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Production and Utilization of Field Peas in South Dakota

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Introduction:

Field Peas (*Pisum sativum* L.) are cool season legumes which have been grown for grain on a commercial scale in South Dakota since the late 1980's. There is anecdotal evidence that they were used in crop rotations and crop mixtures since European settlement but this does not appear to have been a predominant practice. During the more recent introduction they have been primarily grown in central South Dakota. Peas were initially introduced as a rotation crop option that fits well with the winter wheat production area of central and western South Dakota. Field pea acreage has remained limited, fluctuating with markets, market availability, and the acreage of competing crops like sunflower, soybean, flax, canola, etc. Field peas have an earlier harvest date than either soybeans or sunflowers and lower moisture requirements. These qualities give them a better fit in a crop rotation before winter wheat.

Uses:

Field peas were initially seen as an opportunity for livestock producers to grow their own high protein feed. This was especially appealing in lower rainfall areas where soybeans were not as well adapted. Over time many long-term South Dakota pea producers began producing peas for the seed and human food markets. Low acres and the dry environments of central and western South Dakota allowed for production of high quality disease-free seed. This seed can be used for certified seed or for human food in the form of whole or split peas or through fractionation into protein, starch, and fiber ingredients used in food manufacturing. Both green and yellow peas have demand for human food and processing.

Field peas have performed well in livestock feeds and pet foods (1). This nutrient-dense grain legume contains modest fiber, high energy, and is a good source of crude protein. When peas are grown for human food or seed but do not contain the quality required by these markets, then they can be sold as livestock feed.

Research has indicated that field peas grown in crop rotations prior to small grains can result in higher yields of the small grain. This is in part attributed to the break in pest cycles that can occur with crop rotations. This benefit is enhanced even more when a third unrelated crop is also included. The shorter growing period for field peas can also provide a moisture benefit for the next crop. However the beneficial interaction between field peas and small grains is not entirely understood.

There are also situations where field peas planted prior to small grains in a crop rotation can be detrimental. Field peas leave a low amount of crop residue compared to wheat, oats or flax. This can lead to issues in dry years, when winter wheat is planted into field pea residue, the reduced amount of crop residue and the prostrate structure of the residue can leave fields exposed and susceptible to soil erosion. At times this can result in damage to the winter wheat crop. This situation occurred in central South Dakota after the dry fall of 2012.

References: (1) Anderson, V., Harrold, R., Langblom, D., Lardy, G., Schatz, B., Schroeder, J. W. A Guide to Feeding Field Peas to Livestock, AS-1224 NDSU Extension Publication.

Wright, A.T., Yield Effect of Pulses on Subsequent

Cereal Crops in the Northern Prairies. Canadian Journal of Plant Science, *1990, 70(4): 1023-1032, 10.4141/cjps90-125*

Types of Field Peas:

Field pea varieties are classified based on growth habits and color of the seed. Growth habits can include determinate vs. indeterminate, leaf type (which includes leafy vs. semi leafless), and planting date, which can be either in the fall for winter peas or in the spring. Pea seed color is either yellow or green. SDSU conducts field pea variety trials each year to rate different varieties and adaptability to South Dakota. Results of these trials can be located on iGrow.org; (http://igrow.org/agronomy/profit-tips/variety-trial-results/).

Seed Bed Preparation:

Field peas have been shown to be well adapted to most regions of the Northern Great Plains and can be grown on a wide variety of soil types. However they do not tolerate saline or saturated soils.

Peas have a large seed making them very adapted to no-till seeding conditions as well as conventional till situations. Peas require a relatively high amount of moisture in the spring to germinate because of their seed size. For this reason excessive tillage, which can dry out the soil surface, is not recommended. Peas are low in residue, consequently, it is best if they are no-till seeded into fields with high-residue to minimize erosion concerns the following year. Residue should be uniformly distributed to allow for even emergence and to prevent issues with harvest. It is usually not necessary to roll peas when planting with low-disturbance, no-till techniques. However, it may sometimes be necessary to roll them when planting with high-disturbance seeders or where tillage was used prior to seeding. Care needs to be taken during the rolling process. Peas should have emerged before rolling, and soil conditions and vegetation should be dry; even then damage can result from the process.

Seeding:

Peas can be seeded with a conventional seed drill or air seeder in narrow row spacing's of 6-12 inches. They are well adapted to cool spring temperatures and will germinate at soil temperatures of 38°F (3°C). Peas are typically seeded in early spring during the same time period as spring wheat. They can tolerate some light frost in the spring but do not yield well in years when it gets very hot while the plant is flowering. Studies have shown that planting field peas in mid-April promotes more plant development before major heat and water stress occur. Seeding date trials conducted in South Dakota showed no benefit from March planting. Handling pea seed in cold weather can result in damage with reduced germination. Many producers' clean seed in the fall and position it where it can be warmed before it is moved (cone-bottom bins with air or trailers that can be moved into a warm building).

Seed quality has a large impact on crop yield. Pea seed is very susceptible to physical damage from handling. It is very important to handle them gently to maintain quality as cracks and chips can drastically reduce germination. Producers need to use padded towers and decrease air velocity in seeders to help reduce seed damage during seeding. To determine if a seeder is damaging seed, growers may want to sample seed and perform a germ test on seed after it comes out of the seeder. This process needs to occur prior to seeding, allowing enough time for a germination test to be completed, and necessary adjustments made to the seeder. Seed should have both high germination and vigor and any peas intended to be used as seed should be tested for both. Germ tests can be done at home or in a certified lab such at the SDSU Seed Testing Lab (http://www.sdstate.edu/ps/seed-lab/index.cfm).

Pea seed is usually placed approximately 1.5 to 2.5 inches deep at seeding. As mentioned previously, the seed needs to be planted into moisture to germinate as they require 3 times as much moisture as small grains to germinate. Recommended seeding rate in South Dakota is 350,000 pure live seeds per acre.

Semi-leafless varieties have tendrils, which intertwine and weave together as they grow. This results in improved standability and reduced lodging. It can also increase air movement throughout the crop canopy, drying the plants surfaces and reducing disease pressure. If the seeding rate is too low or row space too wide, plants will not inter-twine as desired. This can lead to lodging and problems during harvest.

References: B. Hanson, 1998-2000, Field Pea Planting Date Effects on Yield and Various Agronomic Traits, NDSU.

J. Rickertsen, 2005-06, Planting Date Studies-Field Peas, SDSU

Seed Treatments:

Field peas seeded into cool wet soils are susceptible to root rot caused by Aphanomyces, Fusarium, Rhizoctonia and Pythium spp. Plant disease surveys taken across the Northern Great Plains indicate that Fusarium spp. is the root rot pathogen typically present at the highest levels.

Fungicide seed treatments are effective at protecting germinating field peas and young seedlings from pre- and post-emergence damping off. They are less effective however against root rots that develop during mid to late vegetative growth, particularly those caused by Fusarium or Aphanomyces. Research has not definitely shown that fungicide seed treatments result in improved plant stand and increased yields. Treating pea seed with a fungicide seed treatment however is generally considered an acceptable practice in South Dakota, especially during cool wet springs.

References: Chang et al, 2004 and 2007, Canadian Plant Disease Survey.

Henson, B., Bradley, C., Halley, S., Hanson, B., McKay, K., Halvorson, M., Fungicide Seed Treatment Effects on Disease and Nodulation of Field Pea in North Dakota.

Inoculant:

Field peas are legumes. Therefore they are able to form a symbiotic relationship with soil bacteria of the rhizobia type. These naturally occurring bacteria can convert atmospheric nitrogen into a form that is available to plants. This process, termed nitrogen fixation, occurs when the rhizobia bacteria form a symbiotic relationship with the root of a legume host plant. Rhizobia in the soil come into contact with a legume root. The rhizobium recognizes the root as an appropriate host and enters the root. The plant responds to the bacterial infection by developing a thickened "nodule" around the site of the infection. Atmospheric nitrogen is converted to a plant available nitrogen form inside these nodules with the help of the rhizobia bacteria.

It is common practice to treat legume seed with inoculant containing rhizobium bacteria just prior to seeding even though this bacterium is present in some soils. The bacteria may not be in high enough numbers to infect the roots of all the plants. Inoculant is inexpensive relative to the losses associated with inadequate nodulation. It is easy to apply to pea seed and can provide reassurance that each plant will have proper nodulation and nitrogen fixation.

Different strains of rhizobia infect different legumes. It is important to use inoculant that is specific for field peas. Both pea and lentil roots are nodulated by the same species of rhizobia, Rhizobium leguminosarum. Inoculant is a live product and should be treated as such. It will not survive if left in the heat or sun. The expiration dates on all packages should be monitored. There are different forms of inoculants available such as peat-based, liquid and granular. The liquid and peat formulations are intended to be applied directly to the seed. Some liquid types can be purchased in a frozen concentrate form. This material is thawed slowly and mixed with water or another carrier for seed application. Any water used during the application process must be obtained from a non-chlorinated source, as chlorinated water will kill the inoculant. Seed treated with inoculant should be stored in a cool place and planted as soon as possible. If more than 12 hours elapse between seed treatment and seeding, the inoculant should be reapplied.

The granular product is applied in the seed row using a separate metering system. Many producers like the granular type of inoculant because it delivers more live cells and maintains its viability when stored in a cool location. If seeding is going to be interrupted for more than a day, it is recommended to move the seeder tank to a cool location or to empty the contents of the tank back into a bag that can be moved to shelter. If granular inoculant is left in the tank and a freeze occurs the product may be frozen and will not flow correctly. The best method to handle this situation is to empty the tank and reload the material. Some granular

formulations can experience problems with meter plugging even when it does not freeze. Meters and towers need to be checked regularly.

It is difficult to determine if the inoculant is viable without laboratory testing. It is also difficult to assure granular inoculant is metering appropriately. The best assurance of proper nodulation is obtained by using two different sources of inoculant. Using both a granular plus either a liquid or peat seed treatment will protect against one of the sources being inactive or not delivered properly. Proper nodulation is one of the most important aspects of pea production and it cannot be replaced by nitrogen fertilization. The price of inoculant should be evaluated on the number of live bacteria it provides per seed or per acre at the recommended use rate.

There is some concern that seed treatments can harm inoculants. Researchers have found that the inoculant is usually not harmed, as long as the seed treatment is allowed to dry on the seed prior to the addition of inoculant.

Roots can be carefully dug out of the soil about six weeks after plant emergence to determine if inoculated legume roots have developed nodules and are fixing nitrogen as desired. If nodules are active, they should be easy to find when soil is gently removed from the root. Active healthy nodules will be a pink color inside.

Nodules on roots of pea plant. Photo credit R. Beck

Fertilizer:

The most important aspect of fertilizing field peas is to obtain proper nodulation. Beyond that there are very few differences between peas and other cool-season broadleaf crops. SDSU's Fertilizer Recommendations Guide, EC750 provides fertilizer recommendations for phosphorus and potassium based on soil test levels and yield goals. Most South Dakota soils will not require potassium additions for pea production. The use of potash (KCl) as a source of chloride to lower disease pressure is presently being researched but is not recommended at this time. Phosphorus recommendations vary between 0 and 40 lbs. of phosphate/acre. No nitrogen is recommended for properly nodulated peas. There has been little work on elements like sulfur and some of the micro nutrients. If deficiencies of sulfur, zinc, and molybdenum are known to exist it may be necessary to seek further advice.

The largest fertilizer factor in pea production involves its substantial sensitivity to salinity and seed-placed fertilizers. It is important that salinity stress in the seed zone is kept to an absolute minimum. For this reason, it is probably best not to place fertilizer in the seed trench or to keep the levels very low.

Weed Control:

Weed management in field peas is best accomplished by approaching it as part of the complete production system. Sanitation, competition, and rotation are the primary tools used to keep weeds from being a problem when growing field peas. There are no herbicide programs available at this time that can provide adequate weed control levels when pressure of many problem weeds is high. This is especially true now that semi-leafless varieties are the predominant type grown. These varieties provide significant advantages in terms of lodging resistance and disease avoidance but are less competitive with weeds than traditional types. This means that it is especially important to plant semi-leafless peas in narrow rows and to obtain uniform plant stands with adequate populations.

Weeds that are most troublesome in pea production are perennial broadleaf species and broadleaf species that are winter annuals or grow early in the year. Perennial broadleaf species need to be controlled in the years prior to planting peas. It is much easier

to eliminate Canada thistle in wheat and corn crops than to try to suppress them to acceptable levels in peas. Care needs to be taken to observe appropriate rotational intervals for the products used when employing this approach. Peas are very sensitive to carryover effects of some herbicides commonly used to control thistles.

Cool-season broadleaf weed populations are best addressed by reducing weed seed bank levels as much as possible by using appropriate rotations and good sanitation practices in combination with carefully selected herbicide programs. In low-disturbance no-till systems growing two or more years of grass crops in succession is effective at reducing broadleaf weed seed-bank levels. This works best if some of the species used are warm-season grasses. These preparations allow attaining adequate weed control with the limited number of products labeled for use in peas. Broadleaf herbicide selection is made more challenging due to the fact that peas can be sensitive to many of these products especially when adverse weather conditions occur. In addition, some of the labeled broadleaf herbicides used in peas are challenged by weeds that have developed biotype resistance to their mode of action.

In general, controlling grassy weeds in peas is substantially easier than controlling broadleaf species. Much of this is due to the availability of a number of labeled herbicides with excellent activity on grasses and minimal negative impact on peas when proper tank cleaning protocols have been followed. Unfortunately, inappropriate use of some of these products has caused development of biotype resistance. This is not common in South Dakota but it is in neighboring pea growing regions.

The most reliable herbicide programs utilize a mixture of modes of action in a manner that assures the maximum probability that these will be able to work properly. Soil applied (residual) products are the key to these programs. With these products it is important that they be applied with as much water as practical. These products require substantial amounts of precipitation to move them into the soil and activate them. In drier areas this entails applying part of the product well before seeding to increase the probability that sufficient precipitation will occur before weeds start to grow. This type of program is described as an early-pre-plant program (EPP). When some product is applied early (often as early as late fall) and the remainder is applied after seeding (usually in conjunction with the burndown spray) the program is called an EPP split application. This type of approach has been very effective in some situations, for example when applying Spartan and Prowl H2O (sulfentrazone and pendimethalin). Including a low rate of metribuzin with the second (burndown) application will widen the weed spectrum where soil pH and organic matter properties allow its use. This type of program (other products can be used for the broadleaf and grass control components) provides control of many broadleaf and grassy weeds and (in situations where weed pressure is low) may be all that is needed. It also allows use of post-emergence applications of broadleaf or grass control products to address special situations. Some producers use the residual component to address broadleaf weeds only and rely on post-emergence programs to address grassy weeds. Late fall applications of burndown herbicides does a better job at controlling winter annual weeds than is possible with early spring treatments. This can be included with the fall residual herbicide application if one is used.

Programs that rely only on the use of a seeding time burndown spray followed by later post-emergence herbicide applications substantially increase the potential for less than satisfactory control or crop injury due to unpredictable weather conditions. There are few rescue options for weed control in field peas that do not entail a substantial risk of lack of performance and increased crop damage.

It is always necessary to check with local sources for current information on products labeled for use in field peas in the area they are being grown. In South Dakota this resource can be found at the following link; http://www.sdstate.edu/ps/extension/weed-mgmt/upload/FS525PC.pdf. There are also excellent resources in other pea growing states and in Canada.

References: Beck, D. L. No-till guidelines for the arid and semi-arid prairies

Diseases:

As with any crop, field peas can be prone to disease problems. These problems can be worse in wet years and in situations where peas are grown in tight rotations with themselves, and other legumes such as lentils, beans, and even other broad leaf plant crops such as flax, soybeans or sunflowers.

Outside of seedling root rots, one of the most common diseases found in field peas in South Dakota is **bacterial blight**. Bacterial blight is often seed borne and shows up as tan colored, water soaked lesions on any foliar part of the plant including the seed. The lesions have a shiny or greasy appearance to them. Fields that have experienced damage from high winds, hail and low temperatures (late frost) are often more susceptible to bacterial blight. The damaged plant material provides an entry point for the bacteria. The disease spreads in wet weather. In South Dakota it is common to find low levels of bacterial blight on peas in the spring, however, as the season progresses and the weather warms and dries, the disease often does not move up the plant. Therefore the disease does not result in any significant damage. Although this disease is often present on the seed, expression of symptoms is dependent on environmental conditions. Fungicides are not effective on this disease (it is a bacteria), seed treatments do not control it, and resistant varieties are not available. Crop rotation can be helpful. The disease usually does not affect yields.

Bacterial Blight in Field Peas. Photo credit R. Beck

Powdery Mildew is another disease which can be common on peas in South Dakota. This is a disease which often shows up in July and therefore is more serious in late maturing fields and varieties. Symptoms begin with white powdery spots that occur first on the upper surface of the oldest leaves and stipules and then on stems and pods. The white spots can eventually spread to cover the entire plant. Plants infected with powdery mildew do not mature normally. Spread of this disease occurs in warm dry weather accompanied by cool nights with dews. The spores do not require wet weather to germinate and frequent rains will actually reduce the infections. Managing this disease includes planting resistant varieties, planting early and applying a fungicide at the first trace of the disease. South Dakota's climate can be conducive to this disease. Therefore varieties which are not resistant to powdery mildew should be monitored carefully once they begin to flower.

There are other diseases, besides those mentioned above, which can seriously affect field peas. Three that are becoming significant production concerns in other pulse crop production areas of North America are Fusarium root rot, Mycosphaerella (Ascochyta) blight, and Pea seed-borne mosaic virus (PSbMV). Economic losses to these diseases are generally not reported in South Dakota, however it is safe to assume that as acres continue to expand these diseases could increase in importance in South Dakota.

More information of disease issues in field peas and other pulse crops can be found at http://www.ag.ndsu.edu/CarringtonREC/plant-pathology.

References: Wunsch, M., Identification and Management of Diseases of Peas and Lentils. PPT presentations made in South Dakota on Feb. 4, 2014 and Dec. 2, 2014

Insect Issues:

In South Dakota, insect pests are generally not a major concern for the production of field peas. However, there are a few species of insects that should be monitored to ensure yield loss does not occur. These species are capable of feeding on several hosts, and generally move to field peas when their other host is disturbed (e.g., when alfalfa is cut). Losses attributed to these insect pests can be prevented by learning about their life cycles and feeding habits. In addition to

insect pests, there are also beneficial insects including natural enemies or predators that are present in the field that may naturally manage the pest populations. When scouting for insect pests be sure to evaluate the presence of beneficial insects and also fungal pathogens that reduce the pest insect populations prior to using insecticides for management.

Pea Aphid (*Acyrthosiphon pisum*):

As the name of this insect implies it is a common pest of peas, as well as alfalfa, clover, and several other legumes. The pea aphid adults are large in size for aphids, approximately 1/8th inch or more in length, and vary in color from light to dark green. Other than their size, they can also be distinguished from other aphid species by their red eyes, and long antennae that have a dark band at the end of each segment. The majority of pea aphids are wingless, but under stressful conditions (e.g., overcrowding, reduced host quality) winged forms will develop. Both the nymph and adult pea aphids feed on plant phloem using piercing sucking mouthparts. As a result of feeding on a high sugar diet the aphids produce honeydew that can attract ants and act as a substrate for the growth of molds. Direct feeding by pea aphids can reduce plant health and cause yield losses through reductions to seed set and seed size (Knodel et al. 2014). During the growing season pea aphids reproduce asexually, which allows for rapid population growth. Under optimal temperatures that range from 60-70° F a single female pea aphid can produce 4-5 nymphs per day and a total of 40-70 nymphs in a 10-12 day period (Morgan et al. 2001). In addition to direct feeding, pea aphids are also vectors of several viruses that can negatively affect field peas including *Pea enation mosaic virus, Pea seedborne mosaic virus, Bean yellow mosaic virus,* and *Pea leaf roll virus* (Miller et al. 2005).

Management:

Yield losses are most likely to occur when pea aphid populations reach high densities during the flowering period. Scouting should begin when 50-75% of the crop is flowering and continue through the early pod stage. To scout for pea aphid populations direct plant counts can be conducted by examining the plant tips, or using a sweep net to collect samples. To use a sweep net swing it in ten 180-degree sweeps and count the number of pea aphids present. This should be repeated in four locations throughout the field. For direct plant counts examine five 8-inch plant tips from four locations throughout the field. When examining plants the presence of ants can indicate pea aphid colonies since they are attracted to the honeydew excrement. Insecticide management may be necessary if there are 2-3 aphids per 8-inch plant tip or if 90-120 pea aphids are collected per 10 sweeps. The best time to apply insecticides is when the thresholds are reached and 50% of the plants have produced young pods (Knodel et al. 2014). When scouting for pea aphid populations if numerous natural enemies such as ladybird beetles, syrphid (hover) flies, lacewings, damsel bugs, minute pirate bugs, or aphid mummies are observed it may not be necessary to apply an insecticide. It is recommended that you re-evaluate the

Pea Aphid Acyrthosiphon pisum.
Photo Credit: Shipher Wu and Gee-way Lin

Field damage from pea aphid.
Photo credit R.Beck

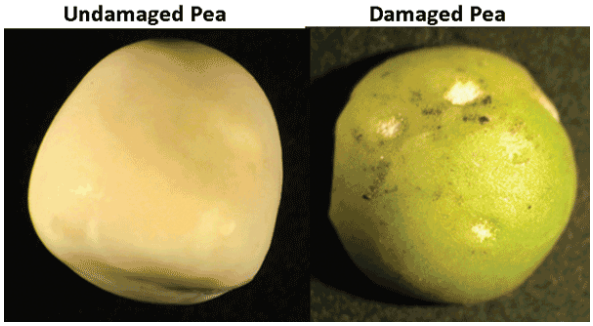
pea aphid infestation in a few days and determine if the natural enemies are providing sufficient reductions in the aphid populations. Aside from insecticide management, there are also options of host plant resistance for managing pea aphid populations. The cultivars 'Century' and 'Tipu' are documented for having antibiotic resistance towards the pea aphid, which results in reductions of pea aphid fecundity and survival. The cultivar 'Trapper' demonstrated tolerance towards pea aphid infestations. If alfalfa fields are located near the field peas additional scouting should occur after each alfalfa cutting (Miller et al. 2005, Knodel et al. 2014).

Tarnished plant bug (*Lygus lineolaris*):

The tarnished plant bug is a generalist pest that is capable of feeding on more than 385 plants. In South Dakota, the tarnished plant bug is known to be a pest of field and forage crops, which include field pea. Tarnished plant bugs are approximately 1/4th inch long and vary in color from green to brown. As adults they have a characteristic "V" or yellow triangle present on their abdomen, and also have the tips of the membranous wings exposed at the end of their abdomen. Another characteristic of the tarnished plant bug is that the tip of their abdomens is depressed and appears to be pointing down compared to the rest of the abdomen. The nymphs of the tarnished plant bug vary in color but are generally green, and are occasionally mistaken for aphids during their early life stages. Both the nymphs and adults of the tarnished plant bug feed on the growing tips, flowers, pods, and seeds using piercing sucking mouthparts. In addition to injury from direct feeding, tarnished plant bugs also inject saliva, which is toxic to the plant and causes necrosis. When feeding to the pods and seeds occur the damage is referred to as chalk spot. The chalk spot damage results in a depression in the seed coat that may or may not also be accompanied by a chalky discoloration. Seeds damaged by tarnished plant bugs have reduced size, germination, deteriorate rapidly in storage, produce abnormal seedlings, and ultimately result in reduced marketability of the seed. Damage similar to chalk spot can occur to seeds when they are harvested with high moisture levels and are handled roughly (Miller et al. 2005, Knodel et al. 2014).

Management:

Tarnished plant bugs are scouted for using a sweet net from the flowering to pod developing stages of field peas. Using the sweep net, make 25 180-degree sweeps from four sampling sites throughout the field during the afternoon. Insecticide management is



Chalk-spot damage in peas
Photo: Janet Knodel, North Dakota State University

Adult and nymph stages of lygus bug (note the characteristic 'V' on the back of adult)
Photo Credit: Scott Bauer (USDA ARS images)

recommended when 10 or more tarnished plant bugs are collected in 25 sweeps. Fields that are located near alfalfa should be scouted intensively after each alfalfa cutting, as tarnished plant bug populations can increase rapidly when they move from the disturbed alfalfa fields to nearby field peas. If insecticide management of a blooming crop is warranted, avoid spraying during bee foraging times and apply the insecticides in the evening (Miller et al. 2005, Knodel et al. 2014).

Grasshopper

There are several species of grasshoppers that are capable of feeding on field pea in South Dakota. The key characteristics for identifying grasshoppers include their elongated large bodies, and hind legs that are modified for jumping. Grasshoppers are generalist insect pests that feed on numerous crop and non-crop plants. Peak grasshopper egg hatch generally occurs in June with the adults becoming abundant in late July. Both grasshopper nymphs and adults feed on green plant material including leaves, flower buds, and pods of field peas. This feeding can result in yield loss (Knodel et al. 2014).

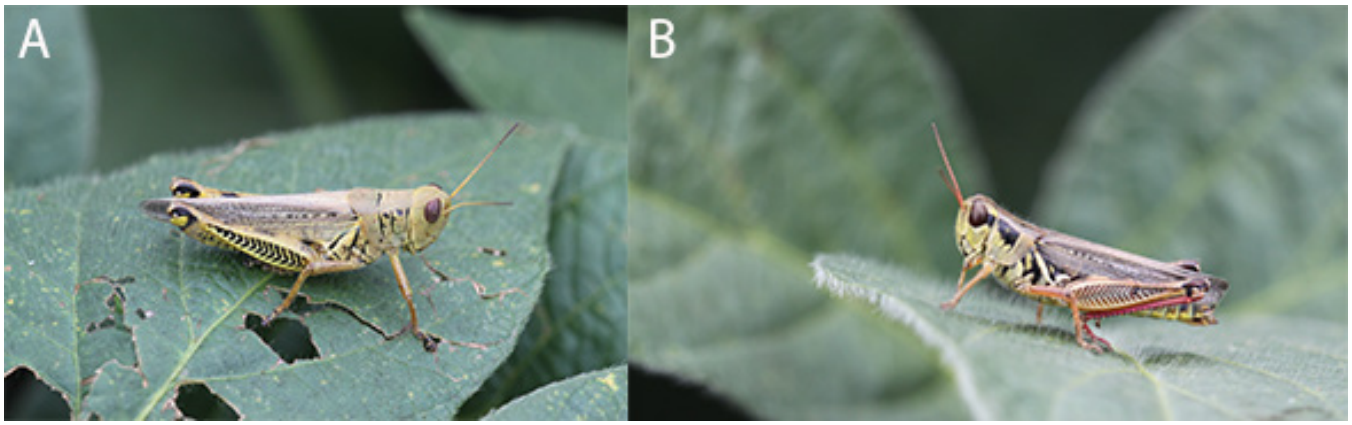
Management:

Large grasshopper populations can normally be attributed to years with low rainfall or drought. Field pea seedlings should be scouted for feeding injury from grasshopper nymphs. Scouting for adult feeding should occur from the early bud stage through pod development (Knodel et al. 2014). Grasshopper populations can be scouted using a sweep net by making four 180-degree sweeps from four locations throughout the field. Insecticide management for field pea seedlings should be considered if there are 50-75 nymphs per four swings near the field margin or 30-45 nymphs per four swings within the field. Management should be considered during the early bud stage through pod development if there are 21-40 adults in four swings near the field margin or 8-14 adults in four swings in the interior of the field.

Early Season Sporadic Pests

In addition to the previously mentioned pests there is also the possibility for field peas in South Dakota to be negatively affected by sporadic early season pests. These pests include several species of cutworms including the dingy cutworm, pale western cutworm, and red-backed cutworm, and also wireworms. Cutworms cause a characteristic injury where the plants are cut, fall over, and dry near the row. Field peas are susceptible to this type of injury from the seedling to 6-8 leaf growth stages. Cutworm moths are attracted to weedy fields, and tend to lay their eggs in those areas. Injury from cutworm larvae is generally first observed in areas where the soil warms more rapidly in the spring. If severe cutting is occurring insecticide management is recommended, and for best results should occur in the evening. Cutworm larvae are nocturnal feeders and hide under the soil surface during the day, which makes management at this time very difficult.

An additional early season pest of field peas are wireworms, which are generally more of an issue in fields that were pasture or grassland the previous year. Scouting for wireworms is very difficult, and requires sampling soil to determine their presence,



Differential grasshoppers (A) and reg-legged grasshoppers are two of the several species that are capable of feeding on field peas.
Photo Credit: Adam J. Varenhorst

Wireworms.
Photo Credit: Frank Peairs, Colorado State University

or placing bait stations 4-6 inches deep in the soil. To soil sample a total of 20 locations throughout the field must be examined. At each location dig a one square foot hole that is 4-6 inches deep, and examine the soil for the presence of wireworms. For bait station sampling, place 10 bait stations randomly throughout a field in September, or 2-3 weeks prior to the first frost. Each station consists of digging a 4-6 inch hole and pouring either one-cup of wheat or corn into the hole and covering it with soil. Place a marking flag on the hole, and then cover it with an 18-inch clear plastic box. After one week dig up the grain and examine for wireworms. Wireworm management using insecticide seed treatments is recommended if an average of one or more wireworm are observed from either sampling technique.

References: Knodel, J. J., P. Beauzay, and M. Boetel. 2014. 2015 Field Crop Insect Management Guide. E-1143 North Dakota State University Extension.

Miller, P., K. McKay, C. Jones, S. Blodgett, F. Menalled, J. Riesselman, C. Chen, and D. Wichman. 2005. Growing dry pea in Montana. MT 200502 AG. Montana State University Extension.

Morgan, D., K. F. A. Walters, and J. N. Aegerter. 2001. Effect of temperature and cultivar on pea aphid, Acyrthosiphon pisum (Hemiptera: Aphididae) life history. Bulletin of Entomological Research 91: 47-52.

Growth Stages/Habit:

Field peas undergo hypogeal germination which means that their cotyledons and seed coat remain below the soil surface. The first node and the second node produce scale leaves. These typically remain below ground or very close to the soil surface. If the young seedling is damaged, regrowth often occurs from these nodes. Basal branches can also develop from these nodes during the season under favorable growing conditions.

The first true leaf is located at the 3rd node and usually consists of one pair of leaflets and one tendril. Leaves developing from nodes further up the plant tend to have increasingly more leaflets and tendrils. A pair of large leaf-like stipules develop at the base of each leaf. Tendrils replace all the leaflets in semi leafless peas, but the stipules are still present. The majority of pea varieties currently grown in South Dakota are semi leafless. Field peas typically produce their first flower at the 12-16th node, and flowering continues at successive nodes as growth continues. Field pea flowers self-pollinate before they open. Mature pea pods are approximately 2-3 inches in length and can carry up to 8 pea seeds. Pea flowers are sensitive to heat and can abort if daytime temperatures remain hot for any length of time.

Harvest:

Once peas mature, the crop can dry very quickly. The bottom pods ripen first. The pods and leaves turn yellow and once the plant reaches 14-20% moisture it is considered physiologically mature. At this time the field peas will feel very firm and it will be difficult to penetrate the seed with a fingernail. Almost all peas are straight combined. If the crop is maturing evenly and is relatively weed free they can be harvested without desiccation. Peas are not prone to shattering if they are combined at the correct moisture. If the peas have gotten overly dry, they can be combined during the humid part of the day to minimize shattering. On humid days pea vines can be too tough to harvest properly. During harvest, peas need to be handled gently to prevent damage to the seed. Combine rotors or cylinders should be set to the lowest speed that does a proper job. The headers used are generally flex headers with either an auger or draper gathering

system. Draper headers used in peas will commonly have an auxiliary top auger to facilitate uniform movement of this fluffy crop.

Peas are very sensitive to damage during handling. Unload augers in the combine and grain cart should be run slow and full. If possible unnecessary handling operations should be avoided. Belt conveyors should be used whenever possible as these reduce damage to the seed. This is especially important when the seed is going to the human edible or seed markets. Some pea markets have no tolerance for cracked, shriveled, bleached, stained, wet or otherwise damaged seed. So handling peas carefully at harvest will be very important

Storage:

Peas can be stored at 16% with aeration used to lower the moisture to 13% for long-term storage. Moisture will need to be monitored carefully while they are in storage. Care needs to be taken when loading and unloading bins. Long drops into the bin can cause damage. Moving the peas from storage in cold weather can cause damage. This was mentioned earlier in reference to seed quality.

Markets:

Field peas have an excellent fit in South Dakota as high protein livestock feed.

However there are numerous other markets available for peas. These include human edible, seed, and pet food. The human edible market includes direct use (split peas, etc.) and fractionation where the components of peas (starch, fiber, protein) are separated and used in food products like breakfast cereals, breads, and mixes. Many buyers are located in North Dakota, however, the list of buyers in South Dakota is increasing. South Dakota buyers are listed on the South Dakota Pulse Growers website at www.sdpulsegrowers.com.

References: Pulse Production Manual produced by The Saskatchewan Pulse Growers

Pea Production in the High Plains, SDSU Extension Fact Sheet 932

Field Pea Production, A-1166, NDSU Extension Service

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