



The Berry Basket

Newsletter for Missouri Small Fruit and Vegetable Growers

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From the Editors

by Marilyn Odneal

Ben Fuqua brings up the recurring theme of New Year's Resolutions and gives us a great month-by-month plan for our blueberry plantings. While we are busy cleaning out our files, making shopping and to-do lists, and generally sweeping out the old and preparing for the new, make plans to attend grower conferences and workshops. The Coming Events list on page 13 offers lots of great ways to obtain valuable information and inspiration for the year to come.

Happy New Year

from the Berry Basket Staff!

Berry Basket Newsletter Staff:

Patrick Byers, Gaylord Moore and Marilyn Odneal - eds.
Pamela Mayer - proofing, copying and mailing list.
Teresa Inman - posting and sending.

Please direct comments to:
Marilyn Odneal, SMSU - Mountain Grove,
9740 Red Spring Road, Mountain Grove, MO 65711
phone: 417-926-4105, fax: 417-926-7421
e-mail: mbo774t@smsu.edu
Internet: <http://mtngrv.smsu.edu>

Challenges or Resolutions??

By Ben Fuqua

Professor, Soil Science, SMSU

New Year's resolutions are usually broken by mid-January, a time when annual "challenges or resolutions" facing Missouri blueberry growers are just beginning. While labor and time needs for growing blueberries vary considerably from one month to another, growing blueberries in Missouri requires a year-round commitment. Resolving to develop and follow a good operational plan can make the challenges of growing blueberries both exciting and (hopefully) profitable activities. Listed below are some resolutions that growers should include in their own specific management schemes to meet the overall objective of growing healthy plants and consistently producing high yields of quality blueberries.

January:

- a) Update mailing lists
- b) Plan advertising/marketing strategies for the harvest season
- c) Secure (or at least locate) supplies needed throughout the year
- d) Revise labor and management requirements if needed
- e) Sharpen pruners - start pruning plants

February:

- a) Prune plants – sanitize pruning equipment frequently
- b) Remove and destroy prunings, diseased, and dead plants
- c) Attend 2004 Small Fruit and Vegetable Conference (February 16-18)

March:

- a) Finish pruning plants
- b) Remove/destroy prunings, diseased, and dead plants
- c) Renew mulch (if needed) to maintain 6-8" depth
- d) Calibrate fertilizer and sprayer equipment
- e) Apply dormant sprays (if needed)

April:

- a) Plant new or replacement plants
- b) Contract for supplemental bee hives if needed for pollination
- c) Apply preemergence herbicide(s) for weed control
- d) Apply fertilizers as needed (based on soil and/or foliar tests)
- e) Apply fungicides (if needed)

May:

- a) Check, clean, and repair irrigation/fertigation equipment
- b) Get ready for harvest - clean or replace buckets, scales, and other picking equipment
- c) Apply fungicides if needed (must follow manufacturer's label on pre-harvest interval)
- d) Apply fertilizers as needed (fertigation)
- e) Implement bird control strategies
- f) Control weeds and grasses by mowing or chemical means
- g) Send out picking information to customers

June:

- a) Harvest ripe berries
- b) Apply fertilizers (second application for solid sources)
- c) Irrigate plants (mature blueberry plants need 1.5 - 2" of water per week from rainfall and/or irrigation)
- d) Control weeds and grasses by mowing or chemical means

July:

- a) Harvest ripe berries
- b) Apply fertilizers
- c) Clean and store harvest equipment
- d) Irrigate plants to maintain sufficient soil moisture level
- e) Control weeds and grasses by mowing or chemical means
- f) Order plants for spring planting next year
- g) Take soil and leaf samples after last harvest

August:

- a) Irrigate plants as needed
- b) Control weeds and grasses by mowing or chemical means
- c) Take soil and leaf samples after last harvest

September:

- a) Irrigate plants as needed
- b) Identify and rogue diseased and dead plants
- c) Control weeds and grasses by mowing or chemical means

October:

- a) Irrigate plants as needed
- b) Control weeds

November:

- a) Winterize irrigation system
- b) Control weeds
- c) Oil and put away equipment
- d) Implement holiday marketing plans of valued-added blueberry products

December:

- a) Review the results of the past year – note changes needed in cultural, labor, and marketing areas
- b) Collect and organize production (tax) records
- c) Market valued-added blueberry products for the holiday season
- d) Make 2005 New Year's Resolutions

Starting Plants at Home

By Gaylord Moore

Horticulture Specialist, UMC

If you decide to grow your own plants from seed at home, be sure to consider the following elements.

Growing Media

It is desirable to use a sterile plant growing medium. Several kinds of soilless germinating and growing mixes are available from various horticulture supply stores. They normally should be free from insects, diseases, and weeds and have enough fertilizer incorporated for the first 3 to 4 weeks of plant growth.

Sowing seeds

Traditionally, seeds are started by sowing them in shallow flats in rows about 2 inches apart and covering them lightly with vermiculite. Soon after the seedlings come up, they can be transplanted to trays, pots, or other containers. However, to save time you may sow seeds directly into the final growing container. This method saves handling the seedlings and avoids transplanting shock.

Temperature

To ensure the proper temperature for seed germination, use a thermometer with a soil probe. Temperature can be increased by several methods. Covering the flats with clear plastic or glass, or by using heating cables or mats are especially helpful. Growing times for plants may be changed significantly by temperature, moisture, and light.

Watering and Fertilization

Watch your watering techniques carefully. Do not allow your planting media to dry out but do not water too much. Overwatering is as dangerous as underwatering at the seedling stage. Dampening off is a common disease when excessive water is applied to the soil.

Once seedlings are established a water-soluble fertilizer such as 10-50-10 at the rate of 1 tablespoon per 1 gallon of water applied weekly should be sufficient. However, carefully watch the moisture levels of your soil. Adjust accordingly to need.

Light

Vegetable plants need direct light. Many gardeners use plant-growing lamps when primary

sources of natural light are inadequate. Two double-tube fluorescent fixtures together are preferable to a single fixture with two fluorescent tubes.

Cool-white tubes are the most commonly used. Seedlings and plants should be lighted 12 to 16 hours per day. A timer that automatically turns the lights on and off is helpful.

Place the lamps close to the leaves of the plants. A distance of 6 to 12 inches is recommended. There is twice as much light intensity 6 inches from a fluorescent tube as 18 inches away.

Before plants grown inside under lights are transplanted outdoors, they should be hardened gradually by exposing them to outside conditions. Place the plants outdoors a few hours each day, starting in a very sheltered location prior to planting them in the garden.

Growing Time

The time required to grow plants to a stage suitable for transplanting in the garden will vary depending upon the vegetable grown and environmental conditions. However, smaller plants may not be as large as they might have been under the best growing conditions, but they are preferable to tall, weaker, spindly plants for starting outdoors.

Growing your own plants can be very rewarding plus offer opportunities to try many different varieties that may not be available at the local commercial greenhouse.

Part I of The Development and Practical Management of Insecticide Resistance

By Daniel Waldstein

Assistant Research Professor,

Integrated Pest Management, SMSU

Development of resistance to pesticides by target pests has been a fairly recent phenomenon. Prior to World War II the number of resistant species that existed was quite minimal. Although the vast majority of pesticide use by humans has occurred in the last half century, significant pesticide use prior to the second World War occurred all

over the world. Sulfur was one of the earliest used pesticides having been used by the Chinese prior to 1000 B.C. From that period until the mid-1940s, many of the pesticides used were heavy metals. This included elements like arsenic, lead, and copper. Natural toxins derived from tobacco and chrysanthemums were also used well before the turn of the century to control insect pests (Ecobichon, 1991).

A number of factors contributed to the relatively infrequent occurrence of pesticide resistance prior to 1950. This can be explained in part by the increase in use of pesticides after that point in time. Another factor to consider is the nature of the compounds used to control pests prior to the modern era of chemical control in agriculture. Heavy metals and other non-specific pesticides can be more difficult to overcome with resistance mechanisms because they have multiple modes of action (target site in the insect that the insecticide affects). The more components of a biological system a compound affects, the more difficult it is for a pest population to adapt by altering each component to overcome the toxic insult. This can be illustrated through genetics and probability. If 1 in 10,000 members of a pest population have resistance gene A and 1 in 10,000 have resistance gene B and both genes A and B are necessary to overcome a pesticide, only 1 in 100,000,000 individuals will be able to overcome the pesticide. Pesticides that are broad ranging biocides and have lethal effects on multiple classes, phyla, and even kingdoms of organisms tend to be difficult to overcome by attaining resistance. In general, pesticides that affect a broad range of organisms (low specificity) and have multiple modes of action have little or no risk for resistance to develop. Conversely, it is easier for pests to develop resistance to pesticides with high specificity and only one mode of action.

To illustrate, suppose I want to disable an automobile (for example, a Volkswagen Beetle). I have two tools that I can use, a spark plug wrench and a sledge hammer. The sledge hammer can be used on any vehicle, a car, a truck, a van, even a

motorcycle. Nothing short of a Sherman tank is immune to a sledge hammer with an effective operator. On the other hand, since the spark plug wrench is one size, it fits the Volkswagen Beetle but not all vehicles. Because I need access to the spark plugs, opening the hood of the Beetle may be a major obstacle especially with an interior hood release on a locked car. Even if I am able to remove the spark plugs, the owner may have an extra set in the glove compartment or could easily buy some from the local automotive store. The sledge hammer represents the non-specific pesticide and the spark plug wrench a specific one. Although the sledge hammer is effective on a wide range of vehicles and difficult to overcome in terms of the ability to repair the vehicle, it also poses a more serious hazard to the operator than the spark plug wrench. One improper swing of the hammer can leave a lasting impact on the operator. What if the operator of the sledge hammer has his car parked next to the VW Beetle? Here again there is the possibility to cause damage where it is not intended or desired.

In order to deal with these issues in a practical manner it is first necessary to have some understanding of what insecticide resistance is and how it develops. The genes that control insecticide resistance are typically present in insect populations at extremely low levels (i.e., 1 in 10,000 to 1 in 1,000,000 or less). The continual use of one insecticide on an insect pest population creates a disadvantage for insects with insecticide susceptible genes and an advantage for insects with insecticide resistant genes. Susceptible insects are killed by the insecticide and resistant insects survive until the proportion of the population with the resistance gene is large enough that field failure of the insecticide results. The rate at which resistance occurs depends on a number of factors including whether the resistance gene is dominant, recessive, or some form of incomplete dominance (part way between dominant and recessive). It also depends on the dynamics of the population. If, for example, susceptible insects are continually entering the population, they may dilute the resistant genotypes in the population and delay insecticide resistance development.

Three major types of insecticide resistance exist. These include decreased absorption of the insecticide by the insect, increased ability to detoxify the compound, and an alteration in the target site where the insecticide exerts its lethal effect (Plapp and Wang, 1983).

Decreased absorption of insecticides is usually a minor source for resistance, typically not accounting for more than a two to three-fold decrease in susceptibility (Plapp and Hoyer 1968). This mechanism of resistance is usually general and not compound specific unlike the other two types of resistance. It typically involves alterations in some physical barrier the insecticide must overcome to reach the target site and kill the insect.

An increase in the ability of an insect to detoxify an insecticide is often referred to as metabolic resistance. Detoxification begins when an insecticide binds like a piece of a puzzle to an insect's enzyme machinery. A series of reactions occur that breaks down the insecticide and increases the water solubility of the metabolite. This enables the insect to excrete the insecticide more rapidly which gives it less of an opportunity to cause damage to the insect. It is important to note that an insect can show resistance to a compound with a new mode of action even if it has never been used before due to the recognition of a particular portion of the insecticide. Cross-resistance occurs when an insect is resistant to a commonly used insecticide "x" and resistance to insecticide "y" occurs even if it has never been used. Cross-resistance can occur when insecticides have similar chemical structures (metabolic resistance) or the same mode of action (target site resistance).

The final method for insecticide resistance to develop is through the alteration of the target site. This can mean a decrease in the number of target sites available to bind the toxin or a change in the target site so the insecticide can no longer effectively bind to it. This type of resistance often occurs with compounds that are difficult to detoxify. It is often characterized by compounds from the same family (e.g., pyrethroids) showing cross-resistance

even without prior use of one of the compounds. Compounds with new modes of action, and therefore a different target site, should not show cross-resistance.

With this background information about insecticide resistance it is important to apply what is known to practical solutions. One of the conventional strategies that will continue to serve a purpose in the future is to wait for new insecticides to be released onto the market. It is no longer possible, however, to rely on this as a solution by itself. New insecticides are typically more expensive than insecticides that have been on the market for several years. New insecticides may have cross-resistance to currently used insecticides. It is also less likely for new insecticides to be labeled for use on fruit crops because the cost to develop a successful insecticide has increased substantially and the frequency of success in agrochemical screening processes has decreased. This also means new insecticides are more likely to be registered and used on big market crops like cotton before smaller markets like fruit.

In Part II of this article, I will discuss methods for slowing the development of insecticide resistance and why some methods may be better than others.

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Summerfield Greenhouses

By Marilyn Odneal

Horticulture Outreach Advisor, SMSU

Seeking sources of annuals and perennials for our campus educational gardens, members of the Mountain Grove Campus Landscape Committee, along with Mr. Gaylord Moore, regional horticulture specialist for southwest Missouri, decided to visit Summerfield Greenhouses in Springfield, Missouri. Touring the colorful greenhouses on this gray December day greatly lifted our spirits.



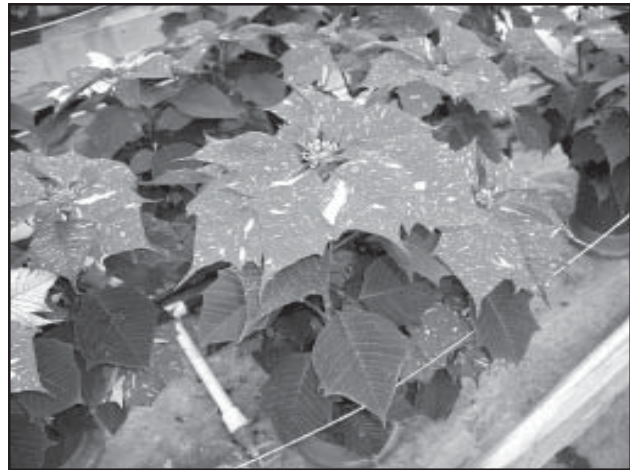
The tour group from left to right: John Avery, Mike Matthews, John Clark, Gale Williams, Patrick Byers, and Gaylord Moore.

You find Summerfield Greenhouses nestled in an older Springfield neighborhood, at the corner of Grand Street and Barnes, just east of Glenstone Avenue. John Clark, the co-owner and general manager, has been in business here since January 6, 2003 although the greenhouses have been in the area for a long time. John said “When I ask my customers how long these greenhouses have been in business, they just say that they’ve been here forever.”

John, with head grower Gale Williams, took us through the greenhouses and talked about the crops that they grow. We walked past many colorful benches of poinsettias as well as cyclamen, herbs, houseplants, and seedlings and cuttings for the spring. John explained “poinsettias and cyclamen are the crops that get you through the winter. We also propagate and sell herbs for cooking during the

holidays as well as several kinds of houseplants.”

Looking over the large selection of poinsettias in different sizes, we noticed that many plants were marked “sold” to be picked up by customers closer to the holidays. In fact, you can even choose and purchase the poinsettias you need on Summerfield’s website. Although John says the traditional red poinsettia is still the best seller, he also has white, pink, and burgundy, as well as variegated varieties including ‘Jingle Bells’ - red with pink splashes, ‘Peppermint’ - white with reddish pink splashes, ‘Glitter’ - white with red splashes, and ‘Marble’ - pink with a white edge.



‘Glitter’ is one of the more unusual poinsettias for sale with colorful red and white bracts.

The poinsettias are started from “plugs” or small cuttings and are grown and managed to produce saleable forms. If the night or dark period is interrupted with too much light, the poinsettias will not color. We asked John if he had any problems with light considering the greenhouses are located right next to a road with car headlights and streetlights. “I don’t have to block the light from the house at all. The headlights are not a problem and all I have to do is call the city and the church next door and tell them that the poinsettias are in. They turn off the streetlights next to the houses. They have been doing this for many years.”

John graduated from Southwest Missouri State University with a degree in horticulture in 1992. He worked at Wickman’s Gardens for several years before purchasing Summerfield. Sara Clark, John’s wife, is co-owner and bookkeeper. Sara, an

SMSU graduate, is also the Web Coordinator for the University. Gale Williams earned his degree in agriculture from SMSU and has worked in the greenhouse business for over 35 years. Kara Hawkins, a horticulture student at SMSU, works part time.



Kara, who works part-time at the greenhouses, used broken terra-cotta pots to create this container arrangement of Hen and Chicks.

Most greenhouses in use now are polyethylene, or plastic, rather than glass. Fewer and fewer glass greenhouses are in use. We asked John if he planned to change over to another type of house as time goes on. "No, not at this point. I like growing under glass. Even though the utility bills are higher, glass will last about 25 years which is several times longer than the poly houses. Humidity is not as high under glass which helps minimize disease problems. You also get a stockier plant under glass."

Summerfield is a neighborhood business that sells mostly to local clientele, "primarily in two zip code areas", as well as schools, businesses, and churches. Summerfield Greenhouses cater to their customers' needs in a way that larger discount operations cannot. "Some of my customers demand the German Striper tomato, a beautiful, very large, rich flavored, yellow fruit streaked with crimson red, which we supply. This variety is very popular here in the Ozarks. We also carry several of the heir-looms and other varieties that are requested."



John Clark and John Avery discuss poinsettia culture.

Summerfield offers a diverse selection of annual bedding plants, herbs, vegetables, and perennials for retail and wholesale. Plans for the future include offering ornamental shrubs and trees. John keeps his eye on consumer trends. He notes that people are very interested in water features and aquatic plants. They are also interested in container plantings and a diverse selection of varieties. "People aren't planting massive vegetable gardens as much, anymore, and don't buy large amounts of a few cultivars or types. They want to see a large variety of plants."

It is nice to see that the Summerfield Greenhouses tradition will continue and that the greenhouses are run by those who not only love plants, but who are professionally trained in horticulture. It is extremely important to our Campus Landscape Committee that the plants used in our educational projects are true-to-name and healthy. Most of all, it is a comfort to know that in this discount center world there is still a place for knowledgeable growers of high quality plants who can offer first class products and support to their customers.

For more information on Summerfield Greenhouses contact:

John Clark

2157 E. Grand Street

Springfield, Missouri 65804

417-869-6635

417-869-0700 (fax)

email: info@summerfieldgreenhouses.com

web: <http://www.summerfieldgreenhouses.com>

Berry Burgers

by *Suzi Teghtmeyer*,

Head Librarian

Paul Evans Library of Fruit Science, SMSU

Yes, you read correctly... berry burgers. As I was paging through the September 2003 NASGA Newsletter I found an intriguing article on unique combinations of berry fruits and hamburger meat to form a 'fruit-filled burger'. In 2003, Al Bushway, a food scientist at the University of Maine, received a \$30,000 grant from the Wild Blueberry Association to explore the feasibility of berry burgers more closely. He states, "Adding blueberry puree or powder to chicken, turkey, or beef patties improves the taste of reheated meat, makes the burgers juicier, and increases the nutritional value." The puree and powder is made from unripe and over-ripe berries, thus opening up the market for farmers to sell those berries to industry. Currently the blueberry burgers are being taste-tested in school lunch programs in selected cities.

Blueberry burgers are not the first (or probably the last) berry burgers to hit the market. The USDA is or has sponsored research on cherry burgers and prune burgers, both of which are being tested on unwitting school children. Cherry-filled meats, once experimented on at Michigan State University, are now available to consumers through Ray Pleva's Products Inc. [<http://www.plevas.com>]. Mr. Pleva says that people can't taste the 'cherryiness' in the fruit, but the burger is juicier and more flavorful than normal burgers. The cherries also extend the shelf life of the meat and supplies antioxidants that aren't generally found in meat products.

Prune burgers are heralded by the California Dried Plum Board as the best fruit-filled burger. A patty mixed with 4% prune puree and a bit of soy can lower the fat content of the burger up to 40%. Jim Dugan of the CDPB states that even with this low amount of prune in the burger, the consumer receives lower fat, higher juiciness, and all the healthy antioxidants, vitamins, and minerals found in the fruit. The only thing you won't get is the laxative effect associated with prunes (that depends, of course, on how many burgers you eat in a sitting!).

To show how far this has gone, a 2003 finalist in the 'Build a Better Burger' competition was the recipe for Double Blue Berry Burgers from Craig Priebe of Glen Ellyn, Illinois (recipe can be found at http://www.buildabetterburger.com/Berry_Burgers.html). Along with a cup of dried blueberries, the recipe calls for pepper sauce, diced blue cheese, endive, sugar, hamburger meat, and other assorted ingredients. Mr. Priebe also shares his special recipe for BBQ Berry Compote, which uses blackberry jam and red wine vinegar.

The moral of the story is, just when you can't think of another value-added product, some quirky individual will come up with something!

For further information, visit the sites:

Berry Burgers: <http://www.berryburgers.com/>

NEA Today: <http://www.nea.org/neatoday/0401/upfront.html>

Survey Says Prune: http://www.findarticles.com/cf_dls/m4PRN/2000_July_21/63586234/p1/article.jhtml

Rocky Mountain News.com:

http://www.rockymountainnews.com/drmn/odd_files/article_0,1299,DRMN_2336_2152488,00.html

The Many Benefits of Specialty Pesticides

*By Jennifer Barnes
Horticulture Specialist, UMC*

I was fortunate to be among twenty-three extension specialists selected nationwide for a horticulture study tour to the west coast last October. The tour was sponsored by RISE (Responsible Industry For A Sound Environment). Our group met with chemical companies in Yuma, Arizona and southern California. We toured Ecke's Poinsettias in Encinitas, Huntington Gardens in San Marino and even the beautiful landscapes at the San Diego Zoo. In Las Vegas we visited a cactus nursery and a Chocolate factory that recycles all of its water by using a plant filtering system. We were there at the start of all the wildfires and saw the billows of smoke in the distance.

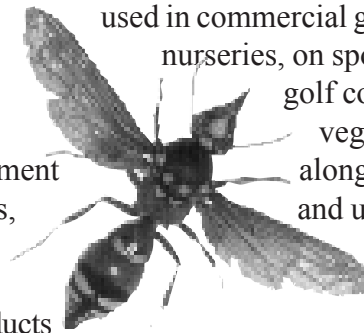
All along the tour, I received a lot of information about the safe and responsible use of pesticides and fertilizers that I found both interesting and useful. I based this article on the information I received.

Our battle against pests has been never-ending since the first human to walk upright stomped on a cockroach or brushed against poison ivy. Fortunately, use of today's pest control products has relieved much of the world of pest problems, and reduced the ability of pests to harm our health and safety. Cockroaches, stinging and biting insects, ticks, rats, mice, weeds, and similar pests are much more than a nuisance. They spread diseases, inflict injury, initiate allergies, trigger asthma, and foul our food.

Pesticides control and contain such pests. Safe and responsible pesticide use helps fight these serious health and safety risks to adults and children in homes, schools, play areas, and workplaces. Yet, many of the facts about pesticides and their benefits may be overlooked, or clouded by misinformation and misunderstanding.

Specialty pesticides are pest management tools used in and around homes, businesses, and public areas as well as on lawns, flowers, and trees.

They're used in commercial greenhouses and nurseries, on sports turf such as golf courses, and for vegetation management along roadways, railroads, and utility rights-of-way.

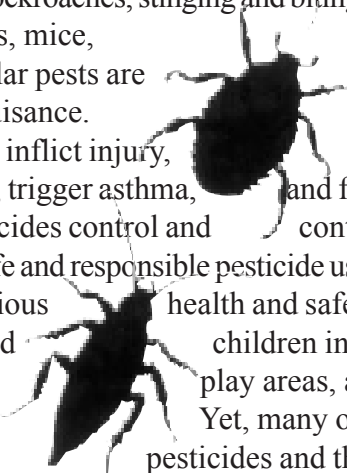


Products used by pest management professionals play a critical role in protecting the public's health and property. In fact, they frequently are the first line of defense in preventing a wide range of vector-borne diseases including West Nile Virus, encephalitis, rabies, Lyme Disease, and hantavirus. More recently, cockroaches have been implicated as a cause of childhood asthma, reaffirming the importance of keeping homes and apartments pest-free.

A well-maintained landscape can add up to 15 percent to a property's value. Healthy turfgrass filters groundwater, absorbs pollutants, retards the spread of fire and acts as a cooling agent around the house while also providing space for numerous family activities. Herbicides, insecticides, and fungicides help protect turfgrass so it will grow into a healthy lawn. One small lawn produces enough oxygen each day for a family of four. Well-managed turf protects water, and because plants absorb CO₂, the maintenance of healthy turf helps reduce the threat of global warming.

Using herbicides to remove weeds along roadsides makes for safer travel. Utility companies use herbicides as an economical tool to ensure reliable electric power, while also improving wildlife habitat.

Commercial growers of ornamental flowers and plants continuously monitor for the presence of pests and use pesticides to control damaging insects such as aphids, thrips, and whiteflies and diseases that damage plant health and quality. By eliminating these pests, growers are able to provide ornamental plants of the highest quality while minimizing the cost



for retailers and consumers.

Herbicides are used in forest management to reduce the amount of brush and weeds so that timber production is maximized. This allows us to enjoy a wide range of economically priced wood products paper and lumber. Using herbicides in forests also reduces the risk of forest fires by reducing the build-up of fire-prone weeds and brush on the forest floor.

Excessive aquatic weeds in ponds, lakes, reservoirs, canals, streams, and rivers can have detrimental effects on the wetlands environment and on water usage. Recreational activities such as boating, fishing, and swimming, as well as the appearance of the water can be adversely impacted. Wetlands habitat for wildlife can be destroyed, hydroelectric screens can be clogged, navigation lanes restricted, water quality can be significantly reduced, and property values can fall sharply because of too much aquatic vegetation. Herbicidal products, along with mechanical, cultural, and biological alternatives, are used to effectively manage aquatic weeds.

Source:

Responsible Industry For A Sound Environment
1156 15th Street NW, Suite 400
Washington D.C. 20005
www.pestfacts.org

Herbicide Sprayer Calibration

By John Avery

Horticulture Research Associate, SMSU

The New Year is here and the middle of winter is upon us. Our fruit plantings are dormant and weeds are weeks away from starting to grow. Now is the time to start preparing for the new growing season. One of the first important tasks in late winter or very early spring is to control weeds with pre-emergent herbicides before they start to grow. So, while the weather is cold and the ground is frozen you need to determine your plan of action for the coming year. Decisions on what herbicide(s) will be used; when they need to be used, and how much of the herbicide needs to be put down to control the

weeds in the planting need to be made. Before you start spraying, you must perform routine maintenance and calibration of the sprayer so money is not wasted by applying too much herbicide or control is inadequate by not applying enough herbicide to control the target weeds. There are several steps in the process of preparing the herbicide sprayer for the coming season.

The first step is to check the sprayer for any problems, leaks or worn parts. The pump should be checked to make sure it is producing adequate pressure for the job. Generally spray pressures in the range of 20 to 40 psi are needed at the nozzle for good coverage of the ground and any weeds present. Most pumps will operate far above this pressure, so by-pass valves are needed to divert excess water back to the tank, thus reducing pressure to the desired level. These valves need to be checked for wear and blockage. Hoses from the various parts of the sprayer should be checked for leaks particularly at the fittings. Filters should be removed and checked for tears in the screen or crusted chemicals which would impede flow of water. There are generally two filters in the sprayer system. The first is a filter at the outlet of the tank leading to the pump. This is a large volume filter for removing debris which may have entered the tank during filling. The other is a filter at the nozzle which removes debris such as rust from fittings, undissolved chemical or calcium flake from the water supply. Last, the nozzle should be checked for wear or damage which would affect their spray output. All of these parts should be checked before sprayer calibration is performed.

After the sprayer is determined to be in good working order the next step is calibration of the sprayer for proper output and coverage. The first item under calibration is to decide what pressure and output is desired for the herbicide application. Generally, spray pressures are in the range of 20 to 40 psi for most herbicide applications. Keep in mind that the higher the pressure the more uniform the application due to smaller droplet size but more drift will occur under windy conditions. For most pre-emergent or systemic herbicide applications set a low spray pressure and for contact herbicides go to the higher spray pressures.

The spray pressure can be adjusted as needed to obtain the desired coverage and output. As the spray pressure increases the output will increase and the droplet size will decrease. Generally, the smaller the droplet size the better the coverage under still conditions. If application is under windy conditions, then coverage can be adversely affected under higher pressure. Spray pressure is usually set for the type of application most often needed and the conditions most often encountered and can be adjusted to fine tune the application rate.

For most herbicide applications the spray output should be in the range of 50 to 100 gallons per acre (GPA). The spray output will be affected by; 1. the nozzle orifice or opening, 2. the spray pressure, and 3. the ground speed at which the herbicide is applied. Of these three items only the nozzle is constant, so if using an old nozzle it should be checked carefully for any damage or wear that would affect its spray pattern or output. When a new nozzle is used the output can be determined from charts by reading the gallons per minute at the pressure desired. There are many types of nozzles to choose from which give different rates of output, angle of spray, and shape of coverage.

Driving speed will also affect the rate of application but can be used to adjust the rate as needed. As the driving speed increases the rate will decrease. Conversely as the driving speed decreases, the rate will increase. The range for driving speed will depend on the tractor used and the comfort level of the applicator. The terrain in the planting and the plant size/spread can also affect the driving speed. A general range of speed is 2 to 4 mph but on smooth, flat ground with smaller plants speed may be increased over 4 mph. Generally, driving speed is more a factor of applicator comfort but can be used to fine tune application rates.

So, with the above information, how do I calibrate my herbicide sprayer for the upcoming year? You can follow along with the "Steps in Herbicide Calibration" on page 12. First, let us assume I have a planting of blueberries, that the sprayer is not new, that I used it last year, and I will be using the nozzles from the previous year. From previous years I have a sprayed area of 2.5 feet on each side of the row. I would like to keep my

driving speed for application of herbicides at about 3 to 3.5 mph. The herbicides I will be using for most of the year will be contact herbicides for which I will need small droplet size to give good coverage of the weeds, so I would like a pressure of about 30 psi (See Step 1). The nozzles I am using have a theoretical output of 1.3 gpm at 30 psi. The first item to check is the actual output of the nozzles at 30psi. I need to fill the sprayer with water and set the pressure to 30 psi. To do this I will set the tractor revolutions per minute (rpm) to 2000 so that the power take off (pto) has an rpm of 540. This conversion from the tractor rpm to pto rpm is standard with most tractors but may vary with make and/or model. The owner's manual should be consulted to find this information for your tractor. The tractor rpm's, that is gear and throttle, will need to be maintained each time spraying is performed so that pressure and thus output is not affected.

Next, adjust the by-pass valve on the sprayer to 30 psi pressure at the nozzle. Once I have the desired pressure then I need to measure the output of the nozzles for one minute. Using a stop watch or the second hand on a watch, use a bucket to collect water from the nozzle(s) for one minute. Measure the water collected to determine your actual spray output for your setup. As an example, let's say our used nozzle(s) have a measured output of 1.5 gpm at 30 psi when we run the test (See Step 3). With this increased output for our nozzles we must decide if they need to be replaced due to wear. A general rule of thumb is 'if the actual output is more than 10% of the theoretical output' then the nozzles should be replaced. But, if the spray pattern and droplet size is still good we can keep the nozzles and continue with the calibration.

We then need to determine the distance covered in one minute by the tractor in a given gear. The number to memorize is 88 feet per minute (fpm) of travel for each mile per hour (mph) that you drive. For tractors with hydrostatic transmissions and/or a mph gauge the distance traveled in one minute can be figured easily. Multiple the mph by the 88 fpm to get the distance traveled per minute. For example, if you want to spray at 3 mph, then multiply this by 88 fpm to determine that you would travel 264 fpm as you spray (See Step 2a).

For tractors with manual transmissions you would have to take the tractor to the field and experiment with the gear range to determine what gear to use for the appropriate distance traveled (See Step 2b). Keep in mind that you will use the transmission gears to adjust the speed of travel, not by adjusting the throttle of the tractor, otherwise you will also change the output of the sprayer.

Once you have the output of the sprayer nozzle(s) figured in gpm and the distance the tractor covers in one minute, you are ready to figure the gallons per acre which the sprayer is putting out (See Step 4). In our example of a blueberry planting, we sprayed a 5 foot wide band over the row, but we sprayed only one side (2.5 foot wide band) of the row with each pass. This is the reason for dividing the sprayed row width by 2 in Step 4. We adjusted our tractor to travel at 3.0 mph or 264 feet per minute. The nozzle output was found to be 1.5 gpm at 30 psi. We know there are 43560 square feet in one acre of ground. So to figure the gallons of water (spray) put on a sprayed acre of our blueberry rows we will use the following: 2.5 feet (half of a row) times 264 feet per minute gives us 660 square feet sprayed per minute. Take 43560 (square feet in acre) divided by the 660 feet per minute gives you 66 minutes to spray an acre. The 66 minutes per acre times the 1.5 gpm gives you 99 gallons per acre. Keep in mind that you will not be spraying all of the ground in an acre of blueberries. At a 10 feet row spacing in the planting you would be spraying about ½ the ground of the planting or about 2 acres of actual plant rows with 100 gallons/acre of spray. You add the per acre rate of herbicide to the amount of water the sprayer is spraying out per acre. For example if the herbicide calls for 8 lb per acre, you would put 8 lb in the 100 gallons of water for the above example.

The herbicide sprayer should be checked at the beginning of each season for leaks, wear of parts, and adequate pressure from the pump. Then calibration of the sprayer should be performed to be sure the correct amount of herbicide is placed in the planting for best control of weeds. Insuring that the correct amount of herbicide reaches the target area is critical to an effective weed management program.

Steps in Herbicide Sprayer Calibration

1. Check pressure and spray pattern.
 - a. Pressure is pre-determined according to the type herbicides used and the environmental conditions for the local area. Generally 20 to 30 psi is used with herbicide applications. Typically nozzles with a flat spray pattern are used for fruit plantings.
 - b. Pressure can be adjusted by the use of by-pass valves to give the pattern and droplet size desired.
2. Determine tractor speed.

Tractor speed in feet per minute (fpm) can be determined by two methods.

 - a. Tractors with odometers can use the formula:

$$\text{speed (mph)} \times 88 \text{ fpm/mph} = \text{feet traveled per minute.}$$

$$\text{mph} \times 88 = (A) \quad \text{fpm}$$
 - b. The second method uses the gear and throttle settings to determine speed. Use and note the gear and throttle setting which is comfortable for you.
 - I. Measure the length of row in your planting for a test run. (B)= ft.
 - II. Determine the time required to travel the row at the preferred speed. (C)= sec.
$$(B) \quad \text{ft.} \times 60 \text{ sec/min.} / (C) \quad \text{sec.}$$

$$= (A) \quad \text{fpm tractor speed}$$
3. Determine nozzle(s) output.

To determine nozzle output set the pressure at the desired setting, place a bucket under the nozzle, and do a one minute timed spray. Measure the water in the bucket in gallons. (D)= gpm
4. Calculate the spray volume.

To determine the output in gallons per acre you will need to determine the sprayed width of your row and divide by 2 because you will be covering only half the width with one pass. (E) ft= width of row/ 2.

Then use the formula:

$$1/[(A) \times (E)] \times 43560 \times D = \text{gpa}$$

Upcoming Events

19th Annual Midwest Regional Grape and Wine Conference

Saturday, Feb. 7 - Monday, Feb. 9, 2004

Tan-Tar-A Resort

Osage Beach, Missouri 65065

For more information, contact:

Denise Kottwitz

1-800-392-WINE

Denise_Kottwitz@mail.mda.state.mo.us

24th Annual Missouri Small Fruit and Vegetable Conference

Back to the Basics Session and Main Conference,

Southwest Missouri Agritourism Conference

Missouri Farmers' Market Vendor Workshop

February 16, 17-18, 2004

Clarion Inn and Convention Center

3333 S Glenstone Ave

Springfield, MO USA 65804

(417) 883-6550

1-800-252-7466 Reservation

(417) 883-5720 FAX

For more information, contact:

Pamela Mayer

1-417-926-4105 pam621t@smsu.edu

Spring Horticulture Seminars

Sponsored by the Tri-County Master Gardeners

and the SMSU State Fruit Experiment Station

1 to 4 pm. Saturday, April 3, 2004

at the SMSU Campus at Mountain Grove

Schedule:

1 pm - 1:25 Registration, refreshments and introductions.

1:25 - 2:10 *Garden Bed and Border Design* presented by Marilyn Odneal, SMSU

2:15 - 3:15 *Roses* presented by Bill Eskes, Hummert International, Springfield

3:30 - 4:00 *Planning and Preparing the Centennial Garden Border* discussion will be held outdoors, weather permitting.

For more information contact:

Marilyn Odneal

1-417-926-4105 mbo774t@smsu.edu

2004 Missouri Illinois Peach Tour

Sponsored by Illinois Cooperative Extension, Southwest Missouri State University's Fruit Experiment Station, and University of Missouri Extension

Friday, May 14, 2004

Tour three orchards in Southern Illinois: Rendleman Orchards of Alto Pass, Grammer Orchards of Carbondale, and Flamm's Orchard at Cobden.

These three orchards include retail as well as wholesale sales, and we will also view sales areas and kitchens where value added products are produced. Lunch will be provided! Registration is recommended for the Missouri/Illinois Peach Tour, and there will be a nominal registration fee to cover materials and refreshments. For more information on the tour and to register, please contact:

Elizabeth A. Wahle, Ph.D.

Extension Educator

Horticulture, Fruits and Vegetable

Edwardsville Extension Center

200 University Park Drive

Edwardsville, Illinois 62025-3649

tel 618-692-9434

fax 618-692-9818

wahle@uiuc.edu

Remember to check <http://mtngrv.smsu.edu/calendar.htm> for all current workshops and conferences with printable schedules and registration forms.

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Your editors of The Berry Basket:

Gaylord Moore, Area Horticulture Specialist,
University Extension, Springfield, Missouri.



Patrick Byers, Fruit Grower Advisor, and
Marilyn Odneal, Research Associate, Fruit
Science, State Fruit Experiment Station, SMSU,
Mountain Grove, Missouri Missouri.



Send address changes and comments to:
Dept. of Fruit Science, 9740 Red Spring Road,
Mtn. Grove, MO 65711 or mbo774t@smsu.edu.
