

Crop Profile for Lentils

I - Generalities

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Crop –Lentil (Lens culinaris L.)

Regions – Brown and Dark Brown soil zones of Saskatchewan, with small acreage in Alberta and Manitoba

Short history and use

Lentil is used mainly for human consumption as a protein source in a diverse range of products ranging from deserts to soups, stews and vegetarian dishes. The lentil is 25 percent protein—second only to soybeans as a source of usable protein. Lentil is an excellent source of vitamin A and provides fiber, potassium, B vitamins, and iron. Unlike meat, poultry, fish and eggs, this protein source contains no cholesterol and virtually no fat. Lentil, eaten with a grain, such as rice, wheat, or barley, provides all the essential amino acids required by the human body in a balanced diet. (1,2)

Researchers have traced lentil cultivation in the Near East back to 8000-7000 BC. From there the crop spread to South Asia, Northeast Africa, and Eastern Europe, Australia and North America. (2)

India, Canada, Turkey, Australia and Nepal, US, Bangladesh and China are the world's top producers. The top five importers are Turkey, Sri Lanka, Egypt, Algeria Colombia and sometimes Spain. Top exporters include Canada, India, Australia, Turkey, US and China. Importers like Turkey and India are also among the largest exporters. (9)

Saskatchewan growers began commercially producing lentil in 1970. There are three types of lentil: (1) small seeded, (2) medium seeded and (3) large seed size. (1)

II – General commodity information

A – Production

Lentil is best adapted to the Brown and Dark Brown soil zones. Around 95% of the Canadian lentil production is centered in these two soils zones in Saskatchewan, with the other 5% split between similar soil zones in Alberta and Manitoba. (1)

Lentil can also be grown in the Thin Black soil zone in years without excessive moisture. Lentil is not well adapted to saline soils, soils that are slow to warm up in the spring, or to high moisture areas since it will not tolerate waterlogged soil. (2)

Production of lentil in Canada has doubled since 1991, and the area seeded to lentil has increased three-fold in that time (see Table 1)(9)

Table 1. World lentil exports (MT)

Year	1994	1995	1996	1997	1998	1999	2000
Canada	266,895	285,819	288,790	316,479	374,092	417,208	518,910
India	16,633	22,718	23,504	23,504	21,000	85,000	191,134
Australia	422	484	43	0	642	24,994	134,109
Turkey	293,218	140,423	246,142	127,150	154,010	105,223	99,730
USA	80,787	87,575	54,646	52,594	53,234	76,063	80,138
China	74,546	47,931	11,455	17,861	26,310	21,889	17,779
Syria	67,458	28,043	160,665	133,588	55,600	39,550	16,457
Belg/Lux	4,119	7,373	3,227	5,821	4,053	3,515	5,469
France	4,052	3,693	6,538	2,862	1,709	6,693	5,075
Spain	757	1,960	2,211	1,569	2,306	2,221	3,150
Nepal	9,024	2,117	10,936	15,443	30,567	20,000	2,365
Germany	2,693	1,095	1,410	2,188	3,114	3,850	2,321
Argentina	2,993	143	12	5	26	1,751	1,517
Netherlands	1,803	1,215	1,206	578	1,191	1,344	1,478
New Zealand	1,512	2,758	1,649	520	919	969	838
Egypt	112	5,918	57	1,572	428	424	738
UK	995	1,004	1,042	727	573	574	623
Morocco	2,351	100	557	759	759	1,000	548
Singapore	901	421	493	347	176	237	186
Kenya	12,572	3	51	1	253	190	10
Total Top 20	843,843	640,793	814,634	703,568	730,962	812,695	1,082,575
TTL	843,640	645,879	815,424	799,602	785,051	819,951	1,089,070

Source – Pulse Canada data ‘Lentil Production 2003’

B – Quality

The Canadian Grain Commission establishes the official lentil grades in Canada. . Grading factors include seed size and color, damaged seeds, heated seeds, and the amount of foreign material (ergot, sclerotia, stones, etc). See Appendix A for the actual grading criteria.

C- Market Diversity

Canada produces several different types of lentil.

PULSE TYPE	1999	2000	2001	2002	2003 EST	% CHANG
Large Green Lentils	361,900	447,909	232,183	183,976	280,000	52
Small Green Lentils	108,570	173,831	107,597	38,918	99,000	154
Other	253,330	292,512	226,520	130,906	162,000	24

Source – Pulse Canada data ‘Lentil Production 2003’

Large lentils (the predominant type grown in Canada) tends to be marketed whole or split, while small green lentils are marketed as whole seed and red lentils are sold in the split or whole form.

D – Market Status

Lentil acreage and production reached a record high in 2000, with a production of 914,000 tonnes. Lentils were also affected by the recent drought, and production in 2002 is estimated to be only 354,000 tonnes, with exports estimated at 330,000 tonnes. However, increases in red lentil production, new varieties and higher yields in all classes contribute to a bright future for the Canadian lentil industry. In 2001, Canadian lentils accounted for 12.4% of world production, and 47.6% of world exports. (9)

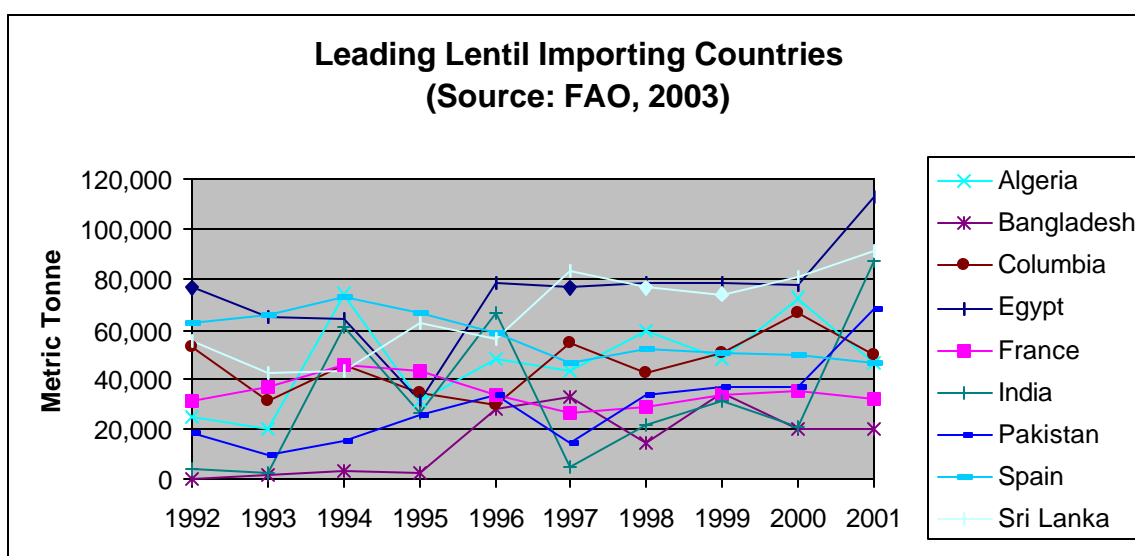


Figure 2. Leading lentil importers – Source FAO website

III – Non-Pest Oriented Cultural Practices

A – Crop Rotation Practices

Disease pressure limits the crop rotation for lentil to once every three years increasing to once every four years where anthracnose is a problem. Planting lentil adjacent to a previous year lentil crop should also be avoided. When lentil is planted next to lentil stubble, the use of a non-host barrier crop such as a cereal planted as a border strip adjacent to the lentil stubble will help avoid crop loss by limiting the spread of disease. The majority of producers will follow a rotation that has lentil follow a cereal. Since lentil is a shallow rooted crop that does not deplete sub-soil moisture levels wheat crops following lentil will have higher yields and with higher protein content. (1,2)

Lentil production is often successful in rotation with cereal grains such as durum wheat. Lentil and durum are suited to the same climatic zones. Lentil does not leave a lot of crop residue and a cereal crop with tall stubble grown before and after lentil provides crop residue or ‘trash cover’ to protect the soil from erosion. However, since the seeds of volunteer crops such as durum or barley are difficult to clean out of lentils care must be taken to control in-crop volunteer cereals. . (1,2)

Highly fertile soils, such as fallow fields with high levels of available nitrogen, may cause excess vegetative growth at the expense of seed production. Tall stubble protects lentil seedlings from damage caused by wind, blowing soil or heat. However, lentil seedlings emerging through poorly spread crop residue can be injured more by late spring frost than lentil grown under conventional tillage systems. (1,2)

Lentil is susceptible to the soil residue from various herbicides used in previous years. Growers must keep accurate records to take this into account when choosing their rotation. For more information about herbicide residue issues, see section D – 1 Summary.

B – Varieties, Cultivars and Rootstocks

Lentil plants are short compared to cereal crops, with vines lying close to the ground. The first two nodes on the stem develop below or at the soil surface and are known as scale nodes. Injury to young lentil seedlings by late spring frost, heat canker or wind damage may cause the plant to initiate re-growth from a scale node below the soil surface. The third node on the stem is the usual site of the first leaf development. Leaves are about five cm long with nine to 15 leaflets. Flowers are self-pollinated. Flower stalks produce one to three flowers that develop pods less than 2.5 cm in length. Pods contain one or two seeds. . (1,2)

Lentil has an indeterminate growth habit. Flowering and pod filling will continue simultaneously or alternately as long as temperature and moisture permit growth to occur. A moisture or nitrogen stress is required to encourage seed set and maturity. . (1,2)

Most lentil varieties grown in Canada have green seed coats and yellow cotyledons (seed leaves). Green lentil is divided into three market types in Canada: large green, medium green and small green. Canada has recently become an important producer and exporter of red lentil. Red lentil varieties typically have brown to pale green seed coats with red cotyledons. When selecting a variety, producers will consider disease resistance (ascochyta blight), days to maturity, lodging resistance, market demand for seed size/color, as well as yield. Producers tend to buy certified seed approximately once every few years. Use of pedigreed seed is higher when new varieties are introduced that have strong market demand. . (1,2)

The variety Laird has been the most common large-green lentil variety grown in Canada with Eston being the most common small-green lentil variety. New varieties from the Crop Development Center (CDC) in Saskatoon are now overtaking these traditional varieties due to increased yield potential, disease resistance and earlier maturity. . (1,2)

C – Crop Establishment

Seed quality is a very important factor in successful lentil production. Seed should be tested for germination, disease levels (ascochyta blight and botrytis grey mould) and purity. If tests indicate an infection level of ascochyta blight, a fungicide seed treatment such as Crown (carbathiin, thiabendazole) should be used. . (1,2)

Lentil must be handled carefully to avoid damage to the seed coat. Dry seed (less than 14% moisture) is brittle and can easily crack or split, leading to reduced germination and increased risk of disease. Tempering the seed with water before planting can help decrease the risk of damage. If the field has a past history of soil borne diseases, the use of a fungicide seed treatment such as Apron FL ® (metalaxyl) is recommended. . (1,2)

Lentil is a member of the legume family. Under ideal conditions with a nitrogen-fixing inoculant (rhizobium) developed specifically for lentil, plants have the ability to fix 60-80 per cent of their nitrogen requirement from the atmosphere. The Rhizobium may die if exposed to stresses such as high temperature, drying winds, or direct sunlight. Peat based inoculants are applied directly to the seed with the use of a ‘sticker’ while granular inoculants are applied adjacent to the seed in the seedbed. When using peat based inoculants producers are advised to plant the inoculated seed into moist soil as soon as possible after inoculation. Care should also be taken when using peat based inoculants and treating the lentil seed. The fungicide seed treatment should be allowed to dry before inoculant is applied. . (1,2)

Lentil should be seeded at 3 to 8 cm deep, preferably into a firm, moist, weed-free seedbed to provide proper germination and assure inoculant survival. Seeding rates will vary based on seed size and percent germination, but typically range from 120 lbs/ha for small seeded varieties, up to 200 lbs/ha for large seeded varieties. Lentil should be seeded as early as possible when the minimum average soil temperature reaches 5°C. Newly emerged seedlings are relatively frost tolerant and spring frost is not an issue. Lentil should not be seeded into excessively wet soils.

Lentil fields should be rolled after seeding. A smooth, uniform soil surface will facilitate easier harvest in the fall, as the lentil plant must be cut very close to the soil surface. Land rolling can be done before or after crop emergence, but before the plants reach the 5-7 node stage. (2)

D – Specialized Production Systems

Lentil seedpods will be located close to the soil surface. Specialized harvest equipment that can gently lift the crop and cut low to the ground is needed for lentil harvest. (2)

E – Crop Cycle / Growth Stages

Lentil has a relatively shallow root system (0.6 m). Lentil is a poor competitor with weeds and will occasionally require an in-crop chemical herbicide application. Foliar diseases can also be an issue in lentil production and one or more in-crop fungicide applications may also be made. (On years with a severe grasshopper or cutworm infestation, an insecticide application may also be needed.)(2)

F – Utilization of Plant Growth Regulators

There are no plant growth regulators used in lentil production.

G – Harvest Practices

Because of the crops indeterminate growth habit, a moisture or nitrogen stress is required to encourage seed set and maturity. Reglone® (diquat) desiccant as well as pre-harvest glyphosate weed control treatments are registered for use on lentil in Canada. Reglone® does not speed maturity of the crop, but rather reduces the time from maturity to harvest. A treatment is made at the same time that swathing would occur.

Swathing should occur when about 30 per cent of the lowermost pods turn tan and their seeds rattle. Swathing under conditions of higher humidity may reduce shattering. Lentil swaths are prone to wind damage. Lentil can also be straight-cut (meaning one-pass with the same implement will cut and harvest the seed from the pods). Swathers or straight-cut combines should be equipped with a flex header, or with a pick-up reel and vine lifters since lentil plants tend to lay quite flat on the ground at harvest. (1)

Excessively dry seed will chip and peel during threshing, so it is best if producers thresh at about 18% moisture and use aeration to dry the sample to 14% for safe storage. (1,2)

H – Post-harvest Practices

A significant amount of the crop is stored on farm for at least a short while before it is delivered to a processor. It is most common for a lentil crop to be stored in a hopper bottom bin with aeration (fan system to circulate air throughout the bin). Lentil can be safely stored at 14% moisture, although a sample with high amounts of green weed seeds should be cleaned or be aerated as soon as possible after harvest to prevent heating. (2)

Lentil varieties with green seed coats will discolor with age, decreasing the grade and price received for the crop. They should be stored in a dry, dark place, and sold before storing through a second summer season to limit losses. (2)

I – Workers Activities and Availability During the Season

Lentil does not require additional workers during the season.

J – Pruning and Nutrient Management

A well-inoculated crop in good growing conditions should not require nitrogen (N). Since it can take up to 3-4 weeks after planting before the lentil plant starts producing its own N, seedlings in soils with poor N reserves may appear yellow and have poor early plant growth. This deficiency can be corrected by adding low levels of starter N at seeding.

Lentil has a relatively high requirement for phosphorous (P). P is needed to promote the development of an extensive root systems and vigorous seedlings. As well as contributing to proper N fixation P increases a crop's frost, disease and drought tolerance. Sulphur (S) is also an important nutrient in lentil production, with most crops requiring 9-11 kg/ha. To date no micronutrient deficiencies have been identified in Canadian lentil production.

Lentil seed is very sensitive to seed-placed fertilizer. Some phosphorous (maximum 22 kg/ha of P₂O₅) can be placed with the seed, with any additional product side-banded away from the seed. Sulphur should be banded or broadcast.

IV – Production Problems

A – Introduction

A lentil crop is disease prone and susceptible to severe injury from disease when soils are wet and humidity is high. The indeterminate growth habit dictates the need for careful harvest management. Few tools are available to assist with the control of key pests such as broadleaf weeds.

B – Non-pest Problems

i) Summary

A complete list of priority needs is listed in *V.Critical Needs*.

The main non-pest problem for lentil production in Saskatchewan is the relative difficulty in harvesting the crop. The crop is short and tends to lodge and therefore must be cut near the soil surface. Rolling the land at seeding to level ridges and bury hazards such as small rock, along with the use of mechanical tools to lift the crop in front of the cutter bar can help ease this problem. Other, non-pest production problems are the need for heat or moisture stress to initiate seed set, safe handling and storage of the crop, days to maturity leading to fall frost damage and heat canker at the seedling stage. (1,2)

ii) Key Factors

- Harvest –Lentil plants are short or prone to lodging and at harvest seed pods are located close the soil surface. The swather or cutter bar on the combine must be operated very close to the ground, increasing the risk of picking up stones, dirt or debris from the field. Stones may cause mechanical damage to harvest equipment and excessive soil pick-up during harvest can lead to staining of seeds or particles of soil adhering to the seed coat that results in a lower grade. Fields that were rolled at seeding are easier to harvest, although ground speed may need to be reduced. There are many reasonably priced specialized products available that can be added to a producers existing harvesting equipment (ie. litter guards, lifters) that can ease harvest of the crop. Producers can also utilize air reels or specialized floating or flexible headers for their combines to ease harvest of the crop. (1)
- Lodging – Tall lentil varieties will lodge when there is heavy vegetative growth, heavy seed set, or when there is increased disease pressure. Lodging, combined with the short stature of the mature lentil plant, can increase problems with harvesting the crop. (1)
- Maturity – Lentil has an indeterminate growth habit. Flowering and pod filling will continue simultaneously or alternately as long as temperature and moisture permits growth to occur. A moisture or nitrogen stress is required to encourage seed set and maturity. A chemical desiccant like Reglone (diquat) is registered for use on lentil. If the lentil plants are immature when the first hard, killing frosts come in the fall, it can increase the amount of green, immature seeds in the sample which will decrease the quality and price of the crop. (2)
- Fall Frost – A killing frost in the fall on an immature lentil crop will result in wrinkled seed coats and immature seeds in the harvested sample which lower the quality and price of the crop. (2)
- Storage – Lentil varieties with green seed coats will discolor with age as tannins within the seed coat oxidize. Other factors such as high humidity and high temperatures can also cause rapid color change. Off-colours decrease the grade and price received for the crop. That can cause color change in lentil. Lentils kept in cold, dark conditions at moisture content at or below 14% have little to no color change. While market demand and price is key in making marketing decisions, lentils sold as soon as possible after harvest (especially

green lentils prone to browning), and preferably before a second summer season will limit color change losses. (1,2)

- Handling – Care needs to be taken when handling lentil seed in order not to crack the seed coat. Handling should be minimized and the use of conveyors will result in less damage than augers. Extremely dry seed can be tempered in the spring before seeding to decrease the risk of mechanical damage. Harvest equipment should be adjusted to minimize damage with augers run at full capacity under lower speeds. The lentil seed coat will become quite fragile under extreme cold and crack easily when handled. (1,2)
- Heat Canker – Heat canker can occur in lentil when the soil surface gets so hot that it will sear the plant stem reducing seedling vigor and under extreme conditions kill the lentil plant. This problem is more predominant in years of extremely low moisture. Standing stubble from the previous crop can partially protect the lentil seeds from the hot sun. (1)

C – Plant Pathogens/Diseases

i. Summary

Disease pressure is one of the biggest production problems faced by Canadian lentil growers. Some diseases are seed-borne (ascochyta blight, botrytis grey mould, and sclerotinia stem rot) and can be minimized by the use of disease-free seed or a proper seed treatment. Other problems are common soil-borne diseases (root rot) with multiple host crops. This disease can be minimized by the proper use of a seed treatment. Once a lentil crop has a disease there is no fungicide treatment that can limit the damage of that disease (although some diseases can be prevented by at least one, if not multiple, in-crop fungicide treatments). (1)

Stemphyllium is a disease that has not yet been seen in western Canada, but is common to other lentil growing areas, especially areas that have been producing lentils for a long time. It is a disease that is similar to anthracnose (seed, soil and residue borne fungus), and producers need to keep an eye out for it in the future. (1)

ii. Key Factors by Pathogen (1)

- Anthracnose (*Colletotrichum truncatum*)
 - Host Crops – Lentil, fababeans, wild vetch
 - Biology – Anthracnose is a devastating seed, soil and residue-borne fungus. The fungus survives as small, pinhead-sized structures (microsclerotia), which can survive in the soil for sometime. Spores are dispersed from plant debris near the soil surface to the newly planted lentil crop by splashing rain droplets. The number of rain events is more important for the spread of anthracnose than the amount of rainfall. High humidity favors infection as infection require 18-24 hours of leaf wetness. There are two races of anthracnose present in western Canada.
 - Percent Hectares Affected – 40% (severity determined by weather conditions)

- o Percent Hectares Treated – 10-20% of seed is treated with a fungicide like Crown (carbathiin and thiabendazole); 50% of the lentil crops are sprayed with an in-crop fungicide like Bravo 500 (chlorothalonil) (around 20% of those fields are sprayed twice)
- o Potential Crop Damage – Can lose up to 70% of your yield if not treated.
- o
- Ascochyta Blight (*Ascochyta lentils*)
 - o Host Crops – Lentil
 - o Biology – Ascochyta blight is a devastating seed and residue-borne fungus. Lesions develop on the stem, leaves and pods. Pycnidia formed within the lesion, produce the spores.. Under moist conditions, the spores will ooze out of the pycnidia and are spread by rain-splash to surrounding plants. It takes at least 24 hours and rainfall or humid conditions for the spores to germinate and penetrate the plant. Optimum temperatures for infections are between 20-25° C. New lesions begin as tiny spots that will continue to expand under moist conditions. Under ideal conditions the disease can have multiple infection cycles within one season. The pathogen can survive for several years on exposed crop residue.
 - o Percent Hectares Affected – 60-70% (severity depends on weather conditions)
 - o Percent Hectares Treated – 10-20% of seed is treated with a fungicide like Crown (carbathiin and thiabendazole); 50% of the lentil crops are sprayed with an in-crop fungicide like Bravo 500 (chlorothalonil) (around 20% of those fields are sprayed twice)
 - o Potential Crop Damage – Can lose up to 25% of your yield if not treated, also a quality issue than yield. Not as aggressive as anthracnose.
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- Botrytis Grey Mould (*Botrytis cinerea*)
 - o Host Crops – Lentil, chickpea, pea, bean
 - o Biology – Grey mould survives in the seed, on crop residues and in the soil. Lentil plants may be infected at any stage of growth. Infected seed is often the primary cause of infection. Infected plants produce masses of spores that may become air-borne and rapidly spread the disease. Once the disease is established conditions under the crop canopy are ideal for infection and spread of the disease. Botrytis grey mould is a very opportunistic disease and poor weather conditions at flowering/podding/harvest, any physical injury to the crop (herbicide damage, wind damage, hail), or a significant amount of pod abortion (increasing the amount of crop residue on the ground) will all increase the disease pressure in a field.
 - o Percent Hectares Affected – 10-15% (worse in some years)
 - o Percent Hectares Treated – 10-20% of seed is treated with a fungicide like Crown (carbathiin and thiabendazole)
 - o Potential Crop Damage – Can lose up to 70% of your yield, as well as decreased quality due to seed discoloration.
- Root Rot (*Fusarium solani*, *Rhizoctonia solani*, and *Pythium sp.*)
 - o Host Crops – Chickpea, dry bean, sunflower, soybean, lentil, pea, canola, clover, flax
 - o Biology – The fungi causing root rot are soil borne. Root rotting fungi can attack any part of the root system and even the lower portion of the stem at the soil line. When young seedlings are infected with root rot, they usually die. Infected plants may appear yellowed and stunted.

- o Percent of Hectares Affected – 10-20%
- o Percent Hectares Treated – 5-10% of lentil seed is treated with a fungicide like Vitaflo 280® (carbathiin and thiram)
- o Potential Crop Damage – Can lose up to 1-2% of your seedlings to Pythium if not treated.
- o
- Sclerotinia Stem Rot (*Sclerotinia sclerotiorum*)
 - o Host Crops - Dry bean, field pea, canola, sunflower, chickpea, lentil, mustard, and potato
 - o Biology - The fungus overwinters as hard black bodies known as sclerotia in crop debris and in the soil. The disease cycle begins with the germination of the sclerotia to produce small, mushroom-like structures called apothecia. Warm (15-25° C), wet weather 1-2 weeks before flowering, coupled with a thick lentil canopy, favour development of the disease. The mature apothecia can release up to 2 million spores over a 5-10 day period. Aided by a dead food source (usually the blossoms or pedals), the spores germinate and infect lentil plants. The disease develops most rapidly at temperatures of 20-25° C. The fungus can spread from the dead blossoms to adjacent flowers, stems, leaves, and pods within 2-3 days. The sclerotia formed may persist in the harvested pods and seed, fall to the soil, or remain in the crop residue.
 - o Percent of Hectares Affected – 5-10% (higher in some years)
 - o Percent of Hectares Treated – No treatment currently available.
 - o Potential Crop Damage – Can lose up to 30-40% of your yield, as well as decreased quality due to seed discoloration.

iii. Pest Assessment(1,2)

- Monitoring
 - o Monitoring should begin early in the season well before flowering. Monitoring for any disease should first be done in fields at high risk. High risk factors are fields that had seed-borne disease present at planting (even if a seed treatment was used), fields that had lentil in the rotation the last two years, or fields located next to infected lentil stubble.
 - o Anthracnose usually first appears when plants have 8-12 nodes on the main stem. Tan coloured lesions develop on lower leaflets. It is difficult to distinguish these lesions from ascochyta blight pycnidia, but the best way is to look for small black hairs (setae). The most severely affected leaflets die and drop to the ground. Anthracnose spores are spread by rainfall, require 18-24 hours of leaf wetness to infect the plant, and take 7-8 days for symptoms to occur. Monitoring should be done approximately one week after a rainfall.
 - o Ascochyta blight symptoms include brown lesions on the stems, leaves and pods. The lesions are light or dark brown in the center, and are surrounded by a darker brown border. Within the lesion, small brown or black round structures known as pycnidia form. Even lentil varieties with resistance to ascochyta blight, will see resistance decrease as the plant matures. Ascochyta blight relies on rain to spread spores. Fields should be monitored for new disease 7-9 days after rainfall.

- o Botrytis gray mould may spread down a seed row resulting in a series of yellow or dead seedlings. It is favored late in the season and is common on pods resulting in shrunken, discolored seeds. Leaves wilt and drop off, pods fail to fill, and infected areas turn grey to brown. Botrytis grey mould lesions may look similar to sclerotinia but will not be soft or easily shredded. The lesions will also be covered by a dark grey, fuzzy fungal growth.
 - o Root rot is most severe when soils are cool and saturated and seedling emergence is delayed. Infected seedlings may first appear healthy, but then will become yellow, wilt and may die. Stems may be girdled and discolored at or just below the soil surface. Roots may have rotted and plants are pulled easily from the ground.
 - o Sclerotinia stem rot will usually occur in patches typically in areas of heavier crop growth. Early signs of sclerotinia stem rot are a light green or yellow discoloration of the plant accompanied by a lesion and rotting along the stem. Initially, sclerotinia infections are soft and wet to touch and may be covered by a white mould. The plant later becomes bleached in colour, and the infected area will easily shred apart. In some cases the fungal bodies called sclerotia will form on or in the infected area.
- Forecasting
 - o Anthracnose is becoming more common in lentil producing areas and is very easily spread from field to field through dust particles. There are two races of anthracnose in western Canada and while a variety may be resistant to one race, it could be susceptible to the other. If there has been any anthracnose in a production area producers should monitor crops closely during the growing season.
 - o Ascochyta blight is commonly found in lentil producing areas and is most common in high moisture years.
 - o Botrytis grey mould will be most severe in a season with high moisture conditions late in the season. A dense canopy reducing airflow and keeping the plant tissue moist will give optimum development conditions for the disease (). All lentil varieties are susceptible to botrytis grey mould.
 - o Root rot will be worst in years with cooler conditions or if there is excessive moisture at seeding, , Root rot rarely causes economic losses as usually only scattered plants are affected.
 - o Sclerotinia stem rot infection rates will be limited under hot and dry conditions. Higher moisture conditions with a thicker crop canopy are ideal for disease growth. All lentil varieties are susceptible to sclerotinia stem rot
- Use of Thresholds
 - o Crown® (carbathiin and thiabendazole) seed treatment is registered for the control of seed-borne ascochyta blight in lentil and should be considered if test results indicate an infection level above 5% in the Brown and Dark Brown soil zones. If production is in the Black soil zone, seed with 0% ascochyta infection should be used. If test results indicate an ascochyta infection level above 10%, new seed should be obtained. The recommendation for the amount of seed-borne botrytis grey mould and sclerotinia stem rot combined on an untreated seed sample is that they should not exceed 10%.
 - o Agriculture & Agri-Food Canada along with Agri-Food Innovation Fund have put together a fungicide decision support system for lentils, which is available at

http://paridss.usask.ca/specialcrop/pulse_diseases/fungicide/step1lentil.html. Producers can calculate each field's risk factors based on plant stand, number of days with rain in the past 2 weeks, 5 day weather forecast, and the symptoms of anthracnose/ascochyta blight present. This system will then give them an estimated risk value number, with a threshold of 50 or higher indicating the need for a fungicide application.

- o Anthracnose – Crops with anthracnose that experience premature leaf drop warrant an application of an in-crop fungicide.
- o Ascochyta blight – Low levels of infection on the bottom leaves is acceptable. There is a risk of yield loss if symptoms occur on the upper half of the canopy or if there is significant moisture during the vegetative, flowering and podding season. When spread of the disease is observed from the lower to upper levels of the plant, fungicide application is warranted.
- o Botrytis grey mould, root rot and sclerotinia stem rot – There are no in-crop treatments.
- Availability of Information/Advisory Sources
 - o Saskatchewan Agriculture & Food and the Saskatchewan Pulse Growers organization have a wealth of disease assessment and production information available to producers for purchase, online or from their local agriculture office.

iv. Pest Management

Preventive Measures

- Cultural practices
 - o Adhering to proper rotations is one of the best preventative measures for all diseases.
 - o Anthracnose – Using disease free seed, adhering to proper rotations, and not planting the crop beside a field infected in the previous year can minimize damage. Infected lentil straw should be left on the surface to hasten breakdown of the anthracnose inoculum.
 - o Ascochyta blight – Damage can be minimized by using disease free seed, resistant varieties, treating seed, adhering to proper rotations, and not planting the new crop beside a field infected in the previous year (minimizing infection by air-borne ascospores). Infected lentil straw should be baled and removed from the field, or deep ploughed to hasten decomposition. Deep ploughing will, however, increase the risk of soil erosion.(1,5)
 - o Botrytis gray mould – Producers can minimize damage by adhering to proper rotations, using disease free seed, treating seed, and taking steps to minimize damage caused by long periods of high humidity in the crop such as choosing varieties with a less lush growth habit, moderating seeding rate, etc.. Rotations that include cereals can also help reduce the build up of these soil borne pathogens.
 - o Root rot – To ensure quick seedling emergence producers should seed at proper depths into a warm, slightly moist, well-drained seed bed. Rotations that include cereals can also help reduce the build up of these soil-borne pathogens.
 - o Sclerotinia stem rot is a common disease with other host crops. Rotations that include non-host crops are the best preventative measure.
- Quarantine measures
 - o None applicable.

Reactive Measures

- Chemical control
 - Anthracnose – There is no benefit from treating seed with a fungicide to control anthracnose. An application of an in-crop fungicide such as Bravo 500® (chlorothalonil) at early flower with a second application at podding when required can help decrease damage. Bravo 500® is a preventative fungicide, and will not stop infections once they have started. It is effective for 10-14 days. Headline has also been recently registered for use on lentils for control of this disease.
 - Ascochyta blight - A seed treatment such as Crown® (carbathiin and thiabendazole) will help control minor levels of seed-borne ascochyta blight. An application of an in-crop fungicide such as Bravo 500® (chlorothalonil) at early flower with a second application at podding when required can help decrease damage. Bravo 500® is a preventative fungicide, and will not stop infections once they have started. It is effective for 10-14 days Headline® has also been recently registered for use on lentils for control of this disease.
 -
 - Botrytis grey mould - A seed treatment such as Crown® (carbathiin and thiabendazole) will help control seed-borne botrytis grey mould.
 - Root rot - A combined seed treatment such as Crown® (carbathiin and thiabendazole) and Apron FL ® (metalaxyl) will provide protection against most root rots.
 - Sclerotinia stem rot - There is no seed treatment or in-crop chemical fungicide currently available for sclerotinia stem rot in lentil.
- Biological control and biopesticides
 - None currently available.
- Other control measures
 - None currently available.
- Availability of IPM and/or ICM programs
 - Anthracnose is an aggressive disease and IPM practices that include non-chemical, cultural practices as listed above must be combined with chemical treatments to save the crop.
 - Ascochyta blight requires both IPM practices combined with chemical treatments to limit losses.
 - Botrytis grey mould – The seed treatment that controls botrytis grey mould is the same seed treatment that controls ascochyta blight. Because seed is commonly treated for ascochyta blight, it will also be protected against botrytis grey mould. The other IPM measures (see cultural practices above) will also help limit the severity of the disease.
 - Root rot – If root rot hasn't been present in other host crops, the use of IPM measures as listed in the cultural practices above should be sufficient to limit losses to root rot.
 - Sclerotinia stem rot – There are no chemical treatment options for sclerotinia stem rot in lentil.

Table 3 - Summary Information on Lentil Diseases

Disease	% ha Infected	% ha Treated	Average Yield Losses		Average % Efficacy of Control Methods*	Problem Priority Level
			Tonnes	CDN \$		
Anthraxnose	40%	seed-treatment 15% in-crop 50%	69,300	\$23,562,000	in-crop (C) chlorothalonil - 70%	1 (yield, quality)
Ascochyta Blight	60%	seed-treatment 15% in-crop 50%	44,550	\$15,147,000	seed-treatment (C) carbathiin and thiabendazole - 90%; in-crop (C) chlorothalonil - 70%	1 (yield, quality)
Botrytis Grey Mould	10%	seed-treatment 15%	17,325	\$5,890,500	seed-treatment (C) carbathiin and thiabendazole - 90%	2 (yield, quality)
Root Rot	10%	seed-treatment 5%	495	\$168,300	seed-treatment (C) carbathiin and thiram - 85%	3 (yield)
Sclerotinia Stem Rot	5%	-	6,188	\$2,103,750	cultural practices - 70%	4 (yield, quality)

* C - conventional; R - reduced-risk, EPA listing; Cu - cultural practices; B - biological, EPA listing

** Rated from 1 (highest priority) to 4 (lowest priority)

Source – Saskatchewan Agriculture and Food Pulse specialist

D – Weeds

i. Summary

Lentil is a poor competitor to weeds. Broadleaf weeds, volunteer broadleaf crops, and perennial weeds are a major issue Weed control options are limited. Broadleaf weeds can easily cause 50 percent yield loss (1)

Lentil is very sensitive to residual from several commonly used herbicides and should not be seeded into a field that has had herbicides that are known to cause lentil damage applied for the last 1-2 years.(3) Examples of these herbicides and their cropping are:

- 2,4-D (2,4-D; do not use in the spring)
- Accord® (quinclorac; 24 months)
- Ally® (metsulfuron methyl; 48 months)
- Amber ® (triasulfuron; 48 months)
- Assert® (imazamethabenz; 24-36 months)
- Attain/Trophy® (fluroxypyr; 22 months)
- Banvel II ® – high rate (dicamba; 12 months)
- Curtail M® /Eclipse® /Prevail® /FlaxMax® /Lontrel® /Prestige® (cloprialid; 22 months)
- Everest ® (flucarbazone-sodium; 24 months)
- Muster ® (ethametsulfuron-methyl; 22 months)
- Prepass® (florasulam; 12 months)
- Pursuit/Odyssey ® (imazethapyr; 12 months)
- Reflex® (fomesafen; 12 months)
- Tordon® (picloram acid; 60 months)
- Unity ® (bromoxynil and triasulfuron; 12 months)

ii. Key Factors by Weed or Group of Weeds (1)

- Broadleaf Weeds
 - Commonly Found Weed Species in Lentil Producing Areas – Wild buckwheat (*Polygonum convolvulus*), kochia (*Kochia scoparia*) and Russian thistle (*Salsola iberica*)
 - Biology – These broadleaf weeds are annual weeds, which can cause yield losses if not controlled early.
 - Percent of Hectares Affected – 100%
 - Percent of Hectares Treated – 100%
 - Potential Crop Damage – Up to 50% yield loss if high weed pressure.

 - Percent of Hectares Affected – 100%
 - Percent of Hectares Treated – 100%
 - Potential Crop Damage – Up to 50% yield loss if high weed pressure.
- Perennials
 - Commonly Found Weed Species in Lentil Producing Areas – Canada thistle (*Cirsium arvense*), sow thistle (*Sonchus arvensis*), quack grass (*Elytrigia repens*)
 - Biology – Perennial weeds tend to have extensive creeping rootstock, which frequently produces shoots that will then produce a new plant. They also tend to readily regenerate through either seed germination, or root fragments (normally they can regenerate from as little as an inch of root fragment). Most of the perennial weed seeds will germinate within a year, but some may remain viable in the soil for up to twenty years or more. Due to their perennial nature, they are hard to control since the entire plant including rootstock must be killed in order to prevent re-growth. Control of these perennial weeds should be done in the year previous to lentil production.
 - Percent of Hectares Affected – 50% (fields)
 - Percent of Hectares Treated – 100% (suppression only)
 - Potential Crop Damage – Up to 30-40% yield loss if high weed pressure.
- Volunteer Crops
 - Problem Volunteer Crops in Lentils – Canola, mustard, flax and cereals
 - Biology – Volunteer crops are annual weeds, which can cause yield losses if not controlled early.
 - Percent of Hectares Affected – 80%
 - Percent of Hectares Treated – 100%
 - Potential Crop Damage – Up to 40% yield loss if high weed pressure, quality also a big issue since cereal seeds are very difficult to clean out of a sample.

iii. Pest Assessment (2,3)

- Monitoring
 - Monitoring for weeds should begin immediately after seeding so required herbicides that can be applied at the proper weed and crop growth stage (maximum crop tolerance at the 1 to 4 above ground node stage).
- Forecasting
 - Based on past crop history.
- Use of Thresholds
 - None available.
- Availability of IPM and/or ICM Programs

- o Best control measures are keeping fields clean in years outside of lentil production.

iv. Pest Management

Preventive Measures

- Cultural practices
 - o Seed into fields with low weed pressure as limited chemical control measures are available. Post-emergent harrowing with tine harrows is an option to control weed seedlings before the crop reaches 10 cm provided that the foliage is dry and it is done on a warm sunny day. Seeding rate should be increased to offset slight plant losses where post-emergent harrowing will be used.
 - o Volunteers – The best practice is to have a cereal between a canola/mustard/flax crop and a lentil crop and control all volunteer weeds in the cereal crop. Cereal volunteers in lentil are easier to control with an in-crop grassy weed herbicide application.
- Quarantine measures
 - o None applicable.

Reactive Measures

- Chemical control
 - o Before seeding – A late-fall application of a phenoxy herbicide such as 2,4-D or MCPA can be used to control winter annual broadleaf weeds in fields planned for lentil production. Spring applications of a phenoxy herbicide or applications that include dicamba should be avoided to prevent possible crop injury. A pre-emergence burn-off treatment of glyphosate can be used in lentil to control weeds before the crop emerges.
 - o Broadleaf weeds – A broadleaf product such as Sencor® (metribuzin) can be used to suppress some broadleaf weeds in-crop, but the weed species suppressed are limited. Note that susceptible weeds are suppressed, not killed.
 - o Grassy weeds – A grassy weed control product such as Poast Ultra® (sethoxydim) can be used to control most in-crop grassy weeds and volunteer cereals.
 - o Perennial – There are no control measures available for perennial weeds.
- Biological control and biopesticides
 - o None currently available.
- Other control measures
 - o None currently available.
- Availability of IPM and/or ICM programs
 - o Not available.

Table 4 - Summary Information on Lentil Weeds

Weeds	% ha Infected	% ha Treated	Average Yield Losses		Average % Efficacy of Control Methods*	Problem Priority Level
			Tonnes	CDN \$		
Broadleaf	100%	100%	50 (300,000)	\$102,000,000	metribuzin (C) - 50%	1 (yield)
Grassy	100%	100%	6 (36,000)	\$12,240,000	sethoxydim (C) - 90%	2 (yield)
Perennial	65%	-	6 (36,000)	\$12,240,000	-	4 (yield)
Volunteers	10%	100%	2 (12,000)	\$4,080,000	metribuzin (C) - 50%	3 (yield)

* C - conventional; R - reduced-risk, EPA listing; Cu - cultural practices; B - biological, EPA listing

** Rated from 1 (highest priority) to 4 (lowest priority)

Source Saskatchewan Agriculture and Food pulse specialist

Table 4A Lentil herbicide use 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	294	158		2	153	3	11	72	75
Seeded Acres ¹	1,809	1,490	-17.6%	15	1,470	5	51	722	717
Use Intensity (%)	96.0%	92.4%	-3.5	100.0%	92.3%	95.2%	99.5%	95.9%	88.4%
Base Acres Treated	1,736	1,377	-20.7%	15	1,357	5	51	693	634
Application Intensity (%)	199.6%	200.8%	1.2	200.0%	200.7%	238.1%	249.2%	206.5%	191.7%
Fall Market	59.0%	11.0%	-48.0		11.0%	47.6%	32.2%	10.8%	9.8%
Spring - Preseed Market	34.3%	54.7%	20.4	117.2%	54.1%	47.6%	32.9%	44.4%	66.6%
Spring - Post Market	106.3%	135.1%	28.8	82.8%	135.6%	142.8%	184.2%	151.3%	115.3%
Application Acres	3,611	2,993	-17.1%	30	2,950	13	127	1,491	1,375
Fall Market	1,068	164	-84.6%		162	3	16	78	70
Spring - Preseed Market	620	815	31.5%	18	795	3	17	321	478
Spring - Post Market	1,922	2,013	4.7%	12	1,993	8	94	1,092	827
Product Application Acres ²									
Dinitroanilines	524	334	-36.2%	3	331			116	218
Glyphosate	1,103	603	-45.4%	15	585	3	31	263	309
Post-emergent Grass	1,196	1,227	2.6%	12	1,210	5	53	635	539
Post-emergent Broadleaf	1,028	964	-6.1%		962	3	37	556	372
Total Market Value (\$000's)		\$27,051		\$221	\$26,701	\$129	\$1,258	\$13,446	\$12,347
Fall Market		\$1,845			\$1,824	\$21	\$116	\$1,043	\$685
Spring - Preseed Market		\$6,340		\$97	\$6,222	\$21	\$89	\$2,226	\$4,025
Spring - Post Market		\$18,866		\$124	\$18,655	\$87	\$1,052	\$10,177	\$7,637

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

Table 4B. Weed species survey of top 10 weed problems in lentils in Saskatchewan. (Data not available in Manitoba and Alberta)

Species	Frequency (% of fields)	Density in occurrence fields (#/m ²)
Green foxtail	44	13.7
Wild buckwheat	65	4.4
Wild oats	65	4.2
Russian thistle	44	6.5
Wild mustard	32	3.5
Thyme leafed spurge	24	6.4
Stinkweed	35	2.5
Canada thistle	32	2.7
Volunteer wheat	41	1.2
Redroot pigweed	29	1.6

Source – Saskatchewan Weed Survey 1997. Published by Agriculture and Agrifood Canada, Thomas, A.G.

E – Insects and Mites

i. Summary

Insects are not normally a major problem in lentil. While there have been some insects reported to be pests in lentil, the damage is often limited. Grasshoppers can be of concern in years of high grasshopper populations. The Lygus Bug is a pest of lentil production in the US, but has not been observed in Saskatchewan.

ii. Key Factors by Pest

- Cutworm
 - Host Crops - The red-backed cutworm feeds on practically all field crops, vegetables, and home garden plants. It is best known for its' feeding on cereals, flax, sugar beets, canola, and mustard. The army cutworm feeds on the foliage of wheat, oats, barley, mustard, flax, alfalfa, sweet clover, field peas, cabbage, sugar beets, corn, oats, potatoes, various weeds (notably stinkweed) and grasses. Almost any crop, present during the early spring, could be a potential host.
 - Biology – There are many different species of cutworms, but the most common ones are the red-backed cutworm (*Euxoa ochrogaster* (guenee)) and the army cutworm (*Euxoa auxiliaris* (Grote)). 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 the Prairies but rather reinvade annually from the USA, aided by southerly winds. Most of our pest species have only 1 or 2 generations per year.

- o Percent Hectares Affected – Sporadic, around 3-5% acres affected, usually in patches in the field
- o Percent of Hectares Treated – 2-3%
- o Potential Crop Damage – Patch areas could be wiped out (may cause around 3% overall yield loss)
- Grasshopper
 - o Host Crops – Grain and forage crops
 - o Biology – There are several species of grasshoppers that are serious pests of grain and forage crops in Western Canada. Eggs are laid in packet-like bunches ½-2 inches below the surface of the soil. They are mainly deposited in uncultivated ground such as field margins, pasture land and roadsides. They may also be laid in considerable numbers in clover, alfalfa, and stubble fields. There are usually five or six nymphal instars that require about 1-2 months to reach the adult stage. Growth is usually completed in the late summer. A late spring or cool summer may delay development so that nymphs are present through the autumn. Adult feeding can continue until the first heavy frost. The eggs are mainly deposited during August and September, where they overwinter and begin hatching in May through June.
 - o Percent Hectares Affected - Variable feeding on the flower buds, flowers and developing pods if grasshoppers are present in the area (2 out of 5 years)
 - o Percent of Hectares Treated – 25% (if grasshoppers present)
 - o Potential Crop Damage – Up to 75% yield loss, quality losses due to improperly developed or discolored seeds (grasshoppers chew parts of the flower pod and leave the seed exposed).

iii. Pest Assessment

- Monitoring
 - o Cutworms may cause damage if they have a history in the field, so monitoring should be done in fields at high risk.
 - o Grasshoppers do not favor lentil foliage, but may feed on the flower buds, flowers and developing pods. Optimum control from an in-crop chemical insecticide is achieved when the grasshoppers are small, but the grasshoppers won't move into the field until the plants begin to flower. Decis® (deltamethrin) and malathion aren't as effective at the high air temperatures present when the lentils are flowering. Lorsban® (chlorpyrifos) is the only option available.
- Forecasting
 - o Cutworms – None available.
 - o Grasshoppers – 2 grasshoppers per m² warrants an insecticide application.
- Use of Thresholds
 - o None available.
- Availability of IPM and/or ICM Programs

There are no established IPM programs for insects since the biggest current threats (cutworms and grasshoppers) have such a wide range of hosts.

Pest Management

Preventive Measures

- Cultural practices
 - o Limiting the frequency of host crops in a rotation (if possible).
- Quarantine measures

- o None applicable.

Reactive Measures

- Chemical control
 - o Cutworms – An application of an insecticide such as Decis® (deltamethrin) can be applied in-crop where warranted.
 - o Grasshoppers –An application of an insecticide such as Decis® (deltamethrin) can be applied in-crop where warranted but should be applied when the grasshoppers are small for optimum control.
- Biological control and biopesticides
 - o None currently available.
- Other control measures
 - o None currently available.
- Availability of IPM and/or ICM programs
 - o No established IPM programs.

Table 5 - Summary Information on Lentil Insects

Insects	% ha Infected	% ha Treated	Average Yield Losses on Infected Acres		Average % Efficacy of Control Methods*	Problem Priority Level
			Tonnes	CDN \$		
Cutworm	5%	2%	70% (17,300)	\$5,882,000	deltamethrin (C) - 80%	2 (yield)
Grasshopper	10%	10%	50% (24,750)	\$8,415,000	chlorpyrifos (C) - 80%	1 (yield & quality)

* C - conventional; R - reduced-risk, EPA listing; Cu - cultural practices; B - biological, EPA listing

** Rated from 1 (highest priority) to 4 (lowest priority)

Source –Saskatchewan Agriculture and Food pulse specialist

Table 5A. Lentil insecticide use as reported to Stratus

	Total Market			By Province in 2002			By Soil Zone in 2002 ²		
	2001	2002	Chg	AB/BC	SK	MB	Black	Dk Brown	Brown
Base Size	132	158		2	153	3	11	72	75
Using Insecticides (%)	20.5%	62.8%	42.3	50.0	63.5		13.9	60.0	71.3
Seeded Acres ¹	1,809	1,490	-17.6%	15	1,470	5	51	722	717
Application Intensity (%)	18.5%	69.1%	50.7	17.2	69.9		18.1	64.3	77.6
Application Acres (000's)	334	1,031	208.2%	3	1,028		9	464	557
Grasshoppers	334	990	196.2%	3	988		9	449	532
Product Application Acres									
Organophosphates	64	649	916.1%		649			285	363
Pyrethroids	255	324	27.1%	3	321			164	160
Don't know brand	16	37	131.2%		37			15	22
Expenditures (\$000)	\$2,129	\$5,296	148.8%	\$12	\$5,284		\$37	\$2,335	\$2,924
Average Cost (\$/acre)	\$6.37	\$5.14	-19.3%	\$4.50	\$5.14		\$4.00	\$5.03	\$5.25

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

F- Other Animal/Vertebrate Pests

No other animal or vertebrate pests are an issue in lentil.

Table 6 - Summary Information on Control Products and Pests

Product	% ha Treated	Rate	Timing & Frequency	Cost / ha	% Control	PHI/REI*	IPM Compatibility**
Crown (fungicide for disease)	15%	0.075-0.15 L / 25 kg seed	seed-treatment	\$24-33	90%	-	-
VitaFlo 280 (fungicide for disease)	5%	0.016-0.11 L / 100 kg seed	seed-treatment	\$20-28	85%	-	-
Bravo 500 (fungicide for disease)	50%	3-4 L / ha	early flowering	\$12-23	Preventative	48 days / 48 hours	-
Poast Ultra (grassy weed herbicide)	100%	0.47 L / ha	weeds in 1-6 leaf stage	\$11	90%	65 days / 48 hours	-
Sencor (broadleaf weed herbicide)	100%	0.41 L / ha	plants are 2.5"	\$18	50%	70 days / 48 hours	-
Decis (insecticide)	2%	0.2 L / ha	germination	\$7	80%	30 days / 48 hours	-
Lorsban (insecticide)	10%	0.6-1.2 L / ha	early flowering	\$4-\$9	80%	30 days / 48 hours	-

* PHI - Pre-harvest interval (days); REI - Re-entry interval (hours)

** R+ - resistance management alternative; RP - alternative to Ops; I - IPM compatible; T - trade issue; Re - losing registration

Source – Saskatchewan Agriculture and Food pulse specialist

Table 6A. Disease control (fungicides and seed treatments) as reported to Stratus

Fungicides

	2001	2002	Chg	AB/BC	SK	MB	Black	Dk brown	Brown
Base Size	132	158		2	153	3	11	72	75
Using Fungicides (%)	15.2%	17.8%	2.6		17.6	66.7	24.4	22.2	12.9
Seeded Acres ¹	1,809	1,490	-17.6%	15	1,470	5	51	722	717
Application Intensity (%)	19.5%	14.4%	-5.1		14.2	95.2	37.9	17.9	9.1
Application Acres (000's)	352	214	-39.2%		209	5	19	129	65
Anthracnose		73			68	5	5	49	19
Ascochyta	251	171	-32.0%		166	5	8	97	65
Don't know	120	29	-75.8%		29		11	18	
Expenditures (\$000)	\$4,240	\$2,653	-37.4%		\$2,601	\$51	\$263	\$1,647	\$743
Average Cost (\$/acre)	\$12.04	\$12.39	2.9%		\$12.45	\$10.00	\$13.61	\$12.72	\$11.37

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

Seed treatments

	Total Market			By Province in 2002			By Soil Zone in 2002 ²		
	2001	2002	Chg	AB/BC	SK	MB	Black	Dk brown	Brown
Base Size	132	87		1	86		9	41	37
% of Growers Using	35.6%	33.5%	-2.1	100.0	33.1		21.3	30.9	37.0
Seeded Acres (000's) ¹	1,809	1,485	-17.9%	15	1,470		31	686	768
Application Intensity (%)	28.2%	29.8%	1.6	100.0	29.1		32.9	29.5	30.0
Acres Treated	510	443	-13.2%	15	428		10	202	230
Diseases	464	268	-42.2%	15	253		6	121	140
Insects	16	8	-50.7%		8			8	
Both	30	16	-46.6%		16				16
Don't Know		151			151		4	73	74
Expenditures (\$000's)	\$2,546	\$1,646	-35.4%	\$120	\$1,526		\$22	\$735	\$889
Average Cost (\$/acre)	\$4.99	\$3.72	-25.5%	\$8.00	\$3.57		\$2.16	\$3.63	\$3.86

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

V Critical industry needs

In June 2002 lentil 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

- Enhance ascochyta and anthracnose resistance breeding programs
- Continued research in control management tools and practices for disease
 - o Modeling/forecasting tool
 - o Fungicide chemistry
 - o Fungicide rotations
- Broadleaf weed control tools
- Evaluate potential of new strobilurins

Regulatory

- Label expansion for Pursuit and other imi's
- Register strobilurins
- 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 PRMA on regulatory flexibility to maintain pulse crops in the minor use system and 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 used by CFIA.

Education

- Educate on disease management, resistance management, disease identification, and field scouting
- Stakeholder awareness of regulatory requirements for pulses
- Educate on rotations and other cultural pest management strategies
- Educate on pesticide persistence
- Develop crop profiles
- 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 PRMA 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

VI Actual research areas

The following trials registered with ICAR and studies related to agronomy and pest management were in progress as of 2002.

ICAR ID	Project Title
<u>22220836</u>	Integrated Control of Seed Decay, Damping-Off and Root Rot in Field Pea, Lentil and Chickpea
<u>22221598</u>	Lentil cooperative test
<u>22221613</u>	Special crops regional variety tests
<u>33330583</u>	Management of Foliar Diseases (Mycosphaerella Blight and Powdery Mildew)
<u>61009318</u>	The improvement of crop species via genetic engineering
<u>90000581</u>	TagTeam: A combined Rhizobium/phosphate inoculant.

VIII Available resources

The following institutions have active pulse research programs or are capable of researching the production of lentils:

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

References

1. Ray McVicar, Provincial Specialist, Special Crops, Saskatchewan Agriculture, Food and Rural Revitalization
2. 'Lentil in Saskatchewan' Published by Saskatchewan Agriculture and Food, 2003,
3. 2003 Guide to Crop Protection Published by Saskatchewan Agriculture and Food, 2003
4. Saskatchewan Agriculture and Food Website. www.agr.gov.sk.ca;
5. 'Ascochyta Blight in Pulse Crops' Published by Saskatchewan Agriculture and Food, 2002;
6. 'Crop Planning Guide 2003 – Specialty Crops' Published by Saskatchewan Agriculture and Food.
7. Agriculture & Agri-Food Canada – Pulse Crop Diseases website (http://paridss.usask.ca/specialcrop/pulse_diseases/index.html)
8. CARC website of ongoing research by commodity. <http://www.carc-crac.ca/english/index.htm>
9. Pulse Canada data 'Lentil Production 2003'
10. Stratus Agrimarketing Inc, Guelph Ontario

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

www.saskpulse.com

www.pulsecanada.com

www.statcan.ca

www.gov.mb.ca/pulse/agriculture/crops/pulsecrops

www.pulse.ab.ca

www.agric.gov.ab.ca/navigation/crops/pulses/

www.agr.gov.sk.ca

Trademark usage

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

Appendix A

Critical Needs and agronomy sections

NAME	ORGANIZATION	CATEGORY	EMAIL
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Bob Conner	AAFC	Research	conner@em.agr.ca