2012 Pulse Pests Calendar

MONTANA STATE UNIVERSITY | EXTENSION

NDSU Extension Service

Northern Pulse Growers Association

ASCOCHYTA BLIGHT

is a limiting disease for chickpea production and may require multiple fungicide sprays for management. Pea and lentil are less susceptible to Ascochyta, but the disease can still require careful management depending on the timing and severity of infection and the prevailing weather conditions. The species of Ascochyta are host-specific, so for example, *Ascochyta rabiei* from chickpea will not infect pea. *Ascochyta fabae* f.sp. *lentis* infects lentil, and three different fungal species can infect pea: *Mycosphaerella pinodes*, *Phoma pinodella*, and *Ascochyta pisi*. Lesions on susceptible varieties of chickpea have a very distinct, target-shaped pattern. Each 'wave' of the lesion is surrounded by a brown to black halo, accompanied by small black fungal structures called pycnidia. Lesions can occur on stems, petioles, and pods as well. Lesions on pea tend to be more restricted, and the 'target' pattern tends to be less obvious. On lentil, lesions tend to be a lighter brown with a dark brown halo, and generally lack the 'target' pattern unless humidity is very high. Lesions on plant tissue coalesce and cause defoliation, stem breakage and lodging. Inoculum can come from infested residue, infested seed, or blow in from other pulse-growing areas. Environmental conditions favoring disease development include cool temperatures (59 to 77°F) and high humidity. The disease can be managed by variety, long crop rotations, and foliar fungicides. In North Dakota, Montana, South Dakota, and Nebraska, *A. rabei* (chickpea only) strains resistant to strobilurin fungicides have been found.

JANUARY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 NEW YEAR'S DAY	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16 MARTIN LUTHER KING JR. HOLIDAY	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

December 2011

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February 2012

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29			

For more information: www.ndsu.edu/pubweb/pulse-info/index.html
and http://wiki.bugwood.org/HPIPM:Pulse_Crops

THE LYGUS BUG

or “tarnished plant bug” has been documented as a serious pest of many fruit and vegetable crops. Lygus bugs feed preferentially on meristematic tissue or developing reproductive tissue. Damage to flower buds or developing seeds occurs in legume crops. Damage is caused by the piercing-sucking mouthpart, which punctures the pods and seed coats, injecting a toxic substance into plant parts. Chalk spot is a pit or crater-like depression in the seed coat with or without a discolored chalky appearance. Damaged seeds are smaller, deteriorate faster in storage, have poor germination, and produce abnormal seedlings as well as lower the grade and marketability. It is important not to confuse damage caused by Lygus bug to damage caused by rough harvesting or handling. For example, peas harvested at high moisture levels are also susceptible to bruising when harvested or handled roughly, resulting in damage similar to chalk spot. Monitor adult lygus bug populations during blooming and podding by using a sweep net, making 25 180° sweeps in at least 5 randomly selected places in a field. Insecticide treatment is recommended when 7–10 adults are collected per 25 sweeps. Spray a blooming crop when there is minimal bee activity, preferably during the evening hours (after 8 PM).

FEBRUARY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2 GROUNDHOG DAY	3	4
5	6	7	8	9	10	11
12	13	14 VALENTINE'S DAY	15 MARDI GRAS	16 ASH WEDNESDAY	17	18
19	20 PRESIDENT'S DAY	21	22	23	24	25
26	27	28	29 LEAP DAY			

January 2012

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

March 2012

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

For more information: www.ndsu.edu/pubweb/pulse-info/commoninsects.html

WILD BUCKWHEAT not only competes with the crop for light, moisture, and nutrients, but can twist itself around the crop and pull it to the ground. The vine also causes harvest problems as it wraps around the reel, header, and cylinder of the combine. To distinguish wild buckwheat (*Polygonum convolvulus*), look for emergence of two long, slender cotyledons oriented at about a 110° angle. The true leaves are heart shaped. Wild buckwheat has a papery sheath called an ocrea on each node similar to other weeds in the buckwheat family. Field bindweed is often mistaken for wild buckwheat because their leaves are also heart-shaped; however, field bindweed does not have the papery sheath (ocrea) at each node. Also, field bindweed has the typical morningglory flower with two short bracts just below the flower. It is critical to minimize wild buckwheat seed production in crops grown prior to pulse crops. A preplant or preemergence herbicide is always recommended for wild buckwheat control in pulse crops. Postemergence herbicides typically provide only suppression of wild buckwheat. Several soil-applied herbicides provide wild buckwheat control or suppression including Spartan, Sonalan, Treflan, Prowl, and Metribuzin. A timely rainfall is necessary to activate these herbicides. Postemergence applications of Basagran, Raptor, or Beyond provide suppression of wild buckwheat. Wild buckwheat is more sensitive to postemergence herbicides at the cotyledon to 2-leaf stage.

MARCH

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
February 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	**April 2012** S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			1	2	3
4	5	6	7	8	9	10
11 DAYLIGHT SAVING TIME BEGINS	12	13	14	15 ST. PATRICK'S DAY	16	17
18 FIRST DAY OF SPRING	19	20	21	22	23	24
25	26	27	28	29	30	31

ROOT ROTS often occur when cool wet weather follows spring seeding for more than 2-3 weeks. Symptoms will include stunted, yellow plants and may be mistaken for nitrogen deficiency. When the plant is dug up the roots will be much thinner than a healthy plant or there may be no secondary roots at all. Roots will be discolored, and the color and pattern of discoloration depends on the pathogen infecting the roots. There are four main types: Pythium root rot, Rhizoctonia root rot (bare patch), Fusarium root rot, and Aphanomyces root rot. These fungi infect a very broad host range, so crop rotation is of limited efficacy. Seed treatments last 2-3 weeks after planting. All pulse crops should have a fungicide seed treatment at planting to prevent damping off and root rot, and to increase plant health and vigor.

APRIL

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 APRIL FOOL'S DAY PALM SUNDAY	2	3	4	5	6 GOOD FRIDAY	7 PASSOVER BEGINS
Plan a seed treatment for control of root rot and damping off at planting.						
8 EASTER SUNDAY	9	10	11	12	13	14
15	16	17	18	19	20	21
22 EARTH DAY	23	24	25	26	27	28
Consider a soil-applied herbicide to reduce early weed competition						
29	30					

March 2012

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

May 2012

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

For more information: www.ndsu.edu/pubweb/pulse-info/index.html
and http://wiki.bugwood.org/HPIPM:Pulse_Crops

DINGY CUTWORM

REDBACKED CUTWORM

CUTWORM species in the northern Great Plains that cause most of the problems to agricultural crops are dingy cutworm, redbacked cutworm, and pale western cutworm. Adult cutworms are a moth, and have dark wing colors (brown to gray) with markings, and about 1 1/2 inch long wing length. A mature cutworm larva is about 1 ½ inches long and the size of a pencil in width. Cutworm damage first appears on hilltops, south facing slopes, or in areas of light soil, which warm up earlier in the spring. Larvae will cut young plants in the seedling to 6-8 leaf stages. Cut plants can be found drying up and lying on the soil surface. As damage continues, fields will have areas of bare soil where plants have disappeared. In a severe infestation, the entire field can be destroyed. Scout fields by looking for freshly damaged (cut off) plants. Dig down three or more inches around the cut-off plant and search for cutworm larvae. When disturbed, cutworms curl up or hide under soil debris. Pulse crops are more susceptible to cutworm damage than small grains, because cut plants do not grow back (grains compensate by tillering). Two to three cutworms per square yard justifies an insecticide treatment. Cutworm larvae are actively feeding at night, so an evening insecticide application is best. As a cultural control technique, weed-free fields and crusted summer fallow fields are less attractive to egg laying adults in late summer.

MAY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1 MAY DAY	2	3 NATIONAL DAY OF PRAYER	4	5
6	7	8	9	10	11	12
13 MOTHER'S DAY	14	15	16	17	18	19 ARMED FORCES DAY
20	21	22	23	24	25	26
27	28 MEMORIAL DAY	29	30	31		

Cutworms are most noticeable in crops from mid-May through late June.

Scout pulse crops for feeding injury from grasshopper nymphs in the seedling stage from mid-May through late-June

April 2012

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

June 2012

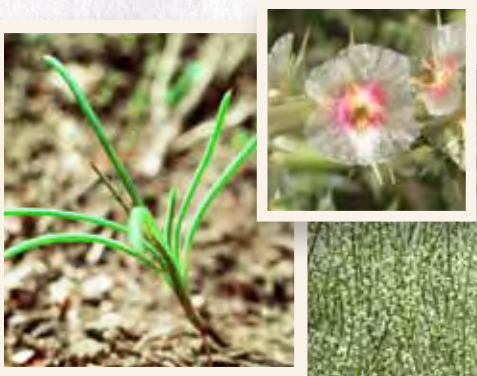
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

For more information: www.ndsu.edu/pubweb/pulse-info/commoninsects.html

CANADA THISTLE —

Cirsium arvense, i.e., creeping thistle – is a perennial that spreads by seed and underground rootstocks. Canada thistle tends to grow in patches and flourishes in wet years. Even low densities can highly reduce pulse crop yield. To distinguish Canada thistle, look for young leaves that are shiny with irregular lobes that are spine-tipped. Flower heads are 1/2 to 3/4 inch in diameter and are typically purple or lavender. Sometimes it is mistaken for perennial sowthistle. Canada thistle leaves typically have deeper lobes, while perennial sowthistle leaves are much less prickly to the touch. Perennial sowthistle stems and leaves contain a milky sap, while Canada thistle does not. Controlling Canada thistle in a pulse crop is nearly impossible, thus scouting should begin in the year prior to growing pulse crops. Canada thistle is best controlled in wheat with a preharvest or postharvest glyphosate application. Target a preharvest glyphosate application in August or a postharvest application in late September or early October prior to a killing frost. A spring glyphosate burndown can give the pulse crop a head start on Canada thistle. There are no herbicides used in lentil or chickpea that will control or suppress Canada thistle. In peas, Basagran can be applied up to two times for Canada thistle suppression.

CANADA THISTLE



RUSSIAN THISTLE

RUSSIAN THISTLE —

Salsola iberica – is rounded, bushy, much branched annual that reproduces by seed. Seeds germinate in spring. Seedling plants have long, fleshy leaves. Adult plants typically are typically ½ to 3 feet tall with stems usually red or purple striped with alternate leaves. Since its introduction in the late 1800s, Russian thistle has become one of the most common and troublesome weeds in the drier regions of North America. It is well adapted to many ecosystems including disturbed wastelands, overgrazed rangeland, and cultivated land. In pulse crops, Russian thistle can reduce crop yield and complicate harvest activities. Pre-plant applications of Pursuit, Sencor, Sonalan, and Spartan can help controlling Russian thistle in pulse crops. In the region, Russian thistle biotypes have been found to be resistant to different herbicides

JUNE

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	July 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31				1	2
3	4	5	6	7	8	9
Scout fields for ascochyta blight Postemergence herbicides are more effective on small wild buckwheat, prickly lettuce, and kochia						
10	11	12	13	14 FLAG DAY	15	16
Scout for Lygus bug during bloom to pod development (until seeds within the pod have become firm), usually mid-June through August.						
17 FATHER'S DAY	18	19	20 FIRST DAY OF SUMMER	21	22	23
24	25	26	27	28	29	30

STEMPHYLIUM BLIGHT (caused by Stemphylium botryosum) is an emerging disease of importance on lentil in Canada and the United States. On chickpea, it causes leaf spots which begin as small, water-soaked lesions that become blackish brown and are divided by leaf veins. They often start at the edge of the leaflet, fuse with adjacent lesions and become large, causing defoliation of the plant. Lesions are oval or irregular in shape, sunken and dark brown with lighter centers and a yellow halo. Older spots on chickpea may develop concentric rings, resembling a target. In lentil, lesions tend to be more beige colored, and dead leaves develop a characteristic rolled and twisted appearance. The pathogen is residue-borne, seedborne, and soilborne. It prefers warm (about 77°F), moist (85% relative humidity and 8 hours of leaf wetness) conditions for disease development. It is windborne and stubble borne. Infected seed has significantly lower germination rates, although it's unknown if it can be seed transmitted.

JULY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4 INDEPENDENCE DAY	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Scout fields for Ascochyta blight

Scout pulse crops for feeding adults grasshoppers in the early bud stage through pod development from late July through August

Scout fields for Stemphylium blight

June 2012

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

August 2012

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

For more information: www.ndsu.edu/pubweb/pulse-info/index.html
and http://wiki.bugwood.org/HPIPM:Pulse_Crops

THE PEA APHID is the most common insect pest found in field pea. They are small, about 1/8+ inch long, and pale green. Aphid populations are usually kept low by heavy rains or by beneficial insects such as parasitic wasps and predators such as lady bird beetle and lacewings. Aphids spread viruses such as bean yellow mosaic virus or pea enation mosaic virus. Entomologists suggest the following guidelines: An insecticide application may be needed if there are more than 10 aphids found on a plant during the period between formation of the 10th node and appearance of the first flower. Population estimates should be calculated by averaging the counts taken from at least five separate areas of the field. One application per season should give satisfactory control. Scout for pea aphids when 50-75 percent of the crop is flowering. Pulse crops are especially susceptible to pea aphids in the flowering and early pod stage can result in lower yields due to less seed formation and smaller seed size. Protein content and other quality issues do not appear to be affected by aphid feeding.

AUGUST

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
July 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	September 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30		1	2	3	4
5 Adult cutworm moths emerge from August through early September	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

For more information: www.ndsu.edu/pubweb/pulse-info/commoninsects.html

PRICKLY LETTUCE grows as a winter annual (1-5 feet tall) with high seed-producing potential. Prickly lettuce – *Lactuca serriola* – can form dense stands if not controlled. Prickly lettuce leaves are alternate, slightly lobed, and have red spines on the mid-rib on the back of the leaf. Prickly lettuce stems and leaves contain a milky sap. At maturity, it has a yellow flower. Prickly lettuce and dandelion look similar in the rosette stage. However, prickly lettuce can be distinguished by the spines on the backside of the leaf. Also, the lobes on the dandelion leaf are more pointed and point back toward the middle of the plant. Pulse growers should consider scouting in late fall for emergence of prickly lettuce. Fall applications of glyphosate will significantly reduce prickly lettuce populations in the spring. Apply glyphosate in the late September or October. A spring burndown is also recommended either before or after planting. Raptor and/or Basagran applied postemergence in peas or Beyond in Clearfield lentil will provide good prickly lettuce suppression or control. These postemergence herbicides are more effective on smaller prickly lettuce (<4-inches tall).

SEPTEMBER

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
August 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	October 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31					1
2	3 LABOR DAY	4	5	6	7	8
Consider applying glyphosate in September or October for Canada thistle control						
9 GRANDPARENT'S DAY	10	11 PATRIOT DAY	12	13	14	15
16	17	18	19	20	21	22 FIRST DAY OF AUTUMN
23	24	25	26	27	28	29
Monitor for emergence of winter annuals such as prickly lettuce, narrowleaf hawksbeard, false chamomile, etc.						
30						

BACTERIAL BLIGHT

is very commonly seen in pea after hail events or rain events associated with high wind which blows soil particles into plants. It is caused by *Pseudomonas syringae* pv. *pisi* in pea and *Xanthomonas campestris* pv. *cassiae* in chickpea. It can be easily confused with Ascochyta blight. Bacterial blight is characterized by angular lesions which are water-soaked at first (when held up to the light, you can see the tissue is translucent). Lesions are limited by leaf veins and are angluar, not circular (in contrast with Ascochyta blight). As the tissue dries, the lesions become dry, brown, and papery. Disease symptoms can also occur on stems, petioles, and pods. If weather conditions remain humid after infection, the disease can progress very rapidly and defoliate plants. Studies indicate that for each 10% increase in canopy area affected by pea bacterial blight, there is a roughly 7 bu/A loss in yield. The pathogen is seedborne, and contaminated seed is considered the most important source of inoculum for field epidemics.

OCTOBER

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8 COLUMBUS DAY	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31 HALLOWEEN			

September 2012

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

November 2012

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

For more information: www.ndsu.edu/pubweb/pulse-info/index.html
and http://wiki.bugwood.org/HPIPM:Pulse_Crops

GRASSHOPPERS are generalists and feed on a wide range of agricultural crops, such as small grains, flax, pulse crops and sunflowers. Adults and nymphs feed on green plant material, creating holes on leaves or pods. Lentil crops are less tolerant to grasshopper feeding than other pulse crops. In lentils, grasshoppers pose the greatest threat from the bud stage through early pod development. Damage on lentil plants is often not highly visible because grasshoppers do not normally prefer lentil foliage. However, grasshoppers will consume flower buds and especially early pods of lentil plants. This can result in yield loss and a delay in maturity due to delayed pod set. Chickpea, however, is not a preferred pulse crop of grasshoppers. In fact, grasshoppers will not feed on green chickpeas, even when it is the only food source present for some distance around. Lentil crop research conducted by Agriculture and Agri-Food Canada at Saskatoon found that 2 grasshoppers per square yard, feeding on lentil flowers or pods, can reduce yields enough to warrant insecticide treatment. A sweep net is an easy method to monitor for grasshoppers, and four 180 degree sweeps with a 15-inch sweep net equals one square yard. Grasshopper outbreaks usually coincide with several years of low rainfall and drought periods. Cool, wet weather increases the diseases that infect and kill grasshoppers.

NOVEMBER

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
October 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	December 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			1 ALL SAINTS DAY	2	3
4 DAYLIGHT SAVING TIME ENDS	5	6 ELECTION DAY	7	8	9	10
11 VETERAN'S DAY	12	13	14	15	16	17
18	19	20	21	22 THANKSGIVING DAY	23	24
25	26	27	28	29	30	

For more information: www.ndsu.edu/pubweb/pulse-info/commoninsects.html

KOCHIA is very competitive with pulse crops and can reduce yield significantly. Kochia — *Kochia scoparia* — can become the size of small "Christmas trees" and can plug up a combine. Kochia typically is more prevalent in dry years. To help identify kochia, note these distinguishing characteristics: it is an annual plant, grows 1 to 6 feet tall, leaves alternate, and leaves lance-shaped and hairy. Horseweed, which kochia is commonly mistaken for, has leaves that are usually a lighter green and more elongated than kochia. Horseweed leaf margins are slightly serrated, whereas kochia leaves are smooth. Kochia tends to branch more and grow more like a bush. Scout fields for kochia within a few days of planting. Kochia may or may not have emerged at the time pulse crops are planted. A burndown with glyphosate is always recommended prior to crop emergence. Since glyphosate can be weaker on "button-size" kochia, cutting glyphosate rates is not recommended. A preplant or preemergence herbicide is always recommended for kochia control in pulse crops. Spartan, Sonalan, Prowl, Treflan, and Metribuzin can be soil-applied in the spring for kochia control or suppression. Fall herbicide applications can be very effective. There are no effective postemergence herbicides labeled for kochia control in lentil or chickpea. However, in peas, Basagran can suppress kochia when applied to very small plants (1-inch).

DECEMBER

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
November 2012 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	January 2013 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31					1
2	3	4	5	6	7 PEARL HARBOR REMEMBRANCE DAY	8
9 HANUKKAH BEGINS	10	11	12	13	14	15
16	17	18	19	20	21	22 FIRST DAY OF WINTER
23	24	25 CHRISTMAS DAY	26	27	28	29
30	31 NEW YEAR'S EVE					

PEA LEAF WEEVIL (*SITONA LINEATUS* (LINNAEUS)) — COLEOPTERA: CURCULIONIDAE

The pea leaf weevil is an exotic insect pest that was most likely introduced from Europe in 1936. Although pea leaf weevil has NOT been detected in North Dakota, it is found in Montana, Idaho, Washington and Oregon in the U.S., and in Vancouver Island, British Columbia and Alberta in Canada. A recent detection in the eastern U.S. occurred in 1984 in Virginia, and this population may have originated from Bermuda. If pea leaf weevil is introduced and becomes established in North Dakota, it could become an important insect pest of pulse crops.

Life Cycle: There is one generation per year. The adult weevil is about 1/5 inch long and grayish-brown with three light-colored stripes on the thorax that often extends onto the abdomen. Adult pea leaf weevils overwinter in stubble of legumes host plants. When temperatures reach 17 C, adults fly or walk short distances to find host plants in the Leguminosae (legumes). Although any legume crop could be infested, preferred host plants are peas, dry beans, alfalfa, clover, faba beans and vetch. Females can lay up to 1,000 to 1,500 eggs in the soil near or on developing legume plant in May through June. Larvae hatch from the egg in about 16 days, and move down to feed on the root nodules. Larvae are small about ¼ inch long when mature, and grub-like with white, C-shaped, legless body with a dark brown head capsule. Larvae molt through five instars in about 35 days, and then pupate in the soil for about 15 days. New adults emerge during late July through August and feed on any pulse crops before overwintering.

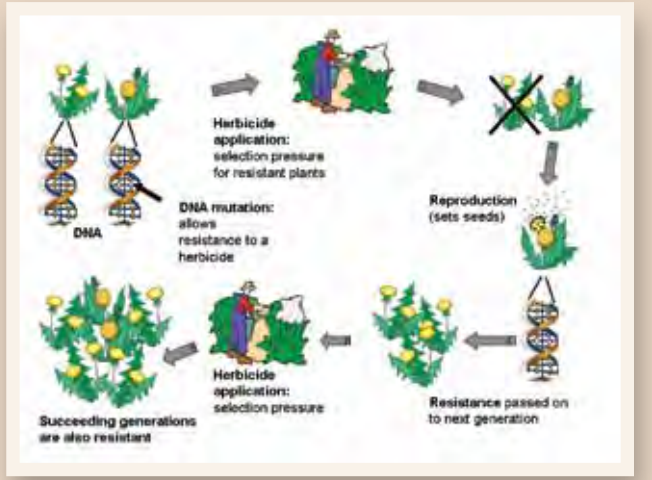
Damage: Adult pea leaf weevil feed on the leaves creating scalloped (notched) edges. In a severe infestation during the seedling crop stage, the terminal growing points of legume seedlings may be damaged killing the plant. Larvae feed on the nitrogen-fixing nodules of legumes resulting in partial or complete inhibition of nitrogen fixation by the plant. However, the direct effect of larval feeding on root nodules on crop yield is variable and depends on the level of nitrogen fertilizer available to the plant in the soil. Root feeding by larvae may also provide an entry point for soil borne diseases and increase their infection risk.

Pest Management: Field scouting during the seedling stage is most critical. A foliar Insecticide treatment is recommended when more than 25 percent of the leaves are notched or there is more than one weevil per plant in the seedling stage. A Canadian threshold emphasizes treatment when one or more feeding symptoms are observed on only three clam-leaf pairs (recently emerged leaves). After 2-4 leaf stage, treatment is justified when 25 percent of the plants have feeding injury and insects are present. Once the 6-8 leaf stage is reached, some defoliation can be tolerated and treatment may not be necessary if weevils are difficult to find during warm, sunny days. Systemic insecticidal seed-treatments, such as Cruiser, also may reduce damage by adults and larvae. Research has shown that no-till fields are less suitable for pea leaf weevil colonization and survival than conventional tillage fields.

PREVENTION AND MANAGEMENT OF HERBICIDE RESISTANCE IN MONTANA

Herbicide resistance is the innate ability of a weed biotype to survive and reproduce after treatment with a herbicide dose that would normally be lethal. In Montana, herbicide resistance has been confirmed in five species– kochia (*Kochia scoparia*), wild oat (*Avena fatua*), Persian darnel (*Lolium persicum*), Russian thistle (*Salsola kali*), and green foxtail (*Setaria viridis*). Herbicide resistance is a serious problem that poses at least three significant challenges for weed management. First, it is very expensive and time consuming to test for herbicide resistance and develop alternative management programs, once resistance has been confirmed. Second, existing herbicides must be protected against resistance development, since very few new products are being released due to their high costs of development. Finally, when producers lose the use of a herbicide because of resistance, as happened for Glean and Telar (*chlorsulfuron*) to manage kochia in Montana's small grain production, it limits their weed management options as well as creates serious economic consequences for agriculture.

Weeds, like every other organism, have inherent genetic variability that arises from mutations. It is this genetic variability that allows one or a few plants already present within a population, usually at a very low frequency (maybe one in several millions) to survive herbicide treatment. Therefore the repeated use of herbicides creates the selection pressure that favors the spread of resistant biotypes. To reduce the risk of selecting herbicide resistant biotypes, producers should rotate among herbicides with different sites of action, applied either as tank mixes, premix formulations or sequential applications. Also, producers should rotate management practices, such as the incorporation of timely cultivation. Finally, crop rotation is an excellent tool to reduce the selective pressure on herbicide resistant weeds. More information on herbicide resistance can be found in Montguide MT200506AG, *Preventing and Managing Herbicide-resistant Weeds in Montana*.



Seed Treatment Fungicides Registered For Use

	Fungicide(s)				
Crop	Active ingredient	Trade Name	Application rate (/100 lbs. of seed)	Class	Disease
Dry Pea	Thiabendazole	Mertect 4.0-F*	1.02 - 2.04 fl.oz.	Methyl Benzimidazole Carbamates (1)	Ascochyta Blight
	Pyraclostrobin	Stamina*	0.4-1.50 fl. oz.	Quinone outside Inhibitors (11)	Damping-off caused by Rhizoctonia solani, seed-borne fungi causing seed decay, seedling damping-off
	Trifloxystrobin	Trilex 2000*	1.0 fl. oz.		Seed and soil-borne disease, Damping-Off, Seedling Blight
	Fludioxonil	Maxim 4FS*	0.08-0.16 fl. oz.	PhenylPyrroles (12)	Seed and soil-borne disease,Damping-Off, Seedling Blight
	Mefenoxam	Apron XL-LS*	0.64 fl. oz.		Pythium Damping-off, early season Phytophthora control
		Apron Maxx RTA*	5.0 fl.oz.		Damping-Off, Seedling Blight, Seed-borne rots due to Pythium, Phytophtora, Fusarium, Rhizoctonia, early season Phytophthora root rot, seed-borne Sclerotinia and Phomopsis seed decay
	Thiamethoxam, Mefanoxam, Fludioxonil	Cruiser Maxx**	1.5 - 3.0 fl. oz.	PhenylAmides (4) PhenylPyrryoles (12)	Damping-Off, Seedling Blight, Seed-borne rots due to Pythium, Phytophtora, Fusarium, Rhizoctonia, early season Phytophthora root rot, seed-borne Sclerotinia and Phomopsis
	Metalaxyl	Allegiance FL*	0.75 - 1.5 fl. oz.	PhenylAmides (4)	Pythium Damping-off, early season Phytophtora control
		Sebring 480 FS*	0.5 - 1.0 fl. oz.		Pythium Damping-off, early season Phytophtora control
		Dyna-Sheild*	0.75 - 3.1 fl. oz.		Pythium Damping-off, early season Phytophtora control
		Acquire*	0.75 - 1.5 fl. oz.		Pythium Damping-off, early season Phytophtora control
Lentil	Thiabendazole	Mertect 4.0-F*	1.02 - 2.04 fl.oz.	Benzimidazole Carbamates (1)	Ascochyta Blight
	Azoxystrobin	Dynasty *	0.153-0.765 fl. oz.	Quinone outside Inhibitors (11)	Ascochyta Blight, Seed and soil-borne disease,Damping-Off, Seedling Blight
	Pyraclostrobin	Stamina*	0.4-1.50 fl. oz.		Damping-off caused by Rhizoctonia solani, seed-borne fungi causing seed decay, seedling damping-off
	Trifloxystrobin	Trilex 2000*	1.0 fl. oz.		Seed and soil-borne disease, Pythium, Fusarium, Rhizoctonia solani damping-off
	Fludioxonil	Maxim 4FS*	0.08-0.16 fl. oz.	PhenylPyrroles (12)	Seed and soil-borne disease,Damping-Off, Seedling Blight
	Mefenoxam	Apron Maxx RTA*	5.0 fl.oz.		Damping-Off, Seedling Blight, Seed-borne rots due to Pythium, Phytophtora, Fusarium, Rhizoctonia, early season Phytophthora root rot, seed-borne Sclerotinia and Phomopsis seed decay
	Thiamethoxam, mefanoxam, fludioxonil	Cruiser Maxx**	1.5 - 3.0 fl. oz.	PhenylAmides (4)	Damping-Off, Seedling Blight, Seed-borne rots due to Pythium, Phytophtora, Fusarium, Rhizoctonia, early season Phytophthora root rot, seed-borne Sclerotinia and Phomopsis species
	Metalaxyl	Allegiance FL*	0.75 - 1.5 fl. oz.	PhenylAmides (4)	Pythium Damping-off, early season Phytophthora control
		Sebring 480 FS*	0.5 - 1.0 fl. oz.		Pythium Damping-off, early season Phytophthora control
		Dyna-Sheild*	0.75 - 3.1 fl. oz.		Pythium Damping-off, early season Phytophthora control
		Acquire*	0.75 - 1.5 fl. oz.		Pythium Damping-off, early season Phytophthora control
Chickpea	Thiabendazole	Mertect 4.0-F*	1.02 - 2.04 fl.oz.	Benzimidazole Carbamates (1)	Ascochyta Blight
	Azoxystrobin	Dynasty *	0.153-0.765 fl. oz.	Quinone outside Inhibitors (11)	Ascochyta Blight, Seed and soil-borne disease,Damping-Off, Seedling Blight
	Pyraclostrobin	Stamina*	0.4-1.50 fl. oz.		Damping-off caused by Rhizoctonia solani, seed-borne fungi causing seed decay, seedling damping-off
	Trifloxystrobin	Trilex 2000*	1.0 fl. oz.		Seed and soil-borne disease,Damping-Off, Seedling Blight
	Fludioxonil	Maxim 4FS*	0.08-0.16 fl. oz.	PhenylPyrroles (12)	Seed and soil-borne disease,Damping-Off, Seedling Blight
	Mefenoxam	Apron XL-LS*	0.64 fl. oz.		Pythium Damping-off, early season Phytophthora control
		Apron Maxx RTA*	5.0 fl.oz.		Damping-Off, Seedling Blight, Seed-borne rots due to Pythium, Phytophtora, Fusarium, Rhizoctonia, early season Phytophthora root rot, seed-borne Sclerotinia and Phomopsis seed decay
	Thiamethoxam, mefanoxam, fludioxonil	Cruiser Maxx**	1.5 - 3.0 fl. oz.	PhenylAmides (4) PhenylPyrroles (12)	Damping-Off, Seedling Blight, Seed-borne rots due to Pythium, Phytophtora, Fusarium, Rhizoctonia, early season Phytophthora root rot, seed-borne Sclerotinia and Phomopsis species
	Metalaxyl	Allegiance FL*	0.75 - 1.5 fl. oz.	PhenylAmides (4)	Pythium Damping-off, early season Phytophtora control
		Sebring 480 FS*	0.5 - 1.0 fl. oz.		Pythium Damping-off, early season Phytophtora control
		Dyna-Sheild*	0.75 - 3.1 fl. oz.		Pythium Damping-off, early season Phytophtora control
		Acquire*	0.75 - 1.5 fl. oz.		Pythium Damping-off, early season Phytophtora control

* 1 Application/Season. ** Do not apply more than 0.266 lbs./A/Season.

Current labels can be found at www.cdms.net or www.greenbook.net

Foliar Fungicides Registered For Use

	Fungicide(s)						
Crop	Active ingredient	Trade Name	Application rate/Acre	Label restrictions - Max # applications/season, etc.	Class	PHI days[1]	Diseases
Dry Pea	Boscalid	Endura	6-11 oz.	2 max # applications/season	Succinate dehydrogenase inhibitors (7)	21	White Mold, Botrytis gray mold, Alternaria leaf and pod spot, Mycosphaerella blight, Rust
	Chlorothalonil	Bravo Weatherstik	1 3/8 to 2 pts.	Do not apply more than 8 pts/Acre during each growing season	Chloronitriles (M5)	14	
		Bravo Ultrex	1.25 to 1.8 lbs.	Do not apply more than 4 times/growing season		14	Downy Mildew, Rust
		Equus DF	1.25 to 1.8 lbs.	Do not apply more than 7.2 lbs/A during each growing season		14	Downy Mildew, Rust
		Bravo ZN	2 to 2 3/4 pts.	Do not apply more than 11.5 pints/A during each growing season		14	Downy Mildew, Rust
		Echo 720	1 3/8 to 2 pts.	Do not apply more than 6 lbs/A during growing season		14	Downy Mildew, Rust
		Chlorothalonil 720 SC	1 3/8 to 2 pts.	Do not apply more than 8 pints/A during each growing season		14	Downy Mildew, Rust
	Prothioconazole	Proline 480 SC	5.7 fl. oz.	Do not apply more than 3 times/ year	DeMethylation Inhibitors (3)	7	Ascochyta Blight, White Mold, Rust
	Azoxystrobin/Chlorothalonil	Quadris Opti	1.6 to 2.4 pts.	Do not apply more than 1.5 lbs of Azoxystrobin/A/Year Do not apply more than 6 lbs of Chlorothalonil/A/Year	Quinone outside Inhibitors (11)[2] Chloronitriles (M5)	14	Bean rust, Alternaria leaf spot, Rust, Web blight, Alternaria blight
	Azoxystrobin	Quadris	6.2 - 15.4 fl. oz.	Do not apply more than 92.3 fl. oz./A/season	Quinone outside Inhibitors (11)[2]	14	Ascochyta Blight, Alternaria leaf spot, Southern blight, Web blight, Alternaria blight, Rust
		Amistar	2-5 fl. oz.	Do not apply more than 1.5 lbs of Azoxystrobin/A/ year		14	Alternaria leaf spot, Southern blight, Web blight, Alternaria blight, Rust
	Pyraclostrobin	Headline	6 to 9 fl. oz.	Do not apply more than 18 fl ozs/A/season		21	Ascochyta Blight, Alternaria leaf and pod spot, Asian soybean rust, Downy Mildew, Mycosphaerella blight, Powdery mildew, Rust
Lentil	Boscalid	Endura	6-11 oz.	2 max # applications/season	Succinate dehydrogenase inhibitors (7)	21	Ascochyta Blight, White Mold, Botrytis gray mold, Alternaria leaf and pod spot, Mycosphaerella blight, Rust
	Chlorothalonil	Bravo Weatherstik	1 to 1.5 pts.	Do not apply more than 8 pts/Acre during each growing season	Chloronitriles (M5)	14	Anthracnose
	Prothioconazole	Proline 480 SC	4.3 to 5.7 fl. oz.	Do not apply more than 3 times/ year	DeMethylation Inhibitors (3)	7	Ascochyta Blight
	Azoxystrobin	Quadris	6.2 - 15.4 fl. oz.	Do not apply more than 92.3 fl. oz./A/season	Quinone outside Inhibitors (11)[2]	14	Ascochyta Blight, Anthracnose, Alternaria leaf spot, Southern blight, Web blight, Alternaria blight, Rust
		Amistar	2-5 fl. oz.	Do not apply more than 1.5 lbs of Azoxystrobin/A/ year		14	Anthracnose, Alternaria leaf spot, Southern blight, Web blight, Alternaria blight, Rust
	Pyraclostrobin	Headline	6 to 9 fl. oz.	Do not apply more than 18 fl ozs/A/season		21	Ascochyta Blight, Anthracnose, Alternaria leaf and pod spot, Asian soybean rust, Botrytis gray mold, Cercospora leaf spot, Downy Mildew, Mycosphaerella blight, Powdery mildew, Rust
Chickpea	Boscalid	Endura	6-11 oz./A	2 max # applications/season	Succinate dehydrogenase inhibitors (7)	21	Ascochyta Blight, White Mold, Botrytis gray mold, Alternaria leaf and pod spot, Mycosphaerella blight, Rust
	Chlorothalonil	Bravo Weatherstik	1 3/8 to 2 pts.	Do not apply more than 8 pts/Acre during each growing season	Chloronitriles (M5)	14	Ascochyta Blight
		Bravo Ultrex	1.25 to 1.8 lbs.	Do not apply more than 4 times/growing season		14	Ascochyta Blight, Downy Mildew, Rust
		Equus DF	1.25 to 1.8 lbs.	Do not apply more than 7.2 lbs/A during each growing season		14	Ascochyta Blight, Downy Mildew, Rust
		Bravo ZN	2 to 2 3/4 pts.	Do not apply more than 11.5 pints/A during each growing season		14	Downy Mildew, Rust
		Echo 720	1 3/8 to 2 pts.	Do not apply more than 6 lbs/A during growing season		14	Ascochyta Blight, Downy Mildew, Rust
		Chlorothalonil 720 SC	1 3/8 to 2 pts.	Do not apply more than 8 pints/A during each growing season		14	Ascochyta Blight, Downy Mildew, Rust
	Prothioconazole	Proline 480 SC	5.0 to 5.7 fl. oz.	Do not apply more than 3 times/ year	DeMethylation Inhibitors (3)	7	Ascochyta Blight
	Azoxystrobin/Chlorothalonil	Quadris Opti*	1.6 to 2.4 pts.	Do not apply more than 1.5 lbs of Azoxystrobin/A/Year Do not apply more than 6 lbs of Chlorothalonil/A/Year	Quinone outside Inhibitors (11)[2] Chloronitriles (M5)	14	Ascochyta Blight, Bean rust, Alternaria leaf spot, Rust, Web blight, Alternaria blight
	Azoxystrobin	Quadris*	6.2 - 15.4 fl. oz.	Do not apply more than 92.3 fl. oz./A/season	Quinone outside Inhibitors (11)[2]	14	Ascochyta Blight, Alternaria leaf spot, Southern blight, Web blight, Alternaria blight, Rust
		Amistar*	2-5 fl. oz.	Do not apply more than 1.5 lbs of Azoxystrobin/A/ year		14	Alternaria leaf spot, Southern blight, Web blight, Alternaria blight, Rust
	Pyraclostrobin	Headline*	6 to 9 fl. oz.	Do not apply more than 18 fl ozs/A/season		21	Ascochyta Blight, Alternaria leaf and pod spot, Asian soybean rust, Downy Mildew, Powdery mildew, Rust

[1] Pre-harvest Interval. [2] Group 11 can only be applied in 2 sequential applications with an alternation of another fugicide not in group 11. * Not recommended for control of ascochyta of chickpea in North Dakota and Montana due to strobulurin-resistant fungal populations

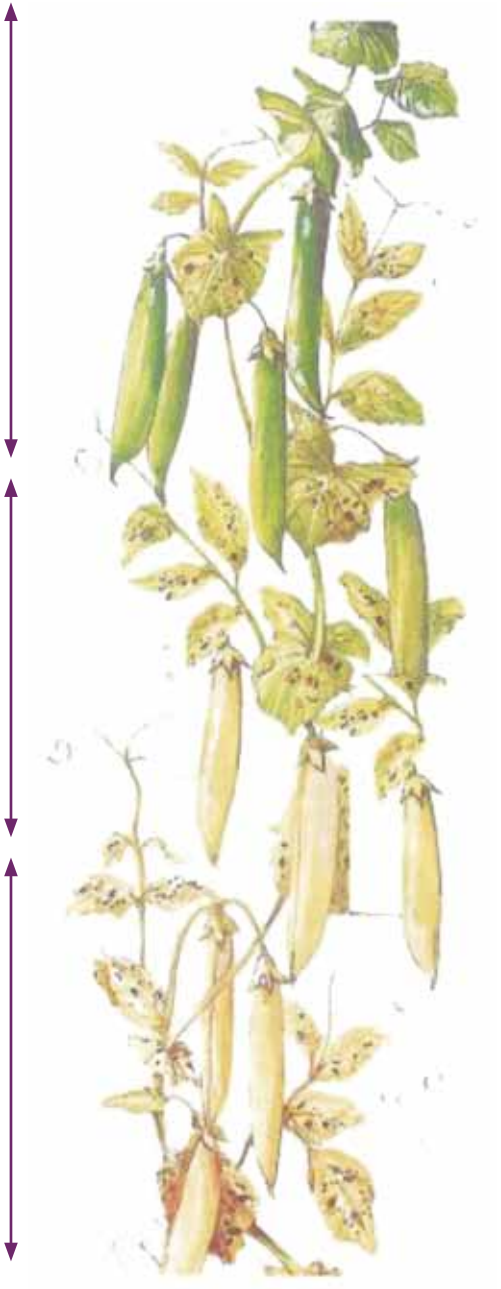
Current labels can be found at www.cdms.net or www.greenbook.net

Ideal Stage for Desiccating Dry Peas

Upper Pods
Pods are fleshy green or starting to turn yellow.
Seeds may be immature.

Middle Pods
Pods are light green to yellow and somewhat shrunken and leathery.
Seeds are full size and soft, but not juicy.
Seeds will split when squeezed.

Bottom Pods
Pods are dry and translucent.
Seeds are detached from the pods.

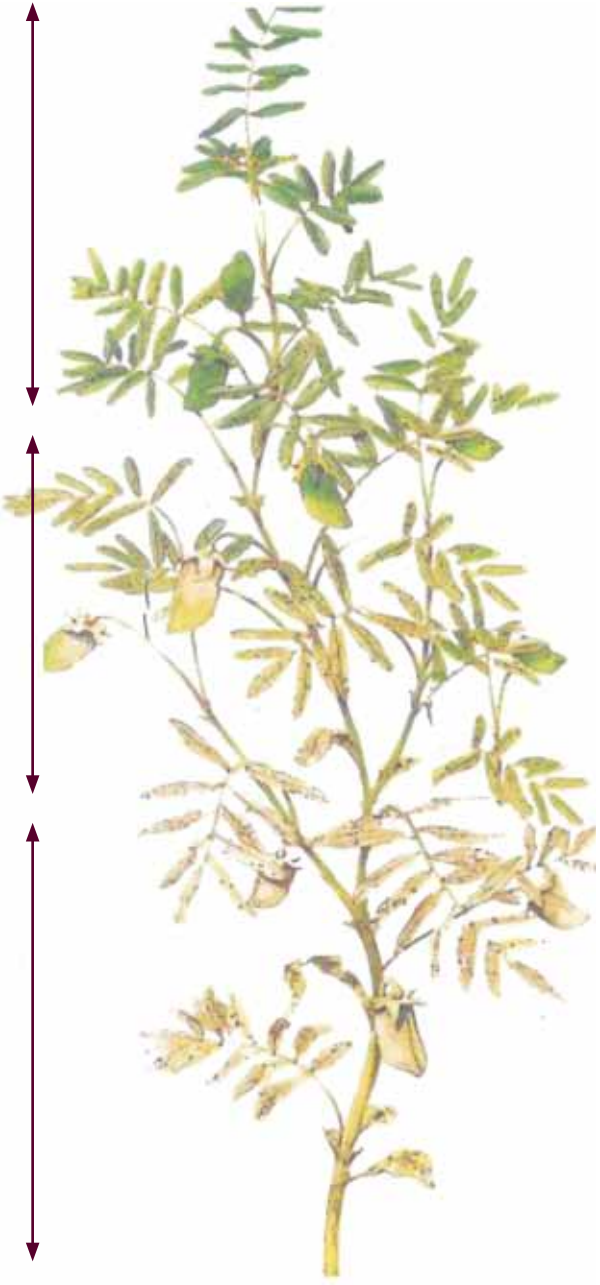


Ideal Stage For Desiccating Lentils

Upper Pods
Pods are fleshy green.
Seeds are immature.

Middle Pods
Pods are light green to yellow.
Seeds are full size and soft,but not juicy.

Bottom Pods
Pods are brown and dry but not split.
Seeds are quite hard and will rattle.



Diagnostics & Identification

Submitting Specimens

Extension Agents: Please use the Plant Diagnostic Information System (PDIS) to submit specimen information and remember to send the specimen with a printout of the sample summary. Please read the directions for PDIS submission and/or watch the video.

Other submitters: Please submit samples through your local county Extension agent. Forms for submission can be obtained on MSU Extension website: http://diagnostics.montana.edu, or NSDU Extension website: www.ag.ndsu.edu/pdl.

Plant Disease/Mushroom Diagnostics

Sampling instructions:

1. Send in whole plants with roots whenever possible.
2. Collect samples with mild, moderate, and severe symptoms as well as a healthy comparison.
3. Keep some soil around the root ball; wrap this in plastic and secure with rubber band around the base of the plant. Loosely enclose the foliage in a DRY plastic or paper.
4. Try to package samples so that when they arrive in the Clinic, we could repot them and have the plants survive!
5. Try to keep sample as fresh as possible until you can get it to the county agent: refrigerate if needed.
6. Include photographs or videotapes illustrating the problem if possible.
7. Send specimens to your appropriate Extension diagnostic lab.
   Note on the outside of the box whether it is plant disease or mushroom.

Please include background information. Plant problems often are influenced by many different factors, so include as much information as possible:

- Plant and variety
- Irrigated or dryland
- Soil type
- Crop history
- Seeding date, rate, and row spacing
- Chemicals used with names, rates, dates
- Rainfall, temperature extremes, and heavy winds
- Pattern of symptoms in the field
- Previous problems in the field

Insect Diagnostics

Sampling instructions:

1. Place all specimens in sturdy plastic containers with tight fitting lids that are strong enough to survive mail or courier services. Hard-bodied specimens can be sent to us alive. Aphids, mites, spiders, small flies and larvae need to be sent in containers with rubbing alcohol or a 50:50 dilution of water and anti-freeze (ethylene glycol). Caterpillars should be flash boiled and then placed in rubbing alcohol
2. Send specimens to your appropriate Extension diagnostic lab.
   Note *Insect* on the outside of the box for the specimen type.

Plant Identification

What to collect:

1. Short grasses, small flowering herbaceous plants, low shrubs: Collect several (at least three if possible) ENTIRE plants, including roots, plus extra flowers and/or fruits if available. Clean debris and soil from roots before shipping.
2. Tall grasses and shrubs, herbaceous forbs, trees, long vines: Collect several samples that adequately show stem features, leaves and leaf arrangement, and flowers and/or fruits. Collect extra flowers and/or fruits if available. If possible, collect or provide information about underground parts, i.e. roots, rhizomes, bulbs, tubers, etc.
3. Record collection data and include State, County, geographic location of collection site, and date. This information is important to the identification process. Please remember to fill out a separate Plant Identification Form 149 for each plant specimen/species submitted for identification, available at http://diagnostics.montana.edu.

How to care for and prepare collected specimens:

1. Plant specimens may be put directly into a plant press in the field or later, and submitted as a dried and pressed specimen.
2. Plant specimens may be allowed to dry without pressing, but are generally more difficult to package and require a larger (than otherwise necessary) box to ship them.Plant specimens may be submitted fresh (not dried or pressed) and are best collected directly into a DRY Ziploc-type plastic bag and kept in a refrigerator until being shipped.

Mailing:

1. Plant identification Form 149 needs to be filled out for each species/specimen submitted for identification.
2. Package the specimen to minimize potential damage from mail handling (place dried specimens between pieces of cardstock or cardboard within the outer package). A box is a preferable mailing container to an envelope.
3. Send specimens to your appropriate Extension diagnostic lab.
   Note *Plant ID* on the outside of the box for the specimen type.

Schutter Diagnostic Lab

Montana State University and MSU Extension provide plant pest identification through the Schutter Diagnostic Lab. Services provided by the clinic include the identification of plant diseases, insects, plants, and mushrooms. We also aid in the diagnosis of cultural problems and give management recommendations for agricultural producers, homeowners and gardeners. We use a wide range of techniques for diagnosis including visual identification, pathogen culture, microscopic identification, and biochemical detection. Our specialists provide recommendations for control and interface with the public to supply information on the best management practices to produce healthy, productive crops.

NDSU Plant Diagnostic Lab

For over 40 years, the NDSU Plant Diagnostic Lab has helped individuals and professionals in agriculture and horticulture identify plant problems. The lab is a member of the Great Plains Diagnostic Network, a region of the National Plant Diagnostic Network, since 2002. A goal of this network is to enhance our ability to detect and diagnose high-risk plant problems earlier.

Your local county extension office or state land grant university plant pest diagnostic lab can provide assistance in solving plant problems. Local experts within your own state or county may be better equipped to address particular questions you have, since different hosts around the country can experience different problems.

Sponsors

Funding for this calendar was provided by Montana State University Extension and the Northern Pulse Growers Association.

The Northern Pulse Growers Association is a nonprofit association representing dry pea, lentil, chickpea, lupin and fava bean growers from Montana and North Dakota. The Northern Pulse Growers Association strives to increase pulse producers profitability through education, research, domestic and international marketing and government relations.

As pulse acres have continued to expand throughout the region, the idea to develop an organization that encompassed growers from both Montana and North Dakota evolved. Growers in both states face similar issues in the areas of marketing, production and pulse research. A regional organization allows the states to share resources and to be a more effective within the domestic and international pulse industry.

The Northern Pulse Growers Association officially got its start on July 1, 2006. Growers in the region are represented by a ten person board representing seven districts from across Montana and North Dakota (three at-large). Board members are nominated and elected by fellow producers at the annual convention held in January of each year.

For more information regarding pulse crop pests, contact:

MONTANA STATE UNIVERSITY | EXTENSION

Schutter Diagnostic Laboratory
Montana State University
121 Plant BioScience Building
Bozeman, MT 59717-3150
Disease: (406) 994-5150
Insects:(406) 994-5690
Plant ID: (406) 994-6296

NDSU Extension Service

NDSU Plant Diagnostic Lab
North Dakota State University
306 Walster Hall
Fargo, ND 58102
(701) 231-7854

Northern Pulse Growers Association

Northern Pulse Growers Association
1710 Burnt Boat Drive
Bismarck, ND 58503
(701) 222-0128
www.northernpulse.com
info@northernpulse.com

Credits

Photos provided from the following

- Montana State University
- North Dakota State University
- Manitoba Agriculture, Food and Rural Initiatives
- USDA, ARS
- Bugwood.org

Contributing Authors:

MSU
- Mary Burrows
- Ed Davis
- Fabian Menalled

NDSU
- Brian Jenks
- Janet Knodel
- Michael Wunsch (Carrington)
- Sam Markell

Design:
- David Ashcraft
  MSU Extension Communications












MONTANA STATE UNIVERSITY | EXTENSION

NDSU Extension Service

Northern Pulse Growers Association