

A1166 (Revised)

Field Pea Production

Revised by

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Introduction

Field pea, or “dry pea,” is marketed as a dry, shelled product for human or livestock food. Field pea differs from fresh or succulent pea, which is marketed as a fresh or canned vegetable.

The major field pea-producing areas include Canada, Europe, Australia and the U.S. Historically, field pea primarily was grown in the Palouse region of Washington and Idaho.

In the 1990s, North Dakota, South Dakota and Montana began producing dry pea. Since the production peak in 2006 (Figure 1), field pea acres have decreased in North Dakota.

In 2015, approximately 275,000 acres were planted in North Dakota. The majority (more than 70 percent) of the dry pea produced in the U.S. is exported.

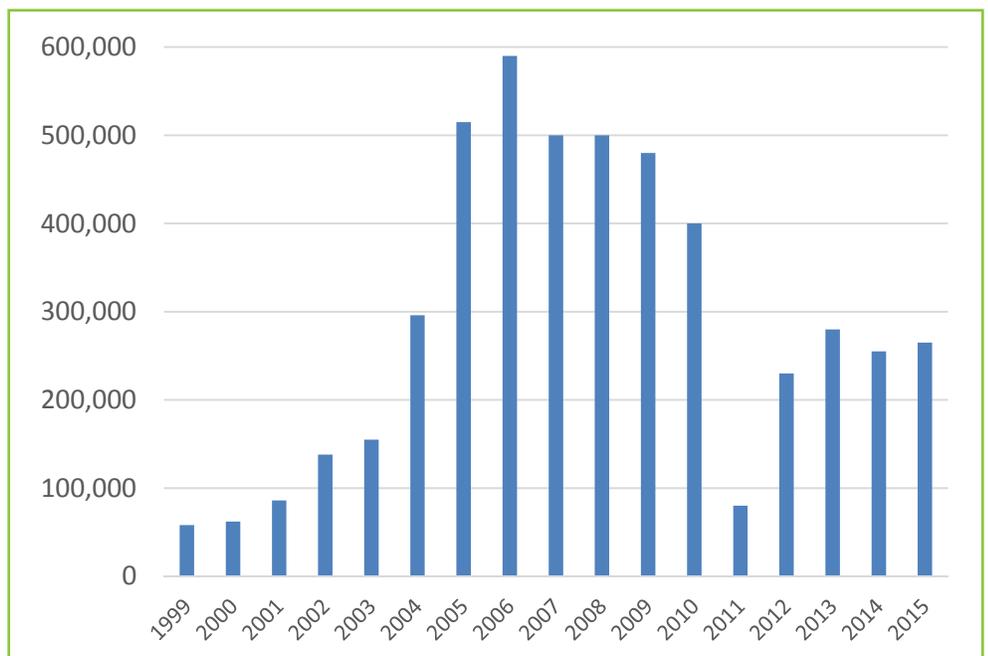


Figure 1. North Dakota Dry Pea Harvested Acreage, 1999 to 2015.

Source: North Dakota Agricultural Statistics Service - U.S. Department of Agriculture.

Uses

Field pea primarily is used for human consumption or as livestock feed. Field pea is a grain legume commonly consumed throughout the world and is popular in human vegetarian diets.

Field pea has high levels of the amino acids, lysine and tryptophan, which are relatively low in cereal grains. Field pea contains approximately 21 to 25 percent protein. Peas contain high levels of carbohydrates, are low in fiber and contain 86 to 87 percent total digestible nutrients, which makes them an excellent livestock feed.

Field pea also contains 5 to 20 percent less of the trypsin inhibitors than soybean. This allows it to be fed directly to livestock without having to go through the extrusion heating process. Field pea often is cracked or ground and added to cereal grain rations.

Research has shown that field pea is an excellent protein supplement in swine, beef cow and feeder calf, dairy and poultry rations.

Cover Crop

Field pea often is used in forage crop mixtures with small grain. Field pea forage is approximately 18 to 20 percent protein. Pea interseeded at 60 to 100 pounds per acre with a small grain such as oat can increase the protein concentration of the mixed forage by 2 to 4 percentage points and increase the relative feed value by 20 points over oat seeded alone.

Field pea also may be grown as a green manure or green fallow crop. Either option can improve or maintain future crop productivity.

The use of field pea for green fallow instead of black fallow protects the soil from erosion and improves soil quality. This use also can substitute water loss by evaporation or leaching from black fallow, with transpiration through plant growth, and exploits rotational benefits. Costs of tillage and idled land in black fallow are substituted with costs of field pea establishment and termination (at early flowering) in green fallow.

Opportunities also exist to utilize just-harvested pea fields for a volunteer

pea cover crop. At harvest, a small percentage of the dry field pea seeds will have dropped to the ground, even when combines are well-adjusted. These seeds may be stimulated to germinate and start growing. This may require a light harrowing of the field to incorporate the seed.

Soil moisture is essential for germination to take place. As the stimulated volunteer plants follow a main crop of field peas, high numbers of *Rhizobium leguminosarum* bacteria inoculum will be in the soil and nodulation is typically excellent.

The growing pea plants will provide a soil cover and protect the soil from erosive forces. This system can make use of the remaining growing season because field pea is tolerant to minor frost.

The total amount of biomass produced depends upon the pea plant density, the timing of initiation of regrowth, soil moisture, rainfall and the date of a killing frost. However, not enough time is left of the growing season to expect to harvest a second dry pea crop for seed.

The volunteer pea crop can be used for grazing or the biomass can be left on the soil or worked into the soil. Research at Carrington in 2008 found that fall-produced dry pea biomass reached 1,500 to 3,000 pounds per acre. After grazing, the pea stubble can be worked into the soil as a green manure or left over the winter.

Adaptation

Field pea is an annual cool season grain legume or pulse crop. Field pea has two main types. One type has normal leaves and vine lengths of 3 to 6 feet; the second type is the semi leafless type that has modified leaflets reduced to tendrils, resulting in shorter vine lengths of 2 to 4 feet. Pea normally has a single stem but can branch from nodes below the first flower.

Most varieties of pea produce white to reddish purple flowers, which are mostly self-pollinated. Each flower will produce a pod containing four to nine seeds. Pea varieties have indeterminate or determinate flowering growth habit.

Indeterminate flowering varieties will flower for long periods, and ripening can be prolonged under cool, wet conditions. Indeterminate varieties are later in maturity, ranging from 90 to 100 days. Determinate varieties will flower for a set period and ripen with earlier maturity of 80 to 90 days.

Field pea is sensitive to heat stress at flowering, which can reduce pod and seed set. Indeterminate varieties are more likely to compensate for periods of hot, dry weather and are more adapted to arid regions. Determinate, semi leafless varieties that have good harvestability are more adapted to the wetter regions.

Pea roots can grow to a depth of 3 to 4 feet; however, more than 75 percent of the root biomass is within 2 feet of the soil surface. A relatively shallow root system and high water use efficiency make field pea an excellent rotational crop with small grains,

especially in arid areas where soil moisture conservation is critical.

Field pea is well-adapted to cool, semiarid climates. Field pea seed will germinate at a soil temperature of 40 F. Emergence normally takes 10 to 14 days. Field pea has hypogeal emergence in which the cotyledons remain below the soil surface. Seedlings are tolerant of spring frosts in the low 20s, and if injured by frost, a new shoot will emerge from below the soil surface until approximately seven nodes are above the soil surface.

Flowering usually begins 40 to 50 days after planting. Flower duration is normally two to four weeks, depending on the growth habit and environment during flowering.

Field pea has shown to be well-adapted to most regions of the northern Great Plains (Figure 2). Field pea yields can be slightly lower or similar to spring wheat on a pound or bushel basis within a specific region. A six year average (2010-2015) of Agassiz field pea yield at the North Central Research Extension Center at Minot was 3,277 pounds, or 55 bushels per acre, compared with Faller hard red spring wheat at 4,241 pounds, or 71 bushels per acre.

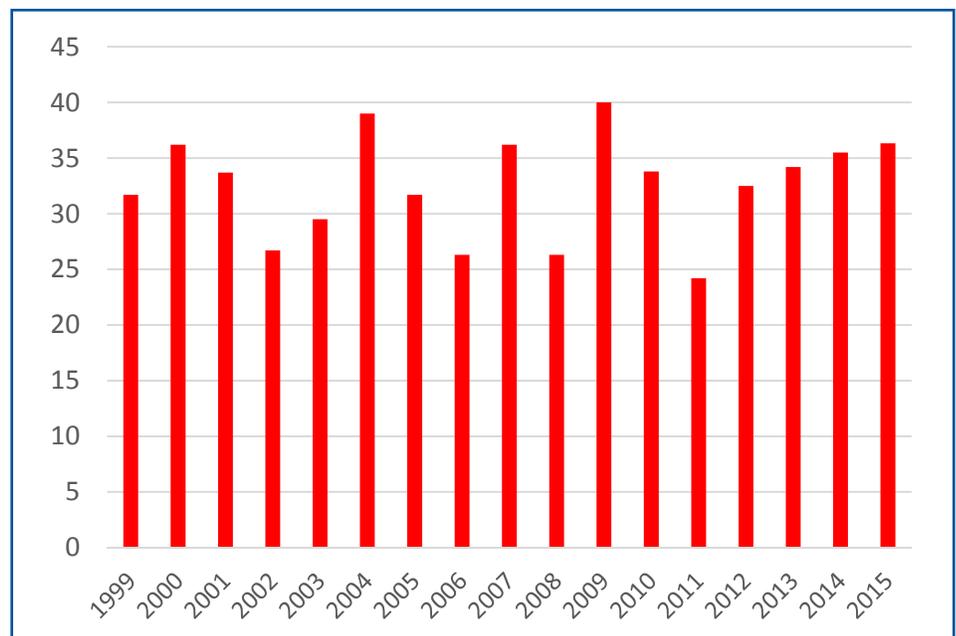


Figure 2. Average North Dakota Dry Pea Yield in Bushels per Acre, 1999 to 2015.

Source: North Dakota Agricultural Statistics Service - USDA.

Varieties, Types and Performance

Selecting the appropriate field pea variety should be based on the review of the many differences that exist among varieties and location grown. Factors to consider should include market class, yield potential, harvest ease, vine length, maturity, seed size and disease tolerance.

The first criterion for selecting a variety should be market class. The green and yellow cotyledon types are the primary market classes. All field pea varieties may be considered feed peas, but only selected varieties are acceptable for the green or yellow human edible market.

After market type is determined, growers should review the field pea performance test information from trials conducted across the state while paying particular attention to those trials reflective of their farming area.

Crop harvestability is a very important factor in variety selection and often is noted by harvest ease scores in trial results. Most growers prefer a variety that will stand upright at harvest because that allows a faster harvest, minimal equipment modification and higher seed quality. The newer varieties that have shorter vines and are semi leafless will be easier to harvest. Reviewing harvest ease data is important because varieties within this plant type differ greatly in standability.

Another factor to consider in variety selection is the producer's location. The indeterminate nature of the long vined normal leaf type varieties may make them a preferred type in western North Dakota, where moisture stress is more prevalent. Indeterminate varieties tend to express more stable seed yields when moisture and heat stress impact crop development. This type of variety normally will be heavily lodged at harvest and require special harvest procedures.

Most growers will select among the semi leafless varieties that are more determinate in development.

When selecting within these semi leafless types, consider the impact of vine length. In areas with higher rainfall and cool summers, the shortest vined varieties may be best, while in the drier regions, a grower should choose a semi leafless type with longer vines.

A wide selection of field pea varieties exists for producers across the region. A good source of information to aid in variety selection is field trial evaluations conducted by the various NDSU Research Extension Centers across the state. These trials include the most promising varieties with information recorded on the important traits necessary for making proper variety selection.

The most recent "North Dakota Dry Pea Variety Trial Results and Selection Guide" (A1469) can be useful for comparing variety data. This publication can be found at www.ag.ndsu.edu/varietytrials or a hard copy is available from county Extension offices.

Field Selection

Field pea can be grown on a wide range of soil types, from light sandy to heavy clay. Field pea has moisture requirements similar to those of cereal grains. However, peas have lower tolerance to saline and water logged soil conditions than cereal grains. Peas will not survive long in water logged conditions. Poorly drained and saline soils should be avoided when growing field pea.

Field pea commonly is grown in rotation following small grains. Field pea will fix the majority of the plants' required nitrogen if the seed is inoculated properly.

Fields with a history of perennial weed problems such as Canada thistle, perennial sowthistle and field bindweed should be avoided. Previous soil-applied herbicides may result in crop rotation restrictions when field pea is planted in the following year(s). Check field application records, rainfall totals, soil type, pH and tillage to make decisions on planting field pea. Consult the most recent "North Dakota Weed Control Guide" (NDSU Extension Service publication W253) and herbicide labels for rotational restrictions.

Seeding

Field pea can be grown in a no till or conventional-till cropping system. Avoid excessive tillage in the spring to avoid drying out the seedbed. Pea seed requires considerably higher amounts of moisture for germination than cereal grains. Field pea typically is seeded in a narrow row spacing of 6 to 12 inches. A conventional grain drill or air seeder that is capable of handling large seed without cracking is important.

Field pea should be seeded early, in April to mid-May, so flowering will occur during potentially cooler weather in June and early July. Seeding date studies conducted in North Dakota indicate that field pea yields decrease significantly when seeding is delayed beyond mid-May. Seeding field pea beyond mid-May will result in the crop beginning to flower in mid-July, which increases the risk of heat stress and disease problems, such as powdery mildew, reducing yields.

Maintaining firm seed-to-soil moisture contact is critical. Seeding pea well into moisture is critical and seeding peas into dry soil should be avoided. A seeding depth of 2 inches is recommended, with a rule of thumb that field pea should be seeded at least ½ inch into moisture and never seeded onto the interface where soil moisture meets dry soil.

Seeding Rate

The seeding rate will depend on the size of the seed. Field pea varieties will range from 1,600 to 5,000 seeds per pound. A plant density of 300,000 to 350,000 plants per acre or seven to eight plants per square foot is recommended.

Always select high-quality, disease free seed. When seeding pea, always adjust for germination and allow for a certain percent of the seed that germinates not to become an established plant. Planting equipment should be calibrated or modified to allow for seed and inoculant to flow properly without cracking the seed or plugging the opener.

Seed Treatments

Field surveys performed across North Dakota from 2008 to 2015 have indicated that *Fusarium* and *Aphanomyces* root rot are most commonly observed and cause the most damage to field pea. However, *Rhizoctonia* and *Pythium* also can cause root rot, seedling damping-off and reduced emergence.

Seed treatment fungicides show limited efficacy against the most common root rotting pathogens, *Fusarium* and *Aphanomyces*; however, the use of seed treatment fungicides is recommended for field pea to control root rots and damping-off caused by *Rhizoctonia* and *Pythium*. This is particularly true when planting into cold or wet soils or when seeding in close rotation with other broadleaf crops.

For a listing of registered seed treatments and specifics on disease control, consult the most current version of NDSU Extension Service publication PP622, "North Dakota Field Crop Fungicide Guide."

Consulting the seed treatment label for its effect on rhizobium inoculants is very important.

Most seed treatments have little or no effect on rhizobium inoculants and nodulation; however, some seed treatments are very toxic to all formulations of inoculants. Allowing the seed treatment to dry fully and adding inoculants just prior to planting always is recommended.

Inoculation

Field pea is a legume crop and has the inherent ability to obtain much of its nitrogen requirement from the atmosphere by forming a symbiotic relationship with *Rhizobium* bacteria in the soil.

Grain legumes vary widely in the proportion of the crop's total nitrogen (N) requirement that may be met through nitrogen fixation. The total amount of nitrogen fixed by the crop also depends on favorable growing conditions. Hot temperatures and dry soils during the later vegetative and early reproductive stages are especially detrimental for N fixation. Field pea is among the most highly efficient nitrogen-fixing crops and may obtain as much as 80 percent of its total nitrogen requirement from fixation under good growing conditions.

However, for this relationship to occur, the seed must be inoculated properly with the appropriate strain of *Rhizobium* bacteria. Producers must be certain that the inoculum product they obtain is specific for field pea. The use of an inoculum labeled for soybean, clover or various other legumes will not allow the nitrogen-fixation process to occur. Inoculants are available in various forms, including dry peat, liquid and granular.

Application of inoculant (*Rhizobium leguminosarum* biovar *viciae*) to the seed is an extremely important procedure. Many failures with nitrogen fixation have been associated with improper application technique. Thorough coverage of the seed is critical because seeds not exposed to the bacteria will result in plants unable to fix nitrogen. Inoculants are living organisms, so proper storage and handling is important.

Granular inoculant has alleviated many of the concerns with inoculant applications. This inoculant is metered through the planter and delivered directly into the seed furrow. Producers should refer to the manufacturer's package labels to review the proper inoculum rate and handling procedure.

Growers should check their fields to determine if inoculation was successful. Normally, nodules will form on the roots two to four weeks after emergence. To check for nodulation, carefully dig up a number of plants and gently clear the soil from the root mass. Nodules will be present on the primary root and lateral roots.

Effective nodules will have a pink to red coloration on their interior. If nodulation does not occur and soil nitrogen levels are low, an application of nitrogen fertilizer over the top may be required to optimize seed yields.

Nitrogen fixation will take place from about four weeks after emergence through seed formation. When field pea has been grown in rotation for a few times in the same field, the need for inoculation is not as critical, compared with growing field pea for the first time in a field.

Fertilization

Under most conditions, the use of inoculants will satisfy the nitrogen requirement of a field pea crop. A soil test should be conducted to determine the status of the primary nutrients.

The addition of a nitrogen fertilizer may be required when field pea is planted on land with less than 30 pounds of available nitrate N in the top 2 feet of the soil profile. Under these conditions, the addition of 20 to 30 pounds of nitrogen with commercial fertilizer is recommended to meet the needs of the developing field pea plant until nodulation becomes fully effective.

Producers should avoid planting field pea on fields that have a high level of nitrogen. Excess nitrogen will promote vegetative development rather than reproductive seed production. Higher nitrogen levels also will reduce the potential of nitrogen fixation and increase the potential for lodging.

Phosphorus (P) fertilization is likely the primary concern for field pea growers. Research has indicated the importance of adequate phosphorus fertility for optimizing seed yield. Proper fertilizer source, rate and placement are necessary to avoid reductions in plant stand while at the same time meeting the P needs of the field pea plant.

Avoid placing fertilizer directly with the seed. North Dakota research has indicated stand loss is likely while yields are not increased. Refer to NDSU Extension Service publication SF882, "North Dakota Fertilizer Recommendation Tables and Equation" for additional information that relates to field pea nutrient requirements.

Weed Control

Field pea is a poor competitor with weeds, especially during the first month after planting. Relatively slow early season growth and a lack of

complete ground cover by the crop canopy allow weeds to be competitive. A well-established stand of seven to eight plants per square foot is critical for field pea to be competitive with weeds.

Perennial weeds and annual weeds that emerge early in the season, including common lambsquarters, kochia, volunteer grain, wild mustard and wild oat, are very competitive with pea. For example, a Canadian trial indicated that two wild mustard plants per square foot reduced pea yield as much as 35 percent.

Good weed control is also very important in raising high-quality human edible pea. Weeds such as kochia, Russian thistle, nightshade and wild buckwheat can cause harvest problems with fields that are intended to be straight combined. Nightshade berries can stain the pea seed at harvest, causing a reduction in quality.

Cultural methods that should be used as part of an integrated weed management system include crop rotation, field selection, rapid crop establishment at an adequate density and use of clean seed. Several soil applied and post emergence herbicides labeled for weed control in field pea are available.

Applying pre-emergence herbicides before planting field pea is encouraged. The soil-residual activity can provide weed control while field pea is emerging. Generally, field pea is a poor competitor with early season weeds. Generally, postemergence herbicides should be applied to small weeds and pea (less than 2- to 4 inch height) to maximize weed control and minimize crop injury. Preharvest desiccants also are labeled to dry weeds for a more efficient harvest.

For more information on registered herbicides and directions for use, consult the "North Dakota Weed Control Guide" (W253). Read and follow all chemical labels.

Diseases

Controlling diseases in field pea begins with crop rotation. A preferred crop rotation would have field pea planted with at least four cropping years between plantings. For the most important root rot pathogens, little to no difference occurs between lentil and field pea in susceptibility, and a minimum of a four-year rotation would be needed for either of these crops, especially when soil conditions are relatively wet. A three-year rotation will be adequate to control foliar disease pathogens.

Blights

Aschochyta (*Mycosphaerella*) blight and bacterial blight are economically important diseases of field pea that are confused easily. On leaves, petioles and pods, *Aschochyta* blight develops as brownish to black flecks, often with a purplish tint: on leaves, it also can cause large, tan, round to oval lesions composed of several concentric rings. On pods, lesions often are sunken and can result in discolored seeds.

On stems, lesions are purplish brown and are centered on nodes; when stem lesions are severe, plants often lodge and sometimes ripen prematurely. Diseased tissue is never translucent, does not readily shatter and is not constrained by veins. *Aschochyta* is always most severe at the base of the plant and is most prevalent when cool, wet weather occurs during late vegetative growth and bloom.

Bacterial blight, which is easily confused with *Aschochyta* blight, causes lesions on leaves, petioles, stems and pods that appear shiny to greasy when the lesions are fresh. Leaf lesions often are constrained by veins and frequently become translucent or shatter as they age.

Bacterial blight often develops at similar severity in the midcanopy as the lower canopy, and it is most sever

after rain storms accompanied by strong winds or after hail storms. Both diseases survive in crop residues and are seed-borne and seed-transmitted.

Aschochyta blight can be managed successfully with fungicides, but fungicides are not effective against bacterial blight. The optimal timing of fungicide applications varies based on conditions but often coincides with full bloom and early pod development. Varieties differ in their susceptibility to Aschochyta, but susceptibility ratings are generally unavailable and no commercial variety carries full resistance to Aschochyta or bacterial blight.

■ Root Rots

Overall, root rots are the most damaging pathogen to field pea in North Dakota.

Disease is most severe with continuous wet weather. Fungal spores may spread to uninfected tissue by splashing rain. Lesions can develop on pods, which may result in the seed becoming infected. Infected seed will be shrunken and discolored.

Ascochyta foot rot will form blackish purple lesions on the stem at the base of the plant. Severe infections of ascochyta will result in premature ripening, lodging and reduced yields. Additionally, low levels of discolored and/or shrunken seed may be present.

These fungi survive on plant debris, and spores can survive for years on field pea stubble. Spores also can be carried on the seed; therefore, planting disease-free seed is very important. Producers who buy or use their own seed should know the level of seed-borne inoculum present on the seed. Tolerance for seed-borne Aschochyta in Canada is very high; however, no tolerance has been established for seed-borne bacterial blight.

Aphanomyces root rot is another disease that can affect field pea.

Aphanomyces root rot is caused by a fungal-like organism. It overwinters in the soil as thick-walled spores (oospores) that can survive for many years. In the presence of pea roots, the oospores will germinate and eventually swimming spores (zoospores) that can infect pea roots will be formed.

Infection may occur at any stage of plant growth. Plants are most at risk when soil is saturated for a long period of time. Symptoms appear as caramel-brown lesions on the roots. The pathogen infects the cortex (outer portion) of the root; therefore, when plants are pulled from the soil, the cortex may slough off, leaving only a small strand of vascular tissue intact.

Planting into well-drained soils and minimizing soil compaction will help manage the disease. Planting oat as a pre-crop also has been shown to reduce disease severity.

■ Stem Rot

Sclerotinia stem rot can infect field pea. Symptoms of the disease include a white, frothy, fungal growth found on dead or decaying tissue. The fungal growth can develop into hard, black bodies (sclerotia) found inside the stem, which can cause premature ripening of the plant.

Typically, long-vine varieties having normal leaf arrangement are more susceptible to sclerotinia because they tend to lodge after flowering, forming a dense canopy close to the soil surface and increasing the risk of infection.

Generally, semi leafless pea that has good standability will avoid any serious sclerotinia infections. Infection risk increases if field pea is planted close in rotation with broadleaf crops such as sunflower, dry edible bean, canola or mustard. Sclerotinia is rarely a disease of economic importance in dryland field pea production in North Dakota.

■ Powdery Mildew

Powdery mildew is an economic disease that is generally most severe in late-planted field pea. Powdery mildew develops on plant surfaces as a white fungal growth that can be wiped off easily with a finger; initially, underlying tissue remains green, but as the disease develops, underlying tissue takes on a bluish hue.

Powdery mildew develops in dry, warm weather accompanied by nights with dew. The disease overwinters on plant residue of field pea and alternate hosts. Powdery mildew infections usually do not occur until midsummer. Yield loss typically does not occur unless the infection occurs during early to midpod set.

Planting field pea after mid-May means it more likely will mature during warm, dry weather favorable to disease development. The combination of planting early and the use of resistant varieties will aid in reducing risk with this disease.

Powdery mildew impacts seed yield, seed weight and seed size. Most commercial field pea varieties are susceptible to powdery mildew but resistant varieties are available. Fungicides have efficacy when applied at the first signs of powdery mildew in the lower canopy but are of limited effectiveness once the disease has spread to the mid- and upper canopy.

For additional information on fungicides labelled in field pea, consult the “North Dakota Field Crop Plant Disease Management Guide” (PP622). Always read and follow label instructions.

■ Pea Aphids

One of the most common insects in field pea is the pea aphid. Pea aphids are small, about 1/8 inch long and light to dark green. Pea aphids have multiple generations per year and overwinter as eggs in alfalfa, clover or vetch.

Pea aphids have piercing-sucking mouthparts and may vector viral diseases. For example, pea seed-borne mosaic virus (PSbMV) is an economically damaging viral pathogen of field pea that can cause significant losses in seed yield and quality, especially when infections occur before or during flowering. Consult the NDSU Extension Service publication PP1704 for more information.

Field pea is especially susceptible to aphid feeding injury during the flowering to early pod stage and drought stress, which can lower yields due to less seed formation and smaller seed size. However, aphid populations are usually kept low by heavy rains and/or by beneficial insects, such as lacewings or ladybird beetles.

Insecticide treatment for pea aphid control should be considered 1) when an economic threshold of an average of two to three aphids per 8-inch pant tips is reached or 90 to 120 aphids per 10 180-degree sweeps of a 15-inch diameter insect net are found, and 2) when few natural enemies are present.

If the economic threshold is exceeded, a single application of insecticide when 50 percent of plants have produced some young pods usually will protect the crop against yield loss. If an insecticide application is necessary during flowering, spray when bee foraging is minimal, preferably during the evening hours (after 8 p.m.).

■ Lygus Bug

Lygus bug (or tarnished plant bug) has the potential of being the most serious insect pest in field pea in North Dakota. Immature and adult *Lygus* bugs feed and inject a toxin into the tissues of the developing pods and seeds of peas.

The symptoms of *Lygus* bug feeding injury is a shriveled and deformed seed, often with chalk spot. Chalk spot is a pit or craterlike depression in the seed coat with or without a chalky white spot. It severely affects the appearance of the seed, lowering the grade and marketability. Chalk spot damage in field pea has been as high as 27 percent when *Lygus* bug densities are high in fields.

Another probable cause of chalk spot is harvesting field peas at a high moisture content, which makes them susceptible to bruising if they are handled roughly. *Lygus* bugs will migrate quickly into fields after alfalfa (preferred host) is cut for hay.

Field monitoring for *Lygus* bug is important during flowering and early pod development. An insecticide treatment is recommended when more than 10 *Lygus* bugs per 25 180-degree sweeps with a 15-inch diameter insect sweep net are present. If an insecticide application is necessary during bloom, spray when bee foraging is minimal, preferably during the evening hours (after 8 p.m.).

■ Grasshoppers

Grasshoppers are usually not a major pest problem in field pea because field pea is not typically a preferred host of grasshoppers. However, grasshoppers can cause damage to field pea, especially when field pea is in the flower to pod-filling stages and when populations are high. Grasshopper outbreaks usually coincide with several years of low rainfall and drought periods.

Insecticide treatment for grasshopper control should be considered when nymph (immature) or adult grasshoppers are present at 30 to 45 and 8 to 14 per square meter in the field, respectively.

For additional information on insecticides registered in field pea, please consult the NDSU Extension Service publication "North Dakota Field Crop Insect Management Guide," E1143. Always read and follow label instructions.

Harvest

Harvest management is especially important to obtain high-quality field pea to be marketed as human food or seed. High-quality product is needed to receive a premium price for the crop. If the crop has quality problems, including bleached, split, cracked or earth-tagged seed, the livestock feed market likely will be the only option. Earth-tagged seed has dirt attached that cannot be removed.

The decision to start the harvest process will depend on three factors:

■ Crop maturity (stage of uniformity):

Look for a large majority of plants with tan pods on the bottom, yellow to tan pods in the middle, and yellow-green pods on the top.

■ Seed moisture content:

Swath or desiccate field pea when the seed moisture content has reached 25 to 30 percent. Straight combine field pea when the seed moisture content has reached 18 to 20 percent.

■ Presence of weed growth:

Do not wait for green weed growth to dry down.

Field pea can be swathed to preserve quality if crop maturity is uneven or heavy weed pressure is present.

When swathing pea, the seed needs to be at physiological maturity. At this stage of growth, the majority of pods should have turned from green to yellow. The crop matures from the bottom pods upward. Swathing normally will result in increased harvest losses, but swather modifications make the procedure easier and will reduce harvest loss.

Vine lifters enable producers to get under the pea vines and lift them over the cutting knife. Many growers use a pickup reel to help in moving plant material off the cutter bar onto the canvas.

Field pea should be swathed in the early morning or late afternoon when the humidity is high and the pods are tough to reduce shattering losses. Combining should not be delayed after swathing because pea swaths are susceptible to movement by wind.

Many short to medium vine and semi leafless pea cultivars have characteristics that allow straight harvesting compared with cultivars with indeterminate and prostrate vine growth. For example, semi leafless pea has a more open canopy, remain erect longer and dry down more rapidly after a rain or heavy dew than the indeterminate long vine type.

Straight combining will eliminate the possibility of windrow damage caused by high winds and reduce losses at the cutter bar. A desiccant may be used to enhance crop drying prior to combining.

Maintaining a low cutter bar height is essential to reduce losses. Floating cutter bars or flex-heads and raking-type pickup reels are available to reduce losses and increase harvest efficiency. To reduce seed shattering, the combine reel should be adjusted to a low speed.

Field pea should be combined with seed moisture of 17 to 20 percent to reduce splitting and seed coat cracking. Breakage increases at moisture contents below 14 to 16 percent. At this moisture range, the seeds are firm and no longer penetrable with a thumbnail.

Losses from shattering may be reduced by harvesting field pea before all pods are dry. Field pea does not ripen as uniformly as other crops, therefore harvesting while green leaves and pods remain may be necessary.

Pea vines must be dry or harvest will be extremely slow and difficult. However, seed that is too dry will be susceptible to seed coat breakage or peeling. Harvest should occur during



humid conditions, such as at night or early morning, when pods are wet with dew, to minimize seed shatter.

Correct combine settings and operation are important to maintain seed quality. Reel speed should be slow to minimize seed shatter. Low cylinder speeds, normally 350 to 600 rpm, should be used to minimize seed cracking or splitting. The cylinder speed should be reduced as harvest seed moisture decreases.

Initial concave settings of 0.6 inch clearance at the front and 0.3 inch at the rear, with the chaffer at 0.6 inch and sieve size at 0.4, are suggested. Use high airflow for good separation. Adjust combine settings as crop and weather conditions change.

Handling

The combine and portable augers should be operated at full capacity and low speeds to reduce pea seed damage. Alternative seed-handling equipment such as belt conveyors should be considered for handling the grain intended for seed or the human food market. Minimize the number of times seed is handled.

Field pea has improved handling characteristics at higher moisture levels. In most cases, the breakage increases with a decrease in temperature. At all temperature levels, seed coat breakage increases linearly with decreasing moisture content. In addition, a study found that a delay in harvest affects postharvest breakage to a greater degree than seed moisture content.

Drying

The test weight of field pea is similar to that of wheat, so the amount of water per point of moisture that needs to be removed during drying is similar.

Drying in a high-temperature dryer should be done gradually at temperatures below 115 degrees to limit hardening or cracking of seed destined for food use and below 110 degrees to prevent germination reduction in seed. For feed pea, drying temperatures up to 160 degrees can be used, but seed damage likely will occur. This is similar to the recommended temperatures for drying soybean.

If the seed moisture content must be reduced by 5 percent or more, drying in a high-temperature dryer should take place in two passes. This permits time for moisture equalization in the seed and minimizes stresses on the seed.

Warm seed should be cooled immediately to near average outdoor temperature after binning.

Little information exists on using natural-air or low-temperature drying to dry field pea. The equilibrium moisture content is similar to cereal grains such as wheat and corn, so these charts can be used to estimate expected moisture contents.

Because the test weight of pea is similar to wheat, using information for wheat should provide appropriate design guidance on required airflow rates and expected drying times. The resistance to airflow of pea is not well documented, but it likely is similar to corn, so select fans for natural-air drying using corn data.

Cleaning

Green weed seeds or foreign material should be cleaned from the crop before storage to reduce the potential for deterioration during storage and enhance market opportunities. In addition, removing foreign material may reduce the moisture content by 1 or 2 percentage points.

Storage

The equilibrium moisture content and allowable storage time of pea is similar to that of wheat, so the recommended storage moisture content and storage characteristics will be similar. The allowable storage time for pea at select moisture contents and temperatures is shown in [Table 1](#). This research showed some differences in allowable storage time between pea and wheat.

Allowable storage time values should be considered estimates. They require using aeration to cool or maintain the

temperature of pea, proper monitoring and storage management similar to what is required for other types of grain.

Pea seed may be stored at 14 percent moisture content as long as the seed temperature is kept below 60 degrees. It may be stored at 16 percent moisture if the seed temperature is kept below 50 degrees. If the temperature of stored pea cannot be maintained below 60 degrees, then the recommended storage moisture content is 13 percent.

An aeration system should be used to cool the stored pea as outdoor temperature cool, similar to other grains. The seed should be cooled whenever the average outdoor temperature is 10 to 15 degrees cooler than the seed temperature. Field pea should be cooled to about 30 degrees for winter storage.

Exposure to sunlight also can cause a degradation in color. Good storage facilities maintain the product by protecting it from direct sunlight.

Table 1. Pea Allowable Storage Time.

| Grain Temperature (F) | — Grain Moisture Content (% w.b.) — | | | | |
|--------------------------|-------------------------------------|-----|----|----|----|
| | 12 | 14 | 16 | 18 | 21 |
| 77 | 31 | 16 | 7 | 4 | 2 |
| 68 | 55 | 28 | 13 | 7 | 4 |
| 59 | 100 | 50 | 20 | 12 | 6 |
| 50 | 200 | 95 | 38 | 20 | 21 |
| 41 | 370 | 175 | 70 | 39 | 20 |

Markets

Primary field pea market opportunities are for livestock feed, seed and human food. Markets are readily available with minimal quality restrictions for peas sold as livestock feed. Prices received for feed peas should be considered base prices. Opportunities exist to enhance the value of feed peas by using the commodity as an on farm livestock feed source. Consult the NDSU Extension Service publication EB76, "Feeding Peas to Livestock," for more information.

Premium prices are associated with the human food and seed markets. Selling peas in the premium markets is a greater challenge than marketing a traditional small-grain crop. Premium pea markets normally are limited and require a more aggressive approach by the grower.

Pea markets should be identified before peas are produced to optimize the ability to harvest a crop that will meet market standards. For example, when marketing food grade peas, numerous factors that affect market grade include market class (for example, green or yellow cotyledon, specialty types), seed size and shape, splitting potential, harvest moisture,

seed handling techniques during harvest and storage, and seed damage factors (for example, bleach, cracked seed coats, splits, shriveled seed, earth tag, chalk spot).

Federal grain standards have been established for whole and split field pea. Splitting involves a mechanical process and results in separation of the two seed cotyledons. After dockage has been removed, the seeds are graded.

Reductions in grade may be the result of weevil damage, heat damage, bleached or shriveled seeds, and seeds with cracked seed coats. A certain percent of splits are allowed in whole field pea and a certain percentage of whole field pea is allowed in split field pea.

After harvest, the crop needs to be graded to determine what markets are options for the grower.

A representative 2 pound sample may be sent to the Federal Grain Inspection Service:

USDA GIPSA FGIS
P.O. Box 13427
Grand Forks, ND 58208 3427

Pea grading U.S. No.1 or 2 qualify for the human food market.

Keeping abreast of current markets by using sources such as written or electronic agricultural publications is important. Due to limited market opportunities for human food grade peas, make sure local, state or regional buyers are aware of the quality and quantity of crop you have available for sale.

A listing of potential buyers and market opportunities is available from:

Northern Pulse Growers Association
1710 Burnt Boat Drive
Bismarck, ND 58503

Phone: 701-222-0128

Fax: 701-222-6340

Email: info@northernpulse.com

Website: www.northernpulse.com

This revision is based the publication Blaine Schatz, director and research agronomist at the NDSU Carrington Research Extension Center, and Greg Endres, NDSU area Extension cropping systems specialist, revised in 2009.

Photos courtesy of the Northern Pulse Growers Association.

For more information on this and other topics, see www.ag.ndsu.edu

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County commissions, North Dakota State University and U.S. Department of Agriculture cooperating.

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