Poor water management is probably the biggest cause of pest infestations. Learn the water requirements of plants and the water-holding properties of the soil at each location. Monitor soil moisture around the plant's root zone and adjust irrigation according to seasonal need. Maintain adequate but not excessive water in the soil to ensure plant survival and good growth. Too much or too little water damages or kills plants.

Insufficient water causes leaves to wilt, droop, and drop. Drought-stress promotes sunburn and sunscald, shoot and branch dieback, bark cracking, cankers, and some fungi. Beetles, mites, and chewing or sucking insects may attack drought-stressed plants.

Excess water, especially near the root collar, is a primary cause of root and crown diseases and increases weed populations. Poor placement of water also promotes some diseases. Splashing water spreads fungal spores and wet foliage promotes some foliar and fruit diseases, such as leaf spots, rusts, and brown rot. Use low-volume drip irrigation or mini-sprinklers instead of overhead sprinklers where feasible.

The first step in pest management is to identify the type and level of infestation of pests (pest scouting). See table this section for Estimated Simple Economic Threshold Levels for selected common insect pests of New Mexico.

Estimated Simple Economic Threshold Levels for selected common insect pests of New Mexico[1].

CROP	PEST	THRESHOLD LEVEL	NOTES
Alfalfa	Alfalfa weevil	15-20 larvae /sweep	Plant size dependent, foliar insecticide, normally 1st cutting only economic, not normally present in 1st year hay
Alfalfa	Alfalfa weevil	25% damaged stems (2 larvae/stem)	Plant size dependent, foliar insecticide, normally 1st cutting only economic, not normally present in 1st year hay
Alfalfa	Aphids (pea and blue aphid)	Greater than 15 per sweep	Plant size dependent, foliar insecticides, may be economic throughout the season, multiple generations per year, population increase following some insecticide applications
Chile	Pepper Weevil	Multiple individuals caught in pheromone trap	Economic threshold level is variety dependent; imported pest, multiple generations per year
Pecans	Pecan nut casebearer	3-5% egg infested clusters	Dependent on crop load and price, sample nut clusters, 3 generations per year
Pecans	Black pecan aphid	1 aphid per compound leaf	Sample compound leaves, foliar insecticides, multiple generations/year, do not tolerate heat

CROP	PEST	THRESHOLD LEVEL	NOTES
Pecans	Black margined aphid	25/compound leaf	Economic problem during a heavy production year
Onions	Thrips sp.	3-5/leaf	Individual plant samples, multiple generations per year
Cotton	Bollworm	5-10% larvae infested plants	Individual plant samples after boll development, 3 + generations/year, populations may migrate from drying corn
Cotton	Thrips	1-4/plant	Seedling pest, individual seedling sampled, normally use insecticide at planting, multiple generations
Cotton	Pink Bollworm	15% infested bolls	Consider days to harvest, multiple generations per year
Corn	Southwestern Corn borer	20% egg or larvae infested plants	Individual plant samples, two generations per year
Corn	Western Corn Rootworm Adults	5-7 adults per plant prior to brown silk	Individual plant samples, larvae controlled with at-planting insecticides, one generation per year
Corn	Western corn rootworm larvae	2nd year in corn and presence of adults the previous year	Larvae controlled with at-planting insecticides, one generation per year
Wheat	Aphids (green bug)	10/stem	Consider dry-land vs. irrigated, can be controlled with at-planting insecticide, multiple generations
Wheat	Russian Wheat Aphid	Determined by yield	50% infestation level result in 25% yield loss, foliar or controlled with at-planting insecticides, multiple generations
Grain Sorghum	Head worms (fall or earworm)	1.5-2 per head	Normally one generation in grain sorghum

CROP	PEST	THRESHOLD LEVEL	NOTES
Grain Sorghum	Green bugs	Growth stage dependent (physical damage present to leaf necrosis at later stages)	Leaf samples and plant observations
Green Beans	European corn borer	Present in the field	Sweep net samples after pod formation
Lettuce	Corn earworm	Less than 1% infested plant	Individual plant samples
Lettuce	Cabbage loopers and beet armyworms	Less than 5% infested plants	Individual plant samples

[1] **Excerpt from Practical Integrated Pest Management, Draft Developed and Presented by Brad Lewis, Research Entomologist, NMSU for NRCS Nutrient and Pest Management Training, 2002, NM Water Quality Tech Note 15, http://www.nm.nrcs.usda.gov/technical/tech-notes/Water/water15.doc**

Integrated pest management should be used when feasible; this would include biological, mechanical, and cultural controls (could also include judicious chemical control). Consider potential for spray drift when applying pesticides with sprinkler irrigation.

Pesticide applications associated with irrigation systems need to be applied according to Irrigation Water Management practice standard and Pest Management standards, http://www.nm.nrcs.usda.gov/technical/fotg/section-4/std-specs.html . The application rate (in/hr) for material applied through irrigation shall not exceed the water holding capacity of the soil root zone. Application amounts must be adjusted to match the soil intake rate.

In order to evaluate site-specific risks of pesticide application on a given field, the Windows Pesticide Screening Tool located at http://www.wsi.nrcs.usda.gov/products/W2Q/pest/pest_mgt.html with instructions at http://www.nm.nrcs.usda.gov/technical/tech-notes/Water/water9.doc needs to be run and the Pest Management Job Sheet filled out. This will help in evaluating the type of risk to surface and ground water and choosing an alternative NRCS conservation practice or management practice to reduce the risk, such as leaching, adsorption, and runoff practices (this section).

Conservation Treatment Technique Summary Guide for Pesticide Losses

Conservation Treatment:	Pesticide Loss Pathways[1]			Comments
	Leaching	Adsorption	Runoff	
Management Practices [2]				
Biological	++	++	++	Pesticide use can be reduced.
Cultural (planting dates)	++	++	++	Pesticide use can be reduced
Cultural (variety)	++	++	++	Pesticide use can be reduced
Formulation	+++	+	+	Less soluble pesticides move slower
Lower Application Rate	+++	++	++	Most effective with highly soluble pesticides
Mechanical (grubbing)	++	++	++	Pesticide use can be reduced
Mechanical (pruning)	++	++	++	Pesticide use can be reduced
Mechanical (roller chop)	++	++	++	Pesticide use can be reduced
Mechanical (tillage)	++	++	++	Pesticide use can be reduced
Mechanical (vacuum)	++	++	++	Pesticide use can be reduced
Mechanical (weeding)	++	++	++	Pesticide use can be reduced
Partial Substitution	+++	++	++	Use pesticides with lower environmental risk
Partial Treatment	++	+++	+++	Banding and directed spraying, most effective with strongly adsorbed pesticides
Scouting	+++	+++	+++	Required to identify pest to be controlled; apply pest management based on economic threshholds
Set-back	++	++	++	Greater distance from surface water and less inadvertent application to water body, greater distance to entry point
Soil Incorporation	+	++	++	Reduces amount of pesticides at the soil surface, reduces macropore flow
Timing of Application	+++	+++	+++	Pesticide losses decrease with time between application and storm events
Conservation Practices [3]				
Conservation Cover (327)	+	+++	+++	For use when land is retired from production
Conservation Crop Rotation (328)	++	+++	+++	Pesticide use can be reduced due to rotational effects on pest complex
Constructed Wetland	-	+	+++	Deposition of sediment and treatment of runoff; leaching can be expected below wetlands
Contour Buffer Strips		+++	+++	Control runoff and sediment losses
Contour Farming (330)		+	+	Infiltration improved, runoff reduced
Contour Orchard (331)		+	+	Control runoff and sediment losses somewhat

Conservation Treatment:	**Pesticide Loss Pathways**[1]			Comments
	Leaching	**Adsorption**	**Runoff**	
Management Practices [2]	+	++	+	Reduces transport of adsorbed pesticides
Cross Wind Trap Strips (589)		++		Reduces transport of adsorbed pesticides
Field Border (386)		+++	++	Buffer action reduces runoff and suspended sediment
Filter Strip (393)	+	+++	++	Reduces runoff, sediment deposited above filter strip
Forage Harvest Management (511)	++	+++	+++	Scheduling harvest periods effectively to control pests can reduce pesticide use.
Grade Stabilization Structure (410)		+++		Reduces mass movement of soil and adsorbed pesticides
Grassed Waterway (412)	+	++	+	Some trapping of adsorbed pesticides
Irrigation Land Leveling (464)	+	++		Reduction of suspended sediment and transport of adsorbed pesticides
Irrigation System Tail Water Recovery (447)	-	++	++	Reductions in runoff and suspended sediment
Irrigation Water Management (449)	++	+	+	Reductions in runoff and suspended sediment
Pasture and Hay Planting (512)	++	+++	+++	Rotation including perennial grasses and legumes generally require fewer pesticides
Prescribed Grazing (528A)		+++	++	Proper management of grazing and browsing animals improves plant health reducing the need for pesticides
Residue Management, No-Till (329A)		++	++	Significant reduction in adsorbed and highly soluble pesticide leaving a field
Residue Management, Mulch-Till (329B)		+++	++	Significant reduction in adsorbed and highly soluble pesticide leaving a field
Residue Management, Ridge Till (329C)		+++	++	Significant reduction in adsorbed and highly soluble pesticide leaving a field
Residue Management, Seasonal (344)		++	+	Slight to moderate reductions in adsorbed and highly soluble pesticides leaving a field
Riparian Forest Buffer (391)	+	+++	+++	Slight to significant reduction in pesticide contamination of shallow ground water and surface water

Conservation Treatment:	Pesticide Loss Pathways[1]			Comments
	Leaching	**Adsorption**	**Runoff**	
Row Arrangement (557)		++	++	Slight to moderate reduction in runoff and sediment loss.
Sediment Basin (350)		++	++	Moderate reduction of sediment and runoff
Subsurface Drainage (606)	++	++	-	Moderate reductions in pesticide movement in ground water and adsorbed pesticides on suspended sediment
Terrace (600)	-	+++	++	Moderate to significant reductions of runoff and suspended sediment carrying soluble or adsorbed pesticides
Tree and Shrub Establishment (612)	++	+++	+++	Moderate to significant reductions in pesticide usage
Waste Storage Facility (313)	+	++	++	Wastes containing pesticide residues are properly contained and not exposed to environmental element
Waste Treatment Lagoon (359)		+++	+++	Pesticides in runoff and adsorbed to suspended sediment are captured and degraded
Waste Utilization (633)	+	++	+	Increased microbial degradation of pesticide residues
Water & Sediment Ctrl. Basin (638)		++	++	Moderate reduction of sediment and runoff
Well Decommissioning (351)	+++			Closure of entry points of pesticides into ground water
Wetland Wildlife Habitat Management (644)	++	++	++	Filtering and degradation of pesticides entering wetland environments
Windbreak Establishment (380)				To control air movement avoiding physical or volatile chemical drift.

[1] Effects are rated as slight (+/-), moderate (++/--), or significant (+++/---).

[2] Additional information on management practices can be obtained from pesticide labels, NMSU pest management publications, and pest management consultants.

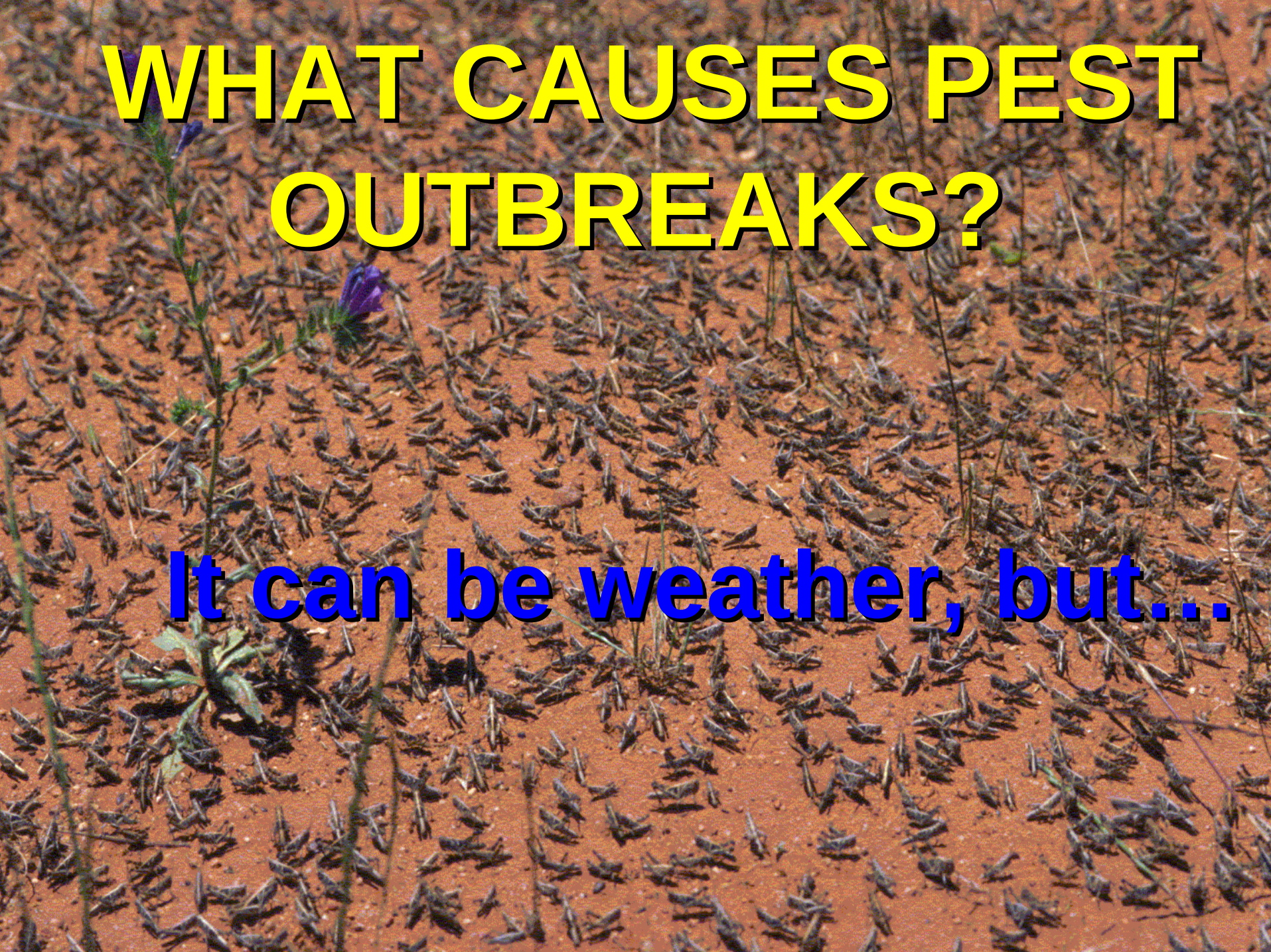
[3] Details regarding the effects of conservation practices on surface and ground water contamination by pesticides are contained in the Conservation Practice Physical Effects found in the National Handbook of Conservation Practices.

Pest Management and IWM Planning

USDA-NRCS

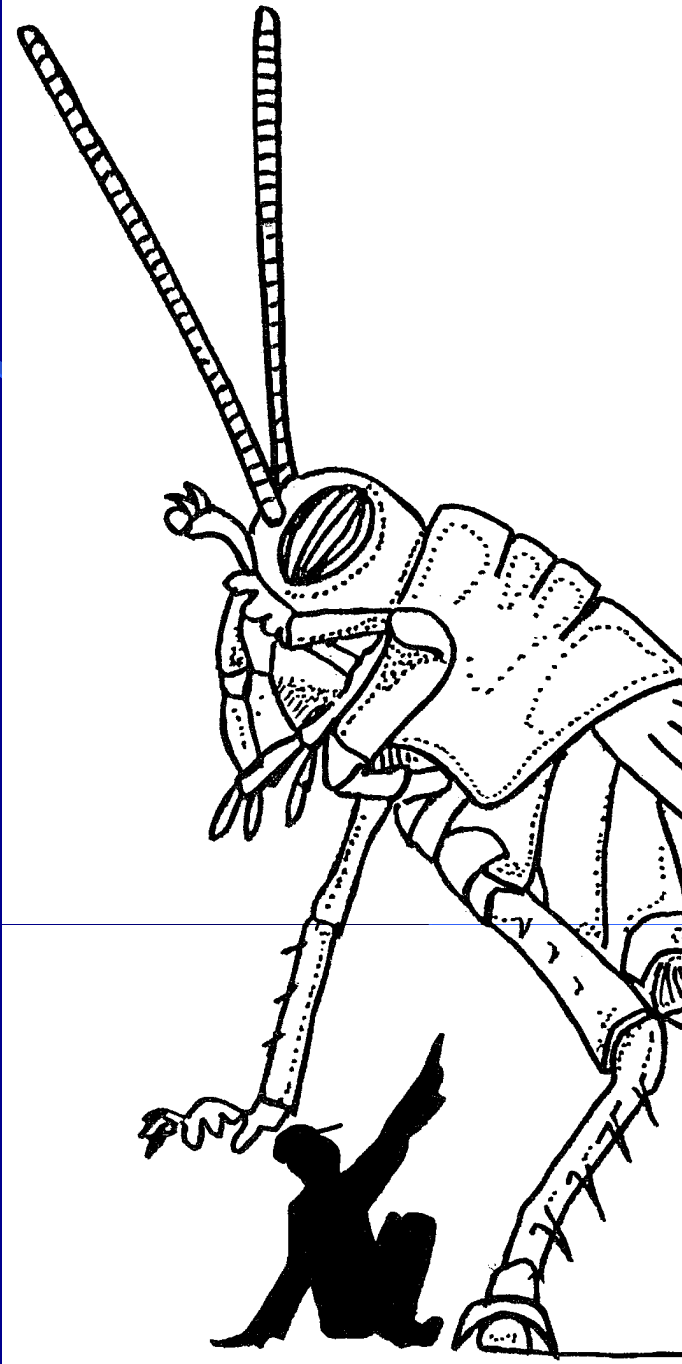
IWM Workshops

(Adapted from NRCS Core 4, NM NRCS Pest Management Planning Course, and Alex Latchininsky, Pests of Field Crops in Wyoming, Univ. Wyoming, Jun. 2006 ppt)


WHAT CAUSES PEST OUTBREAKS?
It can be weather, but…

… Frequently it's our own fault …

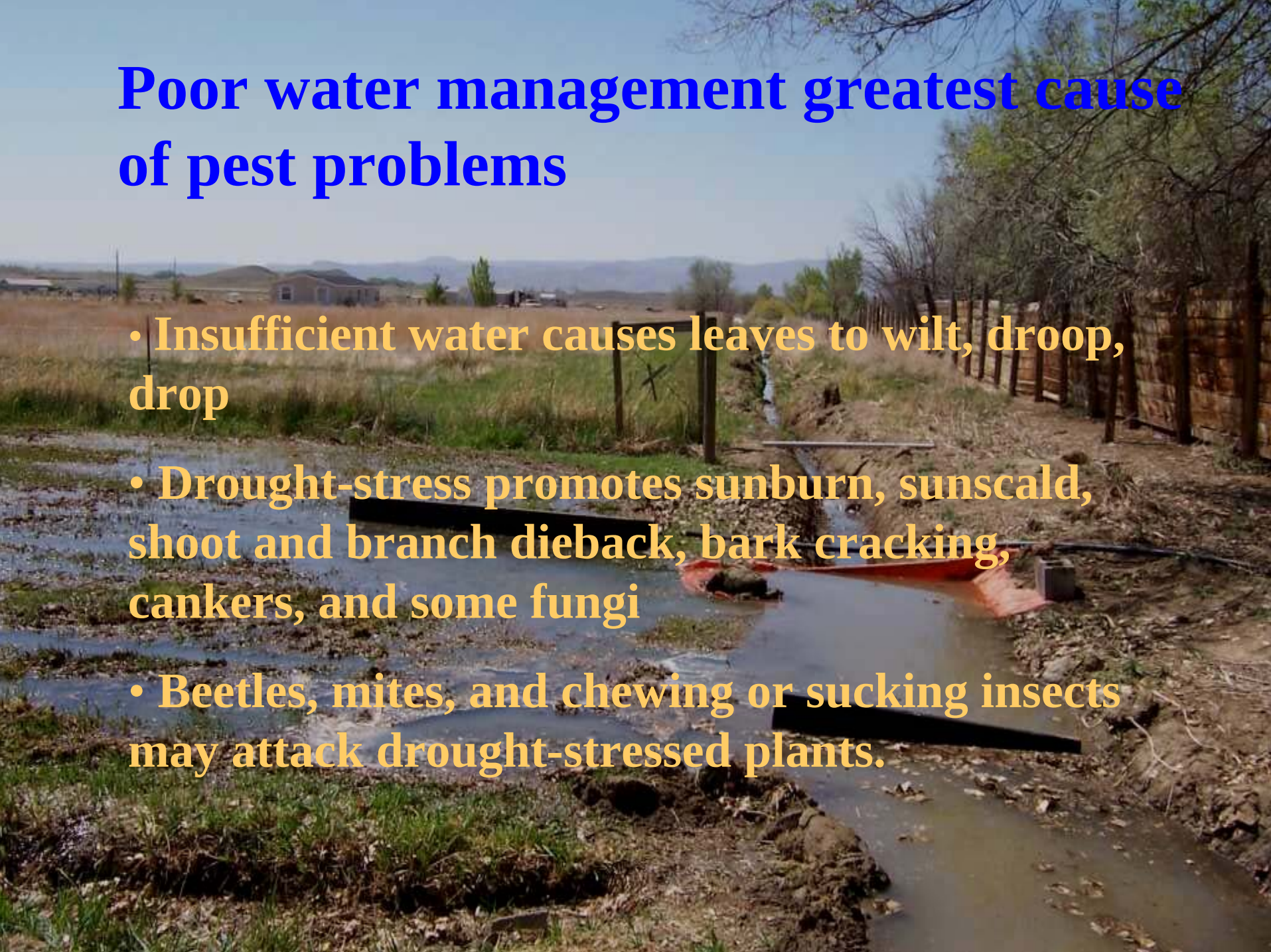
- Large-scale monocultures
- Poor cultural practices
- Overuse of pesticides (killing natural enemies)
- Pest introduction in the new environment
- Disruption of a natural equilibrium



DEFINITIONS

Pest Management: Utilizing environmentally sensitive prevention, avoidance, monitoring and suppression strategies to manage weeds, insects, diseases, animals and other organisms (including invasive and non-invasive species) that directly or indirectly cause damage or annoyance.

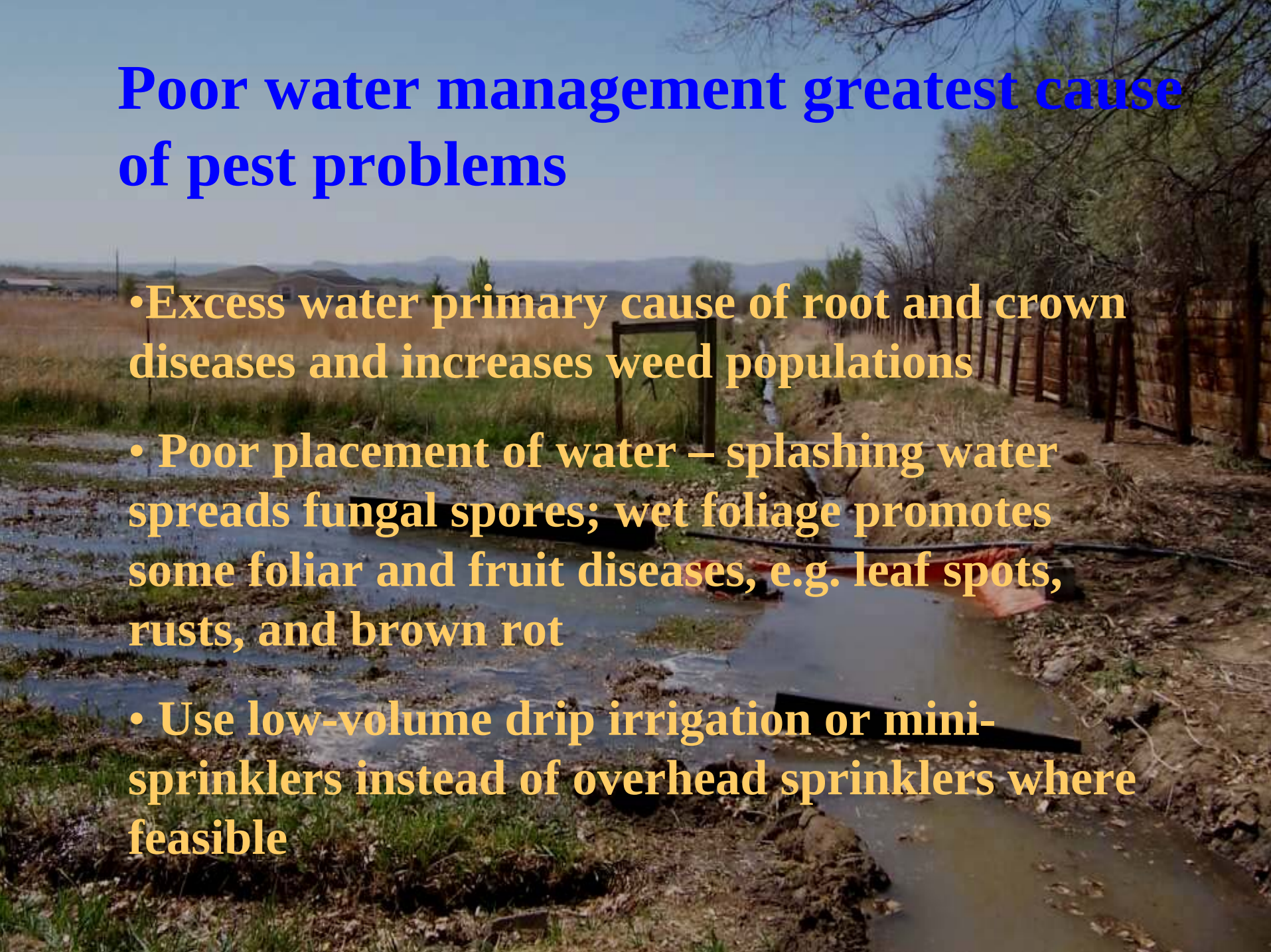
Pests: A weed, insect, disease, animal, and other organism (including invasive and non-invasive species) that directly or indirectly causes damage or annoyance by destroying food and fiber products, causing structural damage, or creating a poor environment for other organisms.



Poor water management greatest cause of pest problems

- Insufficient water causes leaves to wilt, droop, drop
- Drought-stress promotes sunburn, sunscald, shoot and branch dieback, bark cracking, cankers, and some fungi
- Beetles, mites, and chewing or sucking insects may attack drought-stressed plants.

Poor water management greatest cause of pest problems



- Excess water primary cause of root and crown diseases and increases weed populations
- Poor placement of water – splashing water spreads fungal spores; wet foliage promotes some foliar and fruit diseases, e.g. leaf spots, rusts, and brown rot
- Use low-volume drip irrigation or mini-sprinklers instead of overhead sprinklers where feasible

Pest Management – 1st Step

- Identify type and level of pest infestation (pest scouting)

- Apply treatment/control when economic threshold levels are reached

2nd Step – Explore Type of Control

1. Biological

- Introduction of exotic species of parasites and predators
- Conservation of parasites and predators
- Augmentation of parasites and predators
- Microbiological control (pathogens)

Drawbacks: may be costly; often slow and weather-dependent

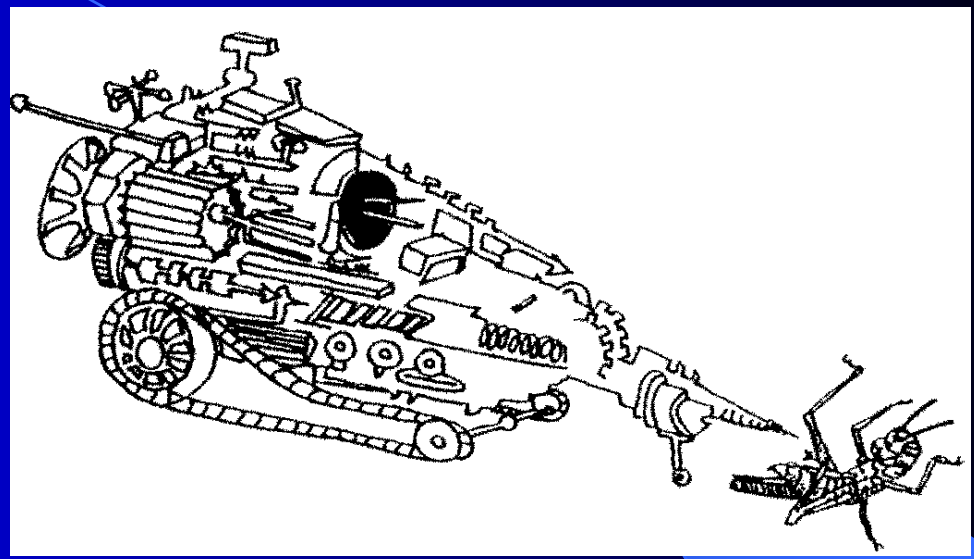
Biocontrol agents

Ladybird beetle larva and adult

Pathogens

TYPES OF CONTROL

2. Mechanical



- Hand picking
- Trapping
- Using devices like screens and barriers

Drawbacks: time- and labor-consuming, slow, often impractical at large-scale

TYPES OF CONTROL

3. Cultural

- Crop rotation – good for insects with long life cycles (e.g., corn rootworms)
- Trap crops – attracts pests; then the trap crop is destroyed or treated with insecticide
- Tillage – good for soil-inhabiting insects
- Clean culture – removal of crop residues
- Timing of planting and harvesting
- Resistant plant varieties, including genetically modified cultivars

Cultural control: advantages

- Normal farming practices, making environments unfavorable for pests
- Preventive strategy
- Economical
- Good for low-unit-value crops

Cultural control: drawbacks

- Will not work in an outbreak situation when pest infestation is heavy

TYPES OF CONTROL

4. Chemical

Reduction of pest populations or prevention of injury by the use of materials to poison them, attract them to other devices, or repel them from specific areas

Still our first line of defense despite adverse publicity

Chemical control: advantages

- Efficient
- Economical
- Fast-acting
- Easy to use
- Generally safe

Chemical control: drawbacks

- Temporary relief
- May cause resistance
- Residues in harvest
- Environment: side-effects to non-targets
- Some insecticides have direct hazards
- Residual carryover

TYPES OF CONTROL

5. Integrated (IPM)

Management of pest populations by the utilization of all suitable techniques in a compatible manner so that damage is kept below economic levels

Ecological approach to avoid economic losses and to minimize adverse effects **; most recommended**

Irrigation Land Leveling

Definition - Reshaping the surface of land to be irrigated to planned grades.

Purposes - To permit uniform and efficient application of irrigation water without causing erosion, loss of water quality, or damage to land by waterlogging and at the same time to provide for adequate surface drainage.

In addition to Irrigation Water management, leveling is essential for pest management.

3rd Step – Evaluate Environmental Risks of Alternatives (NRCS Role)

– Evaluate environmental risks associated with probable pest management recommendations

– Develop appropriate mitigation (conservation treatment) alternatives to minimize environmental risks.

NRCS Roles in Pest Management:

– Assist clients to adopt IPM that helps protect natural resources

– Assist clients to develop and implement an acceptable pest management component of overall conservation plan.

Pest Management Standard

– NRCS NM will use Windows Pesticide Screening Tool to evaluate the environmental risks using specific pesticides (Water Quality Tech. Note 9 on how to use the tool).

–WIN-PST ratings of Intermediate, High or Extra High for potential soil-pesticide interactions, losses and hazards to humans and fish on a given field require a closer look at developing an appropriate alternative combining less hazardous pesticide and conservation practices.

–Water Quality Tech Note 8 for Summary of Mitigation Options for Nutrient and Pest Management Jobsheet 595a for Conservation Treatment Techniques).

Decreasing hazards from non-point source pesticide contamination

- Pesticides can be soluble or attach quickly to soil particles
- If soluble, can move with surface runoff
- If attached to soil particles, can move offsite via erosion

Decreasing hazards from non-point source pesticide contamination

Main ways to approach hazard reduction:

- Manage pesticides differently
  - reduced rate, delayed application, substitution
- Manage crops differently
  - crop rotation, planting dates, resistant varieties
- Control off-site pesticide movement
  - Buffers, Water management, Crop residue management

Controlling non-point source pesticide contamination

Typically conservation treatment techniques:

- Reduce pesticide application lbs/acre
- Utilize less hazardous pesticides
- Prevent pesticide from moving away from point of efficacy (in field)
- Prevent pesticide from leaving field (bottom of root zone - edge of field)

Reducing pesticide application:

- NRCS does not “recommend” any pesticide, rate, formulation, or timing
- All changes in pesticide management must be done with the help of Extension and crop consultants

Reducing pesticide application:

- Integrated Pest Management
  - scouting
  - apply only when economic threshold is reached
  - use pest resistant varieties
  - use good sanitation practices
  - use crop rotation or delayed planting

Reducing pesticide application:

- Keep plants healthy and vigorous (proper irrigation water management is key)
- Use lowest effective rate
- Apply to part of the field
  - banding
  - spot treatment

Reducing pesticide application:

- Avoid treatments that rely mainly on residual activity for control
  - early pre-plant
  - fall application to control spring weeds
- Use post-emergent treatments
- Utilize directed sprays
- Use lower application rate pesticides

Reducing pesticide application:

- Use mixtures of low rate pesticides instead of a single pesticide at a high rate
  - Partial substitution
- Proper maintenance and calibration of equipment

Utilize pesticides that are less environmentally hazardous

- NRCS can help determine *at the field level*
  - Potential pesticide loss
  - Potential pesticide hazard
- NRCS *does not* make pesticide recommendations to producers
- NRCS works with Extension or other crop advisors to help them include environmental risk in their recommendations

Prevent pesticide from moving away from point of efficacy

- Pesticides which move away from their target can no longer control the pest
  - Soil Incorporation (decreases runoff)
  - Use less mobile pesticides

Prevent pesticide from moving away from point of efficacy

- Decrease drift
  - Adjusting spray equipment (droplet size)
  - Don’t apply in windy conditions
- Direct application toward target pest
  - Avoid aerial applications or mist blowers
  - Use wick applicators or other targeting technologies

Prevent pesticide from moving away from point of efficacy

- Use infield conservation techniques that
  - Slow movement of water, chemicals and soil
  - Trap sediment within the field
  - Encourage infiltration within the field
- Examples
  - *Residue Management*
  - *Farming “across the slope”*
  - *Farming “on the contour”*
  - *Contour strip crops*
  - *Contour buffer strips*

Prevent pesticide from moving away from point of efficacy

- Avoid applying pesticide before a heavy rainfall
- Practice efficient irrigation techniques
  - Minimize leaching
  - Minimize runoff
  - Time pesticide application to coincide with irrigation
  - Chemigate judiciously

Prevent pesticide from leaving field (bottom of root zone)

- Practices that decrease leaching
  - Use less pesticide
    - economic threshold
    - lowest effective rate
    - lower rate pesticide
    - Apply to less of the field (banding, spot treatment)
  - Switch to less ‘leachable’ pesticide
    - avoid using high leaching pesticide on high leaching soil

Prevent pesticide from leaving field (bottom of root zone)

Practices that decrease leaching:

- Alter the *'driver'*
  - avoid pesticide application before storms
  - manage irrigation to prevent leaching (and run-off)
- Increase filtration
  - increase soil organic matter
  - disturb surface connected macropores
- Switch to less hazardous pesticide

Prevent pesticide from leaving field (edge of field)

- Use less pesticide
  - economic threshold
  - lowest effective rate
  - lower rate pesticide
  - apply to less of the field (banding, spot treatment)
- Soil incorporate
- Practices that increase infiltration
  - On field
    - residue management
    - increasing soil organic matter

Prevent pesticide from leaving field (bottom of root zone - edge of field)

- Practices that increase infiltration (continued)
  - On field
    - maintaining soil health
    - tillage direction (contour)
    - strip crops
    - preventing/disturbing soil crusts
  - Maintain sub-surface drainage

Prevent pesticide from leaving field (edge of field)

- Catching pesticides at field edge
  - buffer (filter) strips
  - retention ponds
  - constructed wetlands
  - grassed waterways


SEVERAL NM
FIELD CROP
PESTS
©Marlin Rice

Western Corn Rootworm

***Diabrotica virgifera* - beetle**

- **The larvae attack the roots, causing the plants to fall over and become goose-necked.**
- **The adults feed on the silks and, at times, become so numerous that pollination cannot occur.**
- **Overwinter as eggs in the soil. One generation per year.**

Western Corn Rootworm

Heavy root damage

Control

- The most effective means of control is by crop rotation. Corn grown year after year on heavy soil is the most seriously damaged.

- Pesticides: do not use when rotating crops. If necessary, apply granules in a 6-7 inch bank over the row at planting time or as a cultivation treatment.

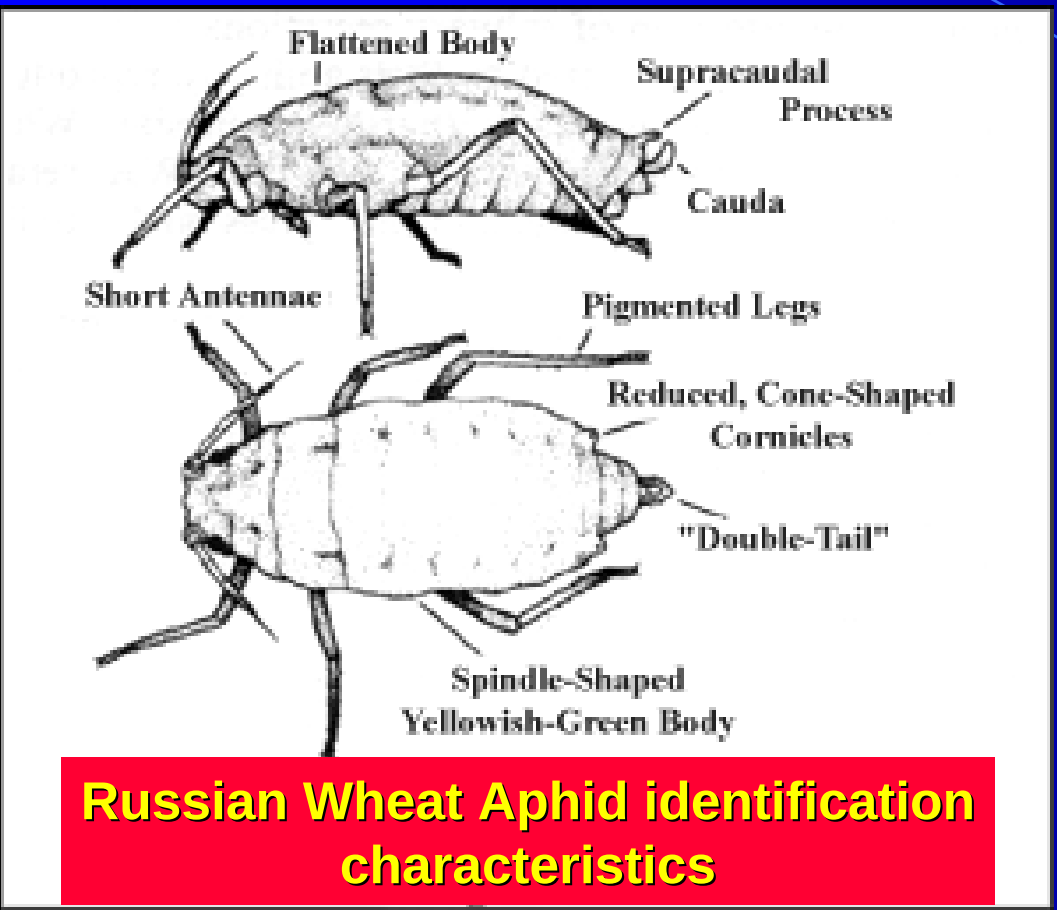
- Do not apply sprays for adults unless pollination is threatened.

Russian Wheat Aphid

Diuraphis noxia

- Native to southern Russia and the Mediterranean region.
- Introduced in the U.S. in 1986.
- Reproduces sexually or asexually.
- Several generations per year.
- Overwinter as immatures or adults in grasses.

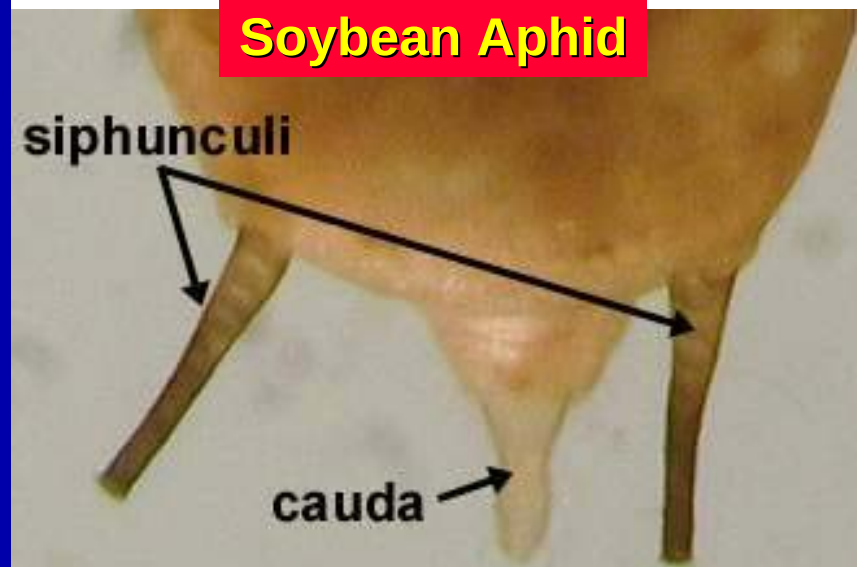
Russian Wheat Aphid



Russian Wheat Aphid identification characteristics

- Elongated
- Short antennae
- No cornicles (“tail-pipes”)
- Forked (double) tail

Soybean Aphid



Russian Wheat Aphid

Damage:

- RWA initiates feeding at the base of the leaves near the top of the plant. It injects a toxic saliva into the plant. The edges of the leaf curl inward protecting the pest.
- Plants become purplish and leaves develop longitudinal yellowish and whitish streaks.
- Tillers of heavily infested plants run parallel to the ground (a prostrate appearance).
- Heads are distorted.

Russian Wheat Aphid

Control:

- Cultural – control volunteer wheat; avoid early planting; use resistant varieties; maintain healthy stand.
- Biological – parasitic wasps, ladybird beetles.
- Chemical – foliar sprays with systemics.

Alfalfa weevil

Hypera postica - beetle

The color is brown with a darker brown stripe down the middle of the elytra.

- **The pronotum has a dark brown stripe through which runs a pale line.**
- **Adult length is about 1/4 inch (6 mm).**

Alfalfa weevil


Eggs

Larvae

- Larva is green or yellow with dark head.
- Damage: mostly by larvae. Skeletonize leaves. Feed on the foliage, especially terminal leaf buds, then drop to the ground and pupate in the litter.
- Adults overwinter. One generation per year.

Alfalfa weevil

Leaf skeletonization by larvae

- **Cultural management:** Early first harvest; fall grazing; spring burning; resistant cultivars.
- **Chemical control:** Mostly organophosphates, which are highly toxic for pollinators (bees) and other beneficials. Apply early in the morning or late in the evening.