

Livestock

Beef Cattle Pests

Sergio Arispe

Latest revision—March 2020

In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

Notes:

1. Materials suggested for use on dairy animals may also be used on beef animals.
2. Some of the products suggested for insect control are registered as drugs, not insecticides, and are regulated by the FDA.
3. For an overview of methods used to control flies and parasites in beef cattle, see <https://s3.wp.wsu.edu/uploads/sites/2049/2017/01/cattle-survey-2006.pdf>
4. **Note:** Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

Beef cattle—Cattle grub

Common cattle grub (heel fly) (*Hypoderma lineatum*)
Northern cattle grub (*Hypoderma bovis*)

Biology Typically, the life cycle of a cattle grub spans about a year, with most of that time spent as a larva migrating inside the animal's body. To avoid adverse host-parasite reactions, cattle should be treated either before or after grubs migrate through the body. The best time to treat is as soon as the heel fly (adult stage) season is over. In practical terms, treatment for grubs may be accomplished at the same time as fall treatment for internal parasites but no later than November 30 to prevent a toxic reaction from dead/dying grubs that have migrated to vital regions such as the esophagus or spinal canal.

Management—chemical control (all drugs)

- ◆ doramectin pour-on (Dectomax)—Apply at 1 ml/10 kg (22 lb) body weight. Apply along the midline of the back in a narrow strip between the shoulders and tailhead. Do not slaughter within 45 days of treatment.
- ◆ doramectin subcutaneous injection (Dectomax)—Apply at 1 ml/50 kg (110 lb) body weight. Inject under loose skin in front of or behind shoulder. Do not slaughter within 35 days of treatment.
- ◆ eprinomectin pour-on (Eprinomectin)—Apply at 1 ml/10 kg (22 lb) body weight. Apply along midline of back. No slaughter interval, no required milk discard time.
- ◆ eprinomectin subcutaneous injection (LongRange)—Apply at 1 ml/50 kg (110 lb) body weight. Inject under the loose skin in front of the shoulder. Do not slaughter within 48 days of the last treatment.
- ◆ ivermectin pour-on (Ivomec, Phoenectin, Noromectin)—Apply at 1 ml/10 kg (22 lb) of body weight. Apply along the midline of the back in a narrow strip between the shoulders and tailhead. Do not slaughter within 48 days of treatment.
- ◆ ivermectin subcutaneous injection (Ivomec)—Apply at 1 ml/50 kg (110 lb) of body weight. Inject under loose skin in front of or

behind shoulder. Do not slaughter within 35 days of treatment.

- ◆ moxidectin pour-on (Cydectin)—Apply at 1 ml/10 kg (22 lb) body weight. Apply along the midline of the back in a narrow strip between the shoulders and tailhead. No slaughter interval, no required milk discard time.
- ◆ moxidectin subcutaneous injection (Cydectin)—Apply at 1 ml/50 kg (110 lb) body weight. Do not overdose. Inject under loose skin in front of or behind shoulder. Do not slaughter within 21 days of treatment.
- ◆ tetrachlorvinphos (Rabon RTU 3%)—After grubs have encysted apply 3 to 4 oz down the backline and rub in thoroughly taking care to get the dust into the warble.

Beef cattle—Face fly

Musca autumnalis

Biology Face flies feed on the secretions of the eyes and nose for short periods of time; only a small percentage of the local face fly population may be found on animals at any one time. These aspects of its life history make management of face fly a very difficult task. Hence, many of the products labeled for efficacious horn fly control indicate that they merely aid in face fly control.

Management—chemical control

Ear tags

- ◆ beta-cyfluthrin/piperonyl butoxide ear tag (CyLence Ultra)—One tag to each ear of all animals older than 3 months when flies appear. Remove tags at end of fly season or before slaughter.
- ◆ diazinon/coumaphos ear tag (Corathon)—One tag to each ear on all mature animals when flies appear. One ear tag per calf. Remove tags at end of fly season or before slaughter.
- ◆ lambda-cyhalothrin/piperonyl butoxide ear tag (Saber Extra)—One tag to each ear on all animals when flies appear in spring. Remove tags in fall or before slaughter.
- ◆ lambda-cyhalothrin/pirimiphos-methyl ear tag (Double Barrel VP; Dominator)—One tag to each ear on all animals in herd when flies appear in spring. Remove tag in fall.
- ◆ permethrin ear tag (GardStar Plus)—One tag per ear on all animals when flies first appear in spring. Remove before slaughter.
- ◆ zeta-cypermethrin/piperonyl butoxide ear tag (PYthon MagnuM; Saber Extra)—Use two tags per head, one per ear, of all mature and weaned animals when flies appear in spring. Remove tag at the end of fly season or before slaughter.

Pour-ons, sprays

- ◆ cyfluthrin pour-on (CyLence)—See label for dosing instructions. Pour along the top of the back and top of the head. Repeat as needed but no more than once every 3 weeks.
- ◆ ddvp concentrated spray (Vapona)—Dilute 1 gal in 50 gal water (1% solution) and apply up to 2 fl oz of solution per animal as a fine mist spray. Do not wet hide. Do not treat Brahman animals or calves under 6 months of age. One day withdrawal. Restricted Use Pesticide.
- ◆ permethrin/piperonyl butoxide pour on (Ultra Boss) at 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Treat once every 2 weeks as needed.
- ◆ permethrin spray (Gardstar 40% EC)—Apply at 30 to 118 ml (1 to 4 fl oz) per 25 gal water (0.013 to 0.05% ai). 1 to 2 quart high pressure spray over body of animal. For low-pressure spray, apply at 118 ml (4 fl oz) to 2.5 gal water, spray till wet but not to runoff.
- ◆ tetrachlorvinphos/ddvp (Ravap)—Mix 1 gal in 75 gal water. Apply as coarse spray, 0.5 to 1 gal spray per animal. Do not treat Brahman cattle or calves under 6 months of age. Do not treat more often than once every 10 days.

Dusts, backrubbers

- ◆ coumaphos EC (Co-Ral Emulsifiable)—Apply at 9.75 fl oz per

gal of No. 2 diesel or fuel oil. Place backrubber where animals congregate.

- ◆ permethrin backrubber or self-oiler (Gardstar 40% EC) at 118 ml (4 fl oz) to 10 gal diesel or mineral oil. Keep rubbing device charged. Results improve with forced daily use.
- ◆ permethrin dust (several brands, 0.25%)—Suspend bags where cattle congregate. Place bags so they hang 4 to 6 inches below animal's backline. Direct applications of 2 oz per animal may be repeated as needed.
- ◆ zeta-cypermethrin/piperonyl butoxide dust (PYthon)—Apply in dust bag, shaker, dusting glove, or mechanical duster. Suspend bags where cattle congregate. Place bags so they hang 4 to 6 inches below animal's backline. Direct applications of 2 oz per animal may be repeated as needed but not more often than once every 3 days.

Feed supplements

- ◆ diflubenzuron feed supplement (Clarify 0.04%)—Prevents development of immature forms in manure of treated animals. For confined beef cattle, mix into grain according to label to provide 0.1 mg ai/kg (4.55 mg/100 lb) body weight/day. Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity. For pastured beef, place in feeders close to water sources and/or resting areas. Allow free choice to cattle. Cattle should consume an average of 0.4 ounces of this product per 100 lb of animal body weight per day, which is equivalent to 4 ounces per day for a 1,000 lb animal.
- ◆ diflubenzuron add-pack for milk (Clarify Add-Pack)—Prevents development of immature forms in manure of treated calves. Mix daily into milk/milk replacer according to label to provide 0.1 mg ai/kg (4.55 mg/100 lb) body weight/day. Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity.
- ◆ tetrachlorvinphos mineral block (Sweetlix Rabon)—For control of fecal flies in manure of treated animals. Feed free choice, 1 block for 5 head of cattle. Consult veterinarian before using this product with pregnant or lactating animals. See label for details.

Beef cattle—Horn fly

Haematobia irritans

Biology The horn fly was introduced into the United States during the 1800s and it spread rapidly across North America. Females lay eggs in fresh cattle manure, which is where immature forms complete development. During warm weather the life cycle of a horn fly is 10–20 days; there are many generations of flies each year. The first flies appear in June or earlier; flies disappear with hard frosts in fall. Both sexes suck blood from cattle and other animals. If enough flies are present, this can lead to reduced weight gains or milk production of cattle. However, cattle can tolerate a low density of horn flies without measurable losses. The generally agreed upon economic threshold is 200 horn flies per animal.

Management—chemical control

Ear tags

- ◆ abamectin ear tag (XP 820)—Apply to all animals in herd when flies become a problem in spring. One or two tags/animal. Remove tags at end of fly season or before slaughter.
- ◆ beta-cyfluthrin/piperonyl butoxide ear tag (Cylence Ultra)—One tag to each ear of all animals older than 3 months when flies appear. Remove tags at end of fly season or before slaughter.
- ◆ diazinon ear tag (Patriot, OPTimizer)—One tag to each ear of all animals older than 3 months. Remove before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—One tag to each ear of all animals older than 3 months when flies appear. Remove before slaughter.
- ◆ diazinon/coumaphos ear tag (Corathon)—One tag to each ear on all mature animals when flies appear. One ear tag per calf. Remove

tags at end of fly season or before slaughter.

- ◆ lambda-cyhalothrin ear tag (Saber Extra)—One tag to each ear on all animals when flies appear in spring. Remove tags in fall or before slaughter.
- ◆ lambda-cyhalothrin (6.8%)/pirimiphos-methyl (14%) ear tag (Double Barrel VP)—One tag to each ear on all animals in herd when flies appear in spring. Remove tag in fall.
- ◆ permethrin ear tag (GardStar plus)—One tag per ear on all animals when flies first appear in spring. Remove before slaughter.
- ◆ pirimiphos-methyl ear tag (Dominator)—One tag per ear on all animals when flies first appear in spring. Remove tags in fall.
- ◆ zeta-cypermethrin/piperonyl butoxide ear tag (PYthon MagnuM)—One tag per head of all mature and weaned animals when flies appear in spring. Remove tag at the end of fly season or before slaughter.

Pour-ons, sprays

- ◆ ddvp concentrated spray (Vapona)—Dilute 1 gal in 50 gal water (1% solution) and apply up to 2 fl oz of solution per animal as a fine mist spray. Do not wet hide. Do not treat Brahman animals or calves under 6 months of age. One day withdrawal.
- ◆ eprinomectin pour-on (Eprinex, drug)—Apply at 1 ml/10 kg (22 lb) body weight. Apply along midline of back in a narrow strip extending from the withers to the tailhead. No slaughter interval, no required milk discard time.
- ◆ gamma-cyhalothrin pour-on (Standguard)—Apply at 10 ml (0.3 fl oz) if < 600 lb or 15 ml (0.5 fl oz) if > 600 lb to backline. Do not apply to face. Repeat as needed but no more than once every 2 weeks and no more than 4 times in a 6 month period.
- ◆ ivermectin pour-on (Ivomec, drug)—Apply at 1 ml/10 kg (22 lb) body weight. Do not slaughter within 48 days of treatment.
- ◆ permethrin ready-to-use pour on (1%; Atroban)—Apply at 0.5 fl oz (0.005 fl oz or 0.15 ml ai) per 100 lb of body weight to a maximum of 5 fl oz (0.05 fl oz or 1.5 ml ai) per animal. Pour along backline and down face. Treat once every 2 weeks as needed.
- ◆ permethrin/piperonyl butoxide pour on (Ultra Boss)—Apply at 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Treat once every 2 weeks as needed.
- ◆ permethrin spray (Gardstar 40% EC)—Apply at 30 to 118 ml (1 to 4 fl oz) per 25 gal water (0.013-0.05% ai). 1 to 2 quarts high pressure spray over body of animal. For low-pressure spray, apply at 118 ml (4 fl oz) to 2.5 gal water, spray till wet but not to runoff.
- ◆ pyrethrins (EverGreen EC 60-6) at 1 to 2 fl oz/gallon of water. Wet hair thoroughly. Repeat as needed. Also available as aerosol.

Dusts, backrubbers

- ◆ permethrin backrubber or self-oiler (Gardstar 40% EC)—Apply at 118 ml/10 gal mineral oil or diesel oil. Keep rubbing device charged. Results improve with forced daily use.
- ◆ permethrin dust (several brands, 0.25%)—Suspend bags where cattle congregate. Place bags so they hang 4 to 6 inches below animal's backline. Direct applications of 2 oz per animal may be repeated as needed.
- ◆ zeta-cypermethrin/piperonyl butoxide dust (PYthon)—Apply in dust bag, shaker, dusting glove, or mechanical duster. Suspend bags where cattle congregate. Place bags so they hang 4 to 6 inches below animal's backline. Direct applications of 2 oz per animal may be repeated as needed but not more often than once every 3 days.

Feed supplements

- ◆ diflubenzuron feed supplement (Clarify 0.04%)—Prevents development of immature forms in manure of treated animals. For confined beef cattle, mix into grain according to label to provide 0.1 mg ai/kg (4.55 mg/100 lb) body weight/day. Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity.

- ◆ (S)-methoprene premix (Altosid IGR Custom 2%)—Use formulas on label to determine proper amounts to mix with feed or minerals. Begin use 30 days prior to fly season; continue feeding until cold weather restricts horn fly activity
- ◆ (S)-methoprene mineral tub (SweetCake)—Feed free choice. Offer one tub for every 15-25 head of cattle, and remove all other self limiting nutritional supplements. Tubs should be placed where cattle congregate (watering, loafing, shade areas). Cattle should consume an average of 0.8 ounces of product per 100 lb of animal body weight per day. Deploy tubs before flies appear and continue use until cold weather marks end of fly season.
- ◆ tetrachlorvinphos mineral block (Sweetlix Rabon)—Feed free choice. 1 block for 5 head of cattle. See label for details.

Beef cattle—Lice

Includes

Cattle chewing louse (*Bovicola bovis*)—biting
 Little blue louse (*Solenopotes capillatus*)—sucking
 Long-nose louse (*Linognathus vituli*)—sucking
 Short-nose louse (*Haematopinus eurysternus*)—sucking

Management—chemical control

A single treatment may not give complete seasonal control because none of the listed products are effective against eggs. A second treatment no later than 14 days after the first treatment is usually recommended.

Ear tags

- ◆ diazinon/chlorpyrifos ear tag (Warrior)—Apply one tag per animal in late fall or early winter.
- ◆ zeta-cypermethrin/piperonyl butoxide ear tag (PYthon Magnum)—Apply one tag per head in late fall or early winter.

Injections, pour-ons, sprays

- ◆ essential plant oils (Essentria IC3)—Apply at 30 to 90 ml (1 to 3 oz) per gal mineral oil. Spray directly on animal in amounts to sufficiently cover.
- ◆ ivermectin subcutaneous injection (Ivomec, drug)—Apply at 1 ml/50 kg (110 lb) of body weight. Inject under loose skin in front of or behind shoulder. Do not slaughter within 35 days of treatment. For control of sucking lice only.
- ◆ ivermectin pour-on (Ivomec, drug) at 1 ml/10 kg (22 lb) body weight. Apply along topline of animal. Do not slaughter within 48 days of treatment.
- ◆ lambda-cyhalothrin pour-on (Saber 1%)—Apply at 10 ml (0.3 fl oz) if < 600 lb or 15 ml (0.5 fl oz) if > 600 lb down backline of animal. Do not apply to face. Repeat as needed but no more than once every 2 weeks and no more than 4 times in 6 months.
- ◆ moxidectin pour-on (Cydectin, drug) at 1 ml/10 kg (22 lb) body weight. No pre-slaughter interval, no milk discard.
- ◆ permethrin/piperonyl butoxide pour-on (Ultra Boss) at 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Treat again in 14 days.
- ◆ permethrin spray (GardStar 40% EC)—Apply at 30 to 118 ml (1 to 4 fl oz) per 25 gal water (0.013-0.05% ai). 1 to 2 quarts high pressure spray over body of animal. For low-pressure spray, apply at 118 ml (4 fl oz) to 2.5 gal water, spray till wet but not to runoff. Repeat treatment 10 to 14 days later.

Dusts, backrubbers

- ◆ permethrin backrubber or self-oiler (Gardstar 40% EC)—Apply at 118 ml/10 gal mineral oil or diesel oil. Keep rubbing device charged. Results improve with forced daily use.
- ◆ permethrin dust (several brands, 0.25%)—Suspend bags where cattle congregate. Place bags so they hang 4 to 6 inches below animal's backline. Direct applications of 2 oz per animal may be repeated as needed.
- ◆ zeta-cypermethrin/piperonyl butoxide dust (PYthon)—Apply

at 2 oz per animal. Apply in dust bag, shaker, dusting glove, or mechanical duster. Repeat as needed but not more often than once every 3 days.

Beef cattle—Scabies mite

Sarcoptes scabiei

Management—chemical control

- ◆ eprinomectin pour-on (Eprinex, drug)—Apply at 1 ml/10 kg (22 lb) body weight. No slaughter interval, no milk withholding period.
- ◆ ivermectin pour-on (Ivomec, drug) at 1 ml/10 kg (22 lb) body weight. Apply along topline of animal. Do not slaughter within 48 days of treatment.
- ◆ ivermectin subcutaneous injection (Ivomec, drug)—Apply at 1 ml/50 kg (110 lb) of body weight. Inject under loose skin in front of or behind shoulder. Do not slaughter within 35 days of treatment.
- ◆ lime sulfur dip or spray (BSP Lime-Sulfur Solution)—Apply at 1 gal in 15 gal warm water. Dipping vats must be maintained at 95 to 105°F. Use mixture only once; retreat animals as needed every 12 days. Lime sulfur corrodes application equipment.
- ◆ permethrin spray (Atroban 11% EC)—Apply at 1 pint in 25 gal water. 1 to 2 quarts coarse spray per animal; thoroughly wet animal. Repeat application in 10 to 14 days.

Beef cattle—Spinose ear tick

Otobius megnini

Management—chemical control

- ◆ diazinon ear tag (Optimizer)—One tag to each ear of all animals older than 3 months when ticks are present. Remove tags at end of fly season or before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—One tag to each ear of all animals older than 3 months when pests appear. Remove tags at end of fly season or before slaughter.
- ◆ permethrin spray (Atroban 11% EC)—Apply at 1 pint to 2.5 gal water. 1 to 2 oz spray per animal, spot treatment.
- ◆ zeta-cypermethrin/piperonyl butoxide dust (PYthon) at 1/3 oz (1 T) directly to inside of each ear. Repeat as needed but not more often than once every 3 days.
- ◆ zeta-cypermethrin/piperonyl butoxide ear tag (PYthon)—One tag to each ear of all animals when ticks appear. Remove tags at end of fly season or before slaughter.

Beef cattle—Tick

Includes *Ixodes* spp. and *Dermacentor* spp.

Management—chemical control

- ◆ abamectin ear tag (Tri-Zap)—One tag to each ear of all animals when ticks appear. Remove tags at end of season or before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—One tag to each ear of all animals older than 3 months when pests appear. Remove tags at end of fly season or before slaughter.
- ◆ essential plant oils (Essentria IC3)—Apply at 30 to 90 ml (1 to 3 oz) per gal mineral oil. Spray directly on animal in amounts to cover.
- ◆ permethrin/piperonyl butoxide pour-on (Ultra Boss) at 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Treat once every 2 weeks as needed.
- ◆ permethrin spray (GardStar 40% EC)—Apply at 30 to 118 ml (1 to 4 fl oz) per 25 gal water (0.013 to 0.05% ai). 1 to 2 quarts coarse spray over body of animal, thoroughly wet.
- ◆ zeta-cypermethrin/piperonyl butoxide dust (PYthon)—Apply at 2 oz per animal. Apply in dust bag, shaker, dusting glove, or mechanical duster. Repeat as needed but not more often than once every 3 days.

Management of Resistance to Pyrethroid Insecticides

Horn fly resistance to pyrethroid insecticides is in all cattle-raising areas of the United States. Strategies for combating the flies, while minimizing further buildup of resistance, need to be addressed. If you treat the herd with the proper dosage of a pyrethroid, but within days of using it see many more flies than before the treatment, then resistance is likely. This resistance may be to a spray, dust, or ear tag treatment. Remember that the following guidelines pertain to horn flies only. If resistance is suspected, do not use pyrethroids.

The following control strategies are recommended (may be used singly or in combination):

- ◆ Do not treat for horn flies. Cattle can tolerate moderate levels of horn flies (up to 200 per head), so no treatment at all is an option. This has the greatest effect on reducing or slowing insecticide resistance.
- ◆ Separate mature animals from calves. There is no evidence that horn flies affect mature cattle, other than reducing milk production in lactating cows. Calves should be treated to optimize weight gain. However, cows without calves and replacement heifers (animals for which efficient weight gain is not imperative) probably should not be treated. With cow-calf pairs, it is more effective to tag cows than calves. Calf weaning weights have been shown to be greater when cows are tagged because of higher milk production. Generally, horn flies aren't a problem on calves until the end of the season.
- ◆ Use a four-year rotation strategy to prolong the effectiveness of insecticide-impregnated ear tags. An example of a rotation follows: for the first year, use tags impregnated with abamectin; the second year, use endosulfan tags; the third year, use an organophosphate ear tag; and the fourth year, use a pyrethroid tag. With this plan, a different class of insecticide with a different mode of action is used each year.
- ◆ Delay control until flies exceed the treatment threshold. To avoid wasting insecticide and getting poor results, do not apply until horn flies build up in the spring or summer. However, show cattle or other special animals may require intensive treatment.
- ◆ Treat periodically with organophosphate sprays, dips, backrubbers, ear tags, oilers, or dusts to reduce early buildup of fly populations. Insecticide resistance can be delayed or reduced by periodic treatments that give high levels of immediate control, followed by a period of no control during which time the pest population again builds up. One to two treatments in early summer may delay the need for more sustained controls.
- ◆ Use feed-through fly control products that contain insect growth regulators instead of pyrethroid products. These products are fed to cattle during the months when flies are present. The risk of insecticide resistance development is very low for insect growth regulators such as s-methoprene and diflubenzuron.
- ◆ Treat late in the season. This should begin before the horn fly enters its overwintering phase. Any effort to reduce the number of flies that overwinter may hold down the initial density of flies the following spring. For late-season control, use an insecticide with a different mode of action than the one used during peak periods. If flies are not a problem late in the season, skip the late-season control.
- ◆ Remove ear tags in the fall; this eliminates the low insecticide pressure during the winter that could foster the development of resistance.

Dairy Cattle Pests

Jenifer Cruickshank

Latest revision—March 2020

In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

Notes:

1. Materials suggested for use on dairy animals may also be used on beef animals.
2. Materials listed below are approved for use in all dairy cattle, including lactating animals, unless otherwise noted.
3. Some of the products suggested for insect control are registered as drugs, not insecticides, and are regulated by the FDA.
4. When using backrubbers or dust bags to dispense product, place the backrubber or bag where cattle will congregate or pass through regularly, such as the exit alley from the milking parlor. For backrubbers, be sure to recharge/resaturate as needed.
5. After use of a spray or pour-on, wash teats thoroughly before milking.
6. For many ear tags, “optimum” control is provided by two tags per animal; “adequate” control is provided by one tag per animal.

Note: Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

Dairy cattle—Cattle grub

Common cattle grub (heel fly) (*Hypoderma lineatum*)

Northern cattle grub (*Hypoderma bovis*)

Biology Typically, the life cycle of a cattle grub spans about a year, with most of that time spent as a larva migrating inside the animal's body. To avoid adverse host-parasite reactions, cattle should be treated either before or after grubs migrate through the body. The best time to treat would be as soon as the heel fly (adult stage) season is over. In practical terms, treatment for grubs may be accomplished at the same time as fall treatment for internal parasites but no later than November 30 to prevent a toxic reaction from dead/dying grubs that have migrated to vital regions such as the esophagus or spinal canal.

Management—chemical control (all drugs)

- ◆ tetrachlorvinphos dust (Rabon 3%)—After grubs have encysted, apply 3 to 4 oz down the backline and rub in thoroughly taking care to get the dust into the warble.

Dairy cattle—Face fly

Musca autumnalis

Biology Face flies feed on the secretions of the eyes and nose for short periods of time; only a small percentage of the local face fly population may be found on animals at any one time. These aspects of its life history make management of face fly a very difficult task. Hence, many of the products labeled for efficacious horn fly control indicate that they merely aid in face fly control.

Management—chemical control

Ear tags

- ◆ beta-cyfluthrin ear tag (Cylence Ultra)—Apply one tag to each ear of all animals older than 3 months when flies appear. Remove tags at end of fly season or before slaughter.
- ◆ diazinon/coumaphos ear tag (Corathon)—Apply one tag to each ear on all mature animals when flies appear. One ear tag per calf. Remove tags at end of fly season or before slaughter. Do not use on lactating dairy cattle.
- ◆ lambda-cyhalothrin ear tag (Saber Extra)—Apply one tag to each ear on all animals when flies appear in spring. Remove tags in fall or before slaughter. Do not use on lactating dairy cattle.
- ◆ lambda-cyhalothrin/pirimiphos-methyl ear tag (Double Barrel VP)—Apply one tag to each ear on all animals in herd when flies appear in spring. Do not use on lactating dairy cattle. Remove tag in fall.
- ◆ permethrin ear tag (GardStar Plus)—Apply one tag per ear on all animals when flies first appear in spring. Remove before slaughter.
- ◆ zeta-cypermethrin ear tag (PYthon MagnuM)—Apply one tag per head of all animals at least 3 months old when flies appear in spring. Remove tag at the end of fly season or before slaughter.
- ◆ zetacypermethrin/abamectin ear tag (Tri-Zap)—Apply one tag per ear of all animals. Remove at end of season or before slaughter.

Pour-ons, sprays

- ◆ coumaphos (Co-Ral Fly & Tick Spray)—Mix 1 qt per 50 gal water. Spray to complete wetting to run-off. Treat no more than 6 times/year. Do not apply less than 10 days apart.
- ◆ cyfluthrin pour-on (CyLence)—See label for dosing instructions. Pour along top of back and head of cattle of all ages. Repeat as needed but no more than once every 3 weeks.
- ◆ dichlorvos spray (Vapona)—Dilute 1 gal in 50 gal water (1% solution) and apply up to 2 fl oz of solution per animal (per day) as a fine mist spray. Do not wet hide. Do not treat calves under 6 months of age. One day meat withdrawal.
- ◆ dichlorvos spray (Prozap Beef & Dairy RTU)—Apply 1 to 2 oz per adult animal as a mist to wet hair. Use proportionately lower rates for smaller animals. Do not exceed 2 oz per animal per day. Do not soak skin or wet hide.
- ◆ permethrin spray (Atroban 11% EC)—Dilute at 1 quart to 50 gal water. Spray 1 to 2 quarts per animal. Treat once every 2 weeks as needed.
- ◆ permethrin pour-on (Ultra Boss)—Apply at 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Retreat as needed but no more than once every 2 weeks.
- ◆ permethrin spray (Gardstar 40% EC)—Dilute at 118 ml (4 fl oz) per 25 gal water (0.05% ai). Apply 1 to 2 quarts high pressure spray over body of animal. For low-pressure spray, apply at 118 ml (4 fl oz) to 2.5 gal water, spray to point of runoff.
- ◆ permethrin spray (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate)—Dilute 0.64 oz (normal infestation) or 1.28 oz (severe infestation) per gallon water (0.05%, 0.10%). Spray to thoroughly cover entire animal. Spray lactating cows only after milking is completed.
- ◆ permethrin RTU pour-on & spray (Permethrin S)—Use undiluted in a mist sprayer. Apply 0.5 oz per 100 lb body weight to neck, face, back, legs, and ears. Repeat treatment as needed but do not exceed 5 fl oz during any 14-day interval.
- ◆ pyrethrins spray (PyGanic Livestock & Poultry Insecticide)—Dilute at 9 oz per gal water. Apply using large-droplet spray to face of animal in morning. Do not exceed 1.5 oz of diluted solution per animal or 1 treatment per day. This organic product is OMRI listed.
- ◆ tetrachlorvinphos/ddvp spray (Ravap EC)—Mix 1 gal in 200 gal water. Apply as coarse spray, up to 0.5 gal per animal. Avoid

contacting teats with spray unless teats are washed and dried before milking. Apply at least 20 minutes before milking or after milking is complete. Do not treat calves under 6 months of age. Do not treat more often than once a day.

Backrubbers (oil)

- ◆ coumaphos (Co-Ral Fly & Tick Spray)—Mix 4 quarts in 13 gal of no. 2 diesel or fuel oil. Place backrubber where animals congregate or travel regularly. Resaturate backrubber as needed.
- ◆ permethrin (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate)—Dilute 8 oz in 5 gal oil (0.125%). Keep backrubber charged.

Dusts

- ◆ permethrin dust (several brands, 0.25%)—Suspend bags where cattle congregate or pass through. Place bags so they hang 4 to 6 inches below animals' backline. Direct applications of 2 oz per animal may be repeated as needed but no more than once every 3 days.
- ◆ tetrachlorvinphos dust (Rabon 3%)—Direct applications of 2 oz per animal by shaker can, rotary duster or by spoon to the upper portions of the back, neck and poll and to the face as an aid in the control of face flies. Rub in lightly to carry the dust beneath the hair. Do not apply more than 1 time per day. Can also be used in dust bag.
- ◆ zeta-cypermethrin dust (PYthon)—Apply in dust bag, shaker, dusting glove, or mechanical duster. Suspend bags where cattle congregate or pass through. Place bags so they hang 4 to 6 inches below animals' backline. Direct applications of 2 oz per animal may be repeated as needed but not more often than once every 3 days.

Feed supplements

- ◆ diflubenzuron feed supplement (Clarify 0.04%; JustiFLY 0.67%)—Prevents development of immature forms in manure of treated animals. Mix into grain according to label to provide 0.1 mg ai/kg (4.55 mg/100 lb) body weight per day (follow table on label). Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity.
- ◆ diflubenzuron for milk (Clarify elim-A-fly Add-Pack 0.16%; JustiFLY 0.16% Milk Replacer Product)—Prevents development of immature forms in manure of treated calves. Mix daily into milk/milk replacer according to label to provide 0.1 mg ai/kg (0.1 oz elim-A-fly /100 lb) body weight per day. Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity.
- ◆ tetrachlorvinphos mineral block (Sweetlix Rabon)—Feed free choice, 1 block for 5 head of cattle.

Dairy cattle—Horn fly

Haematobia irritans

Biology The horn fly was introduced into the United States during the 1800s and spread rapidly across North America. Females lay eggs in fresh cattle manure, which is where immature forms complete development. During warm weather, the life cycle of a horn fly is 10–20 days; there are many generations of flies each year. The first flies appear in June or earlier; flies disappear with hard frosts in fall. Both sexes suck blood from cattle and other animals. If enough flies are present, this can lead to reduced weight gains or milk production of cattle. However, cattle can tolerate a low density of horn flies without measurable losses. The generally agreed upon economic threshold is 200 horn flies per animal.

Management—chemical control

Ear tags

- ◆ abamectin ear tag (XP 820)—Apply one or two tags to all animals in herd when flies become a problem in spring. Remove tags at

end of fly season or before slaughter.

- ◆ beta-cyfluthrin ear tag (Cylence Ultra)—Apply one tag to each ear of all animals older than 3 months when flies appear. Remove tags at end of fly season or before slaughter.
- ◆ diazinon ear tag (Patriot, OPTimizer)—Apply one tag to each ear of all animals older than 3 months. Do not use on lactating dairy cattle. Remove before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—Apply one tag to each ear of all animals older than 3 months when flies appear. Do not use on lactating dairy cattle. Remove before slaughter.
- ◆ diazinon/coumaphos ear tag (Corathon)—Apply one tag to each ear on all mature animals when flies appear. One ear tag per calf. Do not use on lactating dairy cattle. Remove tags at end of fly season or before slaughter.
- ◆ lambda-cyhalothrin ear tag (Saber Extra)—Apply one tag to each ear on all animals when flies appear in spring. Do not use on lactating dairy cattle. Remove tags in fall or before slaughter.
- ◆ lambda-cyhalothrin (6.8%)/pirimiphos-methyl (14%) ear tag (Double Barrel VP)—Apply one tag to each ear on all animals in herd when flies appear in spring. Do not use on lactating dairy cattle. Remove tag in fall.
- ◆ permethrin ear tag (GardStar Plus)—Apply one tag per ear on all animals when flies first appear in spring. Remove before slaughter.
- ◆ pirimiphos-methyl ear tag (Dominator)—Apply one tag per ear on all animals when flies first appear in spring. Do not use on lactating dairy cattle. Remove tags in fall.
- ◆ zeta-cypermethrin ear tag (PYthon MagnuM)—Apply one tag per head of all animals at least 3 months old when flies appear in spring. Remove tag at the end of fly season or before slaughter.
- ◆ zetacypermethrin/abamectin ear tag (Tri-Zap)—Apply one tag per ear of all animals. Remove at end of season or before slaughter.

Pour-ons, sprays

- ◆ coumaphos (Co-Ral Fly & Tick Spray)—Mix 1 qt per 50 gal water. Spray to complete wetting to run-off. Treat no more than 6 times/year. Do not apply less than 10 days apart.
- ◆ cyfluthrin pour-on (CyLence)—See label for dosing instructions. Pour along top of back and head of cattle of all ages. Repeat as needed but no more than once every 3 weeks.
- ◆ dichlorvos spray (Vapona)—Dilute 1 gal in 50 gal water (1% solution) and apply up to 2 fl oz of solution per animal as a fine mist spray. Do not wet hide. Do not treat calves under 6 months of age. One day meat withdrawal.
- ◆ dichlorvos spray (Prozap Beef & Dairy RTU)—Apply 1 to 2 oz per adult animal as a mist to wet hair. Use proportionately lower rates for smaller animals. Do not exceed 2 oz per animal per day. Do not soak skin or wet hide.
- ◆ permethrin spray (Atroban 11% EC)—Dilute at 1 quart to 50 gal water. Spray 1 to 2 quarts per animal. Treat once every 2 weeks as needed.
- ◆ permethrin pour-on (Ultra Boss)—Apply at 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Retreat as needed but no more than once every 2 weeks.
- ◆ permethrin spray (Gardstar 40% EC) Dilute at 118 ml (4 fl oz) per 25 gal water (0.05% ai). Apply 1 to 2 quarts high pressure spray over body of animal. For low-pressure spray, apply at 118 ml (4 fl oz) to 2.5 gal water; spray to point of runoff.
- ◆ permethrin spray (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate)—Dilute 0.64 oz (normal infestation) or 1.28 oz (severe infestation) per gallon water (0.05%, 0.10%). Spray to thoroughly cover entire animal. Spray lactating cows only after milking is complete.
- ◆ permethrin RTU pour-on & spray (Permethrin S)—Use undiluted in a mist sprayer. Apply 0.5 oz per 100 lb body weight to neck,

face, back, legs, and ears. Repeat treatment as needed but do not exceed 5 fl oz during any 14-day interval.

- ◆ pyrethrins (EverGreen Pro 60-6)—Dilute at 1 to 2 fl oz/gal of water. Wet hair thoroughly. Repeat as needed. Also available as aerosol.
- ◆ pyrethrins spray (PyGanic Livestock & Poultry Insecticide) Dilute at 5 to 10 oz per gal water. Spray to thoroughly wet hair. Repeat at intervals of 5-12 days or as needed. Do not exceed 1 treatment per day. This organic product is OMRI listed.
- ◆ pyrethrins/permethrin aerosol (Pystol Farm & Dairy Aerosol)—Thoroughly spray entire animal for 2 to 4 seconds from approximately 2 ft away as it is being released to pasture. Do not spray directly toward animal's face.
- ◆ tetrachlorvinphos/ddvp spray (Ravap EC)—Mix 1 gal in 200 gal water. Apply as coarse spray, up to 0.5 gal per animal. Avoid contacting teats with spray unless teats are washed and dried before milking. Apply at least 20 minutes before milking or after milking is complete. Do not treat calves under 6 months of age. Do not treat more often than once a day.

Backrubbers (oil)

- ◆ coumaphos (Co-Ral Fly & Tick Spray)—Mix 4 quarts in 13 gal of no. 2 diesel or fuel oil. Place backrubber where animals congregate or pass through.
- ◆ permethrin (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate 10%)—Dilute 8 oz in 5 gal oil (0.125%). Keep backrubber charged.
- ◆ tetrachlorvinphos/ddvp backrubber (Ravap EC)—Mix 1 gal in 25 gal approved oil and use in mechanical rubbing device or burlap or rope backrubber. Charge as needed.

Dusts

- ◆ coumaphos dust (Co-Ral 1%)—Suspend bags where cattle congregate or pass through (e.g., milking parlor exit lane) daily. Place bags so they hang 4 to 6 inches below animals' backline. Direct applications of 2 oz per animal may be repeated no more frequently than 10 days apart and no more than 12 applications in 12 months.
- ◆ permethrin dust (several brands, 0.25%)—Suspend bags where cattle congregate or pass through. Place bags so they hang 4 to 6 inches below animals' backline. Direct applications of 2 oz per animal may be repeated as needed but no more than once every 3 days.
- ◆ tetrachlorvinphos dust (Rabon 3%)—Direct applications of 2 oz per animal by shaker can, rotary duster or by spoon to the upper portions of the back, neck and poll and to the face as an aid in the control of face flies. Rub in lightly to carry the dust beneath the hair. Do not apply more than 1 time per day. Can also be used in dust bag.
- ◆ zeta-cypermethrin dust (PYthon)—Apply in dust bag, shaker, dusting glove, or mechanical duster. Suspend bags where cattle congregate or pass through (e.g., exit alley of milking parlor). Place bags so they hang 4 to 6 inches below animals' backline. Direct applications of 2 oz per animal may be repeated as needed but not more often than once every 3 days.

Feed supplements

- ◆ diflubenzuron feed supplement (Clarify 0.04%; JustiFLY 0.67%)—Prevents development of immature forms in manure of treated animals. Mix into grain according to label to provide 0.1 mg ai/kg (4.55 mg/100 lb) body weight per day (follow table on label). Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity.
- ◆ diflubenzuron for milk (Clarify elim-A-fly Add-Pack 0.16%; JustiFLY 0.16% Milk Replacer Product)—Prevents development of immature forms in manure of treated calves. Mix daily into milk/milk replacer according to label to provide 0.1 mg ai/kg (0.1 oz elim-A-fly/100 lb) body weight per day. Start feeding early

in spring before flies appear and discontinue when cold weather limits fly activity.

- ◆ (S)-methoprene premix (Altosid IGR Custom 2%)—Use formulas on label to determine proper amounts to mix with feed or minerals. Begin use 30 days prior to fly season; continue feeding until cold weather restricts horn fly activity.
- ◆ (S)-methoprene mineral tub (Mineralix fly tub with IGR)—Feed free choice with target of 0.4 oz per 100 lb body weight. Place tubs out before flies appear and continue use until cold weather marks end of fly season.
- ◆ tetrachlorvinphos mineral block (Sweetlix Rabon)—Feed free choice, 1 block for 5 head of cattle.

Dairy cattle—Lice

Includes

Cattle chewing louse (*Bovicola bovis*)—biting
Little blue louse (*Solenopotes capillatus*)—sucking
Long-nose louse (*Linognathus vituli*)—sucking
Short-nose louse (*Haematopinus eurysternus*)—sucking

Management—chemical control

A single treatment may not give complete seasonal control because none of the listed products are effective against eggs. A second treatment no later than 14 days after the first treatment is usually recommended.

Ear tags

- ◆ diazinon ear tag (Patriot; Optimizer)—Apply one tag to each ear of all animals older than 3 months. Do not use on lactating dairy cattle. Remove before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—Apply one tag per animal in late fall or early winter. Do not use on lactating dairy cattle. Remove before slaughter.
- ◆ zetacypermethrin ear tag (Python MagnuM)—Apply one tag per head over 3 months of age in late fall or early winter. Remove at end of season or before slaughter.
- ◆ zetacypermethrin/abamectin ear tag (Tri-Zap)—Apply one tag per ear of all animals. Remove at end of season or before slaughter.

Pour-ons, sprays

- ◆ coumaphos spray (Co-Ral Fly & Tick Spray)—Mix 1 qt per 50 gal water. Spray to complete wetting to run-off. Treat no more than 6 times/year. Do not apply less than 10 days apart.
- ◆ cyfluthrin pour-on (CyLence)—See label for dosing instructions. Pour along top of back and head of cattle of all ages. Repeat treatment 3 weeks later.
- ◆ diflubenzuron/permethrin pour-on (Clean-Up II)—Apply at 3 ml per 100 lb of body weight up to 30 ml per animal. Apply down face and along back. Retreat as needed, but no more than once every 2 weeks.
- ◆ permethrin spray (Atroban 11% EC) at 1 quart to 50 gal water. Spray 1 to 2 qt per animal and get thoroughly wet. Treat once every 2 weeks as needed.
- ◆ permethrin spray (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate)—Dilute 0.64 oz (normal infestation) or 1.28 oz (severe infestation) per gallon water (0.05%, 0.10%). Spray to thoroughly cover entire animal. Spray lactating cows only after milking is complete. Second treatment recommended in 14-21 days.
- ◆ permethrin pour-on (Ultra Boss)—Apply at 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Treat again in 14 days.
- ◆ permethrin spray (Gardstar 40% EC)—Dilute at 118 ml (4 fl oz) per 25 gal water (0.05% ai). Apply 1 to 2 quarts high pressure spray over body of animal; get thoroughly wet. For low-pressure

spray, apply at 118 ml (4 fl oz) to 2.5 gal water; spray to point of runoff. Repeat application in 10-14 days.

- ◆ permethrin RTU pour-on & spray (Permethrin S; Synergized Delice)—Use undiluted in a mist sprayer. Apply 0.5 oz per 100 lb body weight to neck, face, back, legs, and ears. To pour, use same dosage applied along back and down face. Repeat treatment as needed but do not exceed 5 fl oz during any 14-day interval.
- ◆ pyrethrins spray (PyGanic Livestock & Poultry Insecticide)—Dilute at 1 qt per 16 gal water. Spray to thoroughly wet hair. Repeat treatment in 10 days. This organic product is OMRI listed.
- ◆ rosemary, peppermint oils spray (Essentria IC3)—Mix 30 to 90 ml (1 to 3 oz) per gal mineral oil. Spray directly on animal in amounts to sufficiently cover. Avoid contacting teats with spray unless teats are washed and dried before milking. Apply at least 20 minutes before milking or after milking is complete.
- ◆ tetrachlorvinphos/ddvp spray (Ravap EC)—Mix 1 gal in 200 gal water. Apply as coarse spray, up to 0.5 gal per animal. Avoid contacting teats with spray unless teats are washed and dried before milking. Apply at least 20 minutes before milking or after milking is complete. Do not treat calves under 6 months of age. Do not treat more often than once a day.
- ◆ thyme oil/2-phenethyl propionate/rosemary oil spray (EcoVia EC)—Dilute 0.5 to 1.5 oz per gal mineral oil USP. Spray to cover thoroughly. Repeat as necessary. Avoid contacting teats with spray unless they are washed and dried before milking. Apply at least 20 min before milking or after milking is complete.

Dusts, backrubbers

- ◆ permethrin backrubber/self-oiler (Gardstar 40% EC)—Mix 118 ml (4 oz) per 10 gal mineral oil or diesel oil. Keep rubbing device charged. Results improve with forced daily use.
- ◆ permethrin backrubber/self-oiler (Synergized Delice)—Mix 1 pint per gal #2 diesel or mineral oil. Keep rubbing device charged.
- ◆ permethrin dust (several brands, 0.25%)—Suspend bags where cattle congregate or pass through (e.g., exit alley of milking parlor). Place bags so they hang 4 to 6 inches below animals' backline. Direct applications of 2 oz per animal may be repeated as needed but no more than once every three days.
- ◆ tetrachlorvinphos dust (Rabon 3%)—Direct applications of 2 oz per animal by shaker can, rotary duster or by spoon to the upper portions of the back, neck and poll and to the face as an aid in the control of face flies. Rub in lightly to carry the dust beneath the hair. Do not apply more than 1 time per day. Can also be used in dust bag.
- ◆ zeta-cypermethrin dust (PYthon)—Apply in dust bag, shaker, dusting glove, or mechanical duster, hung where cattle congregate or pass through (e.g., exit alley of milking parlor). Direct applications of 2 oz per animal may be repeated as needed but not more than once every 3 days.

Dairy cattle—Scabies mite

Sarcoptes scabiei

Management—chemical control

- ◆ lime sulfur dip or spray (BSP Lime-Sulfur Solution)—Dilute 1 gal in 15 gal warm water. Dipping vats must be maintained at 95° to 105°F. Use mixture only once; retreat animals as needed every 12 days. Lime sulfur corrodes application equipment.
- ◆ permethrin spray (Atroban 11% EC)—Dilute 1 quart to 50 gal water. Spray 1 to 2 qt per animal and get thoroughly wet. Repeat application in 10-14 days.
- ◆ permethrin spray (Durvet; 10%, Prozap Insectrin X Fly Spray Concentrate)—Dilute 0.64 oz (normal infestation) or 1.28 oz (severe infestation) per gal water (0.05%, 0.10%). Spray to thoroughly cover entire animal. Spray lactating cows only after milking is completed. Second treatment recommended in 14-21 days.

Dairy cattle—Spinose ear tick

Otobius megnini

Management—chemical control

Ear tags

- ◆ beta-cyfluthrin ear tag (CyLence Ultra)—Apply one tag to each ear of animals older than 3 months when ticks are present. Remove tags at end of season or before slaughter.
- ◆ diazinon ear tag (Patriot; Optimizer)—Apply one tag to each ear of all animals older than 3 months when ticks are present. Do not use on lactating dairy cattle. Remove tags at end of fly season or before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—Apply one tag to each ear of all animals older than 3 months when pests appear. Do not use on lactating dairy cattle. Remove tags at end of season or before slaughter.
- ◆ diazinon/coumaphos ear tag (Corathon)—Apply one tag to each ear on all mature animals when flies appear. One ear tag per calf. Do not use on lactating dairy cattle. Remove tags at end of fly season or before slaughter.
- ◆ permethrin ear tag (GardStar Plus)—Apply one tag to each ear of animals when pests appear. Remove tags at end of fly season or before slaughter.
- ◆ zeta-cypermethrin ear tag (PYthon)—Apply one tag to each ear of all animals over 3 months of age when ticks appear. Remove tags at end of season or before slaughter.
- ◆ zeta-cypermethrin/abamectin ear tag (Tri-Zap)—Apply one tag per ear of all animals. Remove at end of season or before slaughter.

Pour-ons, sprays, dusts, backrubbers

- ◆ permethrin backrubber (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate 10%)—Dilute 8 oz in 5 gal oil (0.125%). Keep backrubber charged.
- ◆ permethrin spray (Atroban 11% EC)—Dilute 1 quart per 50 gal water. 1 to 2 oz spray per animal; spot treat back, face, legs, ears.
- ◆ permethrin spray (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate)—Dilute 0.64 oz (normal infestation) or 1.28 oz (severe infestation) per gallon water (0.05%, 0.10%). Spray to thoroughly cover entire animal. Spray lactating cows only after milking is completed.
- ◆ zeta-cypermethrin dust (PYthon)—Apply 1/3 oz (1 T) directly to inside of each ear. Repeat as needed but not more often than once every 3 days.

Dairy cattle—Stable fly

Stomoxys calcitrans

Biology The stable fly is a very serious economic biting fly pest for confined cattle throughout the US and is becoming a serious pest for pastured cattle as well. Both sexes suck blood and prefer to feed on the lower body and legs of cattle. If enough flies are present, this may lead to reduced weight gains or milk production in dairy cows. Annual economic loss in North America due to stable flies is estimated at nearly \$1 billion. Stable flies breed in many wet places, including old manure, decaying feed, calf bedding, compost, silage, etc. Stable flies will also disperse long distances from where they were bred and become significant pests of humans. The generally agreed upon economic threshold for cattle is 5 flies per leg, at which point beef cattle show reduced weight gains. Similar effects likely occur in milking cows. Management of stable flies is principally through improved sanitation and manure management. When sanitation measures are not enough to control adult populations, application of insecticides to premises or animal quarters may be necessary (see “Fly Control” section). There are a few on-animal chemical control options, listed below.

Management—chemical control

Ear tags

- ◆ diazinon ear tag (Patriot)—Apply one tag to each ear of all animals older than 3 months. Do not use on lactating dairy cattle. Remove before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—Apply one tag to each ear of all animals older than 3 months when flies appear. Do not use on lactating dairy cattle. Remove before slaughter.
- ◆ permethrin ear tag (GardStar Plus)—Apply one tag per ear on all animals when flies first appear in spring. Remove before slaughter.
- ◆ zeta-cypermethrin ear tag (PYthon Magnum)—Apply one tag per head of all animals at least 3 months old when flies appear in spring. Remove tag at the end of fly season or before slaughter.

Sprays, pour-ons

- ◆ dichlorvos spray (Prozap Beef & Dairy RTU) Apply 1-2 oz per adult animal as a mist to wet hair. Use proportionately lower rates for smaller animals. Do not exceed 2 oz per animal per day. Do not soak skin or wet hide.
- ◆ permethrin spray (Atroban 11% EC)—Dilute 1 quart per 50 gal water. Spray 1 to 2 qt per animal. Treat once every 2 weeks as needed.
- ◆ permethrin RTU pour-on & spray (Permethrin S)—Use undiluted in a mist sprayer. Apply 0.5 oz per 100 lb body weight to neck, face, back, legs, and ears. Repeat treatment as needed but do not exceed 5 fl oz during any 14-day interval.
- ◆ permethrin spray (Durvet 10%; Prozap Insectrin X Fly Spray Concentrate)—Dilute 0.64 oz (normal infestation) or 1.28 oz (severe infestation) per gallon water (0.05%, 0.10%). Spray to thoroughly cover entire animal. Spray lactating cows only after milking is complete.
- ◆ pyrethrins (EverGreen Pro 60-6) at 2 to 3 fl oz/gallon of water. Apply 1 qt per adult animal. Wet hair thoroughly. Repeat as needed.
- ◆ pyrethrins spray (PyGanic Livestock & Poultry Insecticide)—Dilute at 9 to 14 oz per gal water. Apply 1 qt per adult animal to thoroughly wet hair. Repeat treatment each week as needed. Do not exceed 1 treatment per day. This organic product is OMRI listed.
- ◆ pyrethrins/permethrin aerosol (Pystol Farm & Dairy Aerosol)—Thoroughly spray entire animal for 2-4 seconds from approximately 2 ft away as it is being released to pasture. Do not spray directly toward animal's face.
- ◆ rosemary, peppermint oils spray (Essentria IC3) Mix at 30 to 90 ml (1 to 3 oz) per gal mineral oil. Spray directly on animal in amounts to sufficiently cover. Avoid contacting teats with spray unless teats are washed and dried before milking. Apply at least 20 minutes before milking of after milking is complete.

Dusts, backrubbers

- ◆ permethrin backrubber or self-oiler (Gardstar 40% EC)—Dilute at 118 ml (4 oz) per 10 gal mineral oil or diesel oil. Keep rubbing device charged. Results improve with forced daily use.
- ◆ pyrethrins 1% dust (Evergreen Pyrethrum Dust)—Directly apply 2 oz to animal with shaker can or other device. Can be applied through dust bag placed in area where cattle congregate or pass through. This organic product is OMRI listed.
- ◆ zeta-cypermethrin dust (PYthon)—Directly apply 2 oz per animal. Make sure to apply dust to legs. Repeat as needed but not more than once every 3 days.

Feed supplements

- ◆ diflubenzuron feed supplement (Clarify 0.04%; JustiFLY 0.67%)—Prevents development of immature forms in manure of treated animals. Mix into grain according to label to provide 0.1 mg ai/kg (4.55 mg/100 lb) body weight per day (follow table on label). Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity.
- ◆ diflubenzuron for milk (Clarify elim-A-fly Add-Pack 0.16%; JustiFLY 0.16% Milk Replacer Product)—Prevents development of immature forms in manure of treated calves. Mix daily into milk/milk replacer according to label to provide 0.1 mg ai/kg (0.1 oz elim-A-fly /100 lb) body weight per day. Start feeding early in spring before flies appear and discontinue when cold weather limits fly activity.
- ◆ tetrachlorvinphos mineral block (Sweetlix Rabon)—Feed free choice, 1 block for 5 head of cattle.

Dairy cattle—Tick

Includes *Ixodes* spp. and *Dermacentor* spp.

Management—chemical control

Ear tags

- ◆ abamectin ear tag (XP 820)—Apply one tag to each ear of all animals when ticks appear. Remove tags at end of season or before slaughter.
- ◆ beta-cyfluthrin ear tag (CyLence Ultra)—Apply one tag to each ear of all mature animals when ticks appear. Remove tags at end of season or before slaughter.
- ◆ diazinon/chlorpyrifos ear tag (Warrior)—Apply one tag to each ear of all animals older than 3 months when pests appear. Do not use on lactating dairy cattle. Remove tags at end of season or before slaughter.

Pour-ons, sprays

- ◆ permethrin pour-on (Ultra Boss)—Apply 3 ml per 100 lb body weight. Maximum of 30 ml (1 fl oz) per animal. Retreat as needed but no more than once every 2 weeks.
- ◆ permethrin spray (Gardstar 40% EC)—Dilute at 118 ml (4 fl oz) per 50 gal water (0.05% ai). Apply 1 to 2 qt high pressure spray over body of animal; get thoroughly wet. For low-pressure spray, apply at 118 ml (4 fl oz) to 2.5 gal water; spray to point of runoff.
- ◆ permethrin spray (Durvot 10%; Prozap Insectrin X Fly Spray Concentrate)—Dilute 0.64 oz (normal infestation) or 1.28 oz (severe infestation) per gallon water (0.05%, 0.10%). Spray to thoroughly cover entire animal. Spray lactating cows only after milking is completed.
- ◆ rosemary, peppermint oils spray (Essentria IC3) Dilute at 30 to 90 ml (1 to 3 oz) per gal mineral oil. Spray directly on animal in amounts to sufficiently cover. Avoid contacting teats with spray unless teats are washed and dried before milking. Apply at least 20 minutes before milking or after milking is complete.
- ◆ thyme oil/2-phenethyl propionate/rosemary oil spray (EcoVia EC)—Dilute 0.5 to 1.5 oz per gal mineral oil USP. Spray to cover thoroughly. Repeat as necessary. Avoid contacting teats with spray unless they are washed and dried before milking. Apply at least 20 min before milking or after milking is complete.

Dusts

- ◆ pyrethrins 1% dust (Evergreen Pyrethrum Dust)—Directly apply 2 oz to animal with shaker can or other device. Can be applied through dust bag placed in area where cattle congregate or pass through. This organic product is OMRI listed.
- ◆ zeta-cypermethrin dust (PYthon)—Directly apply 2 oz per animal. Repeat as needed but not more than once every 3 days.

Fly Control

Sergio Arispe

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In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

Note: Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

Fly control—Dairy barns

Management—cultural control

Under ordinary conditions, using insecticides in the milk room is unnecessary if flies are controlled effectively in other areas of the dairy. Also, use of sanitation and manure management programs will reduce the need for insecticide applications. Reduce fly breeding sites by cleaning up feed spills, removing manure and used bedding regularly, reducing moisture in manure storage and repairing water leaks.

Management—chemical control

Note: Most of the products listed here cannot be used in areas where food animals are present. Check label for restrictions.

- ◆ azadirachtin (Ecozin Plus 1.2%) at 1.25 oz per 1,000 sq ft diluted in 20 to 40 gal water. Direct a coarse spray on fly and beetle breeding sites. Apply weekly during fly breeding season. Add a spray oil or surfactant to enhance penetration into manure and refuse piles. Some formulations are OMRI-listed for organic use.
- ◆ beta cyfluthrin (Tempo Ultra) at 8 ml/gal of water (0.025% solution). Use as general surface, spot, mist or crack and crevice treatment.
- ◆ bifenthrin (Talstar)—Use as a surface spray at 0.33 to 1 fl oz/1,000 sq ft for unoccupied areas. Treatment may be made to cracks and crevices where animals are present, see label for restrictions.
- ◆ cyfluthrin (Cy-Kick) at 1 fl oz/gal water (0.05% solution). Apply as a general surface treatment where flies collect or rest. Do not apply while animals are present.
- ◆ ddvp (Vapona 40.2% [WA]) spray at 1 gal/100 gal water. Apply as a mist spray or as a coarse, wet spray. Do not contaminate water, feed, milk or milking utensils. (Vapona 400E [OR]) Use a 0.5% spray solution by mixing 1 pint of this product with 12 gal water. Apply to building surfaces as a coarse, wet spray at the rate of 1 qt per 1,000 sq ft. Do not contaminate water, feed, milk or milking utensils.
- ◆ ddvp (Nuvan Prostrips, Prostrips+)—Hang strips out of reach of animals. See label for usage restrictions. One strip treats 100-200 cu ft. Replace every 4 months or as needed.
- ◆ deltamethrin (D-Fense SC) at 0.75 to 1.5 fl oz/gal of water. Use as general surface, spot, mist or crack and crevice treatment. Do not spray where or when animals are present.
- ◆ dinotefuran bait (QuikStrike)—Apply as scatter bait or in bait stations. Scatter bait not for use in areas where animals are present. Place bait stations out of reach of animals. See label for restrictions.

- ◆ essential plant oils (Essentria IC3) at 1 to 3 fl oz per gal mineral oil. Apply 1 gal diluted spray per 500-1,000 sq ft where pests rest or congregate.
- ◆ esfenvalerate (FenvaStar EcoCap) at 1 fl oz/gallon to treat 1,000 sq ft. Apply as a surface spray, crack and crevice treatment, spot treatment. Remove animals before spraying and do not allow them back in treated area until spray has dried.
- ◆ fenvalerate (Onslaught) at 0.5 to 1 fl oz/gallon to treat 1,000 sq ft. Apply as a surface spray, crack and crevice treatment, spot treatment. Remove animals before spraying and do not allow them back in treated area until spray has dried.
- ◆ imidacloprid/Z-9-tricosene (MaxForce) fly spot bait—Use at 5.7 to 6.3 oz per 1,000 sq ft in bait stations. Reapply every 7 days as needed. Do not place in areas accessible to animals.
- ◆ lambda-cyhalothrin (Grenade ER) at 0.015 to 0.036% ai (0.2 to 0.8 fl oz/gal). For unoccupied areas of livestock barns. Do not apply to milk rooms or feed rooms. Allow surfaces to dry before introducing livestock.
- ◆ nithiazine (QuikStrike) fly abatement strip—Attach to flat surface out of reach of animals.
- ◆ permethrin/piperonyl butoxide (1% ready to use)—Apply directly to surfaces where flies crawl or rest. Re-treat as needed but not more than once every 2 weeks.
- ◆ permethrin spray at 0.1 lb ai/12.5 gal water. Apply as surface treatment to walls and ceilings, 1 gal dilute spray per 750 sq ft. Remove animals and avoid contamination of feed and water during treatment. Do not treat manure.
- ◆ pyrethrins/piperonyl butoxide (EverGreen EC 60-6)—Allowable use as a fine mist space spray (2 fl oz/gal) in poultry houses but birds should be removed first. Use as a surface spray (1 part product to 59 parts water) in houses not occupied by poultry. Follow manufacturer's directions.
- ◆ pyriproxyfen (NyGuard)—As a surface spray, apply at 1 fl oz diluted in water to cover 1,500 sq ft. As a fogger, 1.5 fl oz diluted in carrier to treat 12,000 cu ft. Not for use in areas where animals are present. Do not contaminate food or water.
- ◆ spinosad bait (Elector)—Use as a scatter bait, in bait stations, or as a paint-on or spray-on. Not for use in milk rooms. Only for areas inaccessible to animals.

Fly control—General, on agricultural premises (other than in dairy barn, milk room, and poultry house)

Management—chemical control

Note: The term ultra low volume (ULV) applies when total spray volume to be applied is 0.5 gal/acre or less and material is applied undiluted. The terms low-volume or concentrate spray apply when total spray volume to be applied will cover the area uniformly but not to the point of runoff. Apply sprays to the point of runoff, usually at a rate of about 0.5 to 1 gal per 1,000 sq ft. The amount of spray needed varies with the surfaces. Any of the materials recommended for use in and about dairy barns may be used. In addition, any of the materials listed below may be used outside barns other than dairy. To eliminate possible trace pesticide residues, avoid using these materials anywhere on dairy premises.

- ◆ gamma-cyhalothrin (Standguard) at 0.16 to 0.33 fl oz/gallon of water. 1 gallon of dilution to treat 500 to 1,000 sq ft. Apply as a general surface and/or crack and crevice spray. Do not apply in areas where animals are present. See label for restrictions.
- ◆ imidacloprid/Z-9-tricosene (MaxForce) fly spot bait—Use at 5.7 to 6.3 oz per 1,000 sq ft in bait stations. Reapply every 7 days as needed. Do not place in areas accessible to animals.
- ◆ imidacloprid (0.5%)/tricosene (Maxforce Granular Fly Bait)—For use only outside in areas such as feedlots, broiler houses, livestock housing structures, and horse stables.

- ◆ permethrin spray (Atroban 11% EC) at 1 quart/20 gal water, or 25% 6 tbs/2 gal water. Apply 1 gal per 750 sq ft of surface. Do not apply these diluted solutions to animals. Do not treat manure or litter. Re-treat as needed but not more than once every 2 weeks.
- ◆ permethrin space spray (Atroban 11% EC) at 1 quart/20 gal diesel or mineral oil. Use 4 oz per 1,000 sq ft of air space.

Fly control—Poultry building

Management—cultural control

Use of sanitary and manure management programs will reduce the need for insecticide applications. Reduce fly breeding sites by cleaning up feed spills, removing manure and used litter regularly, reducing moisture in manure storage and repairing water leaks.

Management—chemical control

Note: Most of the products listed here cannot be used in areas where food animals are present. Check label for restrictions.

- ◆ azadirachtin (Ecozin Plus 1.2%) at 1.25 oz per 1,000 sq ft diluted in 20 to 40 gal water. Direct a coarse spray on fly and beetle breeding sites. Apply weekly during fly-breeding season. Add a spray oil or surfactant to enhance penetration into manure and refuse piles. Some formulations are OMRI-listed for organic use.
- ◆ beta cyfluthrin (Tempo Ultra) at 8 ml/gal of water (0.025% solution). See label for mixing instructions. Do not apply where animals are present.
- ◆ bifenthrin (Talstar)—Use as a surface spray at 0.33 to 1 fl oz/1,000 sq ft for unoccupied areas. Treatment may be made to cracks and crevices where birds are present, see label for restrictions.
- ◆ ddvp (Vapona 40.2% [WA])—Spray at 1 gal/100 gal water. Apply as a mist spray or as a coarse, wet spray. Do not contaminate water, feed, milk or milking utensils. (Vapona 400E [OR])—Use a 0.5% spray solution by mixing 1 pint of this product with 12 gal water. Apply to building surfaces as a coarse, wet spray at the rate of 1 quart per 1,000 sq ft. Do not contaminate water, feed, milk or milking utensils.
- ◆ ddvp treated plastic strips (Nuvan Prostrips, Prostrips+)—Hang strips out of reach of animals. See label for usage restrictions. One strip treats 900-1200 cu ft. Replace every 4 months or as needed.
- ◆ deltamethrin (D-Fense)—Ready to use as a crack and crevice treatment indoor federally inspected poultry plants. Use outside buildings as a general surface spray. Do not spray where or when animals are present.
- ◆ dinotefuran bait (QuikStrike)—Apply as scatter bait or in bait stations. Scatter bait not for use in areas where animals are present. Place bait stations out of reach of animals. See label for restrictions.
- ◆ essential plant oils (Essentria IC3) at 1 to 3 fl oz per gal mineral oil. Apply 1 gal diluted spray per 500 to 1,000 sq ft. where pests rest or congregate.
- ◆ esfenvalerate (FenvaStar EcoCap)—1 fl oz/gallon to treat 1,000 sq ft. Apply as a surface spray, crack and crevice treatment, spot treatment. Remove animals before spraying and do not allow them back in treated area until spray has dried.
- ◆ fenvalerate (Onslaught)—0.5 to 1 fl oz/gallon to treat 1,000 sq ft. Apply as a surface spray, crack and crevice treatment, spot treatment. Remove animals before spraying and do not allow them back in treated area until spray has dried.
- ◆ gamma-cyhalothrin (Standguard)—0.16 to 0.33 fl oz/gallon of water. 1 gallon of dilution to treat 500 to 1,000 sq ft. Apply as a general surface and/or crack and crevice spray. Do not apply in areas where birds are present. See label for restrictions.
- ◆ imidacloprid/Z-9-tricosene (MaxForce) fly spot bait—Use at 5.7 to 6.3 oz per 1,000 sq ft in bait stations. Reapply every 7 days as needed. Do not place in areas accessible to animals.

- ◆ imidacloprid/Z-9-tricosene (MaxForce) fly spot bait—Apply at 16 oz/gallon to surfaces where flies aggregate. Re-apply as needed, but not before 7 days. Spray places that are out of reach of animals.
- ◆ lambda-cyhalothrin (Grenade ER) at 0.015 to 0.03% ai/gal (0.2 to 0.4 fl oz/gal). For unoccupied areas of poultry houses. Allow surfaces to dry before introducing animals. Follow manufacturer's directions.
- ◆ permethrin/piperonyl butoxide (1% ready to use)—Apply directly to surfaces where flies crawl or rest.
- ◆ permethrin spray at 0.1 lb ai/12.5 gal water. Apply as surface treatment to walls and ceilings, 1 gal dilute spray per 750 sq ft. Do not apply this dilution to animals. Avoid contamination of feed and water during treatment. Do not treat litter.
- ◆ pyrethrins/piperonyl butoxide (Evergreen 60-6)—Allowable use as a space spray in houses where birds are not present. Follow manufacturer's directions.
- ◆ pyriproxyfen (NyGuard)—As a surface spray, apply at 1 fl oz diluted in water to cover 1,500 sq ft. As a fogger, 1.5 fl oz diluted in carrier to treat 12,000 cu ft. Not for use in areas where animals are present. Do not contaminate food or water.
- ◆ spinosad bait (Elector)—Use as a scatter bait, in bait stations, or as a paint-on or spray-on. Only for areas inaccessible to birds.

Fly control—Fly larvae

Management—biological control

Wasp parasites (Spalding, Kunafin), when properly applied, can greatly reduce fly populations on dairies, in feedlots and at other confined livestock operations, equine facilities, and poultry farms. The tiny adult female wasp inserts an egg into a fly pupa, killing the fly. The egg hatches into a larva that feeds inside the pupal case and develops into an adult that emerges from the case to seek other hosts to parasitize. Application instructions vary with type of operation and number of animals. For optimum effectiveness, multiple releases are required throughout the fly season. Parasite releases are generally not compatible with insecticide use.

Management—chemical control

- ◆ azadirachtin (Ecozin Plus 1.2%) at 1.25 oz per 1,000 sq ft diluted in 20 to 40 gal water. Direct a coarse spray on fly and beetle breeding sites. Apply weekly during fly-breeding season. Add a spray oil or surfactant to enhance penetration into manure and refuse piles. Some formulations are OMRI-listed for organic use.
- ◆ cyromazine (Larvadex)—Poultry only. See label for rates and restrictions. Feed for 4 to 6 weeks and then monitor manure for fly activity. Continue treatment if larvae appear. Sanitation and adult fly control are essential for satisfactory results.
- ◆ cyromazine (Neporex 2SG)—Scatter 1 lb/200 sq ft or spray 1 lb/gal per 200 sq ft. Spray floor of calf hutches 3 days after manure removal, repeat treatment after each manure removal or when fly larvae are found. In poultry houses, spray entire manure area 1 week after manure removal, repeat treatment after each manure removal or when fly larvae are found.
- ◆ ddvp (Vapona 40.2%)—Spray at 1 gal/100 gal water. Apply as a mist spray or as a coarse, wet spray. Do not contaminate water, feed, milk or milking utensils. Use a 0.5% spray solution by mixing 1 pint of this product with 12 gal water. Apply to building surfaces as a coarse, wet spray at the rate of 1 quart per 1,000 sq ft. Do not contaminate water, feed, milk or milking utensils.

Horse Pests

Dawn M. Sherwood

Latest revision—March 2020

In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

Note: Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

Horse—Bot

Includes

Common bot (*Gasterophilus intestinalis*)

Nose bot (*Gasterophilus haemorrhoidalis*)

Throat bot (*Gasterophilus nasalis*)

Pest description and damage Bot flies have four life stages: a free living non-biting fly, eggs attached to hairs on the animal, larvae migrating through tissues of the mouth, and the internal stage as larvae on mucosa of stomach lining and intestines. The main problem of the free living stage (bot fly) is the annoyance factor. On warm sunny days when bot flies are active, horses will fight the flies from morning until late afternoon. When the bot flies are present, horses will walk, run, bob their heads, and seek shelter in shaded areas. The larvae stages of the bot can do extensive damage to the horse's system.

- ◆ ivermectin oral liquid (Eqvalan)—Apply at 200 mcg/kg of body weight or 91 mcg/lb of body weight. Liquid delivered via nasogastric intubation or oral drench. Effective on a wide range of internal parasites. Not for use in horses intended for human consumption. Dispensed by veterinary prescription only.
- ◆ ivermectin paste (1.87%) —Apply at 91 mcg/lb (200 mcg/kg) of body weight. For oral use in horses only. May be used in horses of all ages, including mares at any stage of pregnancy. Stallions may be treated without adversely affecting fertility. Do not use in horses intended for human consumption. This product should not be used in other animal species as severe adverse reactions, including fatalities in dogs, may result.
- ◆ ivermectin—Apply at 1 ml per 110 lb of body weight. Not for use in horses intended for food purposes.
- ◆ methoprene (0.27%) + pyrethrins (0.2%) + PBO (0.37%) + attractant (Ovitrol Plus II)—Kills adults and eggs. Apply spray directly to horse's coat, giving particular attention to legs, shoulders, flanks, neck and topline. To treat face, dampen a cloth with spray and rub on face and head, being careful to avoid eyes. Repeat every 2 months if necessary. Consult a veterinarian before using on debilitated, aged, pregnant, nursing or horses on medication. For preventing hatch of horse botfly eggs: Spray any infested areas directly at the first sign of visible eggs, paying particular attention to legs, shoulders, flanks, neck and topline. Spray to the point of dampness but not to the point of run-off of the spray. For a high degree of botfly egg control, spray animals every 3-5 days during the botfly season. Do not treat horses destined for food.
- ◆ moxidectin (2%)—Apply at 0.4 mg per kg body weight. For oral use in horses and ponies 6 months of age and older. Extreme caution should be used when administering the product to foals,

young and miniature horses, as overdosage may result in serious adverse reactions. Do not use in sick, debilitated, or underweight animals. This product should not be used in other animal species as severe adverse reactions, including fatalities in dogs, may result. Not for use in horses intended for food.

- ◆ permethrin (0.50%) + pyrethrins ((0.25%) + piperonyl butoxide (2.5%) (Pyranha Equine Spray and Wipe)—Apply 1 to 2 ounces as a light spray mist to coat while brushing lightly against the hair. Avoid spraying in eyes or mucous membranes. Reapply in 10-14 days or as needed to maintain control of pest. Use on horses only. Do not use on foals under three (3) months of age. Do not use on horses intended for human consumption. Do not use on dogs or cats.

Horse—Biting fly

Including

Black fly (Simuliidae)
Deer fly (*Chrysops* spp.)
Horn fly (*Haematobia irritans*)
Horse fly (*Tabanus* spp.)
Stable fly (*Stomoxys calcitrans*)

Pest description and damage There are several kinds of flies that suck blood from horses. These include: horn flies, horse flies, deer flies, stable flies, and in some cases, black flies. The primary concern regarding these flies is annoyance to the horse.

Note: Dusts may be the preferred treatment. Horses often react violently to higher spray pressures. It may be safer to apply dilute sprays with a sponge.

- ◆ butoxypolypropylene glycol (5%) (Endure sweat resistant spray)—Thoroughly brush the hair coat to remove loose dirt. Spray the entire body liberally. Reapply every 5-7 days. As protection builds up, reapply every 10-14 days. Not for use on horses intended for human consumption.
- ◆ coumaphos (emulsified)—Spray at 2.5 oz/4 gal. Apply to runoff. Repeat as necessary. Treat thoroughly all wounds and injuries. Do not apply to sick, convalescent, or stressed horses or to colts less than 3 months old. Do not apply with other medications or treatments or in stress situations. Do not allow contact with treated animals until their coats are dry. (**RESTRICTED USE PESTICIDE:** Acute Oral Hazard. For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certification).
- ◆ coumaphos (flowable insecticide)—Spray at 1 quart/200 gal of water and mix thoroughly. Apply for complete wetting to runoff. Do not spray more than six times per year. Do not make applications less than 10 days apart. (**RESTRICTED USE PESTICIDE:** Acute Oral Hazard. For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certification).
- ◆ coumaphos (Co-ral Fly and Tick Spray)—Apply on-animal spray at 2 quarts/50 gal water or 5 oz/4 gal water. Treat all wounds thoroughly. Do not exceed six treatments per year. Allow at least 10 days between treatments. Not for use in horses intended for human consumption.
- ◆ cyromazine (Solitude IGR Feed-Through Fly Control 2.12%)—Apply 0.5 oz to daily ration regardless of horse breed or size. The 0.5 oz serving provides 300 mg cyromazine/horse per day. Begin feeding before flies begin to appear and feed into the fall until cold weather inhibits fly development. Not for use in horses intended for food purposes.
- ◆ cypermethrin 0.15% + pyrethrins 0.20%—Spray or wipe entire body. Use on clean dry horses. Reapply every 5-7 days, as protection builds; reapply every 10-14 days. Not for use in horses intended for human consumption. Do not use on foals under three (3) months of age.

- ◆ diflubenzuron (Simplify with LarvaStop Feed-Through Fly Control 0.24%)—Top dress grain daily to provide 6.8 mg of diflubenzuron/100 lb of body weight. Daily dosage table provided on label. Not for use in horses intended for food purposes.
- ◆ methoprene (0.27%) + pyrethrins (0.2%) + PBO (0.37%) + attractant (Ovitrol Plus II)—Spray directly to horse's coat until moist but before runoff, being careful to avoid the eyes. Spray every 2 months to aid in fly control. Do not treat horses intended for food purposes. Consult a veterinarian before using on debilitated, aged, pregnant, nursing or horses on medication.
- ◆ permethrin 10%—Apply at 1.28 oz/1 gal water for severe infestations. Spray to thoroughly cover the entire animal. Do not use on foals under three (3) months of age. Do not ride within 24 hours of application.
- ◆ permethrin 10%—Apply at 0.64 oz/1 gal water for normal infestations. Spray to thoroughly cover the entire animal. Do not use on foals under three (3) months of age. Do not ride within 24 hours of application.
- ◆ permethrin (7.4%) + piperonyl butoxide (7.4%)—Pour-on 8 to 16 ml to back and face being cautious of eyes. Pour-on to MATURE horses only. Wipe-on 8 to 16 ml using a damp applicator mitt or towel. Wipe-on can be applied to mature horses and foals. Repeat as needed, but not more than once every two weeks.
- ◆ pyrethrins + piperonyl butoxide synergist—Spray or wipe entire body. Follow manufacturer's directions. No limit. Repeat as needed.
- ◆ pyrethrin (0.1%) + piperonyl butoxide (1.0%) + butoxypolypropylene glycol (7.5%) (Bronco Gold Equine Fly Spray)—As a spray apply a fine mist to and around the horse. Do not wet the horse's skin or exceed 2 ounces per application. As a wipe on moisten a soft cloth and rub over the hair. Give special attention to the legs, shoulders, neck and facial area. Do not use on horses intended for slaughter. Do not use on foals under three (3) months of age.

Horse—Lice

Including

Horse biting louse (*Damalinia equi*)
Horse sucking louse (*Haematopinus asini*)

Pest description and damage There are two types of lice in the Pacific Northwest important to the horse; the biting louse and the blood sucking louse. The blood sucking lice are more injurious because heavy infections mean a large loss of blood that may seriously weaken the animal. Lice occur in largest numbers in the winter months when hair is long. Infections spread from animal to animal in adjacent stalls and around mangers. Sucking lice are usually found on the head, neck, back and inner surface of the thighs. Biting lice may be found anywhere on the body, although they seem to occur in greatest numbers around the withers and the base of the tail. The biting lice feed on the hair and scales from the skin.

- ◆ butoxypolypropylene glycol (5%) (Endure sweat resistant spray)—Thoroughly brush the hair coat to remove loose dirt. Spray the entire body liberally. Reapply every 5-7 days. As protection builds up, reapply every 10-14 days. Not for use on horses intended for human consumption.
- ◆ coumaphos (emulsified)—Spray at 2.5 oz/4 gal. Apply to runoff. Repeat as necessary. Treat thoroughly all wounds and injuries. Do not apply to sick, convalescent, or stressed horses or to colts less than 3 months old. Do not apply with other medications or treatments or in stress situations. Do not allow contact with treated animals until their coats are dry. (**RESTRICTED USE PESTICIDE:** Acute Oral Hazard. For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certification).
- ◆ coumaphos (flowable insecticide)—Spray at 1 quart/200 gal of

water and mix thoroughly. Apply for complete wetting to run-off. Do not spray more than six times per year. Do not make applications less than 10 days apart. **(RESTRICTED USE PESTICIDE: Acute Oral Hazard. For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certification).**

- ◆ coumaphos (Co-Ral Fly and Tick Spray)—Apply at 2 quarts/50 gal water or 5 oz/4 gal water. Apply to runoff. Treat thoroughly all wounds and injuries. Do not exceed six treatments per year. Allow at least 10 days between treatments.
- ◆ cypermethrin (0.15%) + pyrethrins (0.20%) + piperonyl butoxide (1.63%) + Di-n-propyl isocinchomeronate (0.50%) + butoxypolypropylene glycol (4.85%) (Endure Roll-on and Sweat-resistant fly spray; Repel X)—Apply or wipe the horse's entire body at a rate not to exceed 11 ounces per animal. Use a soft cloth to apply to face. Reapply every 5-7 days. As protection builds application can be done every 10-14 days. Do not use on horses intended for slaughter. Use only in well ventilated areas. Do not allow adults, children or pets to contact the treated surfaces until spray has dried.
- ◆ diflubenzuron (3.0%) + permethrin (5.0%) (Clean-up II Pour-on Insecticide with IGR)—Shake well before use. Apply at a rate of 3 ml/100 lb of body weight with a maximum of 30 ml per animal. Apply to legs, shoulders, neck, back and facial areas. Not for use in misting systems.
- ◆ permethrin 10% at 0.64 oz/1 gal water for normal infestations. Spray to thoroughly cover the entire animal. Do not use on foals under three (3) months of age. Do not ride within 24 hours of application.
- ◆ permethrin 10%—Apply at 1.28 oz/1 gal water for severe infestations. Spray to thoroughly cover the entire animal. A second treatment 14 to 21 days later is recommended. Do not use on foals under 3 months of age. Do not ride within 24 hours of application.
- ◆ permethrin (7.4%) + piperonyl butoxide (7.4%)—Pour-on 8 to 16 ml to back and face being cautious of eyes. Pour-on to MATURE horses only. Wipe-on 8 to 16 ml using a dampened applicators mitt or towel. Wipe-on can be applied to mature horses and foals. Repeat as needed, but not more than once every two weeks.
- ◆ zeta-cypermethrin 0.075% dust—Apply up to 2 oz per animal evenly in the hair over the head, ears, neck, shoulders, back and tailhead. Do not apply more often than every 3 days. Never use on dogs or cats.

Horse—Tick

Including

American dog tick (*Dermacentor variabilis*)
Pacific coast tick (*Dermacentor occidentalis*)
Western black legged tick (*Ixodes pacificus*)
Winter tick (*Dermacentor albipictus*)

Pest description and damage In some areas ticks are also a problem. Ticks feed on horses by sucking blood and animals can develop severe anemia. Ticks are usually found on the neck, between front and hind legs, under the jaw, and along ventral abdomen.

- ◆ butoxypolypropylene glycol (5%) (Endure sweat resistant spray)—Thoroughly brush the hair coat to remove loose dirt. Spray the entire body liberally. Reapply every 5-7 days. As protection builds up, reapply every 10-14 days. Not for use on horses intended for human consumption.
- ◆ coumaphos (emulsified)—Spray at 5 oz/4 gal. Apply to runoff. Repeat as necessary. Treat thoroughly all wounds and injuries. Do not apply to sick, convalescent, or stressed horses or to colts less than 3 months old. Do not apply with other medications or treatments or in stress situations. Do not allow contact with treated animals until their coats are dry. **(RESTRICTED USE PESTICIDE: Acute Oral Hazard. For retail sale to and use only by**

certified applicators or persons under their direct supervision and only for those uses covered by the certification).

- ◆ coumaphos (flowable insecticide) spray at 0.5 to 1 gal/200 gal of water and mix thoroughly. Apply for complete wetting to run-off. Do not spray more than six times per year. Do not make applications less than 10 days apart. **(RESTRICTED USE PESTICIDE: Acute Oral Hazard. For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certification).**
- ◆ coumaphos (Co-Ral Fly and Tick Spray)—Apply at 4 quarts/50 gal water or 10 oz/4 gal water. Apply to runoff. Treat thoroughly all wounds and injuries. Do not exceed six treatments per year. Allow at least 10 days between treatments.
- ◆ cypermethrin (0.15%) + pyrethrins (0.20%) + piperonyl butoxide (1.63%) + Di-n-propyl isocinchomeronate (0.50%) + butoxypolypropylene glycol (4.85%) (Endure Roll-on and Sweat-resistant fly spray)—Apply or wipe the entire body at a rate not to exceed 11 ounces per animal. Use a soft cloth to apply to face. Reapply every 5-7 days. As protection builds application can be done every 10-14 days. Do not use on horses intended for slaughter. Use only in well ventilated areas. Do not allow adults, children or pets to contact the treated surfaces until spray has dried.
- ◆ diflubenzuron (3.0%) + permethrin (5.0%) (Clean-up II Pour-on Insecticide with IGR)—Shake well before use. Apply at a rate of 3 ml/100 lb of body weight with a maximum of 30 ml per animal. Apply to legs, shoulders, neck, back and facial areas. Not for use in misting systems.
- ◆ permethrin 10% at 0.64 oz/1 gal water for normal infestations. Spray to thoroughly cover the entire animal. Do not use on foals under 3 months old. Do not ride within 24 hours of application.
- ◆ permethrin 10%—Apply at 1.28 oz/1 gal water for severe infestations. Spray to thoroughly cover the entire animal. Do not use on foals under 3 months old. Do not ride within 24 hours of application.
- ◆ permethrin spray at 0.75 oz ai/50 gal water. Spray to runoff or use 0.5 to 1 gal of spray mix per animal. For spot spray, increase rate to 0.75 oz ai/3 gal water and spray each animal with up to 0.5 pint of spray solution. Not for use in horses intended for human consumption. Do not use on foals under 3 months old. Do not ride within 24 hours of application.
- ◆ permethrin (7.4%) + piperonyl butoxide (7.4%)—Pour-on 8 to 16 ml to back and face being cautious of eyes. Pour-on to MATURE horses only. Wipe-on 8 to 16 ml using a dampened applicators mitt or towel. Wipe-on can be applied to mature horses and foals. Repeat as needed, but not more than once every two weeks.
- ◆ permethrin (0.20%) + pyrethrins (0.20%) + piperonyl butoxide (0.50%) + N-Octyl bicycloheptene dicarboximide + Di-n-propyl Isocinchomeronate (1.00%) + butoxypolypropylene glycol (5.00%) (Equicare Flysect Super-7 Spray)—Apply to entire surface of horse avoiding the eyes, mouth and nose. Wait to dry before saddling horse. For initial treatment apply daily for 2-3 days. As infestation subsides, reapply every 5-10 days or as prescribed by a veterinarian. Consult a veterinarian before using on debilitated, aged, pregnant, nursing or animals on medication.
- ◆ permethrin (0.90%) + tetramethrin (0.25%) + pyrethrins (0.025%) + cypermethrin (0.10%) + piperonyl butoxide (Absorbine Ultra Shield Red)—Apply as a spray or wipe at the rate of less than 2 ounces per horse. Spray or wipe entire body while avoiding the eyes, nose and mouth. Do not wet skin. Reapply every 7 days. Do not use on foals less than 3 months of age. Do not use on dogs or cats. Do not use on horses intended for human consumption.
- ◆ zeta-cypermethrin 0.075% dust—Apply up to 2 oz per animal evenly in the hair over the head, ears, neck, shoulders, back and tailhead. Do not apply more often than every 3 days. Never use on dogs or cats.

Poultry Pests

Craig Hollingsworth

Latest revision—March 2019 (Reviewed March 2020)

In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

Note: Products are listed in alphabetical order and *not* in order of preference or superiority of pest control.

Poultry—Lice and mite

Includes

Chicken body louse (*Menacanthus stramineus*)
Shaft louse (*Menapon gallinae*)
Chicken mite (*Dermanyssus gallinae*)
Northern fowl mite (*Ornithonyssus sylviaum*)
Scaly leg mite (*Menapon gallinae*)

Management—chemical control

For direct application to chicken, duck, goose, and turkey

- ◆ permethrin 0.25% dust at 1 lb per 100 birds. Thoroughly treat vent area.
- ◆ permethrin spray at 3 oz ai/50 gal water. Spray birds, cages, or nests. Spray 0.5 oz dilute spray per bird or 1 gal dilute, coarse spray per 100 birds. Thoroughly treat vent area.
- ◆ spinosad (Elector PSP Premise Insect Control Agent) at 3 fl oz of product to 10 gal water. Labeled for Northern fowl mite control. Apply as 1 gal of coarse spray to 100 birds, directed toward vent area. Retreatment interval 14 days.
- ◆ tetrachlorvinphos + ddvp (Ravap)—28% EC at 1 gal/50 gal water. Apply 1 gal dilution per 100 birds using high pressure to vent areas. Use 1 oz spray per bird. Use 1 to 2 gal/1,000 sq ft of litter. Treat walls, roosts, cracks, and crevices. Retreatment interval 14 days.
- ◆ tetrachlorvinphos (Rabon 50WP) at 0.5% solution. Apply directly to birds using 1 gal spray mixture per 100 birds. Retreatment interval 14 days.
- ◆ tetrachlorvinphos 3% dust—For caged birds, apply 0.48 oz ai per 300 birds. Treat dust box at 0.96 oz ai per 100 birds.

For application to litter and housing

- ◆ cyromazine (Larvadex 2SL) at 0.1% finished spray. Apply finished spray at 1 gal/100 sq ft of area over surface of manure, and other sides. Retreatment interval 21 days.
- ◆ permethrin spray at 4 oz ai/36 gal water. Spray to runoff. Cover feed and water before spraying. Apply 3 oz ai/50 gal when spraying cages.
- ◆ spinosad (Elector PSP Premise Insect Control Agent) at 3 fl oz of product to 10 gal water. Remove or cover exposed food and water. Treat walls, roosts, cracks, and crevices. Do not use as a fog or space spray. Perimeter treatment will enhance control. Retreatment interval 14 days.
- ◆ tetrachlorvinphos + ddvp (Ravap) roost paint—28% EC at 1 gal/25 gal water; use 1 gal spray per 100 sq ft of roost area. Apply as brush-on or spray. Use 1 to 2 gal/1,000 sq ft of litter. Treat walls, roosts, cracks, and crevices. Retreatment interval 14 days..

- ◆ tetrachlorvinphos (Rabon 50W) spray—50% WP at 4 lb/25 gal water. Paint brush or hand spray 1 pint/100 ft of roost. Stir occasionally and apply thoroughly. May also be dusted; refer to label.
- ◆ tetrachlorvinphos 3% dust—Apply to litter at 0.48 oz ai/100 sq ft. For roost paint, make a thick slurry by mixing 1 pint water with 0.48 oz ai dust per 100 linear ft.

For more information

Common Lice and Mites of Poultry: Identification and Treatment (<http://anrcatalog.ucanr.edu/pdf/8162.pdf>)

Pest Management Recommendations for Poultry. <https://extension.psu.edu/pest-management-recommendations-for-poultry>

Sheep and Goat Pests

Scott Duggan

Latest revision—March 2020

In all cases, follow the instructions on the pesticide label. The *PNW Insect Management Handbook* has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications.

Notes:

1. Products labeled for use on dairy goats may not be legal to use on meat goats. Read the label carefully or contact the manufacturer of the product if there are questions. In the event there is conflicting information between this document and the label, the product label is the legal definition for the use of the product.
2. Veterinarians can prescribe insecticides that are not specifically labeled for pests on sheep and goats provided a valid veterinary-client relationship exists.
3. If you have questions, consult your veterinarian or Extension professional before applying any pesticide to livestock.

Note: Products are listed in alphabetical order and not in order of preference or superiority of pest control.

Sheep and goat—Lice

Includes

Angora goat biting louse (*Bovicola crassipes*)
Goat biting louse (*Bovicola caprae*)
Goat sucking louse (*Linognathus stenopsis*)
Sheep biting louse (*Bovicola ovis*)
Sheep foot louse (*Linognathus pedalis*)

Management—chemical control

- ◆ permethrin (spray)—Follow label for dosage depending on severity of infestation and spray location. Spray affected areas or entire body or bedding. Re-treat after 4 to 6 weeks if needed. Remove feed and water while spraying. Do not treat more than once every 14 days.
- ◆ permethrin pour-on—Pour along backline and down face. Use 0.005 oz ai per 100 lb of body weight to a maximum of 0.03 oz ai/animal. Repeat as needed. Use no more than once every 2 weeks. For spot treatment, mix 0.75 oz ai/3 gal and spray each animal with 0.5 pint spray mixture per head. See label for other details. Sheep only.

- ◆ permethrin + piperonyl butoxide—Usage instructions depends upon concentration. Follow label for dosage and precautions. Sheep only.
- ◆ pyrethrin + piperonyl butoxide—Usage instructions depends upon concentration. Follow label for dosage and precautions.
- ◆ rosemary and peppermint oils—Follow label for dosage and precautions.
- ◆ zeta-cypermethrin with piperonyl butoxide dust—Use at 2 oz per animal. Apply directly to animal. Repeat as necessary, but not more often than once every 3 days.
- ◆ zeta-cypermethrin dust—Apply at 2 oz per animal. Apply directly to animal.

Sheep and goat—Sheep ked

Melophagus ovinus

Management—chemical control

- ◆ permethrin—Apply at 8 oz/25 gal water. Do not treat more often than once every 2 weeks. Thoroughly wet all portions of the body by dipping or spraying with sufficient pressure and with a nozzle adjustment to penetrate the wool. Sheep only.
- ◆ permethrin 1% pour-on—Pour along backline and down face. Use 0.5 fl oz per 100 lb of body weight to a maximum of 3 fl oz per animal. Repeat as needed. Use no more than once every 2 weeks. Sheep only.
- ◆ permethrin + piperonyl butoxide—Usage instructions depends upon concentration. Follow label for dosage and precautions. Sheep only.
- ◆ pyrethrin + piperonyl butoxide—Usage instructions depends upon concentration. Follow label for dosage and precautions.
- ◆ zeta-cypermethrin dust—Apply 2 oz per animal, directly to animal.
- ◆ zeta cypermethrin with piperonyl butoxide dust—Apply 2 oz per animal, directly to animal. Repeat as necessary, but not more often than once every 3 days.

Sheep and goat—Tick

Pacific Coast tick (*Dermacentor occidentalis*)

Rocky Mountain wood tick (*Dermacentor andersoni*)

Western blacklegged tick (*Ixodes pacificus*)

Management—chemical control

- ◆ permethrin spray, paint, or dip—11% EC at 1 pint/25 gal water. Some products are not labeled for goats. Use 1 to 2 quarts spray per animal. Read label for instructions and dosage for goats. Do not use within 14 days of slaughter.
- ◆ permethrin + piperonyl butoxide—Usage instructions depends upon concentration. Follow label for dosage and precautions.
- ◆ pyrethrin + piperonyl butoxide—Usage instructions depends upon concentration. Follow label for dosage and precautions.
- ◆ rosemary and peppermint oils—Follow label for dosage and precautions.
- ◆ zeta-cypermethrin with piperonyl butoxide dust at 2 oz per animal. Apply directly to animal. Repeat as necessary, but not more often than once in 3 days.
- ◆ zeta-cypermethrin dust—Apply 2 oz per animal, directly to animal.

Sheep and goat—Wool maggot

Includes black blowfly (*Phormia regina*)

Management—chemical control

- ◆ permethrin screw worm aerosol—Spray at a distance of 12 to 15 inches. Spray affected areas or entire body or bedding. Re-treat after 4-6 weeks if needed but not more than every 14 days. Remove feed and water while spraying.

- ◆ permethrin spray, paint, or dip—Do not use within 14 days of slaughter. Sheep only.
- ◆ rosemary and peppermint oils—Follow label for dosage and precautions.

Swine Pests

Scott Duggan

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In all cases, follow the instructions on the pesticide label. The PNW Insect Management Handbook has no legal status, whereas the pesticide label is a legal document. Read the product label before making any pesticide applications. Contact your veterinarian for information on the proper use of these products for market and breeding animals. Follow all label withdrawal time instructions.

Note: Products are listed in alphabetical order and not in order of preference or superiority of pest control.

Swine—Lice

Hog louse (*Haematopinus suis*)

Note: Do not use rotenone on swine because it may cause a serious reaction.

Management—chemical control

- ivermectin injection—Apply at 1 ml per 75 lb body weight. Treat sows 14 days before breeding. Do not treat 8 days before slaughter.
- permethrin 0.25% dust at up to 1 oz dust per animal. Ear treatment is important. Re-treat in 10 days. Repeat as necessary, but not more often than once every 10 days. In severe infestation, both animals and the bedding may be treated. DO NOT ship animals for slaughter within 5 days of treatment.
- permethrin spray—Apply at 1 quart/100 gal water. Spray affected areas or entire body or bedding. Re-treat no more than every 14 days. Remove feed and water. DO NOT spray directly toward animal's face or eyes. DO NOT spray sick animals. DO NOT ship animals for slaughter within 5 days of last application.
- permethrin (Martin's 13.3% multi-purpose insecticide)—Spray at 8 oz/33 gal water. Spray, dip or sponge to apply 1 pint per pig, especially around the ears. Spray affected areas or entire body or bedding. Re-treat no more than every 14 days. Remove feed and water. DO NOT spray directly toward animal's face or eyes. DO NOT spray sick animals. DO NOT ship animals for slaughter within 5 days of last application.
- tetrachlorvinphos (Rabon 50 WP Insecticide)—Apply at 0.5% solution. RABON 50 WP is suitable for use in conventional power or low pressure knapsack sprayers. Frequent agitation is recommended to prevent undue settling of the suspension. Apply 1 to 2 quarts per head as a coarse spray. Repeat in 2 weeks if necessary. No withholding period.

Swine—Hog mange

Follicle mite (*Demodex* spp.)

Hog mange mite (*Sarcoptic scabiei suis*)

Management—chemical control

- permethrin spray—Apply at 1 quart/100 gal water. Spray until entire animal is covered thoroughly, paying particular attention to ears and hard-to-reach areas. Also spray walls and floor and replace the bedding to kill free living mites. For particularly severe or persistent hog mange, use 1 quart/50 gal water, applied as directed.
- permethrin (Martin's 13.3% multi-purpose insecticide-spray)—Apply at 8 oz/33 gal water. Spray, dip or sponge to apply 1 pint per pig, especially around the ears. Spray, dip or sponge animals. Repeat after 14 days, spraying walls and floor space and bedding to kill late hatching, developing stages. Remove feed and water. DO NOT spray directly toward animal's face or eyes. DO NOT spray sick animals. DO NOT ship animals for slaughter within 5 days of last application.