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HOMEOWNER'S Fruit and Nut SPRAY GUIDE

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Insects and diseases can cause problems in peaches, plums, nectarines and pecans. Homeowners who grow these fruit trees can more easily identify the problems and select the proper control methods if they are familiar with insect pests and diseases, their life cycles and the damage they cause.

Because such problems vary from one area of Texas to another and from one year to the next, it is important that you keep records of pest and disease occurrences. These records can help you make wise control decisions, such as on the timing of pesticide applications.

Plant diseases are most severe in periods of frequent rain or dew and mild temperatures (75 to 85 degrees F). Early-maturing peach varieties are more likely to be affected by brown rot than are late-maturing varieties; late varieties are often damaged more by peach scab.

Insect infestations are not as dependent on weather as are diseases. Insect populations can be monitored by using traps baited with pheromones.

Cultural practices

Healthy plants can survive some insect and disease damage better than can stressed plants. Trees grow best if you select adapted disease-resistant varieties, follow a well-balanced fertility program, and irrigate and prune as needed.

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It's important to clean up and dispose of plant residue to reduce the damage from peach scab, plum curculio, hickory shuckworm, and brown rot of peach. Diseased material that is properly composted can be recycled as mulch or organic material.

Pesticide options

Homeowners face a number of problems in buying chemical products to control diseases and insects. Some products have had their uses canceled or are not as available to homeowners as they once were, and the most effective ones are not always packaged in small quantities and may only be available in commercial-size packages.

If you buy commercial-size packages, the cost is high, the unused portion must be stored for a long time, and the label lists the rates in amounts per acre, which is difficult to convert when mixing a few gallons of spray material.

Another problem is that many products have limits on the number of times they can be applied per season. These limitations may require that you buy more than one chemical to achieve season-long control of diseases or insects.

In some cases, a commercial-size package is your only option. The number of larger packages was limited as much as possible in this guide, but that also limits the pesticide selection. To get a bigger selection, fruit hobbyists with more than a few trees should consider commercial-size packages. For homeowners with just a few trees, the best option may be the combination (insecticide + fungicide) products available at nursery and garden centers (see Table 4).

Disease-control products available in small packages are listed in Table 3. There are so many insect-control options that a complete listing is impractical here. When buying a pesticide, be certain that you will be using it for the purpose stated on the label.

Pecans

The spray guide for pecans is based primarily on insect biology and life cycles, because generally more pecan losses are from insects than dis-

ease. If you plant scab disease-resistant varieties, you may need to treat only for insects. Another reason to concentrate on insect control is the fact that pecan fungicides are available only in commercial-size packages. Apply zinc foliar sprays frequently at the beginning of the season.

Peaches and plums

The most important times to apply disease and insect control products are at petal fall, shuck split and preharvest. You can use combination products (insecticide and fungicide together) for early- and mid-season treatments, but most of them have harvest limitations that prevent application close to harvest, when brown rot control is critical.

Fire ant management

Fire ants can be a severe problem with pecan and small fruit production in both agriculture and urban areas. These ants can damage equipment such as electric motors and irrigation systems; their bites can interfere with harvest and cause medical problems.

Several insecticides are available for producers to use to manage fire ants. With the many possible application sites in an urban area, it is up to the individual to read the product labels for information on where they can be applied and at what rates.

When using baits either for individual mound treatment or as a broadcast application, follow these recommendations to improve bait effectiveness.

- Always use fresh bait. Avoid packages that have a rancid odor. Bait with a strong rancid odor are probably spoiled, and the ants will not be attracted to the bait.
- Store unused bait in cool dry place in a sealed container.
- Avoid applying baits if rain is expected in 12 hours.
- Before baiting a large area, conduct a prebait test by placing a small amount of bait in an area near mounds. Check the baited area after 1 hour to see if ants are gathering the bait. If they are not, conduct another prebait test in a few days.

For additional information on fire ants, see Texas Cooperative Extension publication B-6043, "Managing Imported Fire Ants in Urban Areas" or visit the Texas A&M fire ant web site at http://fireant.tamu.edu.

Pesticide safety

Before using any pesticide, carefully read all the instructions on the container. Follow instructions such as for wearing protective clothing during mixing or spraying. Take the necessary precautions when applying pesticides to avoid being exposed to chemicals.

Mix pesticides in a well-ventilated area or outdoors. Avoid chemical contact with your skin, and do not breathe chemical vapors.

Apply the pesticides at the proper rate. If you use less chemical than is prescribed, it may not control the pests well; if you use more than is recommended, you may damage the plant or leave too much residue on the fruit.

Store chemicals in a secure area away from pets and children. Prepare only the amount required for one application. Dispose of any unused, diluted sprays and empty pesticide containers properly. Store pesticides in their original containers.

The pesticides suggested in this guide are registered and labeled for use by the Environmental Protection Agency and the Texas Department of Agriculture. Regulations on pesticides are subject to change, and may have changed since this publication was printed. The USER is always responsible for the effects of pesticide residues on livestock and crops, as well as for problems caused when a pesticide drifts or moves to others' property. Always read and carefully follow the instructions on the container label.

For more information, contact your county Extension agent.

Table 1. Homeowner's spray guide for pecans

Timing	Pest	Pesticide	Rate/1 gal water[1]	Remarks
Dormant season (winter)	**Insects** Scale insects, mite eggs, phylloxera	97% oil emulsion	4 oz	Spray tree trunks and branches thoroughly. Apply only once, in late dormant but before budbreak. Agitate the spray mixture enough to prevent the oil and water from separating.
Budbreak (just as the buds begin to split and show green color) terminal bud growth should be 2 inches long.	**Nutritional** Rosette	Zinc sulfate WP or Zinc nitrate (NZN) liquid	2 tsp	Zinc sprays are essential for early-season pecan growth. Early, frequent applications work best. Elemental zinc is toxic to most plants except pecans and grapes; therefore, avoid drift. If drift is a possibility, do not use zinc sulfate near peaches, plums, nectarines, apricots or other zinc-sensitive plants. Do not use any zinc product at rates higher than the label stipulates, because it can burn the foliage. When applying more than one zinc spray in 2 weeks, reduce the rate by half. Never spray young bees that are not actively growing.

[1]Because the concentration of pesticides varies in different products, refer to the label for the specific rate per 1 gallon spray solution.

Pecans (continued)

Timing	Pest	Pesticide	Rate/1 gal water[1]	Remarks
Budbreak (continued)	**Insects** Phylloxera	Malathion Malathion 50% EC	2 Tbs	If dormant oil was not used, then treat trees where a history of phylloxera damage indicates a need for control.
	Diseases Scab and other foliage and nut diseases	Thiophanate-methyl (Topsin-M® 70% WP)[2] or	1/2 - 1 Tbs	Do not apply after shuck split.
		Fenbuconazole (Enable® 2F)[2]	1 1/2 tsp/10 gal	Do not apply after shuck split. Limit is 4 applications/season.
Prepollination (when leaves are one-third grown and before pollen is shed) mid-April	**Nutritional** Rosette	Same as for budbreak.		
	Diseases Scab and other foliage and nut diseases	Same as for budbreak.		
	Insects Fall webworm	*Bacillus thuringiensis* or	Refer to label.	Repeat sprays as pest problem recurs. Look for eggs on undersides of leaves.
		tebufenozide (Confirm T/O 2F) or	1/2 to 1 tsp	Do not apply within 14 days of harvest. **For more information, see Extension publication L-1811, "Fall Webworm."**
		Malathion (Malathion® 50% EC) or	2 tsp	
		Carbaryl (Sevin® liquid)	Refer to label.	
Pollination (when casebearer eggs appear on tips of nutlets) – May	**Nutritional** Rosette	Same as for budbreak		Using pecan nut casebearer traps will help you time the sprays. Apply sprays during egg hatch. **(Consult your county Extension agent for precise local timing or see Extension publication L-5134, "Controlling Pecan Nut Casebearer.")** For walnut caterpillar, look for eggs on the undersides of foliage. The absence of foliage also indicates walnut caterpillar damage. No webs are associated with walnut caterpillars. **For more information, see Extension publication L-1835, "Walnut Caterpillars."**
	Insects Pecan nut casebearer and walnut caterpillar	Same as for prepollination		
	Diseases Scab and other foliage and nut diseases	Same as for budbreak		

[1]Because the concentration of pesticides varies in different products, refer to the label for the specific rate per 1 gallon spray solution.

[2]Commercial-size package
WP - wettable powder
EC - emulsifiable concentrate
F - flowable
L - liquid

Pecans (continued)

Timing	Pest	Pesticide	Rate/1 gal water[1]	Remarks
Second-generation casebearer (42 days after first casebearer spray)	**Insects** Pecan nut casebearer	Same as for prepollination		Treat yellow aphids when an average of 25 per compound leaf are found or when excessive honey dew is produced. Repeated use of insecticides can result in strains of aphids that resist insecticides. This can increase losses. Treat black pecan aphids when three or more are found per compound leaf. This insect is common in late season.
	Aphids	Malathion (Malathion 50% EC) or Dimethoate (Cygon® EC)	2 tsp Refer to label.	
	Diseases Scab and other foliage and nut diseases	Same as for budbreak		
Cover sprays	**Diseases** Scab	Same as for budbreak		The number of cover sprays is based on weather conditions, variety and presence of scab fungus. Maintain spray applications as long as weather conditions favor disease development.
Water stage (when inside of the nut begins to fill with liquid) – mid to late July	**Diseases** Scab and other foliage and nut diseases	Thiophanate-methyl (Topsin-M® 70% WP)[2]	1/2 - 1 Tbs	Treat where there is a history of disease or when rainfall is prolonged.
Half-shell hardening – early to mid August	**Insects** Aphids	Same as for aphids listed above		Treat yellow aphids when they average 25 per compound leaf or when excessive honey dew is produced and aphid populations persist. Treat black pecan aphids when 3 or more are found per compound leaf. This insect is common in late season.
	Hickory shuckworm	Carbaryl (Sevin® liquid)	Refer to label.	
		or		
		tebufenozide (Confirm T/O 2F)	1/2 - 1 tsp	Do not apply within 14 days of harvest.
	Pecan weevil	Carbaryl (Sevin® liquid)	Refer to label.	Treat areas with a history of pecan weevil infestation. One to three treatments at 10- to 14-day intervals are needed for heavy weevil infestations. Make first application around August 20. For more information, see Extension publication L-5362 "Controlling the Pecan Weevil."
	Diseases Scab and other foliage and nut diseases.	Same as for budbreak		

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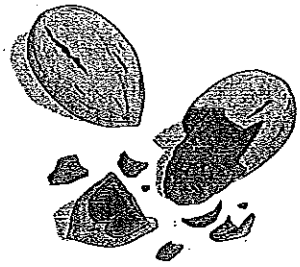

Table 2. Homeowner's spray guide for peaches and plums

Timing	Pest	Pesticide	Rate/1 gal water[1]	Remarks
Dormant season	**Insects** Scale insects	97% dormant oil	4 oz	Apply when temperature is between 40 and 70 degrees F. Apply only if scales are observed. Repeat applications in 2-3 weeks. Agitate the spray mixtures enough to prevent the oil and water from separating.
Late dormant	**Diseases** Peach leaf curl	Copper fungicide or Chlorothalonil (see listing of products, Table 3)	Refer to label for specific rate	Apply if there is a history of leaf curl.
Petal-fall (when flower petals begin to fall) 5 days after bloom (combination products are an option – see Table 4).	**Insects** Plum curculio	Malathion (Malathion 50% EC) or Carbaryl (Sevin® liquid) or Permethrin 2.5% EC	2 tsp Refer to label 2 oz	Apply when 75 percent of petals have fallen, and there is a history of insect damage.
	Peach twig borer	Permethrin 2.5% EC	2 oz	
	Lesser peach tree borer	Permethrin 2.5% EC	2 oz	
	Diseases Scab	Captan or Chlorothalonil or Sulfur (see listing of products, Table 3) or Thiophanate-methyl (Topsin-M® 70% WP)2	 1-2 Tbs	Treat where there is a history of disease problems.
Shuck split (when the calyx separates from base of newly formed fruit) 14 days after bloom. (Combination products are an option – see Table 4).	**Insects** Catfacing insects, plum curculio	Same insecticides as for petal fall.		Treat where there is a history of catfacing insects and/or plum curculio.
	Diseases Scab	Same fungicide selection as at petal fall.		

[1]Because the concentration of pesticides varies in different products, refer to the label for the specific rate per 1 gallon spray solution.

[2]Commercial-size package

WP - wettable powder

EC - emulsifiable concentrate

F - flowable

L - liquid

Peaches and plums (continued)				
Timing	**Pest**	**Pesticide**	**Rate/1 gal water[1]**	**Remarks**
Cover sprays (repeat at 14-day intervals) (Combination products are an option – see Table 4.)	**Insects** Catfacing insects, plum curculio	Same as for petal fall.		
	Diseases Scab	Captan or Sulfur (see Table 3)		
Pre-harvest (for early-maturing varieties and during periods of frequent rain or dew-spray 3 weeks, 2 weeks and 3 days before picking; for mid- to late-maturing varieties-spray at 2 weeks and at 3 days before picking) (Combination products are an option if applied within preharvest interval (PHI) – see Table 4.)	**Insects** June beetles and wasps	Carbaryl (Sevin® liquid)	Refer to label.	Do not apply within 3 days of harvest. June beetles and wasps are attracted to and feed on ripe fruit. Treat only if insects are present.
	Diseases Brown rot	Thiophanate-methyl (Topsin M® 70% WP)[2] or Captan (see Table 3) or Myclobutanil (see Table 3)	1-2 Tbs 1/2 fl oz	Do not apply within 1 day of harvest. May be applied up to day of harvest.
Post harvest – mid to late August	**Insects** Peach tree borer			For best results, treat for borers after Sept. 1. Sprays should be applied to the trunk of the tree.
		Permethrin 2.5% EC or Endosulfan (Thiodan® 9.7% EC)	2 oz 2 Tbs	Do not apply within 7 days of harvest. Use 2 applications, 3-4 weeks apart.
	Diseases Peach rust	Chlorothalonil (See listing of products, Table 3).	Refer to label	Begin applications at first sign of rust in the summer and continue at 2- to 3-week intervals until early October. Rust is a problem in counties south of a line from Houston to Hallettsville and Rio Grande City.

[1]Because the concentration of pesticides varies in different products, refer to the label for the specific rate per 1 gallon spray solution.

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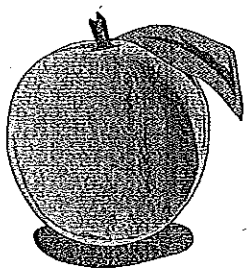


Table 3. Products available in small packages for disease control on peaches and plums

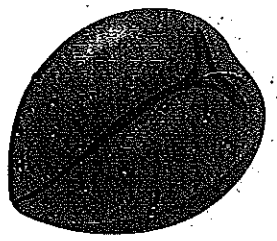
Pesticide	Trade name	Brand name	Rate/gal.	PHI*/Remarks
Captan	Captan Fungicide (50% WP)	Hi-Yield	2 Tbs	0. Not cleared on plums.
	Captan Fruit & Ornamental (50% WP)	Bonide	2 Tbs	0. Not cleared on plums.
Chlorothalonil	Multi-Purpose Fungicide - Daconil (29.6%)	Ortho	2 1/4 tsp	Do not apply after shuck-split.
	Fung-onil Concentrate (29.6%)	Bonide	3 Tbs/4 gal	Do not apply after shuck-split.
	Bravado Fungicide (29.6%)	Monterey	3 Tbs/4 gal	Do not apply after shuck-split.
(Copper fungicides)				
Copper ammonium complex	Liqui-Cop (8%)	Monterey	2-4 Tbs	Do not apply after full bloom. Not cleared on plums.
Copper sulfate	Bordeaux Mix Fungicide	Hi-Yield	8-9 Tbs	Do not apply after pink bud. Not cleared on plums.
	Bordeaux Fungicide	Dexol	8-9 Tbs	Do not apply after pink bud. Not cleared on plums.
Copper hydroxide	Copper Fungicide	Hi-Yield	1/3 - 5 1/3 tsp	Peaches: 3 wks; plums: do not apply after white bud.
Myclobutanil	Immunox Multi-Purpose Fungicide (1.55%)	Spectracide	1/2 fl oz	0
Sulfur	All major companies market a sulfur product			0

*PHI = Pre-harvest interval, the minimum number of days before harvest that product can be used.

Table 4. Combination products for disease and insect control on peaches and plums

Pesticide	Trade name	Brand name	Rate/gal.	PHI*/Remarks
Captan 10% + malathion 7.5%	Fruit Tree Spray	Ferti-Lome	3 1/2 Tbs	Peaches – 7 Plums – 3
Captan 12% + malathion 6% +	Liquid Fruit Tree Spray	Dexol	2 1/2 Tbs	21 – not cleared for use on plums
methoxyclor 12% + carbaryl 0.3%	Fruit Tree Spray	Bonide	2 1/2 Tbs	21 – not cleared for use on plums
Captan 12% + malathion 6% + carbaryl 0.3%	Rescue	Martin's	2 1/2 Tbs	21 – not cleared for use on plums

*PHI = Pre-harvest interval, the minimum number of days before harvest that product can be used.



Organic disease management

Some fungicides and insecticides are made of naturally occurring ingredients and are considered acceptable for organic gardening. For allowed products, refer to the Texas Department of Agriculture Organic Certification Program Materials List (TDA publication Q694A).

Peaches, plums, nectarines and apricots: Use sulfur fungicides throughout the spray program. Make applications at the shortest interval allowed. Shortened intervals are important during the late bloom, shuck split and first cover period and again during the preharvest period. These are periods when fruit diseases are the most damaging.

Pecans: Copper sulfate is considered an organic fungicide, and some formulations are approved for use on pecans to control pecan scab and other foliage diseases. Copper sulfate is highly toxic to fruit trees such as peaches, plums, apricots and nectarines and to some ornamental plants. Be careful when using this product near sensitive plants if there is a possibility of drift.

General considerations: For infection to occur, most plant diseases require that the leaf, fruit or nut remain wet for a certain period. The following precautions reduce the length of time the plant is wet after dew or rainfall:

- Prune the trees to allow sunlight to penetrate the leaf canopy.
- Space the trees to allow for air circulation.
- Plant the trees in an area that will receive early-morning sun and where air circulation is not blocked by buildings or other plants.
- Avoid wetting trees during irrigation.

Select varieties that are naturally resistant to the major diseases of your area. Resistance does not mean that the plants are immune to infections. Fungicide applications are usually more effective on plants with some resistance.

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Revised

POND MEASUREMENT
DETERMINING AREA IN ACRES, VOLUME IN ACRE-FEET AND AVERAGE DEPTH

Billy Higginbotham, Professor and Extension Wildlife & Fisheries Specialist,
Texas AgriLife Extension Service

1 *Square or Rectangular Pond*

FORMULA: Area = Length x Width

> Example: Pond is 200' x 350' = 70,000 square feet
> 70,000 ÷ 43,560 = 1.6 surface acres
> Average depth = 3.2 feet
>
> 1.6 acres x 3.2 feet = 5.1 acre feet of water

2 *Triangular Pond*

FORMULA: Area = ½ x Base x Height

Hint: **Base** = shoreline length along the dam and **Height** = distance from centerpoint of shoreline along dam to the upper end of pond

> Example: Pond averages 4.2 feet and is 200' along the dam and 500' to upper end from dam
>
> ½ (200' x 500') = 50,000 ÷ 43,560 = 1.1 surface acres
> 1.1 surface acres x 4.2 feet = 4.6 acre-feet of water

- 1 surface acre contains 43,560 square feet of surface area
- 1 acre-foot of water contains 43,560 cubic feet of water or 326,000 gallons of water

(continued on other side...)

3 *Circular Pond*

FORMULA: Area = 3.14 x $(\text{Radius})^2$

nt: **Radius** is ½ of the pond's diameter

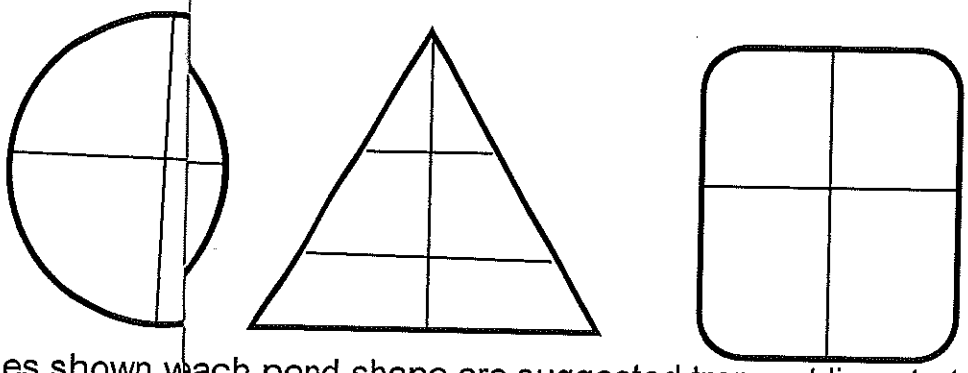
Exampond averages 3.9 feet deep and is 150' cross the middle (diameter)

$3.14 \times (75')^2 \div 43{,}560$

62.5 ÷ 43,560 = 0.41 surface acres

41 acres x 3.9 feet = 1.6 acre-feet

CALLATING AVERAGE DEPTH



The lines shown each pond shape are suggested transect lines to take depth soundings along.

FORMULA: n of All Soundings ÷ No. of Soundings

Hint: Measure in feet using a calibrated rope and anchor or pole marked in feet. Begin ransect at the bank with a zero and end on the far bank with zero. The transects and the more soundings taken along each transect, the more accur ur depth estimate will be!

Example: r pond has depths (in feet) of 0, 3, 3, 6, 7, 4, 2, 0 for ct 1 and 0, 3, 6, 6, 4, 4, 1, 0 for Transect 2.

49 ÷16 = 3.1 feet

Average depth of pond is 3.1 feet

My Fish Are Dying!

Billy Higginbotham
Professor and Extension Wildlife and Fisheries Specialist
Texas AgriLife Extension Service

Fisheries biologists and county Extension Agents will hear these words countless times throughout the year, especially during the summer months. As a general rule, small ponds intensively managed for catfish are the most susceptible to die-off problems. How do you determine the cause? In most cases, asking the right questions will lead you to the cause or causes. Here are the questions I ask and the assessments made based on answers received to help a frantic pondowner:

1) ***How many different species are dying?*** What you are trying to determine with this question is that if more than one species of fish is dying, you probably are faced with a water quality problem (i.e., oxygen, ammonia, nitrites). If only one species of several species present are dying, it *may* be a disease/parasite problem, but not always because different species may have different tolerance levels for water quality parameters. If only one species of fish is in the pond and a die-off is occurring, you need more information.

2) ***Have any pesticides been used recently that were introduced into the pond?*** This could include pasture insecticides washing into ponds or even cattle that were treated with an insecticide standing in the pond to escape the summer heat. Some herbicides washing into a pond may also lead to untimely vegetation die-offs.

3) ***How big is the pond?*** The pondowner usually thinks the pond is 2x to 3x larger than it really is! Walk them through the process of estimating surface area in acres by dividing square footage by 43,560. Remember, excessive depth *does not* make up for lack of surface area when it comes to fish production!

4) ***How many pounds of fish are present?*** Once you know the surface acreage, try to determine the pounds of fish present by asking: (1) ***for an estimate of fish stocked*** (minus those caught out) and (2) ***the average weight of the fish present.*** This will help you estimate the total poundage of fish present.

STOP RIGHT HERE — if the total pounds of fish exceed 1,000 pounds per surface acre (that's only 100 pounds in a 0.10 acre pond), you are probably dealing with an oxygen depletion. This accounts for about 85% of all fish die-offs in Texas farm ponds!!!

When the fish standing crop exceeds the 1,000 lbs/acre carrying capacity during the hot months, the stage is set for a die-off. Why the summer months? Because warm water cannot hold as much oxygen as cool water, yet the fish need more because their metabolism (and therefore their oxygen requirements) increases as water temperature increases. A farm pond that could easily carry 2,000 to 3,000 pounds of fish per surface acre through the winter months won't stand a chance once the dog days of summer arrive. Remember, oxygen is usually lowest right at

daylight, so that's a good time to check and see if fish are swimming at or near the surface. In many cases, the larger fish will be the first to exhibit signs of oxygen stress. Now that the "hammer is cocked", additional events that could "pull the trigger" and further contribute to an oxygen depletion include:

1) A couple of hot, still, cloudy days in succession that reduce photosynthesis and therefore oxygen production,

2) Aquatic herbicide treatments in hot weather that kill too much vegetation in too short a period of time resulting in an oxygen debt and,

3) Overfeeding/overfertilization resulting in nutrient decomposition or phytoplankton die-off.

So, how do you correct for low oxygen?

1) Reduce the fish load present to well below 1,000 lbs of fish/acre,

2) Aerate by backing a boat on a trailer into the pond and running the motor in a fixed position to circulate the water and increase oxygen,

3) Add fresh well water, but aerate it well before it enters the pond, and

4) Circulate water with a pump, but set the intake near the pond surface (pumping water off the pond bottom and spraying it back over the surface only compounds the problem!).

Other Common Water Quality Problems

Ammonia can also kill fish and can occur in ponds with heavy loads of fish (near or over 1,000 lbs/acre). Heavy fertilization in the watershed followed by run-off rains washing into the ponds can cause toxic levels of ammonia. This includes chicken litter. Ammonia becomes more toxic as pH and temperature increase. A water test is required to determine if ammonia is present. The only cure is to add fresh water, remove dead water from the bottom and reduce the load of fish present.

Nitrites are converted from un-ionized ammonia by the Nitrosomonas bacteria. Nitrites can cause brown blood disease, so called because the fish affected have chocolate colored blood. If nitrite poisoning is suspected, cut open an affected fish and observe the blood color—instead of the normal bright red color, the blood appears dark or brownish. Nitrites bind to the blood's hemoglobin and form methhemaglobin, which is ineffective at removing oxygen from the water - resulting in the fish's inability to breathe. The fish exhibit the same signs as when an oxygen depletion occur by swimming lethargically at the surface—but this may be observed even during mid-day when oxygen production should have improved. Ponds suffering from nitrite poisoning are usually heavily fed catfish ponds, and nitrites usually don't show up until late summer or early fall. Heavy pasture fertilization with run-off into a pond can also cause elevated levels of

nitrites. Nitrites can be "neutralized" by adding stock salt. The amount to add varies with the level of nitrites but typically 200 pounds per surface acre is sufficient to adequately increase the chloride levels in most ponds and negate the impacts of nitrites. However, blanket recommendations of "adding salt to the pond," without the benefit of a water test tends to give pondowners a false sense of security. If possible, remove some bottom water from the pond to reduce organic loads.

Diseases/Parasites

So, what if it's not a water quality problem killing my fish?

Well, then your pondowner is in the vast minority. Even many disease problems are triggered by stress brought on by poor water quality. Diseases and parasites normally only affect one species, even if there are many species present. Proper identification is a must, but typically the most common diseases are:

Fatal – Common Parasites/Diseases

1) Ich - typically occurs when water temperatures are below 70-75° F. Fish may have tiny white pimples covering the surface of the skin - only a problem between November and March. Consult a specialist for verification and control options.

2) Bacterial Disease - occurs during periods of transition (summer to fall or winter to spring) when water temperatures are changing or any time fish may be subject to stress. Fish may have eroded fins, irregularly shaped discolored areas on their backs and sides or even eroded holes in their heads or backs. Consult a specialist for verification and control options.

Non-Fatal – Common Parasites/Diseases:

1) Grubs - Once fishing season arrives, anglers catch a few fish and during cleaning (normally filleting) notice white, yellow or black "worms" encysted in the skin or flesh. These grubs have an interesting yet complex life cycle involving fish, snails and wading birds, but seldom kill fish by themselves. Breaking the cycle can be difficult, although some pondowners achieve success by controlling plants (food for snails), or stocking redear sunfish (feeds on snails).

2) Contracaecum - This roundworm looks like a watch spring and is often found attached to the mesentery outside various internal organs. It's more of a curiosity to anglers cleaning fish than anything else.

For more detailed information on diseases/parasites, consult a copy of the "Inland Aquaculture Handbook" issued to each county office. You can also refer pondowners to the TVMDL at the TAMU-Vet School by calling 1-888-646-5623. They no longer offer fish disease services to

pondowners but they can provide a list of alternate aquatic disease laboratories. As always, you can also contact one of the Extension Fisheries specialists for advice.

Hope this helps as we are entering what appears to be a pretty good summer season of fish losses.

Table 1. Treatment Response of Common Aquatic Plants to Registered Herbicides and Grass Carp

Aquatic Group & vegetation	Aquatic Herbicide[1]														Grass Carp[9]
	bispyribac	copper & copper complexes - ~~algicides~~ copper complexes - herbicides		diquat	endothall	fluridone	flumioxazin	glyphosate	imazamox	imazapyr	penoxsulam	sodium carbonate peroxy-hydrate	triclopyr	2,4-D	
Algae															
Chara/Nitella	P	**E**		P	**G**[2]-P[3]	P	P	P						P	**G**
filamentous		**E**		**G**	**G**[2]-P[3]	P	**G**	P				**G**[6]		P	F
planktonic		**E**		P	**G**[2]	P	F	P				**G**[6]		P	
Floating Plants															
azolla		P		**G**		**E**		F			**E**			F	
duckweeds		P		**G**	P	**E**	**E**	P		P	**E**			F	F
salvinia	F	P		**G**		**E**	**G**	**G**	**E**		**E**			**G**	P
water hyacinth	**E**	P	**G**[4]	**E**		**E**	P	**G**	**E**	**E**	**E**		**E**	**E**	P
watermeal	F	P		F		**G**	**E**				**G**			F	P
water lettuce	**E**	P	**G**[4]	**E**		**G**	**E**	**G**		**E**	**E**		**G**	F	
Submerged plants															
coontail	P	P	**G**[4]	**E**	**E**	**E**	**G**							**G**	F-G
elodea		P	**G**[4]	**E**	F	**E**	**E**				**G**				**E**
fanwort		P	P	**G**	F	**E**	**G**				**G**			F	F
hydrilla	**E**	P	**G**[4]	**G**	**G**	**E**	**G**		**G**		**E**				**E**
milfoils	**G**	P	**G**[4]	**E**	**E**	**G**	**G**		**G**		**E**		**E**	**E**	F
naiads		P	**G**[4]	**E**	**E**	**E**	**E**				**G**			F	**E**
parrotfeather		P	P	**E**	**E**	**E**	**G**		**G**	**G**[5]	**G**		**G**	**E**	**G**
pondweeds	**G**	P	**G**[4]	**G**	**E**	**E**	**G**		**E**	**G**[5]	**G**			P	**E**

[1] E = Excellent control, G = Good control, F = Fair control, P = Poor control, blank = indicates unknown or no response
[2] Hydrothol formulations
[3] Aquathol formulations
[4] specific copper complexes only - e.g. Nautique, Komeen (see label).
[5] spray only emergent portion
[6] best on blue-green algae (higher concentrations for green algae)
[7] E for sedge
[8] F for rush
[9] Permit required from Texas Parks and Wildlife Department

Aquatic Group & vegetation	bispyribac	copper & copper complexes - algaecides	copper complexes - herbicides	diquat	endothall	floridone	flumioxazin	glyphosate	imazamox	imazapyr	penoxsulam	sodium carbonate peroxy-hydrate	triclopyr	2,4-D	Grass Carp
	Aquatic Herbicide[1]														
Emergent Plants															
alders		P		F	P	P		**E**		**E**			**E**	**E**	
alligatorweed	**E**			P		F	**G**	**G**	**G**	**E**			**E**	F	
arrowhead	**E**	P		**G**	**G**	**E**	**G**	**E**	**E**	**E**				**E**	
buttonbrush		P		F	P	P		**G**		**G**				F	
cattails	P	P		**G**	P	F	P	**E**	**E**	**E**				F	
common reed		P		F		F	P	**E**	**G**	**E**				F	
frogbit	**E**		F[4]	**E**			**G**	F	**E**	**E**			**E**	**E**	
pickerelweed	F		F[4]	**G**		P	P	F	**E**	**E**			**G**	**G**	
sedges & rushes	F	P		F		P	F	**G**		**E**[7] F[8]	**G**			F	
slender spikerush		P		**G**		**G**	P	P		F					
smartweed	**G**	P	F[4]	F		F	P	**E**	**E**	**E**	**G**		**E**	**E**	
southern watergrass		P				**G**		**E**		**E**				P	
waterlilies	F	P		P		**E**	F	**G**	**G**	**G**	**G**		**G**	**E**	
water pennywort	**G**	P		**G**		P	**G**	**G**		**E**	**G**		**E**	**G**	
water primrose		P		F	P	F	**G**	**E**	**E**	**E**			**E**	**E**	
watershield		P		P		**G**	**G**	**G**	**G**	**E**				**E**	
willows	P	P		F	P	P	P	**E**		**E**			**E**	**E**	

Active Ingredients	Commonly Available Trade Names
bispyribac	Tradewind
copper	Copper Sulfate, Cutrine, Cutrine Plus, K-Tea, Komeen, Captain, Algae Pro, Agritec, Cleargate, Nautique
diquat	Reward, Weedtrine D
endothall	Aquathol K, Aquathol Super K, Hydrothol 191
flumioxazin	Clipper
fluridone	Sonar, Avast, WhiteCap SC
glyphosate	Rodeo, Aquamaster, AquaNeat, Eraser AQ, Refuge®, and others
imazamox	Clearcast
imazapyr	Habitat (for use by licenced aquatic applicators only)
penoxsulam	Galleon
sodium carbonate peroxyhydrate	Green Clean, PAK 27, Phycomycin
triclopyr	Renovate
2,4-D	Navigate, Weedar 64

Table 2. Aquatic Vegetation Herbicide Control Water Use Restriction[1] (number of days after treatment before use in private waters only)

	Human Use				Livestock	Irrigation		
Common Name	**Drinking**	**Swimming**		**Fish**	**Watering**	**Turf**		**Crops**
bispyribac	0	0		0	0	30		30
copper complexes	0	0		0	0	0		0
diquat	1-3[3]	0		0	1	1-3[3]		5
endothall[4]	7-25	1		0	7-25	7-25		7-25
flumioxazin	0	0		0	0	5		5
fluridone[6]	0	0		0	0	7-30		7-30
glyphosate[5]	0	0		0	0	0		0
imazamox	0	0		0	0	1		1[10]
imazapyr	*[14]	0		0	0	120[9]		120[9]
penoxsulam	0	0		0	0	0		*[15]
SCP[11]	0	0		0	0	0		0
triclopyr	*[13]	0		0	0	0[7]		120[8]
2,4-D	*[12]	*[12]		*[12]	*[12]	*[12]		*[12]

[1] Aquatic vegetation control can result in period of low dissolved oxygen which can stress and/or kill fish. It is best to treat most aquatic vegetation early in the growing season, when the plant is rapidly growing. Treating small areas (e.g. 1/4) of pond at a time at 10-14 day intervals will allow for decomposition usually without causing an oxygen depletion.

[2] If water is for drinking, the elemental copper concentration should not exceed 1.0 ppm (i.e. 4.0 pp. copper sulfate).
[3] Depending on formulation - **Read label.**
[4] Length of use restriction for endothall varies with concentration used. **Read label.**
[5] Do not apply within 0.5 mile of a functioning potable water intake.
[6] Do not apply within 0.25 mile of a functioning potable water intake.
[7] No restriction on irrigating established grasses but **do not harvest hay for 14 days after application. Read label.**
[8] Or until non-detectable concetrations in immunoassay analysis.
[9] or until <1.0 ppb
[10] Do not use treated water to irrigate greenhouses, nurseries or hydroponics.
[11] Sodium carbonate peroxy-hydrate
[12] Water restrictions on 2,4-D vary with formulation, location, rate, and time of year. **Read label.**
[13] Minimum setback distances from potable water intakes required and laboratory tests to determine < 0.4 ppm for use. **Read label.**
[14] > 1/2 mile from potable water intake
[15] Do not use water from any treated site for food crop irrication until residues are determined to be less than or equal to 1 ppb.

Additional information is available through the following references and websites

Aquatic Vegetation Identification Card Deck $12.00 includes postage. Produced by Dr. Michael P. Masser - Publication Number B6095

Contact - Distribution and Supply, Texas A&M University
P.O. Box 1209, Bryan, TX 77806
979/845-6573

Texas AgriLife Extension Bookstore
agrilifebookstore.org

Web Sites - <aquaplant.tamu.edu> <srac.tamu.edu> <wildlife.tamu.edu>