Integrated Weed Management for Fresh Market Production

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The **Integrated Pest Management Program** expands the use of IPM in Wisconsin crops to reduce the use of chemical pesticides, increase the use of cultural and biological pest control tactics, improve production efficiency and maintain the competitiveness of Wisconsin growers by producing crops with the lowest pesticide inputs necessary. Go to http://ipcm.wisc.edu

PURR is the collective effort of 14 agricultural organizations which are working together to reduce pesticide use and risk through Integrated Pest Management and other system strategies. For more information on PURR and its member organizations, go to http://www.thinkIPM.org

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Weeds are considered one of the true constants in crop production. Unlike other migratory pests, the persistence of weed seed in the soil guarantees their survival for many seasons to come. The primary effect of weeds is competition for limited resources such as light, water and nutrients. In addition, weeds can reduce the quality of fruits and vegetables, harbor insects and disease, interfere with harvest and even cause health problems such as allergies. Consequently, more labor and expense is often spent on weed management than on any other fruit/vegetable production input.

Weeds can be found in all shapes and sizes, and vary greatly in their pattern of growth. By exploiting these differences, weeds fill a niche environment (often within a crop) in which the weed not only survives, but thrives, much to our dismay. With this in mind, it becomes clear that understanding how a weed grows, why it is found where it is, and what actions will limit its growth, are all important in developing a weed control strategy. This manual will guide you through the considerations necessary in establishing a successful integrated weed management program.

Types of Weeds

All weeds can be categorized into one of three very different growth patterns: annual, biennial, or perennial. Understanding a weed's life cycle will allow more efficient utilization of actions aimed at controlling its numbers.

Annual weeds complete their life cycle in a single growing season. These weeds germinate from seed, grow quickly, flower, set viable seed and die all within one growing season. Seeds produced disseminate and fall to the ground where they may germinate to produce multiple generations within the same growing season, or if the seed is dormant, supply a source of seed for future years. Annuals reproduce exclusively by seed, although some fleshy weeds such as purslane are able to root from severed shoots not removed from the soil. Annual weeds are characterized by very high seed production to ensure their survival. A few annuals (referred to as winter annuals) germinate in the fall and complete their life cycle the following spring. Some common examples of annual weeds include: common lambsquarters, velvetleaf, and green foxtail. Examples of weeds usually found as winter annuals include shepherd's purse and wild mustard.

Velvetleaf is an annual weed

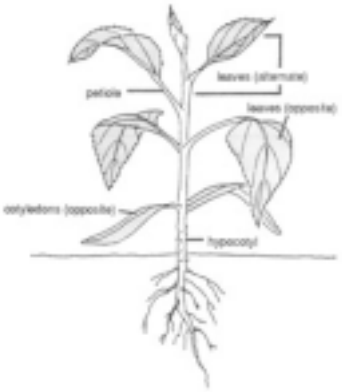
Musk thistle is a biennial weed

Biennial weeds require two growing seasons to complete their life cycle. Their first year of growth is devoted entirely to vegetative growth, often in the form of a rosette or circular cluster of leaves growing very close to the soil surface. The second year of growth provides additional vegetative growth followed by reproductive growth including flowering, seed set and death of the plant. Because of the two-year cycle of growth, these weeds are often found in areas of low soil disturbance such as pastures, waterways and fencerows. Examples of weeds with a biennial growth pattern include bull thistle and wild carrot.

Perennial weeds grow for more than two years and are quite versatile, able to thrive in both areas of reduced soil disturbance or fields of row crops. They are able to set seed in their first year of growth or may delay seed production for several years depending on environmental conditions. Most perennials rely on vegetative reproduction as their primary means of spreading. Roots, rhizomes, stolons, cut roots or stems, and tubers are all means by which various perennials vegetatively propagate. With much of their reproductive potential found below the soil surface, perennials can be extremely difficult to manage. Quackgrass, Canada thistle and common milkweed are all perennial weeds.

Weed Identification

In developing your weed management strategies, it is critical to correctly identify problem weeds. Even very closely related weeds within the same family may respond quite differently to the same control measures. In general, weak points can be found in every weed's life cycle. Control measures aimed at exploiting these weaknesses will ultimately provide more consistent and environmentally sound controls.



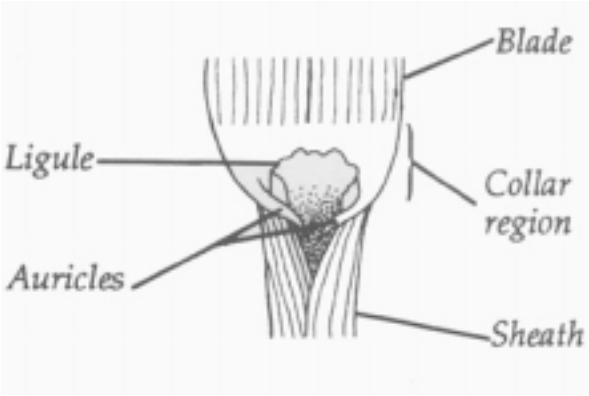
Broadleaf plant structures

Broadleaf weeds have leaves in an alternate (top) or opposite (bottom) pattern

Broadleaved plants are referred to as dicots, having two seed leaves (cotyledons) in their seed. Dicots usually have leaves with a pronounced branching or netted venation and flower parts that occur in groups of four or five. Ragweed, velvetleaf, purslane and pigweed are all broadleaved weeds. To identify broadleaved weeds you will need to know that leaves can be found attached to the stem in either an alternate or opposite pattern (see accompanying figure). The cotyledons or seed leaves, which are the first two leaves to appear on a broadleaf seedling, are often thicker

and have a different (usually more basic) shape than subsequent leaves. In addition, the cotyledons will always be found in an opposite configuration, regardless of the later leaf pattern.

Grasses are monocots that have seedlings with one seed leaf or cotyledon. Grasses and sedges are the two groups of monocots that commonly occur in Wisconsin. Grasses and sedges have long, narrow leaves with a parallel venation pattern and flower parts that typically occur in groups of three. Of the two plant types, grasses are generally much more difficult to identify than broadleaves. Subtle differences differentiate the grasses, many of which are based upon very small and inconspicuous plant parts. The figure at right labels some of the plant structures important in grass identification. The *auricles* are a pair of lateral projections at the juncture of sheath and blade of certain grass leaves. The *blade* refers to the flattened portion of the leaf and may be smooth or hairy. The *collar* is the junction of the leaf blade and leaf sheath. The *sheath* is the tubular lower portion of a grass leaf and can be either smooth or hairy.



Grass plant structures


Ligule absent


Membranous ligule


Hairy ligule

The *ligule* is one of the most important characteristics in identifying grasses, and also one of the most difficult to view. If possible, bend the leaf blade over your index finger and hold the collar region up to a light or sky to better view the ligule. The ligule may be non-existent, formed of a thin sheath (membrane) or composed of a fringe of short hairs. The drawings above illustrate these different ligule types.

Even if you are not interested in knowing on sight every weed that you encounter, knowledge of these basic plant structures and terminology will enable you to utilize the many high quality weed identification resources available from bookstores, garden

centers and Cooperative Extension Publications. A few references you may wish to consider including in your library:

Books

- *Weeds of the North Central States* – Contains black and white line drawings and descriptions of 230 weed species. Available through any County Extension Office. Approx. $10.00
- *Weeds of the Northeast* – Contains color pictures and descriptions of nearly 300 weed species. Approx. $32.00

CD Roms

- *Weeds of the United States* – Contains excellent color photos and descriptions of common weeds of the U.S. Approx. $90.00
- *Broadleaf Weed Seedling Identification* – Contains line drawings and color pictures of 57 broadleaf weed species in cotyledon or seedling stage. Approx. $80.00

Guides

- *Common Weed Seedlings of the North Central States* – Contains sharp color photos plus close-ups of key features for 17 grasses and 36 broadleaf weeds. Available through any County Extension Office. Approx. $3.00
- *Pigweed Identification, A Pictorial Guide to the Common Pigweeds of the Great Plains* – Shows how to distinguish between nine pigweed species. Approx. $1.50

Information on ordering any of the above references as well as additional weed identification information can be found on the UW Integrated Crop and Pest Management website at: http://ipcm.wisc.edu/uw_weeds/extension/articles/plntidref.htm

Weed Management Strategies

Successful weed management requires an integrated approach that includes multiple strategies. There are three general strategies involved in weed management: (1) prevention, (2) eradication, and (3) control.

Prevention is the use of any practice that prevents the introduction or expansion of a weed population. Growers have many opportunities to prevent the spread of weeds. Preventing weed dispersal is perhaps the most important. Weeds are very prolific seed producers, many of which can remain viable for a long time in the soil (see accompanying figures).

Weed seed production potential per plant

Redroot Pigweed	230,000
Common Lambsquarter	38,000
Pennsylvania Smartweed	6,500
Eastern Black Nightshade	40,000
Giant Foxtail	4,000
Wooly Cupgrass	40,000

Weeds are very prolific seed producers, and many seeds remain viable for a long time in the soil

Maximum longevity of weed seed buried in soil

Species	Years
Quack grass	6
Shattercane	10
Giant foxtail	20
Velvetleaf	40
Common lambsquarters	40
Redroot pigweed	40

The highly prolific and enduring nature of weeds requires diligence in preventing the addition of new seeds to the soil seed bank. Using weed-free crop seed, cleaning tillage and harvest equipment between fields, preventing current weeds from producing seeds, and properly composting manure and plant materials are all examples of prevention techniques. The old adage that an ounce of prevention is worth a pound of cure is excellent advice in dealing with weeds!

Eradication should rarely be the goal of a weed management program. In fact, eradication is nearly impossible for most common annual weeds well represented in the seed bank. Eradication is only possible in dealing with small areas infested with a new, serious weed to avoid its spread to an entire field. An acceptable eradication example would be the removal of a patch of Canada thistle plants that have appeared in a field for the first time.

Control involves the management of existing weeds in a manner that minimizes their impact on the surrounding crop. There are four general methods used in the control of weeds: (1) cultural, (2) mechanical, (3) chemical, and (4) biological. Successful weed control requires a system that integrates two or more of these methods.

Crop nutrients supplied by manures or fertilizer should be based on a soil analysis

Cultural Weed Management

Cultural methods include good crop management practices, which have the added bonus of providing some level of weed control. In general, the goal of cultural weed management practices is to produce a healthy and vigorous crop, capable of providing maximum competition with weeds. This includes such things as:

Optimizing crop inputs – Maintaining sufficient levels of crop nutrients and irrigation will help the crop gain a competitive edge over the weed population. Crop nutrients supplied by animal manure, green manure crops, and purchased fertilizer should all be applied based on soil analysis or tissue analysis (fruit) and expected crop need. Correct application rates will also help to promote farm sustainability by maximizing farm profits while reducing excess nutrients released to the environment.

Selecting appropriate crop cultivars – Choosing crop cultivars best suited to your environment will also help improve crop competition. Unfortunately, many specialty fruits and vegetables that are highly desired in the marketplace may not be well adapted to Wisconsin's northern climate. Pay careful attention to new hybrids and selections released each year, many with traits making them more adaptable to a wide range of environments. When possible, conduct your own small-scale experiments with new crops and cultivars to determine how they will grow and perform on your farm.

Transplants vs. direct seeding – Although some crops are best direct seeded, the use of transplants, when appropriate, is an excellent method of advancing the crop's level of competition relative to weeds. Using transplants has many other advantages as well. *Planting dates* can be moved up, sometimes months, by seeding indoors in Wisconsin's unpredictable spring environment. *Germination* percentages improve considerably making transplants a more economical use of often very expensive vegetable seed. And finally, correct *plant populations and seeding depth* are more easily attained using transplants, while precise field placement of very small seed can be difficult.

Transplanting plugs gives plants an competitive advantage over weeds while providing other benefits

Row spacing – Theoretically, planting crops in narrow rows improves yield for a given area since it allows the crop to capture more of the available light, water and nutrients. More importantly, narrow rows provide maximum crop competition with neighboring weeds. Fresh market vegetable production does however provide some inherent limitations to narrow rows. Crops like onions with limited top growth are poor at competing with weeds at any row width, and may have to be spaced to allow mechanical cultivation. Plants requiring multiple harvests (such as tomatoes or peppers) may require additional space for hand harvesting and removal of produce from the field. Strawberry yield is more closely related to the linear feet of row edge than the square feet of soil surface covered. You will need to balance the benefits and limitations of row spacing as they apply to your specific production system.

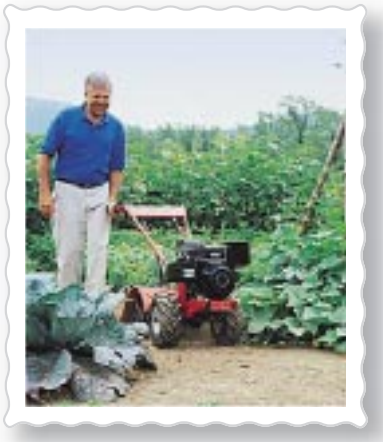
Crop rotation – If a crop is grown in the same place for an extended period of time, there are certain predictable weeds with similar life cycles that will be found in association with it. Regular disruption of an environment by switching to a crop with a different life cycle and field operations makes it more difficult for a specific weed species to proliferate. Rotation can involve movement of crop patches within a field or rotating crops from field to field, growing either a production crop, cover crop, or fallowing the land during the "off-years." Crop rotation should be practiced proactively to prevent serious weed outbreaks, but can also be used to correct existing weed problems. For example a perennial cover or green manure crop such as clover or alfalfa competes very well with problem annual weeds like common lambsquarter and foxtails. If perennial weeds like quack grass or common milkweed are problems, growing an annual crop like sweet corn or green beans will help because these weeds will not tolerate the annual tillage operations. In addition, if herbicides are an option on your farm, you can rotate to a crop in which a labeled herbicide controls a problem weed. For example, if you have problems with eastern black nightshade in potato (a crop in which no labeled herbicides are very effective on nightshade), you may wish to rotate to a crop like sweet corn, where several labeled herbicides are very effective in controlling eastern black nightshade.

Insect and disease management – Effective insect and disease management are important factors in maintaining a healthy and highly competitive crop. In addition, many of the strategies just covered in cultural weed management also have insect and disease implications. Too much or too little fertilizer/irrigation can at times make the crop more attractive to insects and diseases. Cultivar selection should not only be based on maximizing competition with weeds, but must also include selecting for insect and disease resistance. Row spacing too close together may result in reduced air movement, an environment more favorable to some diseases. It is therefore very important to consider the many interactions that may result from your cultural weed management decisions.

Many cultural weed management strategies have insect and disease implications

Mechanical/Physical Weed Management

Tillage – Removing existing weeds with tillage equipment prior to planting is one of the most universal weed management methods used in nearly all (except no-till) production systems. The key to maximizing the benefit of this common practice is to till immediately prior to crop planting to minimize early weed competition. In vegetable production systems this may mean tilling small portions of a field at different times to correlate with the different planting dates of the various crops. The concept of a *sterile seedbed* involves tilling the soil several times prior to planting, each time reducing the weed seed-bank as a new flush of weeds is tilled under. How much tillage is right for you will depend on your soil type, soil moisture level, weed type and intensity, and crop grown. Too many tillage passes can destroy soil structure, increase compaction from equipment and increase soil losses due to erosion.



Rototilling can be effective in controlling weeds if it is done strategically

Cultivation – Removing weeds from within the crop as they emerge during the growing season is a primary method of weed management for most fresh market vegetable growers. Cultivation can range from hand tools such as hoes and multi-tined weeders, to power equipment such as roto-tillers and tractor-mounted cultivators. Regardless of the equipment used, a few simple strategies will maximize the effectiveness of this often time-consuming strategy. Try to cultivate only when the soil is slightly moist. The moisture will aid in weed removal and breaking up any surface crusting without throwing large clods onto crop plants. Only till deep enough to uproot weeds. Excessively deep cultivation increases the likelihood of injuring crop roots and moving a fresh supply of weed seeds to the surface. And finally, cultivation must be timed before weeds are too large to be effectively dislodged, buried or cut down. If crop plants are still very small, this may require the use of shields on power cultivation equipment.

Mowing – Mowing many annual and perennial weeds just above the soil surface will prevent or limit their seed production potential with the root systems left behind helping to stabilize the soil from erosion losses. Mowing can be effective against many weeds including foxtails, ragweed, pigweed, velvetleaf and common lambsquarter. Repeated mowing however, will cause some weeds to set a limited amount of seed very close to the soil surface and over time will cause species shifts in which low growing weeds unaffected by mowing such as crabgrass and purslane predominate.

Mulches – Mulching controls weeds by preventing light needed for weed seed germination from reaching the soil surface and provides a physical barrier to emerging weeds. Mulches are excellent for controlling annual weeds emerging from seeds.

Aggressive perennials, however, which have much greater food reserves in roots or rhizomes, are often able to push through mulches and will require additional control measures. Mulch has the added benefits of conserving soil moisture, reducing erosion and soil compaction, and keeping the fruits of some crops clean of soil. There are many types of mulch available. Your choice of materials will depend on cost, ease of use and availability of mulching material.

Organic mulches are derived from plant material such as bark, straw, leaves, grass clippings, crushed corncobs, sawdust or wood shavings, and well-rotted animal manures. To be most effective, apply organic mulches at a depth of 4 to 6 inches prior to weed germination and add additional mulch as needed to compensate for losses due to decomposition during the growing season. Although organic mulches can supply nutrients to the soil as they decompose, many require additional nitrogen during the decomposition process. This is especially true of mulches containing high amounts of cellulose, such as sawdust, straw and leaves. During decomposition soil microorganisms cannot get enough nitrogen from these materials to adequately break them down, so they absorb additional nitrogen from soil reserves, making it temporarily unavailable to the crop, leading to possible nitrogen deficiency.

Organic mulch like this bark should be applied at a depth of 4 to 6 inches prior to weed germination

Fertilizer value of mulches (based on dry weight)

Mulch	N	P_2O_4 %	K_2O
Alfalfa hay	2.45	0.50	2.10
Oak leaves	1.49	0.00	0.00
Grass hay	1.20	0.35	1.75
Wheat straw	0.50	0.15	0.60
Sawdust/wood shavings	0.20	0.10	0.20

The ratio of carbon to nitrogen (C:N) in several mulch materials is shown on the next page. If the C:N ratio is less than 20, microorganisms will decompose the material while increasing the supply of available nitrogen in the soil. If the C:N ratio is between 20 and 50, there is neither an increase nor decrease in the level of available nitrogen. If the C:N ratio is greater than 50, microorganisms will use available soil nitrogen during the decomposition process. Therefore when the C:N ratio is greater than 50, additional N beyond the crops requirement may need to be added to prevent nitrogen deficiency.

Carbon to nitrogen ratios (C:N) of mulches

Mulch	C:N ratio	
Alfalfa hay	12:1	*Supply of available nitrogen increases*
Rotted manure	15:1	
Grass clippings	19:1	
Tree leaves	60:1	*Additional nitrogen may be required*
Straw	80:1	
Sawdust/wood shavings	500:1	

Paper mulches are also organic, but in a much more processed form than any of the above organic mulches. Paper mulches begin to break down a few weeks after application, so they may not provide season-long control. Combining a layer of paper mulch with another organic mulch over the top helps extend the length of weed control. Newspaper and black mulch paper are the two types of paper mulches most often used. The availability and low cost of old newspapers however, makes it the choice of growers using paper mulches. When selecting paper for mulching avoid bleached white paper and glossy colored papers because of possible toxic residues. If spreading mulch around perennial plants such as fruit trees, don't pile the mulch deeper than 3-4 inches. Deep mulch can serve as habitat for rodents. During the winter, high rodent populations will gnaw the bark off trees, sometimes girdling and killing the trees.

Synthetic mulches are primarily polyethylene (colored or clear plastic), but may include treated paper, wax-coated papers, and aluminum and steel foils. Black or opaque colored plastic is the most popular synthetic mulch for fresh market growers. Excellent weed control, conservation of soil moisture, increased soil temperature (if opaque), cleaner fruit, and increased yield of warm season crops such as melons, peppers and tomatoes are all benefits of polyethylene mulch. Black or opaque plastics, which exclude light, work better than clear plastics, which can allow weeds to germinate and grow beneath the plastic. Most synthetic mulches are tough and stay in place during the growing season. Plastic mulches also have many disadvantages including cost, no added organic matter to the soil, high labor in removing them by hand after the growing season, and disposal of the used plastic.

Opaque plastic provides excellent weed control, conserves moisture, increases soil temperature and can lead to increased yields

Living mulches are cover crops such as wheat, rye, or clover that are left in place between the rows to physically out-compete weeds. In addition to weed control, cover crops reduce soil erosion, provide habitat for beneficial insects and capture between row nutrients, which may otherwise have leached out of the system. *Cover crops* usually

require some mowing and management to limit their competition with the crop and prevent them from becoming weeds themselves. Because cover crops will use some nutrients and water, these inputs will need to be managed more aggressively in a cover crop system to ensure that crop plants are adequately supplied. *Green manures* are cover crops grown during a fallow period and incorporated prior to crop planting. Green manures help to limit weed growth during the fallow period and may provide some natural weed control after incorporation (called allelopathy). During decomposition, chemicals released from incorporated rye residue inhibit the growth of other plants nearby. Rye is well known for its allelopathic effects, however, little is known about its effects on the desired crop. It is believed that the greatest risk would be to small, direct-seeded crops such as carrots or lettuce. In addition, green manure crops may provide habitat for some soil borne insects and diseases. As with any pest management alternative, care must be taken to balance the potential benefits and disadvantages of green manure crops. See UWEX bulletin *Mulches for Home Gardens and Plantings* (A3383) for more details.

Living mulches are left between rows to out-compete weeds

Chemical Weed Management

Herbicides are a method of weed control used in many production systems. Organic producers and those not comfortable in using herbicides on their crops must rely solely on cultural and mechanical strategies. If your production system permits, herbicides can be a useful tool when combined with other weed management strategies. No single herbicide will control all weeds, nor is any one safe to use around all crops. Therefore herbicide use requires a great deal of additional information and management.

Herbicide labels contain all of the information needed to properly use that specific product. Weeds controlled, the crops it is registered for use on, directions for mixing, rates and application techniques permitted, required personal protection equipment, as well as human and environmental safety information can all be found on the label. All pesticides, including herbicides, must be used in accordance with labeled instructions. In Wisconsin, herbicides classified as restricted use pesticides by the EPA can only be applied by applicators certified by the Wisconsin Department of Agriculture,

Herbicides are a method of weed control used in many production systems

Trade and Consumer Protection. Always read the label and follow directions.

Herbicide applications are categorized as pre-plant incorporated, pre-emergent, or post-emergent. Pre-plant incorporated (PPI) applications are made to bare soil and then mechanically mixed into the upper soil surface prior to planting. Pre-emergence (PRE) applications are usually made after planting, but before the crop and weeds emerge. Both PPI and PRE applications target germinating weeds and need to be in place prior to weed germination. Post-emergence (POST) applications are made after the crop and/or weeds appear. POST applications may be either contact or systemic herbicides. Contact herbicides only kill the parts of the plant they contact. Uniform coverage is therefore important for effective weed control. Contact herbicides are most effective against annual weeds, since perennials will usually re-grow from underground structures. Systemic herbicides are translocated throughout the plant, killing all plant parts, making them much more effective even on perennial weeds. A good starting source of vegetable herbicide information available from any County Extension Office is publication A3422 - *Commercial Vegetable Production in Wisconsin*.

Biological Weed Management

Biological weed control refers to the use of natural enemies (insects or pathogens) to control weeds. Extreme care must be taken to ensure that the natural enemy has a high level of specificity for the weed and that it will not adversely affect any desired plants. This is often a difficult task since many crop and weedy species are very closely related. Although detecting and testing potential biological control agents is a slow, and time consuming project, the rewards of a control agent that leaves no residues, self-perpetuates, and seeks out their weedy host continues to drive this research. Unfortunately, there are very few examples of bio-controls used on weeds that are important in vegetable production systems.

Further considerations for fruit crops:

Because all fruit crops grown in Wisconsin are perennial, weed management is slightly different than for annual vegetable crops. Crop rotation in the short term is not possible. However, land should be rotated out of fruit crops or fallowed for two years prior to returning to the same site with the same crop. Longer intervals are better.

Physical weed control (tillage, hoeing, hand weeding) on the same area selects for perennial weeds over time.

Tree fruits

Tree fruits are most sensitive to grass weeds. No vegetation, especially grasses, should be allowed to grow within 24 inches of the tree trunk. Weed growth can be managed by shallow cultivation, mulching or with non-residual herbicides like glyphosate. If you use herbicides make sure the herbicide does not contact the trunk of the tree. Wrapping the trunk with aluminum foil or plastic wrap prior to spraying will protect the trunk.

Over time cultivation selects for perennial weeds. When cultivating make sure to cut the weeds off at or slightly below the soil surface. Don't just bend them over. Controlling perennial weeds by hand-pulling and cultivation is difficult and may take more than a year of constant vigilance.

Tree fruits are most sensitive to grass weeds

For more information about pest management (including weeds) see bulletins *Apple Pest Management for Home Gardeners* (A2179) and *Apricot, cherry, peach and plum Pest Management for Home Gardeners* (A2130).

Small fruits

Strawberries: Herbicides are not recommended for small strawberry plantings. If perennial weeds were controlled prior to planting, adequate weed control can be achieved through hand pulling and hoeing. Cultivating between the rows after harvest to narrow the rows will also serve to control weeds. When removing a winter mulch rake the straw between the rows to reduce mud and inhibit weed growth.

Raspberries: Some herbicides are registered for small-scale raspberry production. See bulletin *Raspberry Pest Management for Home Gardeners* (A2128) for more details. Tillage to keep rows narrow will help to control weed growth at the row exterior. Hand pulling is best for the row middles.

Grapes: Do not use any herbicide containing Dicamba or 2,4-D anywhere near grapes. Grapes are hypersensitive to these herbicides that cause the growth to be malformed and clusters to abort. Non-residual herbicides like glyphosate are registered for grapes. Again, take precautions to prevent glyphosate from contacting vine trunks. Keep vegetation at least 24 inches from the vine trunks. For more information see bulletin A2129 *Grape Pest Management for Home Gardeners*.

PUBLICATION 8017. Fresh-Market Tomato Production in California. MICHELLE LE STRANGE, University of California Cooperative Extension Farm Advisor, Tulare and Kings Counties; WAYNE L. SCHRADER, UCCE Farm Advisor, San Diego County; TIMOTHY K. HARTZ, Extension Vegetable Specialist, UC Davis.Â Fresh-market tomatoes have traditionally been grown on poles in Southern Californian coastal counties. This practice greatly increases total production costs but decreases unit costs.Â Integrated Pest Management for Tomatoes, Fourth Edition, publication 3274 Commercial Cooling of Fruits, Vegetables, and Flowers, publication 21567 Commercial Greenhouse Vegetable Handbook, publication 21575. Integrated Weed Management, Armidale, New South Wales. 131 likes Â· 4 talking about this. We're aiming to develop an integrated weed management strategy...Â Last week, Michael presented on behalf of the team on 'Integrated management options for nutgrass (Cyperus rotundus) in Australian vegetable production' as part of a nutgrass management on-farm discussion arranged by the National Vegetable Extension Network (Victoria) and hosted by Peter Schreurs & Sons. Part of this presentation focussed on the potential for clear or translucent plastic mulch films to manage nutgrass more effectively than black plastic mulches. Plastic mulch films are commonly used for certain high-value vegetable crops, particularly in northern production re