

Crop Profile for Peas

I – Generalities

Authored by Mark Goodwin, Pulse Canada, March 2003.

Crop – Dry peas, including food and feed peas. Peas make up the subfamily Papilionoideae, family Fabaceae (formerly Leguminosae). The field pea is classified as Pisum sativum L. variety arvense.

Regions – All soil zones in Western Canada.

Short history and use

First cultivated as early as 9,000 years ago pea is among the world's oldest crops. Feed peas belong to the family of cool season legume crops commonly referred to as pulses, which includes lentil, fababean, bean and chickpea. The pea is native to the Middle East, and has been cultivated in Europe for several thousand years. It is now grown in all climatic zones including the tropics where it is grown at high elevations. (6)

While used primarily for human consumption, the pea is also known as a high quality animal feed (9).

Dry peas have been grown in western Canada since farming began on the prairies over 100 years ago. Peas were grown on about 20,000 hectares in the years immediately after the Second World War with production concentrated in Manitoba. Pea production slowly started increasing in 1977 and has continued to grow across Western Canada. The impetus for expanding production was the opening of the European feed pea market in 1985 and high returns for pea producers in Western Canada. Pea harvest increased 17 fold from 74,400 ha in 1985 to 1,297,018 ha in 2002. (10,11)

II – General commodity information

A. Production

In the period from 1991-2000, 68 percent of Canada's dry pea crop was produced in Saskatchewan while Alberta and Manitoba comprised approximately 22 percent and 10 percent respectively. (12)

Dry pea and other pulse crops extend and diversify crop rotations, increase nitrogen availability, improve soil tilth and contribute to soil organic matter. Pea residue breaks down more rapidly than the residues of many other crops, such as wheat or canola, providing nutrients to subsequent crops. (10)

Dry pea has a relatively shallow root system and is best adapted to the moist Dark Brown and Black soil zones; however, it is relatively drought resistant and productive in most years in the Brown soil zone. Dry pea does not tolerate water-saturated or salt-affected soils. Well-drained, clay loam soils are ideal for pea production. Dry pea can tolerate some hot weather or drought stress during flowering but yields may be reduced. (10)

Table 1. Basic production information (2003)

Region	Yield (t/ha)	Area grown (X1000ha)	Production (X1000t)	% Cdn production	Cash value	Ann prod costs
Manitoba	2.2	80.8	176.9	13.0%	\$ 37,149,000.00	\$ 28,949,839.39
Saskatchewan	1.2	789.1	963.6	70.6%	\$ 202,351,800.00	\$ 274,927,353.60
Alberta	1.2	178.1	221.6	16.2%	\$ 46,536,000.00	\$ 63,811,465.28
B.C.	1.8	2.0	3.5	0.3%	\$ 735,000.00	\$ 716,580.18
National	1.3	1050.0	1365.6		\$ 286,771,800.00	\$ 376,204,596.00

Source – Pulse Canada data ‘Pea Production’

According to Statistics Canada, average price for peas has fluctuated from \$135/tonne to \$225/tonne since 1991. Prices were at this high in 2003 (a drought year).

Canada has become a world leader in dry pea exports

Table 2. Pea exports (MT)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Canada	1,441,000	1,454,700	1,173,000	1,762,200	2,336,900	2,251,900	2,864,300	2,196,400
France	3,378,000	2,701,000	2,562,000	3,052,000	3,223,000	2,617,250	1,938,000	1,680,000
China	1,275,000	1,000,000	1,176,000	1,080,000	1,090,000	1,040,000	1,020,000	1,100,000
Russia	2,287,200	1,212,100	1,322,920	1,419,000	660,140	598,070	900,000	1,000,000
India	640,000	632,000	670,000	740,000	550,000	700,000	700,000	700,000
Ukraine	2,470,000	1,376,000	985,000	903,000	652,000	498,000	499,000	695,000
Germany	151,000	216,000	301,000	399,000	589,378	610,039	408,902	557,495
Australia	240,407	529,919	454,193	303,000	298,000	357,000	401,000	410,000
United Kingdom	370,000	286,000	240,000	297,000	311,000	355,000	309,000	312,500
USA	138,800	269,080	150,680	300,000	304,450	249,070	192,860	204,840
Denmark	376,650	282,242	256,779	384,000	384,000	192,508	180,000	180,000
Ethiopia	85,837	148,456	132,963	142,484	97,347	121,214	147,379	147,379
Belarus	104,000	112,000	181,000	287,000	217,000	130,000	173,000	127,000
Hungary	134,423	142,863	101,406	110,887	131,000	107,936	47,559	90,000
Czech Republic	149,351	130,428	120,139	93,015	121,789	105,382	75,256	84,413
Pakistan	73,694	73,963	78,348	78,500	81,822	93,208	78,065	78,065
Austria	133,770	60,262	92,654	80,000	80,000	62,410	62,400	62,400
Slovakia	159,704	107,633	89,002	58,356	64,318	48,026	18,213	29,072
Total Top 20	13,608,836	10,734,646	10,087,084	11,489,442	11,192,144	10,137,013	10,014,934	9,654,564
Others	815,538	757,913	832,600	802,934	807,719	782,630	776,368	857,007
World	14,424,374	11,492,559	10,919,684	12,292,376	11,999,863	10,919,643	10,791,302	10511571

Source – Pulse Canada data ‘Pea Production’

The average yields (per hectare) for field pea increased steadily over the past ten years (Table 2). The 10-year average yield in is approximately 2,100 kg/ha (32 bu/ac). The bushel weight for dry pea is 60 pounds. Yields in 2001 and 2002 were drastically reduced due to drought conditions.

B. Quality

The Canadian Grain Commission has established separate grades for feed peas, green peas and peas other than green peas. Peas other than green peas predominantly are yellow peas with grades of No. 1 Canada, No. 2 Canada, Extra No. 3 Canada, No. 3 Canada or Sample. Grading factors include natural colour, other classes (colours), bleached (for green peas), foreign material, cracked seed coats including splits, shrivelled, heated, insect damage and other damage. (3)

C. Market diversity

Prior to 1985 all pea exports were destined for the human food market in both commercial and food aid markets. Exports of whole or split pea were cleaned and bagged prior to shipment. As the feed pea export market developed, feed pea exports were shipped in bulk, in both rail car and aboard ship. (1)

The pea crop is stored on the farm after harvest and can be delivered to bagging facilities throughout western Canada. The pea crop also moves in bulk to both human consumption and feed markets. There are also a number of pea splitting operations in Western Canada that dehull, split and bag split peas for the export market. Dry pea for human consumption can be shipped to port bagged in container, by truck or rail for containerization at the port or in bulk form for bulk shipment or for bagging and containerization at the port. Feed peas are delivered and shipped in bulk. (1)

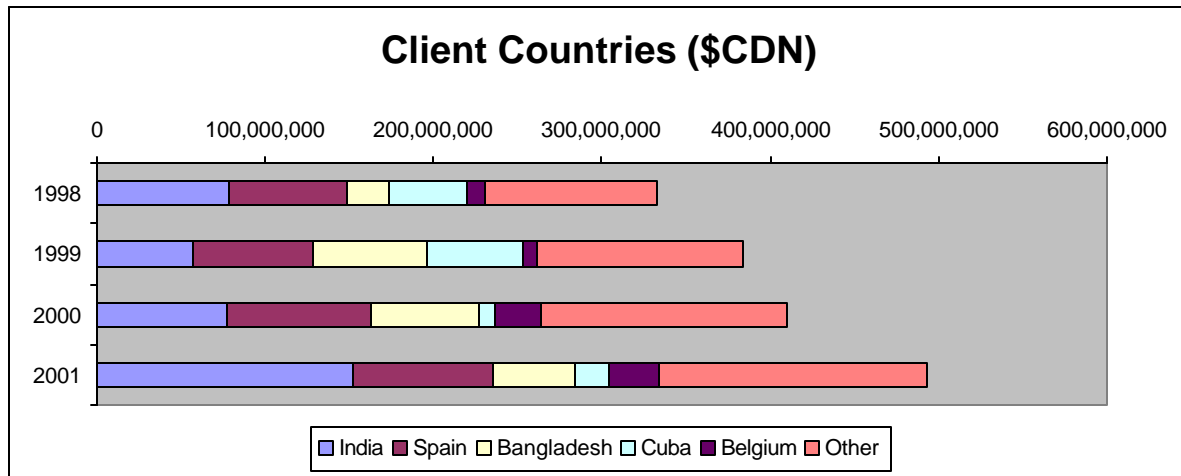
Some of the pea crop is processed in western Canada into component products, such as pea hulls, pea flour, pea starch, and pea protein concentrate. Pea hulls are used in high fibre bread. Pea starch has applications in adhesives and carbonless paper. Pea protein concentrate has limited applications in human food and in the production of pea protein isolates. A dry milling process is employed by Parrheim Foods, Saskatoon, SK, and a wet milling process is also used by the same company. The wet process is more expensive, but most of the bitter pea flavour components are flashed off during drying, producing a product that has much potential in human food applications. (1,7)

A portion of Canada's dry pea crop is used domestically for human food such as pea soup. The export human consumption market has been growing as more pulse-consuming countries, such as India and Colombia, purchase whole or split pea to provide relatively low-cost protein to their growing populations. (1,10)

D. Market status

Canada is the leading pea exporter in the exporting to over 100 countries. India has emerged as Canada's largest market followed by Spain, Bangladesh, and Belgium (Figure 3) with India and Spain accounting for over one-half of Canada's total dry pea exports in 2001. (10,11)

Figure 1: Dry Pea Exports



Source-Pulse Canada data 'Pea Production'

Table 3. Basic market information-supply and demand (MT)

Note that exports by producing region figures are not available.

Crop Year	Production	Imports (b)	Total Supply	Exports (b)	Total Domestic Use (d)	Ending Stocks	Average Price (e) \$/t
1996-1997	1,169	8	1,512	856	441	215	209
1997-1998	1,747	12	1,974	1,116	523	335	180
1998-1999	2,337	10	2,682	1,705	602	375	135
1999-2000	2,252	12	2,639	1,417	822	400	135
2000-2001	2,864	12	3,276	2,196	885	195	138
2001-2002	2,023	27	2,245	1,264	706	275	190
2002-2003	1,378	30	1,683	1,000	583	100	195-225
SUB-TOTALS	18,551	155	21,395	12,778	5,908	2,709	

Source - Pulse Canada data 'Pea Production'

E. Problems

Specific pest issues by region are discussed in 'Production Problems'.

III. Non-pest oriented Cultural practices:

A. Crop rotation practices

Dry pea production is most often successful when grown in rotation with cereals such as barley or spring or durum wheat. (6)

Dry pea is able to efficiently use soil moisture in stubble conditions when the top meter of the soil profile has been recharged by fall or spring rains. Soil moisture below the depth of 1m is left in reserve for deeper-rooted crops. Research carried out at the Semiarid Prairie Agricultural Research Centre at Swift Current, Saskatchewan indicates pea roots reach a depth of approximately 0.75 to 1m, compared to 1.5 to 2m for wheat. In crop rotation tests, wheat and durum wheat grown on dry pea stubble produced higher yields and higher protein content compared to wheat grown on wheat stubble. (6)

Research indicates that sowing dry pea into standing cereal stubble helps protect the land from erosion and provides shelter for newly emerging seedlings. Late spring frosts in 1998 and 2000 revealed that leaving cereal straw in clumps or piles in the field increases frost injury to newly emerged pea seedlings. Spreading the straw evenly in the field helps to prevent spring frost injury and avoids mechanical problems with seeding and harvesting equipment. (6)

Rotating pea with cereal crops has the added benefit of interruption of pest cycles. Most cereal diseases do not affect pulse crops. Soil-borne root rots in continuous cereal systems may cause average yield losses up to 10 percent. Grasshoppers do not thrive in pea crops nor is dry pea a host for wheat midge. (6)

Pea is susceptible to mycosphaerella blight (ascochyta) and sclerotinia (see Disease Control), and careful consideration must be given to crop rotation to avoid these diseases. Where mycosphaerella blight is a problem, pea should not be grown on the same field more often than one year in three. In areas where sclerotinia is a problem, avoid seeding susceptible broadleaf crops (canola, sunflower, hemp, chickpea, pea, lentil) in the same field more often than one in four years. (6)

Highly fertile soils, such as fallow fields high in available nitrogen (N), may produce excess vegetative growth at the expense of seed production. (6)





Selection of a clean field is important, as the pea plant is a poor competitor with weeds. Perennial weeds such as Canada thistle and sow thistle should be controlled in the years prior to pea production. Dry pea is susceptible to the soil residues of some herbicides used in previous years. It is important to record herbicide use each year and to avoid seeding dry pea in fields with the following herbicide history:

Tordon®, Glean® > 5 years (persistence is extended when soil pH is 7.5 or greater); Ally®, Amber® 4+years (persistence is extended when soil pH is 7.5 or greater); Accord® 2 years; Muster® Assert®, Lontrel®, Unity®, Curtail®, Prestige®, Prevail®, Banvel®, (non-crop summer fallow rate) 1 year; fall applications of Rustler®, Banvel®, high rates of 2,4-D; and spring application of 2,4-D at low

rates used for winter annual control. Proper crop rotation indicates that dry pea be produced in the same field once every four years. Continuous production of broadleaf crops can result in increases in some seedling diseases and sclerotinia. (13)

B. Varieties

The Canadian pea industry initially was based on the Century pea, a cultivar with large yellow seeds. It was registered in 1960 and soon became the standard for food quality peas. The Century pea remained the dominant pea cultivar in western Canada until about 1987. The large increase in pea production and the shift in production from Manitoba to Saskatchewan and Alberta have resulted in a tremendous increase in the number of registered pea cultivars. This was further stimulated by the advent of Plant Breeders Rights legislation. Many of the new cultivars were developed in Europe and are well adapted to the cooler, moister pea production areas, particularly in Alberta. Currently, over 60 pea cultivars are registered for western Canada. (6)

	<p>Austrian Winter Peas Seed Size: 100-160 mg</p>
	<p>Yellow Peas Seed Size:</p> <ul style="list-style-type: none"> ● Small (Trapper) 120-180 mg ● Medium 200-250 mg ● Large 250-300 mg ● X-Large 300+ mg
	<p>Green Peas Seed Size:</p> <ul style="list-style-type: none"> ● 180-220 mg ● 260+ mg
	<p>Marrowfat Peas Seed Size: 280-400 mg</p>



The majority of the Canadian pea production for food use prior to 1990 was dry yellow pea. Production of dry green pea was minimal. In general, dry green pea produces a lower yield than dry yellow pea and in some years bleaching of the dry green pea reduces quality for the food pea market. Dry green pea usually receives a small premium, relative to dry yellow pea to compensate for the lower yield. The dry pea producing area of northern Idaho and eastern Washington traditionally produces mostly dry green pea, largely because their dry growing season minimizes the risk of bleaching losses. However in the drought year of 1988, their production was inadequate to fill forward sales contracts and the premium for dry green peas was very high in 1988 and several subsequent years. This greatly stimulated interest in dry green pea production in western Canada and by 1990 over half of the Canadian production was dry green peas. By 1993, dry yellow pea production was low enough that dry yellow food peas actually sold at a premium to dry green food pea. The rapid increase in dry green pea production occurred soon after registration of the Radley pea and consequently, most of the dry green pea production in western Canada from 1989 to 1993 was based on the Radley pea. The Radley pea has good bleaching tolerance and was able to meet food quality standards in most instances. Food peas are sold at a slight to moderate premium over feed peas because of the quality requirements. In 2002, over 70% of the pea production in Canada was yellow pea. (6)

The older cultivars, such as Century, produced vine growth often in excess of two meters in length. Tall pea varieties lodged badly and presented many harvest problems, especially in wet harvest seasons. Most of the newer cultivars are semi-dwarf and vines are often less than one meter in length. In fact, some of the newer European pea cultivars may be too short to produce reasonable yields, if subjected to a drought stress before flowering starts. However, this reduced vine length results in delayed lodging, thus delaying the onset of sclerotinia infection in wet years and minimizing yield losses from sclerotinia infection. Harvest is facilitated by the reduction in vine length. Furthermore, some of the newer cultivars are semi-leafless, i.e., tendrils replace the leaflets. These tendrils bind the plants together and result in a more open canopy. This makes crop canopy conditions more favourable for disease prevention and facilitates harvest. The more open canopy also permits faster drying, so that threshing can start sooner after a rain or heavy dew. (6)

C. Crop establishment

Dry pea inoculated with the appropriate strain of *Rhizobium* bacteria is able to fix a portion of its nitrogen (N) requirement from the atmosphere.

The use of high quality seed is important for successful pea production. Seed-borne diseases such as mycosphaerella blight (ascochyta) can reduce seedling vigour and lead to yield and quality losses. It is important to have pea seed tested for germination, purity and disease levels by an accredited seed test laboratory. Seed from a pea crop that had a pre-harvest application of glyphosate may result in uneven germination and poor seedling vigour. (6)

Pea seed is highly susceptible to mechanical damage during harvest, handling or seeding operations. Dry seed (14% moisture or less) is brittle and can easily crack or split, leading to reduced germination. Tempering the seed with water before seeding can reduce mechanical injury.(6)

Fertilizer requirements vary by soil type. Growers will generally use phosphorus applied with the seed at no more than 17 kg/ha (Seed-applied phosphorus at higher rates may cause injury). Sulphur may also be required on some soils. (6)

D. Production system

Spring seeded annual crop

E. Growth stages

Herbicides will be applied to a pea crop when the vines are anywhere up to 15 cm in length (Usually in mid to late June). The plants will stand upright early in the season as a result of the intertwining of tendrils although the weight of the crop can cause it to lay flat as harvest approaches. This tendency to lay flat and the challenges this creates at harvest time has led to breeding of varieties that have a shorter internode or fewer leaves. These varieties have better standability. This however, leads to a lessening of the crops ability to compete with weeds. (6)

F. Growth regulators

There are no growth regulators used in peas.

G. Harvest Practises

Pea crops should be monitored closely to determine the proper stage for harvest. Generally, plants mature from the bottom up. Crops are nearing maturity when the bottom 30 percent of pods are ripe, the middle 40 percent of pods and vines are yellow-coloured, and the upper 30 percent of pods are turning yellow. This is the proper stage for crops to be swathed or desiccated. (6)

Great care should be taken when harvesting dry pea for human consumption. Pea samples that contain excessive amounts of foreign material or cracked, peeled or discoloured seeds are suitable only for the feed market. Soil stuck to the seed is called earth tag and is a common factor in downgrading dry pea. Earth tag may occur during combining when wet soil is picked up by the combine or when moisture from weeds or heavy dew causes soil or dust to stick to the seed. (6)

The most important grading factor for the human market in green pea is seed colour. The maximum allowable bleach level for green pea destined for human consumption is 2 percent. Green varieties are susceptible to bleaching as they near maturity. High humidity, bright sunshine and warm temperatures cause bleaching of seed. For this reason, extra care should be taken to harvest green pea varieties as soon as possible. (6)

Dry pea may be swathed prior to full maturity or straight-combined at full maturity. The swather or straight-cut header should be equipped with vine lifters (pick-up guards) and/or a pick-up reel to ease the harvest of lodged or tangled crops. (6)

The swather can also be used to cut the crop at full maturity. The combine should follow immediately behind the swather, as even moderate winds can damage pea swaths. (6)

A desiccant herbicide can be applied to pea to kill green weeds and speed the dry-down of the crop. This treatment does not mature the crop, but can eliminate the need for swathing and dry-down green weeds that interfere with harvesting. Desiccation will reduce the risk of bleaching in green pea varieties by shortening the time the crop is left in the field. (6)

Reglone® (diquat) is a registered desiccant for ground or aerial application on dry pea (13). Straight-cutting dry pea has gained popularity due to the increased use of land rollers, development of flex-headers and the introduction of varieties with improved standability. The crop is permitted to completely ripen and harvested at approximately 18 percent-20 percent seed moisture with the combine equipped with a flex-header. These pick-ups have a positive motion that breaks the brittle, ripe vines off at the soil surface, eliminating the need to swath. (6)

Mature pea pods can shatter easily when dry, thus care must be taken to reduce shattering during swathing or straight combining. Shattering can be reduced by harvesting during the humid part of the day, and by reducing the reel or pick-up speed to keep the action against the crop to a minimum.

Dry pea is often combined at 18 percent-20 percent seed moisture content to reduce the risk of seed cracking or peeling. Harvest equipment is adjusted to reduce seed cracking. Combine and grain augers should be operated full and at low speeds to reduce cracking and splitting seeds. (1,6)

H. Post-harvest practices

Dry pea residue must be handled properly to reduce seeding problems in the following year. Pea straw used for livestock feed should be removed soon after combining to retain feed quality. When pea straw is being left in the field it should be chopped and evenly spread during harvest. Proper residue management will eliminate problems with extensive plugging of cultivation and seeding equipment in the following spring. If needed, heavy harrows can be used spread pea residue before seeding. Disc implements can be used to chop and spread the residue however this practise may increase soil erosion. Direct seeding equipment with narrow openers and good trash clearance can seed directly into pea residue leaving a smooth seed bed when the straw has been chopped and evenly spread during the previous harvest. (1,6)

Storage and Handling

Samples containing green weed seeds and other high moisture materials should be cleaned as soon as possible to prevent heating. (1,6)

Moisture levels up to 16 percent and temperatures below 15°C are considered safe for pea storage. The use of aeration fans to reduce moisture and temperature levels will improve storage.

If supplemental heat drying is necessary, air temperatures should not exceed 43°C to preserve germination. The sample should not be dried by more than four to five percentage points per pass through the dryer. Temperatures up to 70°C should only be used for drying feed pea. (1,6)

A great deal of respiration occurs in pea seed after it is placed in storage. Extra care should be taken to monitor the grain inside the bin for moisture build-up or spoilage. Aeration fans can be used to cool the grain in the fall and warm it in the spring to reduce moisture condensation in the bin. Pea seed is more susceptible to cracking and peeling if handled at temperatures below -20°C. (1,6)

The Canadian Grain Commission (CGC) sets standards for grading dry pea in Canada. Information on pea grading standards can be found at the CGC website: <http://www.cgc.ca/main-e.htm> (3)

I. Workers activities and availability during the season

Not applicable.

J. Pruning and Nutrient management

Nitrogen - Nitrogen (N) is necessary for high pea yields, but generally N fertilizer application is not required. When properly inoculated with an appropriate *Rhizobium* inoculant, dry pea can derive up to 80 percent or more of its N through N fixation. The remaining N comes from what is available in the soil at seeding, plus N that is released from the soil during the growing season. (1,6)

Nodule formation and subsequent N fixation are very sensitive to external N sources, including fertilizer and available soil N. As the supply of N available from soil and fertilizer increases, the amount of N fixed decreases. When the combined levels of soil and fertilizer N reach 28-40 kg/ha (25-35 lbs/ac), any additional N will reduce nodulation and N fixation. Combined soil and fertilizer N levels greater than 55 kg/ha (50 lbs/ac) can prevent nodulation and N fixation. (1,6)

It can take three to four weeks after planting before nodules are functioning fully. Early plant growth may be poor in soils with N levels less than 11 kg/ha (10 lb/ac), and plants may appear yellow prior to the onset of active N fixation due to an N deficiency. This early N deficiency can be corrected by adding low levels of starter N at seeding. However, it is important to remember that fertilizer N applications resulting in combined N levels (i.e., soil and fertilizer) greater than 35 kg/ha (30 lb/ac) can be counterproductive and reduce nodulation and N fixation. Although high levels of starter N may appear to help the crop overcome a N deficiency during early crop growth stages, final seed yields may not increase. Monoammonium phosphate (ex. 12-51-0) provides the small amount of N needed for early plant growth and, depending on the soil test, may provide the entire starter N required. Provincial extension services have published information on inoculation. (1,6)

Phosphorus - Dry pea has a relatively high requirement for phosphorus (P). Phosphorus is needed to promote the development of extensive root systems and vigorous seedlings. Encouraging vigorous root growth is an important step in promoting good nodule development. Phosphorus also plays an important role in the N fixation process. Pea planted on soils testing low in available P or under cool or wet conditions may respond dramatically to P fertilizer. As with cereals, yield responses are not always achieved when applying P in the form of phosphate fertilizers. However, a pea crop may benefit from

increased frost tolerance, resistance to disease, improved nodulation and N fixation and drought tolerance as a result of a P application. (1,6)

The maximum safe rate of actual phosphate applied with the seed is 17 kg/ha (15 lb/ac) in a 2.5 cm (1 in) spread and 15-18 cm (6-7 in) row spacing under good to excellent moisture conditions. Rates of seed-placed phosphate fertilizer must be reduced if the seedbed has less than ideal moisture conditions. Higher rates of phosphate fertilizer placed in the seed row with narrow openers like discs or knives can damage the emerging seedling and reduce the stand. If higher phosphate rates are required, banding the fertilizer away from the seed (sideband or to the side and below) or the use of the product Jumpstart[®] should be considered. If side banding is available, sideband all the phosphate fertilizer, especially when using narrow openers. (1,6)

Sulphur - A 40 bu/ac pea crop requires about the same amount of sulphur as a 40-bu/ac wheat crop, approximately 9-11 kg/ha (8-10 lb/ac). Soils testing low in available sulphur should have this deficiency corrected with ammonium sulphate, which contains sulphur in a plant-available form. Most research indicates no yield response to the addition of sulphate-sulphur fertilizer except in fields testing very low in sulphur. The SAF publication, *Sulphur Fertilization in Crop Production*, contains more details for correcting sulphur deficiencies.(1,6)

Potassium - Dry pea has a high demand for potassium (K), and is about 135-165 kg/ha (123-150 lb/ac) K₂O for a 50-bu/ac crop. Fields low in K should be corrected based on soil test recommendations. Banding K fertilizer is effective (1,6)

IV. Production problems

A. Introduction

A summary of priority needs for peas is given in *Section V Critical Needs*.

B. Non-pest problems

Peas require cool temperatures and adequate moisture to yield well. Excessive temperatures at flowering can lead to yield loss.

C. Plant Pathogens/Diseases (6)

Pea is susceptible to mycosphaerella blight (ascochyta), powdery mildew and sclerotinia, and careful consideration must be given managing these diseases. A combination of rotation, cultural techniques, genetic resistance and chemical controls make up the bulk of the integrated approach customarily used by growers of peas. These will be discussed in detail below. In general terms however, the following integrated pest management techniques apply;

1. Use of effective crop rotations. Plant dry peas only once every four years in the same field. Continuous production of broadleaf crops can increase some seedling diseases and sclerotinia if host crops are included. Where mycosphaerella blight is a problem, pea should not be grown on the same

field more often than one year in three. In areas where sclerotinia is a problem, avoid seeding susceptible broadleaf crops (canola, sunflower, hemp, chickpea, pea, lentil) in the same field more often than one in four years.

2. Use of the best seed available. A seed test will indicate the presence of seed-borne diseases.
3. Use of a registered fungicide seed treatment may be warranted, especially if seeding early into cool, wet soils.
4. Early seeding.
5. Monitoring of fields for diseases.

Key factors by pathogen (6,10)

Mycosphaerella blight - This fungal disease is also known as ascochyta blight. There are three *Ascochyta* species that infect dry pea. In Saskatchewan, the most common species is *Ascochyta pinodes*. The sexual stage of this species, which produces air-borne spores, is called *Mycosphaerella pinodes*. Infection can be caused by inoculum from infected pea stubble in neighbouring fields. Thus, crop rotation is not a guarantee against infection.

Early symptoms of mycosphaerella blight are small purplish-black, irregularly shaped spots on lower leaves, stems and pods. These spots turn brown or black, grow together and spread up the plant. The impact on yield depends on the timing of the initial infection and on weather conditions. If the infection originates within the same field, the disease can develop early and the likelihood of loss is greater. If the initial infection occurs at the base of the plant, footrot can occur and the plant may prematurely lodge and die

Seed infection is a significant factor in introducing mycosphaerella to an area. However, seed transmission is less significant than transmission from infected pea stubble. No commercial dry pea varieties are resistant to mycosphaerella blight; however, some varieties are more resistant than others. Provincial extension services publish lists of varieties along with disease tolerance information. Bravo 500 is registered for the post-emergence control of mycosphaerella blight in dry pea.

Sclerotinia stem rot (*Sclerotinia sclerotiorum*) - This disease attacks many broadleaf crops, but is most severe on sunflower, dry bean and canola. It overwinters in the soil as small, black bodies known as sclerotia. Sclerotia may remain viable for three to five years.

Infection can take place when sclerotia in close contact with the pea root, germinate and cause infection at the base of the plant. A second method of infection occurs when sclerotia germinate under a dense plant canopy developing tiny mushroom-like structures that produce spores. These spores colonize dead plant material such as fallen flower petals or hail-damaged leaves. Spores can be scattered by the wind. Therefore planting pea next to previously infected fields can assist in spreading the disease.

Once infection has occurred, it can spread very quickly by plant-to-plant contact, especially when there is moisture under a heavy crop canopy. If infection occurs late in the growing season, there may be little effect on yield. However, the build up of sclerotia in a field may have a negative impact on subsequent broadleaf crops in the rotation. There are no fungicides registered for the control of sclerotinia in pea.

Root Rot - Root rotting fungi (*Pythium*, *Rhizoctonia*, *Botrytis*, and *Fusarium* species) can attack any part of the root system up to a short distance above the soil surface. Crop rotation can minimize the build-up of soil-borne fungal organisms. Continuous production of broadleaf crops in the same field can lead to a build-up of root rot and seedling rot diseases.

Bacterial blight (*Pseudomonas syringae* pv. *pisii*) - Infections of this disease are not common in the major growing areas. . It is primarily seed-borne emphasizing the importance of obtaining seed free of bacterial blight. Crop rotation is an important component in the control of this disease as the bacteria can also overwinter on crop residues. Symptoms first appear as small, water-soaked spots on leaves, stems and pods. A creamy white ooze may appear on the spots during wet weather. When this material dries, the spots become dark brown and may appear shiny. These leaf spots appear translucent when held up to the light. The bacteria are spread by rain-splash. Hail or other physical injury to the plant may favour infection.

Powdery mildew (*Erysiphe polygoni*) - Infection of pea crops usually begins about mid-July. Pea crops seeded in early spring have often progressed past the stage of economic impact because pods and seeds are formed before the disease appears. Delayed seeding increases the risk of an economic impact.

Most varieties of dry pea commonly grown in Western Canada are susceptible to powdery mildew. Plant breeders are selecting for resistance to powdery mildew in most new dry pea lines. Powdery mildew thrives under warm, dry, daytime conditions with nights that are cool enough to cause dew formation. Rain showers will disrupt the spread of powdery mildew.

Symptoms include the development of white, powdery spots on lower leaves and stems that can quickly spread to the entire plant. Severely affected crops are covered in a white mat of powdery spores and may appear to have a bluish or silvery sheen. The underside of infected leaves turns yellow below the powdery infection. The disease can reduce yield, delay maturity and reduce uptake of desiccants.

Kumulus DF® is registered for the control of powdery mildew on dry pea. This product, which is 80 percent sulphur, is a protectant fungicide and does not cure leaves already diseased. Application must be made prior to infection or at the first sign of infection. Repeat applications may be required at seven- to 10-day intervals if favourable weather conditions persist.

Other Diseases - Other fungal disease of minor importance include downy mildew, anthracnose, septoria blight and rust. Virus-like diseases can also occur in dry pea and are spread by aphids.

Pest assessment –Monitoring and Forecasting

Specific economic threshold information for the diseases mentioned above is not currently available. However, growers can use a fungicide decision support system that allows the grower to input specifics relating to the crop so that a risk assessment can be made. This risk assessment allows the grower to decide whether a fungicide application is required. The model requires the grower to inspect the pea crop at no later than 10% flowering. The grower chooses the risk values that most closely describe plant stand, number of days with rain in the past 14 days, and the 5-day weather forecast.

This resource has been tested primarily in Saskatchewan and is available at http://paridss.usask.ca/specialcrop/pulse_diseases/fungicide/step1pea.html

Pest management

Ascochyta Blight of Pea

- ❖ **Cultural practices/quarantine or exclusionary methods Crop rotation:** Pea should not be planted any more frequently than once in four to allow reduction of the stubble-borne inoculum. Field bean, fababean and grass pea may all harbor ascochyta and should be rotated as well. To avoid problems with sclerotinia in pea, canola and other broad-leaved crops,

these crops should not be planted back to back. Furthermore, pea should be planted as far as possible from ascochyta-infected pea fields of the previous season.

- ❖ **Tillage practices:** Zero or minimum tillage does not seem to increase the risk of foliar diseases such as ascochyta. It is the weather conditions, especially rainfall frequency, that determine the rate of ascochyta blight development in a given year.
- ❖ **Resistant cultivars:** Although several hundred pea entries have been screened extensively for resistance to ascochyta blight, no sources of resistance have been found. However, some pea cultivars yield acceptably in the presence of ascochyta blight, and are said to be resistant to the disease. Some of these cultivars are Carneval, Radley, Century, Trapper and Explorer.
- ❖ **Healthy seed:** Clean, ascochyta free seed is the safest way to establish a healthy pea crop. A seed analysis certificate from an accredited laboratory will indicate the level of seed borne infection. Seed should be chosen from crops that were grown and harvested under dry weather conditions. As a rule of thumb, up to 10% ascochyta infected seed will not significantly affect plant establishment and yield, especially if soil conditions promote quick germination and good seedling vigour.

Chemical control (reactive measures)

- ❖ **Seed treatments:** The following seed treatments are available for control of seed rot and seedling blight; Captan® (30% captan, Norac Concepts), Agrox® (15% captan fungicide + insecticide, Norac Concepts), Apron® (methalaxyl for control of *Pythium* and downy mildew, Gustafson), and Thiram® (Gustafson).
- ❖ **Fungicides:** Headline® and Bravo 500® (50% chlorothalonil,) control ascochyta blight in peas.

Powdery mildew

Cultural practices/quarantine or exclusionary methods

- ❖ **Crop rotation:** Crop rotation is of limited usefulness in managing this disease.
- ❖ **Tillage practices:** Weather factors are more important than tillage regime in the incidence of this disease
- ❖ **Resistant cultivars:** Certain pea cultivars, such as AC Melfort, CDC Handel, CDC Mozart, Highlight, AC Tamor, Tara (yellow-seeded) and SW Parade (green-seeded) are resistant to powdery mildew, but most cultivars are highly susceptible. Early seeded crops and early maturing cultivars are often less affected by this disease than late-harvested crops because the fungus has less opportunity to spread and affect yield. Furthermore, the disease is often more severe in a lush pea stand.
- ❖ **Healthy seed:** Weather conditions predominate with respect to incidence of this disease and disease free seed is not the primary means of managing the pathogen.

2) Chemical control (reactive measures)

- ❖ **Seed treatments:** None
- ❖ **Fungicides:** Headline® and Kumulus® may be used.

Root rots

Cultural practices/quarantine or exclusionary methods

- ❖ **Crop rotation:** Rotate away from broadleaf crops to minimize the buildup of root rot organisms.
- ❖ **Tillage practices/seeding:** Plant stress (poor fertility, water logging, drought, herbicide injury) increases the risk of root rot problems and should be avoided where possible. Using healthy seed with high germination is important because vigorous seedlings have a better chance to outgrow early-season infection. Slow emergence due to cool weather or poor seed can result in problems with seed decay and root rot.
- ❖ **Resistant cultivars:** All pea cultivars are susceptible to seed decay, damping-off and root rot.
- ❖ **Healthy seed:** Cultivars with wrinkled seed release more nutrients when they germinate than those with smooth seed. Nutrients attract the mobile spores of *Pythium*, so pea lines with wrinkled seed are often more susceptible to seedling infection. Similarly, seed damaged by rough handling releases more nutrients during germination and is therefore very susceptible to damping-off and seedling blights.

Chemical control (reactive measures)

- ❖ Seed treatments: Fungicide seed treatments such as Apron® (metalaxyl), Agrox®, Captan Flowable® (captan) and Thiram 75WP® (thiram) can be used to protect the seedlings in early stages of plant establishment.

Table 4. Summary Information table on Diseases for 2003

REGION	DISEASES	% ha infected	% ha treated*	Average Yield Losses		Average % efficacy of prevailing control methods ¹	Problem priority level ²
				Tonnes	CDN \$		
Ontario, Manitoba, Saskatchewan Alberta	Root rot	80-100	100% of certified seed, <5% of common	5% (8800 tonnes)	\$1.8 million	80%	1 (E)
Ontario Manitoba Saskatchewan Alberta	Ascochyta	80% infected at levels of at least 2-3% of leaf area	100% of certified seed, <5% of common. See next table for fungicide use.	15% (26,000 T)	\$5.2 million	80%	1 (E), 2 (R)
Ontario Manitoba Saskatchewan Alberta	Powdery mildew	15%	<10%	5-10% (8800 to 17000 T)	\$1.8 to 3.6 million	60 to 80%	2 (E)
TOTAL				43,600-51,800	\$8.8 - \$10.6 million		

Source – Pulse Specialists, Saskatchewan Agriculture and Food, Manitoba Agriculture and Food, Alberta Agriculture and Food

Table 5. Fungicidal use by Stratus survey over two years in peas

	Total Market			By Province in 2002			By Soil Zone in 2002 ²		
	2001	2002	Chg	AB/BC	SK	MB	Black	Dark Brown	Brown
Base Size	406	320		58	234	27	143	95	82
Using Fungicides (%)	0.0	0.0	-3.2		0.3	7.4	1.4		
Seeded Acres ¹	3,610	3,205	-11.2%	638	2,350	200	1,480	897	829
Application Intensity (%)	0.0	0.0	-4.4		0.1	3.3	0.5		
Application Acres (000's)	166	8	-95.3%		1	7	8		
Ascochyta	73	8	-89.0%		1	7	8		
Expenditures (\$000)	\$1,480	\$92	-93.8%		\$19	\$73	\$92		
Average Cost (\$/acre)	\$8.90	\$11.82	32.8%		\$15.00	\$11.20	\$11.82		

Source – Stratus Agrimarketing

Table 6. Seed treatments in peas by Stratus survey over two years

	Total Market			By Province in 2002			By Soil Zone in 2002 ²		
	2001	2002	Chg	AB/BC	SK	MB	Black	Dark Brown	Brown
Base Size	406	274		64	189	21	170	58	46
% of Growers Using	38.9%	29.8%	-9.2	43.2	25.2	33.3	31.1	22.2	34.2
Seeded Acres (000's) ¹	3,610	3,205	-11.2%	655	2,350	200	1,666	858	680
Application Intensity (%)	31.8%	35.3%	3.5	45.3	34.0	18.4	39.0	27.3	36.4
Acres Treated	1,149	1,131	-1.5%	297	798	37	649	234	248
Diseases	1,133	646	-43.0%	160	486		426	153	67
Insects		5			5			5	
Both	15	91	504.6%	30	61		19	11	61
Don't Know		390		106	247	37	203	67	120
Expenditures (\$000's)	\$4,643	\$4,976	7.2%	\$1,315	\$3,498	\$163	\$2,871	\$921	\$1,184
Average Cost (\$/acre)	\$4.04	\$4.40	8.9%	\$4.43	\$4.38	\$4.44	\$4.42	\$3.93	\$4.78

¹ Statistics Canada - June Estimate of Principal Field Crop Areas

² Seeded acres by soil zone based on distribution of acres reported in survey sample

Source – Stratus Agrimarketing

D. Weeds:

Peas compete poorly with weeds so selection of a clean field is important. Perennial weeds such as Canada thistle and sow thistle should be controlled in the years prior to pea production. Dry pea is susceptible to the soil residues of some herbicides used in previous years. The predominant weeds across the pea-producing region include both grassy and broadleaf weeds (see Table below)

Key factors

Priority areas are discussed under *Section V. Critical Needs*. Early removal is important for the control of weeds in peas due to the lack of competitive ability of the crop. Overwintering annuals and early-germinating spring annuals can be controlled using pre-seeding tillage or pre-seeding glyphosate. Perennials should be controlled the fall prior to planting peas because there are no in-crop means of controlling key perennial weeds like Canada thistle and sow thistle.(18)

Pest assessment – monitoring and forecasting

Weeds are ubiquitous in all pea-growing areas. Economic thresholds are not widely used because mixes of species require a multi-species model for calculation of yield loss potential. Advisory services in the form of field scouts are available for field assessments of a general nature. These services are usually provided by the chemical dealer.

Table 7. Dominant weeds in peas by province– ranked by frequency

	Alberta	Manitoba	Saskatchewan
1	Chickweed	Green foxtail	Wild Oat
2	Wild Oat	Wild Oats	Canada Thistle
3	Stinkweed	Wild Buckwheat	Green foxtail
4	Wild Buckwheat	Canada Thistle	Volunteer canola
5	Canada Thistle	Redroot pigweed	Perennial sow-thistle
6	Shepard's-purse	Wild Mustard	Stinkweed
7	Cleavers	Smartweed species (annual)	Wild Buckwheat
8	Lambs-quarters	Perennial sow-thistle	Shepard's-purse
9	Field Horsetail	Lambs-quarters	Quack grass
10	Hemp nettle	Quack grass	Lambs-quarters

Source – Weed Survey Series, Thomas et al.(16)

Table 8. Summary information on pea weeds – note that % over action threshold information is not available

Weeds	% Ha infested	% Ha treated	Loss in yield (T)	Loss in yield (\$ million)	Average efficacy	Problem priority level
Broadleaf	100	100	10% (130,000 T)	26	80%	1 (E)
Grassy weed	100	100	5% (70,000T)	13	90%	2 (R)
Perennial	30	0	5% (70,000T)	13	0%	1 (E)
Volunteers	10	10	5% (70,000T)	13	85%	1(R – GMO canolas)

Source – Weed Survey Series, Thomas et al. Agriculture and Agrifood Canada

Pest management (6, 18)

Effective weed control depends on careful field preparation and controlling perennial weeds at least one year prior to planting pea crops. The use of clean seed, maintenance of good sanitation with respect to equipment and field edges is also important.

As can be seen from the Table herbicide application remains the key method of weed control owing to the lack of crop competition provided by a pea crop. Use intensities of up to 141 percent show that the growers require more than a single application.

In Saskatchewan, Canada’s largest pea growing region, volunteer canola is now considered a serious problem for pea growers. The abundance of genetically altered herbicide resistant canola is causing a once easily controlled volunteer crop to become a serious problem with limited control solutions.

Reactive measures include the use of imidazilinone chemistries (Pursuit®, Odyssey®) either alone or mixed with graminicides. The use of metribuzin and MCPA sodium salts has been largely supplanted by these chemistries. Perennial weeds are typically controlled using glyphosate the year prior to seeding peas.

Table 9. Herbicide use and intensity in field peas as reported to Stratus.

(000's of acres)	Total Market			Provinces - 2002			Soil Zones ³ - 2002		
	2001	2002	Chg	AB/BC	SK	MB	Black	Dark Brown	Brown
Base Size	346	320		58	234	27	143	95	82
Seeded Acres ¹	3,610	3,205	-11.2%	638	2,350	200	1,480	897	829
Use Intensity (%)	94.5%	88.8%	-5.7	85.8%	88.7%	98.2%	90.0%	89.1%	86.3%
Base Acres Treated	3,412	2,846	-16.6%	547	2,085	196	1,332	799	715
Application Intensity (%)	141.9%	137.9%	-4.0	124.4%	141.0%	147.4%	133.5%	154.7%	127.4%
Fall Market	24.9%	23.8%	-1.1	11.4%	26.9%	29.7%	26.7%	30.7%	11.4%
Spring - Preseed Market	26.8%	20.5%	-6.4	24.9%	19.5%	18.6%	11.6%	21.4%	35.3%
Spring - Post Market	90.2%	93.6%	3.3	88.1%	94.6%	99.1%	95.3%	102.6%	80.8%
Application Acres	5,123	4,419	-13.7%	793	3,313	295	1,976	1,387	1,056
Fall Market	898	763	-15.0%	72	632	59	394	275	94
Spring - Preseed Market	968	656	-32.3%	159	459	37	171	192	292
Spring - Post Market	3,258	3,000	-7.9%	562	2,222	198	1,410	920	669
Product Application Acres ²									
Dinitroanilines	370	292	-21.2%	19	243	30	69	83	140
Glyphosate	1,402	1,100	-21.5%	212	827	61	483	384	234
Post-emergent Grass	2,920	2,511	-14.0%	490	1,842	178	1,207	671	633
Post-emergent Broadleaf	2,669	2,338	-12.4%	442	1,697	182	1,119	685	534
Total Market Value (\$000's)		\$62,473		\$11,541	\$46,048	\$4,812	\$29,450	\$18,251	\$14,772
Fall Market		\$7,227		\$678	\$5,844	\$705	\$3,522	\$2,501	\$1,204
Spring - Preseed Market		\$4,589		\$960	\$3,386	\$243	\$1,205	\$1,322	\$2,061
Spring - Post Market		\$50,657		\$9,903	\$36,818	\$3,865	\$24,724	\$14,427	\$11,506

¹ Statistics Canada - June Estimate of Principal Field Crop Areas

² Post-emergent grass/broadleaf products are reported under both "post-emergent grass" and "post-emergent broadleaf" categories

³ Seeded acres by soil zone based on distribution of acres reported in survey sample

E. Insects and mites

Insect problems in peas are centered around three key pests (1) pea aphid, (2) cutworms and (3) grasshoppers. All three can occur in varying severity depending on cyclical factors and weather.

Key factors (6,1,15)

Pea aphids. Although pea aphids rarely survive winter in the prairies, they may overwinter as an egg attached to the stems or leaves of alfalfa or clover. The eggs hatch in early spring and the young aphids feed on the newly emerged alfalfa or clover plants. During May and June, depending on weather and host plant conditions, the insects develop wings and with the aid of wind currents fly to pea fields. The majority of aphids in pea fields are blown in on warm southerly winds from the United States in June or early July. The pea aphid weakens the plant directly by sucking its sap, and may be responsible for transmitting virus diseases.

Cutworms. These insects can occasionally attack pea crops. Cutworm moths may lay several hundred eggs on their host plants. After the eggs hatch, the larvae feed on the host plants. They moult several times, eventually reaching about 5 cm (2 in.) in length. The larvae tunnel into the soil to form earthen cells where they pupate. The new moths emerge, exiting through the soil using the old larval tunnels. Some species overwinter as eggs (e.g., the red-backed cutworm); others, as larvae or pupae. Still others do not overwinter in Western Canada but rather re- invade annually from the USA, aided by southerly winds. Most Western Canada pest species have only 1 or 2 generations per year.

Aphids. Pea aphids overwinter as eggs on leaves and stems of perennial legumes (e.g., on the crowns of clover or alfalfa). In the spring, when plants resume growth, a small, light green, wingless female hatches from each egg. These aphids, all females called "stem mothers", can reproduce without mating. They feed on the growing plants and give birth to female young. Some aphids of the 2nd and 3rd generations become winged and migrate to field peas and other acceptable host plants where they feed and produce wingless females who in turn give rise to winged and wingless females.

Aphids develop from birth to maturity in 5-50 days depending on the weather. All pea aphids are female throughout spring and summer. A summer female can produce 50-150 young during her life. If the host crop is cut during spring or summer, the winged aphids leave to search for new plants on which to live.

In late September or October, winged males and wingless females are produced. These mate and the females lay eggs on leaves and stems. There may be 7-15 generations per year.

Grasshoppers. Grasshoppers have one generation per year in Canada. Egg-laying usually begins in late July and continues into the fall. The female places egg pods in a cavity in the soil. Most grasshoppers overwinter as eggs in the soil. Egg hatch usually begins in late April or early May, peaks about mid-June, and is complete by late June. Hatching begins when the soil temperature has been 15-16 degrees C for about 200 hours.

Newly hatched grasshoppers are about 5 mm (1/4 in.) in length. These nymphs resemble the adults but have wing pads instead of wings and, therefore, cannot fly. There are usually 5 or 6 nymphal instars. Grasshopper nymphs mature in 35-55 days. The adults may live for 4-6 weeks after mating and egg laying.

Pest assessment/monitoring/forecasting (1,6,8,14)

Aphids. Economic thresholds for aphids are available in provincial government publications such as the Guide to Crop Protection, published by the three prairie extension services. Sampling to determine aphid density should be done when 50-75% of the pea plants are in flower. The threshold in Century peas is 2-3 aphids per 20 cm (8 in.) of plant tip at flowering. Trapper peas can tolerate higher levels. Plants infested before the flowers open recover without loss of yield.

Cutworms. Cutworm control in field crops is usually necessary when cutworms destroy 5-10% of the crop or when cutworm populations exceed 3-4 cutworms per square metre (sq. yd.).

Grasshoppers. When populations exceed 8-12 hoppers per square metre (sq. yd.), control is usually warranted. Monitoring is available for grasshoppers. A grasshopper forecast map is available from the provincial extension services. These maps can be found at

http://www.gov.mb.ca/agriculture/crops/insects/forecast/grasshopper_map.html

http://www.agr.gov.sk.ca/DOCS/crops/integrated_pest_management/insects/images/hoppermap2003.gif

and http://www.agric.gov.ab.ca/pests/forecast/2003hopper_forecast.html

Pest management

Cutworms

- ❖ **Preventive Measures.** Cultural control methods center around monitoring. Crop rotation is of limited use since the insect attacks a wide range of hosts. There are no resistant varieties available.
- ❖ **Reactive control measures.** Chemical control is available when cutworms exceed economic thresholds. Spraying is most efficacious when done at night.

Pea aphid

- ❖ **Preventive Measures.** Cultural control methods center around monitoring. Pea aphids attack a wide variety of hosts. Additionally, populations can be blown in from great distances and so crop rotation is of limited use.
- ❖ **Reactive control measures.** Chemical control is available when aphids exceed economic thresholds. Specific application methods are discussed in provincial extension service publications such as the Guide to Crop Protection, published by the prairie extension services.

Grasshoppers

- ❖ **Preventive Measures.** Cultural control methods center around monitoring. There are no resistant varieties.
- ❖ **Reactive control measures.** It is usually possible to limit treatment to field perimeters since this is the area where the insect does the most damage. Grasshoppers will eat peas but prefer other crops. Fieldwide treatment often is not necessary.

Table 10. Summary Information Table on Insect Pests

Source – Pulse Specialists, Saskatchewan Agriculture and Food, Manitoba Agriculture and Food, Alberta Agriculture and Food

REGIONS	PEST	% ha over action threshold+ Action Threshold ¹	% ha treated	Average Yield Losses		Average % Efficacy of Prevailing Methods ²	Problem priority level ³
				tonnes	CDN \$		
All	Aphids	2 to 4%	<5%	<1%	N/a	>80%	5
All	Cutworms	2 to 4%	<5%	<1%	N/a	>80%	5
All	Grass hoppers	2 to 4%	<5%	<1%	N/a	>80%	5
Totals				<5%	N/a	>80%	

Table 11. Summary Information Table on control products and pests

REGIONS	Product (ai target)		Percent Area Treated	Typical Rates	Timing & Frequency	Cost per ha	% Control	PHI/REL ⁵	IPM Compatibility ⁴
All	Malathion 500	Aphids	<3%	2.25 l/ha	Once near flowering	\$25.00	80%	3 days	Re
All	Ambush/Pounce	Cutworms	<3%	0.15 L/ha	Early season (Once)	\$7.00+	80%	1 day	RP
All	Agrox (captan diazinon lindane)	Wireworm seed treatment	<3%	0.05 kg/kg seed	On seed	\$2.50/ per 25 kg seed	60%		Re
All	Dimethoate	Aphids	<3%	0.25 L/ha	Once near flowering	\$2.50	80%	3 days	Re

Source – Pulse Specialists, Saskatchewan Agriculture and Food, Manitoba Agriculture and Food, Alberta Agriculture and Food

Table 12. Summary Information Table on IPM control methods

Pest type ¹	Method type or combination ²	Estimated % Efficacy	Cost per ha (CDN \$)	% Adoption by farmers	Comments ³
Aphids	Monitoring/ economic thresholds	100	\$12/ha	Est. 50%	
Cutworms	Monitoring/ economic thresholds	100	\$12/ha	Est. 50%	
Grasshoppers	Monitoring/ forecasting	100	\$12/ha	Est. 90%	

Source – Pulse Specialists, Saskatchewan Agriculture and Food, Manitoba Agriculture and Food, Alberta Agriculture and Food

V. Critical Industry needs

In June 2002 pea growers and grower support interests developed the following critical needs at a prioritization meeting held in Saskatoon. A list of participants is found in Appendix A

Research

- Develop new annual broadleaf products to replace imi's
- Disease management tools: modeling, resistance, decision-making tools
- Harvest aid management tools
 - o Shorter grower season areas
 - o New market classes
- Breeding for mycosphaella resistance
- New stand-up leafy peas

Regulatory

- New labels: strobilurins, broadleaf herbicides
- Harmonize (with U.S.) and streamline registration process
 - o Compressing trial zones
 - o Increase acceptance of U.S. data
 - o Expedite setting up a Canadian IR-4
- Pulse industry to work with PMRA on regulatory flexibility to maintain pulse crops in the minor use system, to obtain product registration in pulse crops

- Industry to explore potential of picking up minor pesticides
- Coordination within Canada to generate data to fill requirements for minor use registrations
- Examine “novel trait” plant definition

Education

- Harvest management
- Educate stakeholders about regulatory requirements for pulses
- Educate on rotations and other cultural pest management strategies
- Educate on pesticide persistence
- Develop crop profiles
- Educate general public on pest management and role of pesticides
- Professional development requirement for regulators

General

- Develop super-crop groupings
- Pesticide harmonization
- Additional IPM crop protection tools for disease
- Additional IPM crop protection tools for broadleaf weeds
- Work with int’l trade partners so that MRLs don’t become trade irritants
- Catch up pesticide registration and on-farm food safety; develop list of products that need to be registered
- Re-evaluate zone maps for residue trials
- Crop profiles
- Define, monitor, and document IPM practices in pulses
 - o Educate regulators
 - o Educate public
 - o Standardize measurements

VI. Actual Research Areas

The following agronomy/pest management trials are ongoing and are registered with CARC.

ICAR#	Title
<u>22220840</u>	Practical Control Strategies for Ascochyte (Mycosphaerella) Blight in Field Pea and Chickpea

<u>22221143</u>	Selection of superior field pea cultivars for Alberta
<u>22221144</u>	Intensive Pea Management
<u>22221145</u>	Granular inoculant evaluation on field pea productivity
<u>22221189</u>	Développement de lignées de pois sec.
<u>22221534</u>	Évaluation de protéagineux
<u>22221613</u>	Special crops regional variety tests
<u>33330583</u>	Management of Foliar Diseases (Mycosphaerella Blight and Powdery Mildew)
<u>33330849</u>	Implementation of marker-assisted selection for lodging resistance in pea breeding
<u>33330923</u>	Glycinebetaine: Value-added product from Sugarbeet waste
<u>33330924</u>	Screening for Chilling Tolerance using fluorometer
<u>33331035</u>	Development of field pea for Saskatchewan.
<u>88880000</u>	DEVELOPMENT OF CONSERVATION TILLAGE PRODUCTION SYSTEMS IN CEREAL, PULSE AND OILSEED CROPS FOR THE PARKLAND
<u>88880371</u>	Pulse crop breeding, pathology, and agronomy for western Canada.
<u>88880373</u>	Molecular genetic approaches toward improved end use traits in western Canadian crops.
<u>90000233</u>	Impact of aphid parasitoids on aphid populations in some Manitoba field and forage crops
<u>90000581</u>	TagTeam: A combined rhizobium/phosphate inoculant.

VII- Available Resources

The following public institutions have capabilities, past experience or are currently engaged in research on peas.

Institution	Areas of expertise
Scott Research station, Scott, SK	Agronomy/weeds
University of Saskatchewan, Saskatoon, SK	Weeds/Agronomy/Breeding/Pathology
Swift Current Research Station, Swift Current, SK	Agronomy
Indian Head Research Station, Indian Head, SK	Agronomy/Weeds
Lacombe Research Station, Lacombe AB	Weeds, agronomy
Melfort Research Station, Melfort SK	Agronomy
Brandon Research Station, Brandon MB	Agronomy, Fertility, Pathology, Weeds
Morden Research Station	

The following websites have information on pulse crop production and crop protection.

Production information - www.saskpulse.com

Markets and general information - www.pulsecanada.com

Production and marketing statistics - www.statcan.ca

Production information - www.gov.mb.ca/pulse/agriculture/crops/pulsecrops

Production information - www.pulse.ab.ca

Production information - www.agric.gov.ab.ca/navigation/crops/pulses/

Production and marketing - www.agr.gov.sk.ca

Quality and grading - : <http://www.cgc.ca/main-e.htm>

Trademark usage

Trademarks used are followed by a ®. These include the following products: - Vitaflo 280® - Gustafson, Accord® Pursuit®/Odyssey® Reflex® Headline®/Ronilan®/Kumulus® Rustler® Assert® - BASFCanada. Ally® Assure II® Benlate® Glean® and Muster® - Dupont Canada Amber® Unity® Reglone® Bravo®-Syngenta. Attain/Trophy® Tordon®,Curtail M® /Eclipse® /Prevail® /FlaxMax® /Lontrel® /Prestige®, Edge®, Lorsban® - Dow Agrosciences, Everest® - Arvesta Corp, Select®, Sencor®, Decis® - Bayer Crop Sciences. Jumpstart®-Philom Bios.

References

1. Bell, J.M. 1992. Personal communication and presentation given to Sask. Pulse Crop Growers, January 1992. Dept. of Animal and Poultry Science, University of Saskatchewan, Saskatoon.
2. Special crop outlook: Supply and Disposition, November 1, 2001
3. Canadian Grain Commission, 1991. Grain quality handbook for western Canada. Canadian Grain Commission, Winnipeg, MB.
4. Crop Year 1991-2002 from Agriculture and Agri-food Canada, Strategic Policy Branch-Market Analysis Division, Winnipeg
5. McLean, L.A., F.W. Sosulski, and C.G. Youngs. 1974. Effect of nitrogen and moisture on yield and protein in field peas. *Can. J. Plant Sci.* 54:301-305.
6. McVicar, R., S Hartley, C. Brenzil, K. Panchuk, P. Pearse, Saskatchewan Agriculture and Food, T. Warkentin, B. Vendenberg, University of Saskatchewan, T. Hogg, Canada Saskatchewan Irrigation Diversification Centre. "Dry Pea In Saskatchewan". Saskatchewan Agriculture and Food Web Site.
7. Miller, M. 1996. Global outlook of the special crops market. Third Canadian Special Crops Exporters Course. C.I.G.I. November 21, 1996. Winnipeg. MB.
8. Slinkard, A.E. and H.L. Blain, 1988. Production of pea, lentil, faba bean and chick pea in North America. Pp. 1059-1063 in R.J. Summerfield (ed.). *World crops: Cool season food legumes*. Kluwer Academic Publ., Dordrecht, Netherlands.
9. Feed pea nutritional information. 2003 (In press). Pulse Canada.
10. Saskatchewan Agriculture and Food website www.agr.gov.sk.ca 'Pulses'
11. Saskatchewan Pulse Growers website XXXXXXXXXXXXXXXXXXXX.10
12. Canada Grains Council Statistics Handbook
13. Guide to Crop Protection 2002. Published by Manitoba Agriculture and Food
14. Pulse Canada data 'Pea Production' (2003)
15. Personal communication, R. MacVicar, Pulse Specialist, Saskatchewan Agriculture and Food
16. Weed Survey Series. Saskatchewan Weed Survey (1997), Alberta Weed Survey, Manitoba Weed Survey. Thomas, A.G.. Saskatoon Research Station. Agriculture and Agrifood Canada.
17. Stratus Agrimarketing Inc, Guelph Ontario
18. Guide to Crop Protection in Alberta 2002. Published by Alberta Agriculture.

Appendix A

Critical Needs and agronomy sections

NAME	ORGANIZATION	CATEGORY	EMAIL
Brenda Harris	Crop Protection Inst designate	Crop Life	bjharris3@dow.com
Neil Harker	AAFC	Research	HarkerK@EM.AGR.CA
Rudy Esau	Consultant	Research	Rudy.Esau@gov.ab.ca
Ken Lopitinsky	Alta Ag	Extension	kenlopetinsky@gov.ab.ca
Bruce Brolley	Man Ag	Extension	bbrolley@gov.mb.ca
Dr. Dave McAndrew	AAFC	Research	dmcandrew@em.agr.ca
Sabine Banizza	U of S	Research	sabine.banizza@usask.ca
Rick Holm	U of S	Research	holm@sask.usask.ca
Ray McVicar	SAF	Extension	RMcVicar@agr.gov.sk.ca
Penny Pearse	SAF	Extension	PPearse@agr.gov.sk.ca
Lyle Minogue	Sask Pulse Growers	Pulse Grower	lyle.minogue@sk.sympatico.ca
Vince Walker	Sask Pulse Growers	Pulse Grower	vwalker.wsl@sk.sympatico.ca
Garry Meier	Sask Pulse Growers	Pulse Grower	kqbmeier@sk.sympatico.ca
Tom Kieper	Manitoba Pulse Growers	Pulse Grower	kiepert@mb.sympatico.ca
Dallas Watt	Manitoba Pulse Growers	Pulse Grower	dalwatt@mb.sympatico.ca
Richard Aucoin	PMRA	Regulatory/policy	Richard_Aucoin@hc-sc.gc.ca
Rick Istead	Syngenta	Life Sciences Co	rick.istead@syngenta.com
Greg McDonald	Dupont	Life Sciences Co	greg.j.mcdonald@can.dupont.com
Garth Patterson	Sask Pulse Growers	Association	gpatterson@saskpulse.com
Linda MacNair	Manitoba Pulse Growers	Association	mpga@cici.mb.ca
Shea Fang Hung	Alberta Research Ccl	Research	hwang@arc.ab.ca
Veldon Sorensen	Bayer	Life Sciences Co	veldon.sorensen.b@bayer.com
Kent Jennings	BASF	Life Sciences Co	jennink2@basf.com
Byron Irvine	AAFC	Research	Blrvine@em.agr.ca
Mark Goodwin	Pulse Canada	Association	mgoodwin@sharperpencil.ca
Bob Conner	AAFC	Research	conner@em.agr.ca

