you have many choices. Many are produced commercially or can be grown from seed collected in fall or winter. For a list of growers and producers see the *Grow Native!* web site. According to Dr. Jaime Piñero, Lincoln University Cooperative Extension (LUCE) Integrated Pest Management (IPM) Extension Specialist, landowners can improve habitat for native pollinators and honeybees by increasing native plant diversity on their property. Pollinators require nectar and pollen during spring, summer and fall, and it is important to provide flowers of different colors, shapes and blooming periods. In this article, 10 easy-to-grow species are described which are adapted to broad environmental conditions, bloom at different times of the year and are favored by pollinators such as honeybees, native bees, wasps, beetles, butterflies and/or birds, especially hummingbirds.



Beetle and sulphur butterfly on common milkweed

1. **White anemone (*Anemone canadensis*)**. A perennial related to crowfoots and buttercups (*Ranunculus* spp.), it reaches two feet in height and produces white flowers from May to July. It can be propagated or reproduced from seed and underground stems, requires open ground in moderate shade and can be used as a ground cover.
2. **Common milkweed (*Asclepias syriaca*)**. This perennial (a type of plant that will come back every year) blooms from May to August, can reach up to six feet in height and has pink fragrant flowers. It spreads from rhizomes (a root-like, often thickened, and usually horizontal underground plant stem that produces shoots above and roots below) and can be grown from seed in most soils. Spring shoots, flowers and green pods are edible for humans. It is the most common of 17 species of milkweeds (*Asclepias* spp.) in Missouri. All members of the milkweed family provide forage for Monarch Caterpillars.
3. **Aromatic aster (*Symphotrichum oblongifolius* or *Aster oblongifolius*)**. This is another perennial with purple flowers that blooms from July to November. It forms a round crown and can

reach up to three feet in height. It grows well in dry soils with good drainage. During a preliminary study conducted on the Lincoln University campus, honeybees, some native bees and butterflies visited this plant constantly during sunny days in late fall. Other asters that attract many insects include the New England aster (*S. novae angliae*), also with purple flowers. Two more common asters with white flowers are heath and willow asters (*S. pilosum* and *S. praealtum*).

4. **Partridge pea (*Chamaecrista fasciculata*)**. A re-seeding annual (a plant that completes its life cycle in one growing season), it blooms from July to October. It can reach up to three-and-a-half feet but not in poor soil. Flowers only provide pollen but leaves have dish-shaped glands that secrete nectar which attracts insects. Ants form a relationship by removing eggs or larva of insects that feed on partridge pea. A member of the bean family, it is a nitrogen-fixing legume that can be used to improve the soil. Partridge pea and other similar species provide forage for species of sulphur caterpillar butterflies. Partridge pea grows in poor soil, from dry to moist conditions. It can be grown from seed planted during same year.

5. **Joe-Pye weed (*Eupatorium maculatum*)**. This perennial blooms from June to September. A member of the sunflower family, it can reach up to five feet in height. It grows in full sunlight to moderate shade and has been used in landscaping for its handsome purple flowers. It grows well in swales, a low-lying or depressed and often wet stretch of land. It can be grown from seed and is available commercially. Other *Eupatorium* species (tall, late and common boneset) are very attractive to many insects.

6. **Bee balm (*Monarda fistulosa*)**. Another perennial and a member of the mint family with characteristic square stems, it blooms from June to September and can reach up to five feet in height. It is commonly used in

(Cont'd on pg. 3)

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Tomato Grafting: Methods and Management

By Dr. Sanjun Gu, Assistant Professor and State Specialist—Horticulture

Steps for Tomato Grafting:

Step 1: Select rootstock and scion varieties. Tomato rootstocks available commercially in 2012 include Maxifort, Beaufort, Multifort, Emparador, Trooper, Colosus and RST04-106-T. Research shows that Maxifort seems to be the most vigorous one. Trooper, Colosus and RST04-106-T are relatively new releases. Seed companies that carry rootstocks in 2012 include Johnny's (<http://www.johnnyseed.com>) and Seedway (www.seedway.com). Scion (a detached living portion of a plant such as a bud or shoot) varieties can be your favorite heirlooms or hybrids. Grafting cherry tomatoes is not recommended. If you are not confident in grafting with real rootstocks at the beginning, some vigorous and disease resistant cherry tomatoes can actually be used as rootstocks. When choosing rootstock and scion, *grafting compatibility* is important. Search research publications or consult with an extension specialist for current recommendations. Luckily for most tomatoes, *incompatibility* does not occur very often. The 2011 field research at Lincoln University showed no signs of incompatibility when 25 heirlooms were grafted onto Maxifort and Beaufort.

Step 2: Plant rootstock and scion seeds. Most of the time rootstock seeds should be planted one to three days earlier than scion seeds. For tube or slice grafting techniques, the most important consideration in terms of sowing time is to assure that the diameter of *hypocotyl* (the 'stem' below the cotyledons--the first leaf or one of the first pair of leaves developed by the seed plant) or *epicotyl* (the stem between the first true leaf and cotyledons) of rootstock and scion seedlings match each other. Management of rootstock seedlings is similar to that of scion. Healthy, straight seedlings are ideal for grafting. Leggy seedlings should be avoided, especially for rootstocks.

Step 3: Preparation for grafting. A healing chamber should be constructed. For small farmers this can be a simply built frame covered with plastic film pieces (see pictures below). A household humidifier can be used for moisture control in the chamber. Razor blades/scalpels, clips, and tubes or tape should be ready before grafting. Water the seedlings thoroughly 24 hours prior to grafting. Before grafting, the bottom of the chamber should be covered with plastic to avoid

Photo by Sanjun Gu. Far left: grafting tubes and clips. Other pictures: simple healing chamber examples



losing moisture. Mist the chamber and have the humidifier running for a day before moving in any grafted transplants.

Step 4: Grafting. Tube, slice and cleft methods can be chosen. These methods can also be used in pepper and eggplant grafting.

When grafting, sanitation is very important. Sterilize the working space with Clorox and wear disposable gloves if possible. Choose only healthy, disease-free seedlings to graft. Grafting needs to be conducted indoors or inside a greenhouse/high tunnel. Avoid direct sunlight if at all possible.

Step 5: Acclimation. The most challenging part in grafting is acclimation, which is done in a healing chamber. Grafted seedlings take about 7-10 days to heal. To ensure low mortality, high humidity and shading in the chamber must be maintained. Otherwise, grafted plants will wilt and eventually die. Keep the chamber in 90 percent darkness and maintain at least 90 percent relative humidity for the first three days after grafting. Cover the healing chamber's clear plastic with an additional layer of black plastic to provide the needed darkness. It is also helpful to have a shade cloth above the healing chamber to block direct sunlight. If the humidifier cannot keep up with the needed humidity, mist the sides of the chamber with water. Direct misting on grafted seedlings should be avoided. Temperature should be kept at 68-80°F. Lift up the plastic on one side of the chamber to conduct ventilation 2-4 times per day about five minutes each time. It is normal for newly grafted plants to show some wilting at day one. Starting from day four, the black plastic can be gradually removed and humidity level in the chamber should be slowly decreased. After seven days the chamber can be kept open. All plastic film can be removed after 10 days, or move grafted transplants out of the chamber.

Day 1-3
Close to 100% darkness
>90% relative humidity

Day 4-7
Slowly reduce darkness
>75% relative humidity

Day 8-10
Avoid direct sunlight
Regular humidity

Step 6: Management of grafted transplants. Once grafts survive, they can be moved from the healing chamber and managed as regular transplants. Tubes will fall off as plants grow. They can be picked up, sterilized and saved for future use. For cleft grafting, clips will not fall and need manual removal.

Tube Grafting

This is the most common method in tomato grafting and is a variation of slice grafting method. Tube grafting was so named because special silicon tubes (0.10mm and 0.25 mm) were designed for this purpose.



Picture credit Cary Rivard

The best time for tube grafting is when seedlings have 3-5 true leaves (the first two 'leaves' are cotyledons, not true leaves), which takes about three weeks. This method is shown to the left.

Cut the rootstock with a sharp razor blade or scalpel at a 45 degree angle. It is recommended to cut the 'stem' below cotyledons (hypocotyl), not above (epicotyl). Discard the top part of a rootstock immediately or place it in a clearly labeled container if you choose to reuse it. To save time, you can cut a batch of rootstocks

(for example, a flat of plants which were sowed in 4-cell inserts) at the same (Cont'd on pg. 4)

THE IPM CORNER: Organic Management of Cucumber Beetles and Squash Bugs

By Dr. Jaime Piñero: State Specialist—Integrated Pest Management at LUCE

Organic management of hard-to-control insects such as cucumber beetles and squash bugs in cucurbit crops will entail a combination of sequential tactics. Below are four management options that can be integrated. Use of resistant varieties and cultural practices such as crop rotation and sanitation are very important but they are not discussed here.



A young cucumber plant treated with Surround (kaolin clay, a naturally-occurring mineral) (left) next to an untreated cucumber plant (right)

TRANSPLANTS: If possible, plant three-week-old transplants of your desired crops in the field and at the same time as a direct-seeded crop. This provides various advantages such as: (1) good germination (germination of untreated seeds in cool soils can be spotty), (2) transplants provide a jump on the weeds, (3) plants are bigger when pest insects arrive so that they are less vulnerable to both feeding damage and to wilt, and (4) planting dates are more flexible (plants can be held inside to avoid late frost or growers can wait until fields are dry (or wet) enough to plant.

DELAYED-REMOVAL OF ROW COVERS: If the planted area is not too large, research

conducted at the Iowa State University with muskmelon indicates that spun bond polypropylene row covers can significantly suppress bacterial wilt (a disease that is transmitted by cucumber beetles) throughout the growing season and enhance yield if removal of covers is delayed for 10 days. More specifically, they recommend either (1) opening row cover ends during bloom to enable pollinator access, then removing covers completely 10 days later, or (2) introducing a bumble bee hive under one end of the row cover at bloom, re-sealing the row cover, and then removing the entire cover 10 days later.

APPLICATION OF KAOLIN CLAY: At transplanting time, treat seedlings with Surround® WP (kaolin clay). Kaolin clay is a naturally-occurring mineral and acts as a repellent, mechanical barrier and irritant. Weekly applications of Surround® can significantly reduce (up to 82 percent reduction) the numbers of cucumber beetles on cucumber plants. Beetles repelled from Surround®-treated plants have to go somewhere; thus, this approach works best when used in combination with trap crops (see below).

TRAP CROPS: Use of trap crops has proven effective at managing cucumber beetles in other systems but almost no research has been conducted in organic systems. Blue Hubbard squash is an excellent trap crop option because this plant is very attractive to cucumber beetles and squash bugs, and it is not susceptible to bacterial wilt. For a garden having some cucurbit plants (e.g., zucchini, cucumbers, etc.), two to three Blue Hubbard squash plants may be sufficient to lure the insect pests to those plants, where they can be killed. For bigger plots (> 0.5 acres), two perimeter rows of Blue Hubbard squash can be planted two weeks before the cash crop. Monitor for insect



Young Blue Hubbard squash with hundreds of spotted cucumber beetles feeding on it, this plant is an excellent trap crop option to manage cucumber beetles

pest activity in the trap crops as well as in the cash crop. Apply insecticides to the trap crop only based on the results of scouting. The Organic Materials Review Institute listed insecticides PyGanic® EC 5.0 (Pyrethrins) and Entrust® (spinosad) only show moderate efficacy. After spraying, scout again to determine if repeat sprays are needed in the border. Several sprays may be needed as beetles continue to colonize.

Vegetable Plant Grafting Workshop
Saturday, April 21, 2012
1 p.m. - 4 p.m.
Lincoln University Cooperative Extension
St. Louis Urban Impact Center
Space is limited. To Register contact
Miranda Duschack at
DuschackM@LincolnU.edu
or (314) 406-4744

Native Plants for Native Pollinators (cont'd from pg. 1)

landscaping and prairie restoration. Its lilac flowers and leaves are very fragrant. It establishes well in poor soil from dry to moist conditions, spreading from underground stems and produces well from seed. Its fragrant flowers and leaves can be used for hot tea and soaps.

- 7. Foxglove or beartongue (*Penstemon digitalis*).** This is a perennial that blooms from June to August. This member of the snapdragon family with white tubular flowers reaches heights of two to four feet and grows in full sunlight to moderate shade in moist to average soils. It can be grown from seed but seedlings are easily available in the native plant commercial trade.
- 8. Slender mountain mint (*Pycnanthemum tenuifolius*).** Another perennial member of the mint family, reaching up to three feet in height. It can be established from seed in disturbed or poor soils. It has fragrant white flowers and leaves, and blooms from June to September. It is propagated from seed and cuttings. A similar species, hairy mountain mint (*P. pilosum*), may bloom as early as May.
- 9. Blue sage (*Salvia azurea*).** A perennial and member of the mint family reaching up to five feet with stems that do not branch. It has fragrant and tubular purple flowers and leaves. It blooms from July to November, in full sunlight and well-drained soil.
- 10. Cup plant (*Silphium perfoliatum*).** Square stems separate this

perennial species from similar members of the sunflower family. Leaves are sessile and joined around the stem, forming a cup. It can grow from 4 to 8 ft in height. Its flowers are yellow and form branches at the upper part of the plant. It can grow in most soils and provides edible greens. The hollow stems can provide nesting for some native bees. Other members of the sunflower family important for bees include sawtooth and maximilian sunflower (*Helianthus grosseserratus*, *H. maximilianii*) and Jerusalem artichoke (*H. tuberosus*).



Great Spangled Fritillary on *M. fistulosa*

Important tip: Before you start establishing your natives, allow the area you are choosing to grow undisturbed and consult with your nearest naturalist to determine what volunteer vegetation is growing there. The Native Plants Program (NPP) at Lincoln University Cooperative Extension also offers assistance. Outdoor laboratories and gardens are open to the public in Jefferson City, Marshall, Kansas City and Haywood City, in the Bootheel region. For information contact Dr. Nadia Navarrete-Tindall at Navarrete-TindallN@LincolnU.edu or call (573) 681-5392. To download a copy of the poster 'Native Plants for Pollinators' visit: <http://www.lincolnu.edu/web/programs-and-projects/native-plants> and click publications.

ISFOP

If you are a small farmer and need information, please contact an ISFOP Farm Outreach Worker (FOW). FOWs live and work in your community. They can provide information on ways to better manage your resources, reduce expense and increase income. They can also provide information on other programs and resources that may increase your income and the overall quality of life for your family.

You are eligible to participate if:

- Your family lives on a farm, rural or urban.
- Farm products or income from the farm are necessary for you to live where you do.
- Your family provides the management and most of the labor for your farm.
- Your total annual family income is less than \$50,000.

Tomato Grafting (cont'd from pg. 2)

Slide a right-sized tube onto the rootstock and make sure the cut surface is facing the "wall" of a tube, not the opening. Placing tubes onto all cut rootstocks will save time. Cut and collect scion shoots in a clean container. Pick-up a scion shoot, cut the stem at a 45-degree angle, choose a rootstock with a similar stem diameter and slide the scion shoot into the tube.

The two cut-surfaces should be in close contact. The picture (on page 2) shows a complete graft ready to be transferred to a healing chamber. Once a batch of rootstocks are grafted, gently move them to the healing chamber. Sometimes, in order to save money, leftover rootstock shoots can be re-rooted and be re-grafted with the cleft grafting method. If you choose to do this, the container holding collected rootstock shoots during grafting needs to be clearly labeled. The visual differences between shoots of rootstock and scion are minor, unless the scions are all of potato-leaf type.

Cleft Grafting

This method was adapted from the cleft grafting in tree fruits. Before grafting, scion plants should have four to five leaves, while rootstock plants should have five to six. This reflects about *four* weeks growth of the scion and about five weeks for rootstocks. For pepper and eggplant grafting, this period will be longer, as they grow slower than tomatoes.

When plants reach the four to five leaf stage, make a cross cut to the stem of a rootstock. Rootstock plants should have two to three true leaves remaining on the stem after cutting. Then, make a longitudinal (vertical) cut, about one-third of an inch in length along the stem. For scions, cut the stem to a wedge, and fit the tapered end into the cleft cut. The scion should also have two to three true leaves remaining on the stem. Once this is done, place a clip over the cut. Make sure the clip is clipping the rootstock sides, not the scion sides. This method is illustrated to the left. The clip may not hold the two pieces very well, so careful transfer of grafted seedlings to the healing chamber cannot be over-emphasized. In order to hold the graft better, stretchable Parafilm® can be used. However, the Parafilm® needs to be manually removed later.



Photo by Dr. Xin Zhao

How to Contact

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time. Sterilize the blade or switch to a new one after finishing one batch, or if you cut a diseased plant.

When planting grafted transplants, make sure the graft union is at least half an inch, or ideally one inch or more, above the ground. Otherwise, adventitious roots from the scion can develop and grow into soil where casual agents of soil-borne disease may exist. This may also result in losing the advantage of vigor from the rootstock. Any suckers (lateral shoots) from rootstocks should be removed, which is especially important if cleft grafting was chosen or tube grafting was done on an epicotyl. Most rootstocks will provide enhanced vigor to the scion, so you can keep two or more leaders (main shoots) in production. This is especially true when rootstock Maxifort is employed. Other managements are similar to those of regular tomato plants.

Planting and Management of Grafted Transplants

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