

Massachusetts Agriculture in the Classroom

Social Studies
Economics
Nutrition
Science



Workshops on the Farm

\$30 Each Workshop - 9 a.m. to 3 p.m

Organic Gardening - School & Farm
Thursday, June 26
Holly Hill Farm, Cohasset

Horticultural Therapy Adaptations
Thursday, July 10
Perkins School for Blind, Watertown

Renewable Energy & Sustainable Ag.
Wednesday, July 16
Hancock Shaker Village, Pittsfield

Chickens, Embryology & Heritage Breeds
Wednesday, July 23
Diemand Egg Farm, Miller's Falls

Heritage Breeds, Heirloom Seeds, Local Foods & Sustainable Agri.
Wednesday, August 6
Moon in the Pond Farm, Sheffield

Dairy Goats, Ruminants & Cheese
Tuesday, August 12
Bob Cote's Family Farm, Pascoag, RI

Making the Link from Farm to Classroom

Massachusetts Agriculture in the Classroom (MAC) is a very small non-profit organization, but with a big impact. Since 1982, this dedicated group of volunteers has been committed to the promotion of agricultural education and literacy across the Commonwealth, joining in a national effort that was initiated through a directive from the Secretary of the U.S. Department of Agriculture.



Teachers board wagons to tour Verrill Farm in Concord during a summer workshop on the farm.

MAC has grown over the past twenty-six years to reach more than 11,000 educators in every school in the state. Our programs and services help teachers to make the connection between the foods that they, and their students, eat and the agricultural roots that make these foods and other products available. Resources offer a link between production agriculture and retail products and emphasize the impact that each has on our everyday lives - past and present.

As Massachusetts educators attend our educational programs and use the information and resources that we provide, we all become an integral part of assuring a stronger future for agriculture and the many products upon which we all depend. One of our most popular programs is our seasonal newsletter. Each issue focuses on a unique agricultural topic with background information and activities that can be used in the classroom.

The teachers who participate in our workshops on the farm, annual conference and summer graduate course appreciate the chance to meet farmers and learn about the work that they do. They also share ideas and resources with other educators who are dedicated to bringing agriculture alive for their students.

Our popular mini-grant program reviews proposals three times a year and rewards educators who foster agricultural learning. Other resources include educational manuals, an award for Teacher of the Year, collaboration on the Massachusetts Agriculture Calendar and more.

MAC also has an active website which provides more information on all of our educational materials. Teachers can download information from all past newsletters, check out workshops and conferences, review mini-grant winners and guidelines or connect to other agricultural education sites. Visit MAC's website at www.aginclassroom.org.

Feature Topic: Plants that Resist Drought



Mission: Massachusetts Agriculture in the Classroom is a non-profit 501 (c)(3) educational organization with the mission to foster an awareness and learning in all areas related to the food and agriculture industries and the economic and social importance of agriculture to the state, nation and the world.

Mini Grants

Last April, Massachusetts Agriculture in the Classroom awarded a mini-grant in the amount of \$400 to the **Winship Elementary School in Brighton**. Teachers **Nicole Maniez** and **Teresa Strong** developed the program to raise awareness throughout the school about how food is grown, highlighting topics including nutrition, the environment, growing practices and improved observation. The program culminated in the fall with a harvest festival featuring locally grown foods.

Any Massachusetts teacher or school can apply for a mini-grant to support their agricultural education efforts. Each year MAC awards grants of up to \$1,500 to teachers for agricultural education projects. Mini-grants are due the first of April, September and November. To receive a copy of our mini-grant guidelines, send a letter to MAC or visit www.aginclassroom.org.

Educational Resources Available from MAC

School Gardens & Their
Community Partnership Manual \$10

Farm Field Trip Manual \$12

8 Lessons about Agriculture &
the Environment Manual \$5

Heirloom Tomato Benefit

Once again this year, MAC board member, **James Munger** will raise heirloom tomatoes seedlings to support MAC. Jim will sow the seeds of these popular plants, transplant them, and have them ready in May or June for those who wish to sell them at their farm, school or business as a benefit to MAC. Visit the MAC website for information on how to order your heirloom tomatoes.



President's Message

In March, I traveled to Harrisburg in Pennsylvania, where I had the pleasure of meeting with leaders from Agriculture in the Classroom programs throughout the Northeast at the 2008 Regional Conference of the Northeast AITC Coordinators. We were hosted by the **Pennsylvania Farm Bureau**. Everyone had the opportunity to share their current triumphs, concerns and trends. It was good to see people who are usually only e-mail companions and to welcome to the group three new, young educators from New York, Vermont and Pennsylvania.

Louise Lamm, Director of the North Carolina Agriculture in the Classroom program and **Ellen Gould**, Curriculum Specialist for North Carolina AITC offered a terrific presentation and preview of a new curriculum that is available to educators across the country. It was developed with assistance from local educators, North Carolina Farm Bureau and Agriculture in the Classroom and USDA leaders, and offers lessons that are lively and timely.

This new curriculum is titled *The Farmer Grows A Rainbow*. The goal is "to enhance the MyPyramid nutrition and health lessons, integrate them with traditional academic subjects and emphasize the vital role played by the farmer in food production."

Louise and Ellen emphasized that "many educators define learning as an acquisition of knowledge that results in permanently changed behavior. These new lessons strive to meet that goal by providing many new facts, concepts and skills to young learners that will enable them to: become more successful student citizens; make healthy dietary choices; keep physically fit; live healthy lives, and show appreciation for the American farmer for all that she/he provides."

The bounty produced by all farmers is celebrated. Take a moment to review these new and innovative lessons at www.agclassroom.org/rainbow/index.htm. Adopt one or more to compliment your conversation with children, teachers, customers and family.

Marjorie Cooper
Co-President



Learn about farming, best management pest practices and more during our summer workshops.

Graduate Level Course

Massachusetts Agriculture in the Classroom is collaborating, again this summer, with **Fitchburg State College** to offer a three-credit graduate course. Using Massachusetts farms as their classrooms teachers will participate in agricultural-literacy training through fun, hands-on study and investigation. The course also offers agriculture education resources to help enhance curricula and meet many MCAS requirements.

The graduate course will meet on **Wednesdays, June 25 and August 13** at the **Brigham Hill Community Farm in North Grafton** from 9 a.m. to 3 p.m. Each participant must attend both these sessions and also participate in six additional workshops during the summer, selected from twelve workshops on a variety of topics at locations across the state. Participants will also keep a journal of their agricultural journey and spend ten hours developing a classroom project, which they will present to their peers on August 13.

This course will assist new educators and those who want to expand their offerings to integrate agriculture into the classroom. The fee for this eight-day course is **\$450** and includes all materials; farm workshops; some meals and **three graduate credits** or 67 professional development points from Fitchburg State College. Participants will be paired with a MAC board member for access to agricultural resources and support. For more information and workshop descriptions and locations visit our website at www.aginclassroom.org.

Drought Resistant Resources

Massachusetts Flower Growers' Association
8 Gould Road
Bedford, MA 01730-1241
781-275-4811
www.massflowergrowers.com

Mass. Nursery & Landscape Association
P.O. Box 387
Conway, MA 01341
www.mnla.com

Massachusetts Water Resources Authority
Gardening and Landscaping Tips
www.mwra.state.ma.us/04water/html/gardening.htm

UMass Extension
Water Conservation Checklist
www.umassgreeninfo.org/fact_sheets/plant_culture/water_conservation_checklist.html

U.S. Environmental Protection Agency
www.epa.gov/reg3esd1/garden/natres.htm
www.epa.gov/greenacres/wildones/handbk/wo8.html

Ecological Landscaping Association
60 Thoreau Street # 252
Concord, MA 01742 978-874-1373
www.ecolandscaping.org

Other Websites

Bibliography for Drought Tolerant Plants
www.azwater.gov/dwr/drought/

Calif. Water Service - 10 ways to Conserve
www.calwater.com/WaterConservation.html

Colorado State University - Xeriscaping
www.extension.colostate.edu/4DMG/Xeris/xeris1.htm

Desert Ecology in the Classroom
http://eebweb.arizona.edu/links/desert/index.htm

Desert USA
www.desertusa.com/du_plantsurv.html

H₂House - Water Saver Home Calculator
www.h₂ouse.org/

North Dakota University - Xeriscaping
www.ag.ndsu.edu/pubs/plantsci/landscap/h957w.htm

Saving Water Outside Partnership - Seattle
www.savingwater.org/outside.htm

Books

The Dry Garden, Beth Chatto, J. M. Dent & Sons, Ltd. 1978.

Elegant Silvers: Striking Plants for Every Garden, Jo Ann Gardner, 2005.

Plants for Dry Gardens: Beating the Drought by Jane and James Taylor, 1998.

Redesigning the American Lawn: A Search for Environmental Harmony, F. Herbert Bormann, Diana Balmori and Gordon T. Geballe, 2001.

The Natural Lawn and Alternatives, Janet Marinelli, ed., Brooklyn Botanic Gar., 1993.

Information for this newsletter was taken from the resources listed above.

Plants That Resist Drought

Water is essential to all plant life. It is the main constituent of plant cells and a critical element for making food energy and for cooling. Plants take in most water through small hairs on their roots. It is transported by capillary action through tiny tubes called **xylem** to the leaves. Under normal circumstances, the roots absorb more water than the plant needs. As much as 90 percent of water passing through a plant evaporates into the atmosphere, cooling the plant and the air around it.



The leaf regulates the amount of water in the plant through a process called **transpiration**. Any excess water is eliminated through tiny pores, known as stomata, located on the undersides of the leaf. **Stomata** is the Greek word for mouth. They are so tiny that one inch of leaf may contain 250,000 of them. Guard cells at these openings regulate the amount of water transpired.

Water in the leaf also combines with carbon dioxide from the air to make food energy during photosynthesis. The CO₂ enters the plant through the stomata and the oxygen byproduct of photosynthesis is expelled through the tiny pores. Each time the pores open to take in CO₂ or release O₂, a small amount of water also evaporates.

For optimum growth, plants need a steady supply of water. When there is not enough water, photosynthesis and transpiration are slowed. Eventually leaves will wilt and die. However, rainfall is variable in both frequency and quantity throughout the world. It also varies seasonally and is often unavailable for the plant to use.

Plants that live in arid environments, where there is not enough water, must be adept at conserving and storing water. They can tolerate conditions of low water, bright sunlight, extreme heat, dry winds and rapid temperature changes through a diverse variety of mechanisms, both physical and behavioral. Most successful plants utilize a combination of these characteristics.



In desert areas

there is less than six inches of rainfall a year. Sunlight is unrelenting and the temperature ranges from extremes of heat during the day to cold at night. Yet deserts are alive with plants. Those that have survived have adapted to conserve and store water, reduce transpiration from the leaves and take advantage of the brief rains that fall.



In **high mountain regions** the growing season is short, soils are dry and rocky, sunlight is strong and winds are persistent. Successful plants are often compact, low-to-the-ground and have small hairy leaves that are adapted to conserve water and take advantage of the short growing season.

Along **the coasts**, sunlight from above is supplemented by the glare of reflected light from water and rocky shores. Strong winds and salt spray may also cause desiccation. Along the sandy shores, dunes are constantly moving, which can uproot plants unless their roots are deep.

Evergreen trees in our northern climates

must withstand the winter sun, and its reflection off the white snow, at a time of year when the ground is frozen and water might not be available to be taken up through their roots. Leaves are small, narrow and leathery with a thick waxy cuticle to protect from winter drying. Rhododendrons roll the edges of their leaves under very cold conditions to prevent water loss, serving as a rough natural thermometer. Because they are evergreen, these plants can take advantage of even a brief winter thaw to photosynthesize and make food energy. They also do not have to use limited energy to make new leaves each spring.



During droughts as well as during the midday hours of the summer sun, some **grassland plants and prairie**

plants, such as little bluestem grass, prevent excess water loss by rolling their long, narrow leaves inward.



An extensive root systems permits many meadow plants to tap moisture from dry, shallow soils.

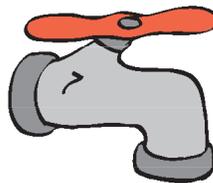
Even in the **tropical rainforests**, where rainfall is plentiful there are plants that are not able to get enough moisture. Water quickly runs through deep well-drained soils and other plants are epiphytes that live high in the trees with their roots out of the soil. These roots are covered in a waxy protection and are primarily used to attach the plant to the tree, not to take in water. Many epiphytes have adapted to collect water in other ways. Some bromeliads have leaves that overlap in the center to form a vase-like watertank that holds water.

The **classroom** can often resemble and arid, desert-like environment. When the only window with suitable light is located over the radiator, plants are baked with heat and low humidity. Then on the weekend, the heat is turned off at school and plants struggle and even die.

The **school yard garden** can also be a challenging environment. Disturbed soils offer low water holding potential and poor nutrient value. Then during the summer vacation, plants must survive with little or no supplemental watering.

Although New England is not known for its long periods of unrelenting drought, the past decade has brought several long summer and autumn growing seasons with little or no rain for a month or more. The summer and fall of 2007, was just one example of a prolonged drought that affected crops and gardens.

Fortunately most communities in the northeastern United States have access to adequate water to meet needs.



However, increasing demands for water from growing municipalities, suburban development, irrigation of lawns, agriculture and industrial usage has made water consumption an important issue across the region.

We need only look at the lower water tables in our reservoirs and the outdoor watering bans in local towns

to see the results. With the threat of changing water patterns and hotter and drier growing seasons that are predicted with global warming, we must all make wiser choices about how we use available water.

Start now by conserving water in your landscape. You can create a beautiful site that requires less water and maintenance by looking to plants from these arid regions for your inspiration. Reduce the amount of turf and permit your lawn to go dormant during times when we get less than an inch of rainfall a week. Plant drought tolerant varieties whenever possible and choose plants that are best adapted to our own climate and your particular conditions. Amend the soil to add water holding capacity, use mulch and drip irrigation to reduce evaporation and conserve water and try collecting rainwater.

Remember that plants, that get less than the needed amount of water, will be stunted and suffer stress. Stressed plants are more susceptible to infection by diseases. Evidence also indicates that stressed plants attract insects more readily than unstressed plants. A garden of drought free plants, will be a happier garden.

Tips for Conserving Water

As we experience more and more droughts, like the one in 2007, and water is perceived as a critical and valuable resource, we can look to the western United States for new ideas on gardening in dry climates. Xeriscaping refers to concepts and practices that reduce water needs by altering the landscape. Pronounced with a z, Xero, is the Greek word for dry. Xeriscape originated with the Denver Water Department in 1981 and is trademarked by them.



Principals include appropriate planning and design, soil improvement, more efficient irrigation, practical turf areas, appropriate plant selection, use of mulches and maintenance. Gardens can still be beautiful while reducing consumption of water, landscape maintenance, use of fertilizers and pesticides. Here are some principals:

1. **Group plants** with similar water needs together, allowing them to be watered as needed with little waste of water.
2. Use **drip irrigation** systems to apply water directly to plants, reducing water consumption as much as 60 percent from the use of sprinkler.
3. **Choose plants** that either avoid or tolerate dry conditions, including native plants. While these plants are tolerant to drought once established, they need watering for the first year or two after planting.
4. Plant **annuals at least 12 inches apart and perennials 18 to 24 inches apart** to reduce competition for water.
5. **Amend soil**, whether clay or sand, with organic material, such as compost, aged manure and shredded leaves to promote water percolation and retention.
6. **Grade beds** to allow water to soak into the soil and avoid runoff. Raised beds are discouraged as they dry out more quickly.
7. **Mulch garden beds** to reduce water demand by as much as 40 percent, keep the soil cooler, eliminate weed competition, and reduces evaporation from the soil surface. However, keep mulch away from the crowns of native plants and from against the trunks of trees. You can add a thin layer of sand or fine gravel around plants from arid climates to keep the crowns dry and avoid winter heaving in heavy soils.
8. The lawn is the most demanding user of water in the home landscape. Wherever possible, **reduce lawn size** by adding walkways, ground covers, and shrub borders. Consider the use of turfgrasses other than Kentucky Bluegrass. Water lawns only when there has been less than one inch of rainfall in a week. Consider allowing the lawn to go dormant when there is no rainfall.

Physical Characteristics

Water is lost through the **stomata**, during transpiration and also when these tiny pores open to obtain CO₂ and release O₂. The stomata are located on the underside of the leaf away from the drying effects of direct sunlight. Some plants that are tolerant to drought have fewer stomata; others open only at night when it is cooler.

Plants with **small or narrow, needle-like leaves** have less surface area from which water can be lost. Some desert plants, such as cacti, have **no leaves**, replacing them with thorns and using chlorophyll in the outer tissue of the stem for the manufacture of food.



Some arid acclimatized plants have a **waxy coating** over their leaves and stems that serves as a waterproof barrier that seals in moisture. Others have a **powdery bloom** that protects from glaring sunlight, temperature extremes, wind and salt spray. It can easily be rubbed off and will no longer be there if the plant is grown in conditions where it is not required. **Scales** can also cover the entire leaf, as in epiphytic bromeliads.

Downy hairs of silver, gray-green or white on leaves form a protective layer to help reduce the evaporation of moisture from the leaf surface by reflecting sunlight and inhibiting the drying effects of air currents. Silky hairs also trap water vapor, raising the humidity near the leaf and protecting from extremes of heat and cold.

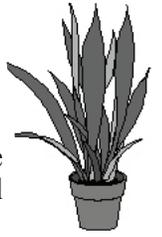
In areas where sunlight is reflected from stone, water or snow, leaves may have **pale undersides**, often covered with downy hairs. These hairs deflect the reflected light protecting the stomata from water loss.

Thickened leaves are insulated, to some extent, from extreme heat, which also slows transpiration. Many also store water. Plants that **store water in their leaves, stems or roots** can survive a long time on water collected from a single rainfall. A few arid **plants dehydrate** under extreme conditions, rehydrating again when water is available, with little or no damage to the cells.

Plants with **evergreen foliage** are physiologically ready to take advantage of a winter thaw in the north or a rare shower in the desert, absorbing moisture through their roots to quickly begin to photosynthesize.

Vertical leaf orientation decreases the exposure and absorption of sunlight by leaves, keeping them cool.

Some tropical bromeliads, from the pineapple family, have plastic-like leaves that form a **central water reservoir**.



Spines and thorns protect plants from animal predators, shade it from the sun and also collect moisture.

Alpines and some desert plants grow **low-to-the-ground** with a whorled, **compact shape** that reduces their exposure to high winds and extreme temperatures.

Prairie and dune grasses and many desert plants have a **shallow but expansive root system** that is able to collect large amounts of surface water when it rains. Other drought-resistant plants have **long tap roots** that can reach underground water sources. These long roots also protect the plant from being blown about in high winds or shifting soil.

Plants known as living stone, expose only a few of their leaves to the sun. The rest of the plant **remains underground**, safe from the sun and heat.

Behavioral Mechanisms

Plants must conserve water and protect it and themselves from animals in search of water. Some desert plants have **spines or a taste that is bitter and toxic**. Other plants may grow only in **inaccessible places or be camouflaged**.

Drought tolerance is another beneficial survival mechanism.

To avoid desiccation, some plants will **drop their leaves**

and become dormant. Leaf drop not only prevents the loss of moisture from evaporation during tough times, but also slows the growth of the plant so it uses less water, food and energy. These plants often have an extensive root system that can quickly absorb available water. When the short rain season arrives, they are able to rapidly sprout leaves and flowers.



Many prairie, alpine and desert wildflowers are **annuals or ephemerals**; and begin their lives as seeds. While annuals germinate and bloom yearly, plants in arid regions germinate only when there is rain. They are more accurately called ephemerals. Both mature quickly, release their seeds and then die. These **seeds can survive dormant** for an indefinite period of time. After the rains, seeds will sprout when temperatures are moderate. Many complete their life cycle in months or even weeks.

Perennials in arid climates may **slow growth for part of the year** to conserve moisture and energy and maximize growth during seasons of optimum moisture and temperatures. Some, like the saguaro cactus, grow slowly their whole lifetime, taking as long as 200 years to reach a mature height. With slow growth, it expends less energy, food and water.

Many desert plants are **located some distance away from one another**, reducing competition for limited moisture. Others release toxins from their roots to assure distance.

Bulbs are another example of a type of perennial that utilizes dormancy as a means of evading drought. These members of the lily family have tops that dry out completely and leave no trace of their existence above ground when dormant. They are able to store enough nourishment to survive for long periods in rocky or alluvial soils.



Many plants have a **symbiotic relationship with fauna**. Animals aid in both fertilization and dispersion of seeds, assuring the continued profusion and diversity of plant life in arid areas.

Right Plant - Right Place

Successful gardening, whether indoors or out, depends on using the best gardening techniques. It is also important to consider the climate and growing conditions of your particular area. These include soil conditions, water, temperature, humidity and fertility.

In addition to cultural factors, there are microclimates within the garden, home or school with cold and hot spots and differing amounts of wind, sun and snow. Access to water and nutrients vary with soil conditions as well as the gardener, and provide the best opportunity for control.



Selecting plants that will flourish in your environment is a practical first step to success. Most plants that we grow in the school, home or garden are horticultural cultivars of plants that once grew in the wild. Learn as much as you can about the original habitat and growing conditions of the parent species. These include how much light they receive, moisture, drainage and pH. You may not be able to match their environment exactly, but may find an area that will be suitable for growth.

Sometimes, existing conditions can be modified to accommodate plant preferences. Soil can be amended with organic matter to improve water holding capacity or with grit to speed drainage or nearby trees can be limbed up to provide more sunlight. However, for optimum success, it is better to understand your site and then select plants that are compatible.

Use drought tolerant plants in dry, sandy, exposed areas, while plants adapted to wet soils should be planted in low spots or areas of low drainage. Light, humidity and salt requirements also need to be considered and plants found that will thrive under your conditions. Then group plant according to their water, fertilizer and maintenance needs for ease of care.

Massachusetts Agriculture in the Classroom
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www.aginclassroom.org

Plants to Defy Drought

At Tranquil Lake Nursery in Rehoboth, Massachusetts the soils are sandy and water quickly drains. The display gardens are planted with tough plants that thrive in these light sandy soils and perennial bouts of drought, with supplemental watering. Here are a few recommendations:

Annuals: California poppy; cleome; dahlberg daisy; gazania; globe amaranth; dusty miller; helichrysum; lantana; lavatera; nasturtium; nicotiana; perilla; portulaca, sanvitalia, senecio, sweet alyssum, verbena and viola

Perennials: achillea; amsonia; antennaria; anthemis; arabis; armeria; aster; baptisia; centaurea; cimicifuga; coreopsis; crambe; dictamnus; echinacea; echinops; epimedium; eryngium; euphorbia; geranium; helleborus; hemerocallis; heuchera; hosta; Iris sibirica; lamium; liatris; limonium; lychnis; oenothera; Patrinia scabiosifolia; papaver; penstemon; Perovskia atriplicifolia; Potentilla tridentata; rudbeckia; salvia; sedum; sempervivum; solidago (Goldenrod); verbascum; veronica; Viola labradorica; waldsteinia and yucca.

Herbs: artemesia, basil; catmint; chamomile; chives, coriander; dill; fennel; germander; lady's mantle; lamb's ear, lavender, mint; oregano, rosemary; rue; sage; santolina; sweet woodruff, tansy & thyme.

Grasses: Calamagrostis; Carex glauca & pensylvanica; Miscanthus sinensis 'Morning Light' & 'Strictus'; Molinia caerulea 'Variegata'; Panicum virgatum, Pennisetum, and Schizachrium scoparium.



Woody Trees & Shrubs: Acanthopanax sieboldianus; Acer negundo; Amorpha canescens; Aronia arbutifolia; Caryopteris; Ceanthus americanus; Comptonia peregrina; Cornus sericea 'Silver & Gold'; Cotinus coggygia; Cytissus; Fothergilla 'Blue Shadow'; Hydrangea arborescens 'Annabelle'; Indigofera; Heptacodium miconoides; Juniperus; Lespedeza; Myrica pensylvanica; Physocarpus opulifolius; Pinus banksiana; Pinus virginiana; Rhus typhina; Rosa glauca; Rosa rugosa; Salix elaeagnos; Sorbaria sorbifolia; Spiraea japonica; Spiraea thunbergii; Thuja occidentalis 'Rheingold'; and Weigela.

Activity Ideas

1. Take a walk in a park or natural area near the school and try to find as many examples as possible of plants with physical characteristics that protect them from drought, such as: needle-like leaves; small leaves; succulent leaves; hairy leaves; white, silver or gray foliage; pale leaf undersides; leaf scales; thorns or spines; low compact foliage, etc.

2. Ask students to analyze the environment of their own school room, garden or school yard to determine the moisture, drainage, soil, pH, light and temperature conditions. Remember to consider conditions unique to your setting, such as school heat turned off at night and on weekends or school vacations and summer breaks without supplemental watering.

3. Ask students to research and make a list of plants that are suited to these conditions.



In the Classroom

1. Examine the undersides of leaves of a variety of plants with a hand lens and a microscope to see the stomata.

2. Ask students to generate a list of "things we know about leaves" and a list of "questions we have about leaves." Identify the questions that can be answered by experimentation and those through research.

3. Conduct an experiment to see what happens when a plant is over-watered and is under-watered. Use two similar plants with thin leaves such as a coleus. Allow one plant to sit in waterlogged soil. Water the second plant well and then refrain from watering it. Observe daily and make records. What happened? Why?

4. Make a garden in the classroom for cactus and succulents. Research their native habitat and decide where they are best located and when to water.

Workshops on the Farm

Join us for one of more of our summer workshops and try some activities for the classroom while you explore local farms. Workshops runs from 9 a.m. to 3 p.m., offer classroom-ready activities and focus on a unique area of agriculture with exploration of the work that takes place at that farm. The fee of \$30 includes pdp's, lunch and all materials.

Thursday, June 26, takes us to **Holly Hill Farm in Cohasset**. Spend the morning observing the summer youth educational programs. Learn organic farming and gardening practices as we tour the fields with farm educator **Jon Belber** and owners **Frank and Jean White**. In the afternoon, take an in-depth look at the organic gardening curriculum developed by the farm in cooperation with teachers and students at South Shore Charter Public School in Norwell and try out some recommended activities.

Spend **Thursday July 10** at the **Perkins School for the Blind in Watertown** learning about the field of Horticultural Therapy and remarkable work that takes place in the gardens and greenhouses at this school for the blind and visually impaired. Horticultural Therapist **Deborah Krause** will lead a tour of the gardens and greenhouse and explain adaptations in horticultural techniques and devices that make gardening accessible to this special population. She'll also offer techniques for teaching science MCAS.



Heritage Breeds with 5th grade teacher **Lenore Paul**. Following a farm lunch, we'll tour this growing family farm with **Anne Diemand**. Founded in 1936 as a chicken farm, it converted to egg production in the 1960s, added turkeys in the 1980 and now offers value added products and catering.

Join us on **Wednesday, August 6** at **Moon in the Pond Farm in Sheffield**. Farm owner **Dominic Palumbo** will introduce heritage breeds, heirloom seeds, local foods and sustainable agriculture practices. You'll have the chance to harvest and prepare your own lunch. Then tour the farm and learn about the educational programs, apprenticeships and farm stewardships that takes place here.

On **Wednesday, July 16** explore **Hancock Shaker Village in Pittsfield**. The Shakers have long been renowned for their innovations, progressive practices and technologies, and quest for and creation of an overall sustainable community lifestyle. Look closely at the historic renewable energy and sustainable agriculture resources preserved and interpreted at the Village with Education Director **Todd Burdick** and staff, and discuss suggestions and examples of modern applications.

Travel to **Diemand Egg Farm in Miller's Falls** on **Wednesday, July 23**, to learn about incubating and raising chicks and the value of

On **Tuesday, August 12th** travel across the border to **Pascoag, RI** and the small family farm of Mansfield teacher **Bob Cote**. Spend the morning learning about raising and caring for dairy goats, the digestive system and diets of small ruminants and try your hand at making goat cheese. Following a farm lunch, we'll tour this small but busy farm to meet llamas, chickens, honeybees and an organic farm garden.

Massachusetts Ag Tags

Now is the time to order your new Mass. Agriculture Specialty License Plate. Proceeds will go to the Mass. Agricultural Trust, which will fund marketing and education programs and services to help farmers succeed.



Once 1,500 plates are ordered, they will be produced and sent to the regional RMV offices for distribution. The cost to transfer your registration to an "Ag Tag" is \$60, including a \$40 donation to Agricultural Trust, and a \$20 fee to swap the plate when it arrives. Renewals, every second year, cost \$81, including a \$41 RMV registration fee, and \$40 contribution to the Trust. To apply for your Mass. Ag Tag License, send a \$40 check made payable to the RMV. For more information on the Ag Tag, visit www.mass.gov/agr/agtag.

REGISTRATION ... DONATION... MATERIAL ORDER FORM

Please fill out this form and return it to: MAC, Inc. P. O. Box 345 Seekonk, MA 02771

Name _____

School or Organization _____ Address _____

City _____ State _____ Zip _____

Phone Number (day) _____ (evening) _____ e-mail _____

I am registering for the following workshop (s): \$30 enclosed for each workshop registration, please send directions

- | | |
|---|---|
| <input type="checkbox"/> June 26, Holly Hill Farm, Cohasset | <input type="checkbox"/> July 10, Perkins School for Blind, Watertown |
| <input type="checkbox"/> July 17, Hancock Shake Village, Pittsfield | <input type="checkbox"/> July 23, Diemand Egg Farm, Miller's Falls |
| <input type="checkbox"/> August 6, Moon in Pond Farm, Sheffield | <input type="checkbox"/> August 12, Bob Cote's Farm, Pascoag, RI |

- I am registering for the Summer Graduate Course \$450 is enclosed (Make Check payable TO MAC)
 Please send information on: The Summer Graduate Course; MAC Annual Report; Mini-Grant Guidelines
 Farm Field Trip Manual \$12; 8 Lessons about Agriculture & Environment \$5; School Gardening Manual \$10

I'd like to make a tax-deductible donation in the amount of: \$50; \$25; \$10 Other donation _____



Calendar

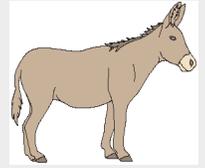
- May 24-25, 34th Sheep & Woolcraft Fair, Cummington, \$6 per car. Visit www.masheepwool.org/aboutus.htm.
- May 31, Plant Sale at Tower Hill Botanic Garden, Boylston. Heirloom tomato sales support MAC. For information, www.towerhillbg.org.
- July 19, Summer Festival, Tranquil Lake Nursery in Rehoboth. Food Sales support MAC. Call 508-252-4002 or visit www.tranquil-lake.com.
- June 25-28, National Agriculture in the Classroom Conference in Costa Mesa, CA. For more information visit www.agclassroom.org.
- August 8-10, 34th Annual NOFA Summer Conference (NE Organic Farming Assn.) at UMass, Amherst, visit www.nofa.org. A series of grazing workshops will also be held throughout the summer. For information, visit www.massgrass.org.
- September 12-28 at Eastern States Exposition in West Springfield. For information visit www.thebige.com.
- Sept. 20-21, North Quabbin Garlic & Arts Festival, Orange, \$5 adults, visit www.garlicandarts.org.

Resources

- “Fresh from the Farms: The Mass. Farm to School Cookbook” with 45 recipes (50-100 servings), nutritional analysis, vegetable preparation tips and more can be ordered from Nutrition Resources on the MA Dept. of Education site or at www.mass.doe.edu/cnp.
- MyPyramid Lesson Plans & Poster at www.mypyramid.gov/ can be combined with the **Farmer Grows a Rainbow** nutrition lessons at www.agclassroom.org/rainbow.
- June is Dairy Month. Find educational tips from the National Dairy Council and more resources at www.nationaldairyCouncil.org.
- “The Science & Scientists Behind the Food” multimedia resource kit at http://school.discoveryeducation.com:80/foodscience/science_resources.html.
- Join the Great Sunflower Project to order and plant free sunflower seeds, count and record honeybee pollinators, and check where the bees are across the country. Visit www.greatsunflower.org.
- Cotton Lesson Plans & contest for teachers for lesson plan due June 10 at www.cottonsjourney.com.

- 2009 Massachusetts Agriculture Calendar Photo Contest. Photos must be at least 4” by 6” and no larger than 8” by 10” and must have been taken in Massachusetts in the past three years. Send photos of local rural scenes, farm animals or produce by June 1 to Photo Contest, Mass. DAR, 251 Causeway Street, Suite 500, Boston, MA 02114. For more information, call Rick LeBlanc at 617-626-1759 or send an e-mail to Richard.LeBlanc@state.ma.us. The twelve winners will be featured in the 2009 Massachusetts Agriculture calendar. and will be honored at the Big E this Sept.

To receive more information, add a name to our mailing list or give us your comments:



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