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Title: Growing Industrial Hemp in Ontario

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Introduction

Industrial hemp (*Cannabis sativa*) is one of the oldest cultivated plants in the world. For centuries, its fibres have been used to make ropes, sails and clothing. The species was banned in North America in the 1930s because its leaves and flowers contain a hallucinogenic drug known as delta-9 tetrahydrocannabinol (THC). It was banned internationally in 1961 under the United Nations' Single Convention on Narcotic Drugs.

In 1998, Canada created Industrial Hemp Regulations under the Controlled Drugs and Substances Act. These regulations allow for the controlled production, sale, movement, processing, exporting and importing of industrial hemp and hemp products that conform to conditions imposed by the Regulations.

Under the Regulations, industrial hemp seeds must be of a variety listed in Health Canada's List of Approved Cultivars. Plants and plant parts may not contain more than 0.3% THC when sampled and tested in the approved manner. Products made or derived from hemp must not contain more than 10 micrograms of THC per gram. Industrial hemp stalks, with leaves and flowers removed, and non-viable hemp seeds (grain), are exempt from the Act.

Anyone found in possession of hemp plant parts - other than the stalk and non-viable grain, without the appropriate licence - is in possession of a controlled substance and may be charged under the Act.

Industrial hemp may only be grown under licence from Health Canada. Leaf or seed residue found in vehicles or machinery, without the proper licences, may constitute possession of a controlled substance in Canada or elsewhere. Thorough cleaning of vehicles and equipment is required under the Industrial Hemp Regulations.

Industrial hemp licences are issued for a calendar year only and must be renewed if product is carried into the new year. Hemp licences are only valid in Canada. Transporting product in any form to another country, including the United States, may constitute an offence in that country.

Figure 1: Power-washing the combine to remove illegal material.

Licences to grow industrial hemp are issued for crops of 4 ha (10 acres) or more. Seed breeding and small-scale experimental activities may be carried out using Breeder or Research permits only. Applicants for any commercial hemp licence must submit a current police criminal record check with their licence application.

Because industrial hemp is a controlled substance, every aspect of its handling, production and marketing is controlled by licences issued to the operator. Information about varieties, licences and regulations may be obtain from the Health Canada's web site or by contacting:

Health Canada
Office of Controlled Substances
Healthy Environments and Consumer Protection Branch
280 Slater St., A.L.: 3502A
Ottawa, ON K1A 1B9
Tel. (613) 954-6524
Fax: (613) 941-5360
E-mail: hemp_bdstpd@hc-sc.gc.ca

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Table 1. Hemp Quick Grow Facts

Varieties	See Health Canada's List of Approved Cultivars
Soil	Well drained, loamy is best Not compacted; pH 6.0 to 7.5
Seedbed	Fine, Firm, Level 8-10^{o}C at 2-4 cm Seed depth: 2-3 cm
Seeding Rate	Fibre: 45 kg/ha Grain: 23 kg/ha (based on 16kg/1,000K seed density)
Plant Population	Fibre: 200-250 plants/m^2 Grain: 100-150 plants/m^2
Fertility	Nitrogen (N):70-110 kg/ha Phosphate (P_2O_5): up to 80 kg/ha Potash (K_2O): 40-90 kg/ha According to recent soil test for winter wheat
Weed Control	None needed No herbicides registered
Diseases and Pests	No pesticides registered Botrytis Head Blight Sclerotinia Stem Rot
Harvest	For Fibre: During pollination For Grain: When 70% of seed is ripe 22-30% moisture
Retting	14-21 days Turn once or twice
Storage	Stalk moisture <15% Grain Moisture <12% For long term grain storage: 8%-10%
Marketing	Contracts with known processors Local cottage industry

Growers of industrial hemp must give the Office of Controlled Substances the exact Global Positioning System (GPS) co-ordinates of each proposed industrial hemp plantation. Volunteer plants or other hemp plants found outside these co-ordinates contravene the Industrial Hemp Regulations and fall under the Criminal Code. These plants may be destroyed by cutting, pulling, cultivation or by herbicides. Refer to Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) Publication 75, Guide to Weed Control for recommendations. The grower must also arrange for tissue sampling of the crop by a certified sampler and laboratory THC analysis. The cost of these operations is borne by the grower.

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Development of the Industry

Historically, industrial hemp is known for its bast fibre used to make strong fabrics and ropes. Earlier technology was very labour-intensive, and is not suitable in today's high-speed industrial environment with high labour costs. Canadian and European entrepreneurs are developing new technology for woven fibre textiles, but it is not in general use at this time. Non-woven materials such as felts, carpet padding and plastic reinforcing are creating some markets for hemp fibres. Core fibres are being used for horse and pet bedding, but are adaptable to a wide variety of other products.

Hemp grain is a source of food oil and meal and has many applications for human and animal food products. Hemp oil contains a unique mixture of omega 6 and omega 3 fatty acids, as well as gamma linolenic acid (GLA), an acid involved in the synthesis of prostaglandins in the body. The oil is being used in cosmetic creams and food products. The main drawbacks at the present time are hemp's relatively low yield of grain, oil extraction technology and stability of the oil.

In spite of these constraints, oil may be the first industrial hemp product to be commercialized successfully. One industrial hemp seed company in Ontario has a breeding program aimed at creating varieties with specific oil and fibre characteristics.

Hemp oil meal and the de-hulled hemp grain, known as hemp nut, are used to make such food products such as granola bars and cookies. Because they are new products with unique flavours, it may take some time for these products to gain general acceptance by consumers.

Whole hemp grains must be sterilized if they are to be used as birdseed, sold as roasted seeds for human consumption or for any other use or for export. Unsterilized grains may be used for processing within Canada.

Markets for hemp fibres and seed products are being developed, but may not be close to the desired growing location. Transportation of raw materials is a significant cost factor in the manufacture of goods. Growers should make sure they have secure contracts before planting industrial hemp as a cash crop in Ontario.

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Description

Industrial hemp is made up of varieties of Cannabis sativa that contain less than 0.3% THC as described earlier. It is an annual broadleaf plant with a taproot and is capable of very rapid growth under ideal growing conditions. The female flowers and seed set are indeterminate, meaning that the seeds continue to develop and mature over an extended period of time. This means there are both ripe and immature seeds on the same plants at time of grain harvest.

Figure 2: Hemp plants grown for fibre.

When grown as a fibre crop, hemp may grow to a height of 2-4 m without branching. In dense plantings, the bottom leaves atrophy due to the exclusion of sunlight. Male plants die back after shedding pollen.

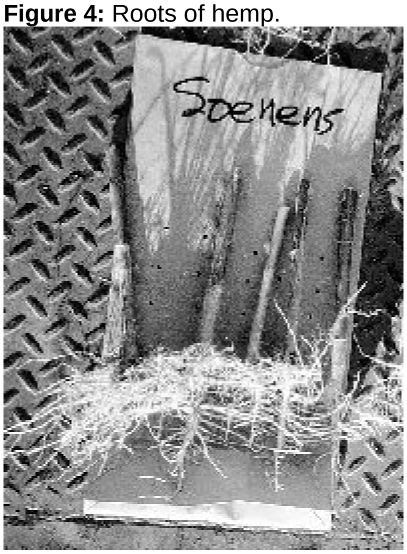
The stem has an outer bark that contains the long, tough bast fibres. They are similar in length to soft wood fibres and are very low in lignin content. These give the quality and strength for which hemp is renowned. The core contains the hurds, or short fibres, similar to hard wood fibres, that are useful in other applications like particleboard or horse bedding.

For grain production, the plants may branch and reach heights of only 2-3 m. Tall plants do not necessarily produce more grain than short ones. Shorter plants are preferred for combining.

In well-structured and well-drained soils, the taproot may penetrate 15-30 cm deep. In compacted soils, the taproot remains short and the plant produces more lateral fibrous roots.

Figure 3: Cross-section of hemp stems.

Figure 4: Roots of hemp.



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Varieties

Industrial hemp varieties tested in Ontario to date have all been of European origin, with the exception of new Ontario-bred varieties such as Anka and Carmen. They come in 2 types: Dioecious, which have male and female flower parts on separate plants (e.g., Kompolti and Unico B), and Monoecious, which have male and female flower parts on the same plant (e.g., Ferimon and Futura). A third type of cultivar, known as Female Predominant, is a dioecious type that has 85%-90% female plants. It is believed this type can produce a higher yield of grain. Most French varieties are hybrid populations of predominantly female types.

Each industrial hemp variety has its own set of characteristics: small or large seed; higher or lower oil content; different oil composition, etc. Varieties grown for fibre may contain from 15%-25% of bast fibres. As markets develop, contracts to grow industrial hemp may specify the exact varieties that will be grown to meet specific market needs.

Only varieties of industrial hemp that are named in the List of Approved Cultivars, published by Health Canada, are approved for planting in Canada. These varieties are known to produce plants containing less than 0.3% THC under normal conditions. The THC level may vary with stage of growth and increase under environmental stress conditions. They mature to fibre in 60-90 days and to grain in 110-150 days. Using home grown or "common" seed is illegal.

Dual Purpose Cultivars

Most of the French and Romanian cultivars are suitable for both grain and fibre production. These tall cultivars present some challenges for harvesting. Growers need also to consider that weather conditions after grain harvest (late August or September) may not be suitable for retting and drying of the stalks. The FIN 314 variety, which will grow to a maximum height of 0.9 m (36 in.), and other short stalked grain types (1-1.5 m) are not suitable for dual production. Industry trends seem to be moving toward specific grain or fibre varieties.

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Soil Conditions

Hemp responds to a well drained, loam soil with a pH (acidity) above 6.0. Neutral to slightly alkaline (pH 7.0 - 7.5) is preferred. The higher the clay contents of the soil, the lower the yield of fibre or grain produced. Clay soils are easily compacted and hemp is very sensitive to soil compaction. Young plants are very sensitive to wet soils or flooding during the first 3 weeks or until growth reaches the fourth internode (about 30 cm. tall). Water-damaged plants will remain stunted, resulting in a weedy, uneven and poor crop.

Poorly structured, drought-prone sandy soils provide very little natural fertility or support for the plant. Accordingly extra nutrients and water are required to achieve maximum yields on these soils. The cost of irrigation on sandy soils may make production uneconomical.

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Seedbed Preparation and Planting

For optimum germination, industrial hemp seed requires good seed-to-soil contact. The seedbed should be firm, level and relatively fine; similar to that prepared for direct-seeded forages. The soil can be worked and planted as soon as the ground is dry enough to avoid compaction. A shallow, firm seedbed allows seed to be placed at a uniform depth, resulting in a more even seedling emergence. Industrial hemp is normally sown using a standard grain drill. Plant seed at a depth of 2-3 cm. Optimum soil temperature at that depth for fast germination is 8-10^{o}C, although hemp seed will germinate at 4-6^{o}C.

Industrial hemp that is planted for fibre is usually sown in 15-18 cm (6-7-in.) rows, using every run of the drill. Optimum final stand is about 200-250 plants/m^2. Early seeding (as soon as soil conditions are appropriate) is recommended. Researchers recommend a minimum seeding rate of 250 seeds per m^2. Planting rate is recommended at 45 kg/ha. This could be higher if germination is low and seed is large. Table 2 shows how the seeding rate changes according to seed size and density (weight per 1000 seeds) for most varieties. Seed density is specific to each variety, and is more or less constant from year to year. Seed density information should be available from the seed supplier.

Figure 5: Ideally prepared seed bed.

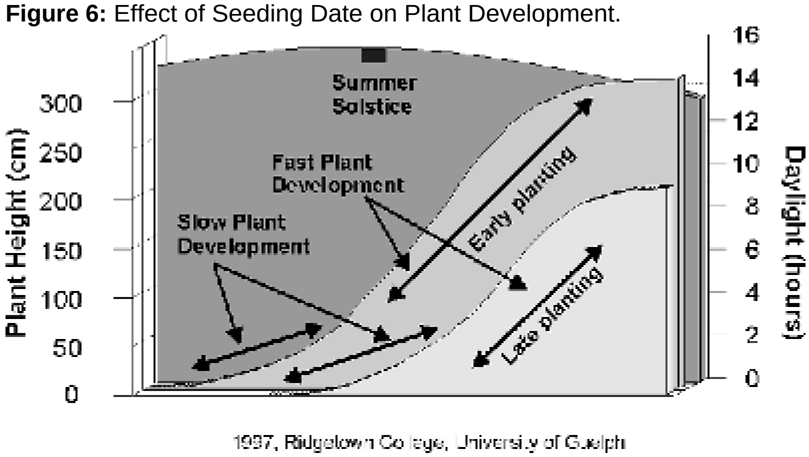
Table 2. Seeding rate based on seed size and density

Weight (grams) of 1000 seeds	Seeding rate (kg/ha) to get 100 seeds/m2	Seeding rate (kg/ha) to get 150 seeds/m2	Seeding rate (kg/ha) to get 200 seeds/m2	Seeding rate (kg/ha) to get 250 seeds/m2
10	10	15	20	25
12	12	18	24	30
14	14	21	28	35
16	16	24	32	40
18	18	27	36	45
20	20	30	40	50
22	22	33	44	55
24	24	36	48	60
26	26	39	52	65

Industrial hemp is day-length sensitive, resulting in greater vegetative growth if planted earlier, as shown in Figure 6. As days become shorter, 4-5 weeks after the summer solstice (June 21) vegetative growth slows and flower development is triggered. Early planting takes advantage of this feature, resulting in taller plants with higher fibre yields. This does not change the cutting date significantly.

For grain production, desired final plant population is around 100-150 plants/m^2. Like fibre hemp, seeds are still planted in 15-18 cm (6-7 in.) rows. Soil temperature determines the optimum planting date. This date may range from late April in Kent and Essex counties to late May in Northern Ontario. Do not plant after the first week of June. Observations in Northern Ontario indicate that grain yield may not respond as positively to early planting as does fibre yield, but early planting may help to advance the harvest date.

Figure 6: Effect of Seeding Date on Plant Development.



Climatic Conditions

Hemp requires a lot of moisture. Measurements at Ridgetown College indicate the crop needs 300-400 mm (10-13 in.) of rainfall equivalent. Since that amount of rainfall seldom occurs during the growing season, it is important to make use of early soil moisture and to obtain early ground cover to reduce surface evaporation, as well as to maintain good weed control.

About half of this moisture is required during flowering and seed set in order to produce maximum grain yields. Drought during this stage reduces seed set and produces poorly developed grain heads. Continued drought results in low yields of light grain.

During the period of vegetative growth, hemp responds to daytime high temperatures of 25°C-28°C. Young volunteer plants grow slowly at temperatures as low as 2°C., both in Northern and southern Ontario. After the third pair of leaves develops, hemp can survive daily low temperatures as low as -0.5°C. for 4-5 days.

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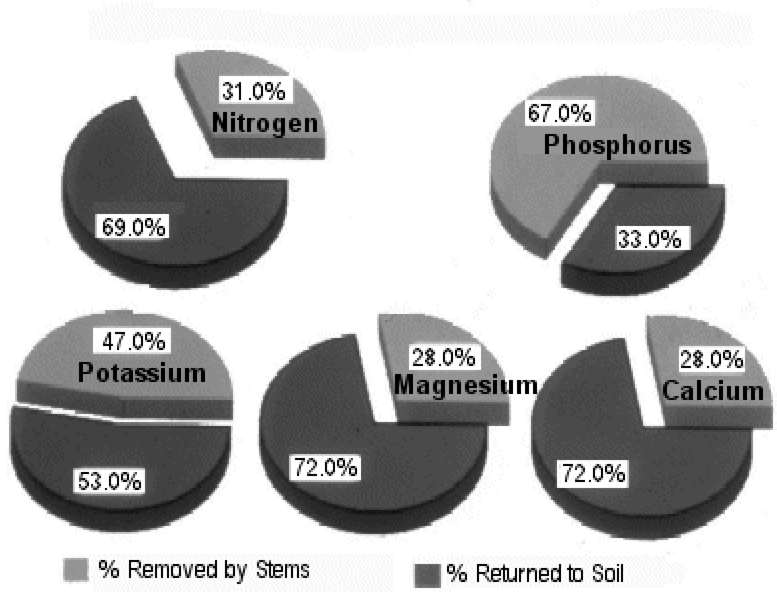
Fertility

Hemp requires approximately the same fertility as a high-yielding crop of wheat. Research is continuing to define the exact nutrient requirements. Apply up to 110 kg/ha of nitrogen, depending on soil fertility and past cropping history. Research to date supports the application of 40-90 kg/ha of potash for fibre hemp. Base your phosphorus (P205) and potash (K20) applications on a recent soil test. To interpret soil test information, follow the nitrogen, phosphate and potash recommendations for winter wheat in OMAFRA Publication 811, Agronomy Guide for Field Crops.

Growers in Northwestern Ontario may benefit from adding sulfur at 20-30 kg/ha. It is important to balance the nutrients applied with the crop requirements and with each other. Excessive nitrogen, combined with inadequate potash, for example, can result in stalk breakage and loss of the crop.

About 42% of the plants' biomass returns to the soil in the form of leaves, roots and tops. These contain over half of the nutrients applied to the crop. Many of these nutrients will be available to help feed the following crop.

Figure 7: Hemp Plant Nutrient Uptake and Return.



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Weed Control

If hemp is planted in well-drained, fertile soil under nearly optimum temperature and moisture conditions, it will germinate quickly and reach 30 cm in 3-4 weeks from planting. At this stage it will give 90% ground shade. Weed growth is suppressed by the exclusion of light from the soil. It appears that rapidly growing hemp, at a final population of 200-250 plants/m^2, will suppress nearly all weed growth, including twitch grass. For preplant site preparation guidelines, see OMAFRA Publication 75, Guide to Weed Control.

Weed suppression is not a permanent condition. Weeds may appear on the same field next year if the field is rotated out of hemp production. Perennial grasses may be weakened or killed if hemp is grown a second year on the same ground. However, this practice increases the opportunity for crop diseases to develop.

Under grain production conditions, weed suppression may be less complete. The lower plant population or uneven stands allow more light to penetrate the canopy, aiding the germination of weed seeds. Research in northwestern Ontario indicates that plant populations as low as 50-100 plants/m^2 may give adequate, though not 100%, weed control. Cross seeding may improve canopy distribution and subsequent weed control where very early, shorter varieties are grown.

No herbicides have been approved for industrial hemp. Early planting, as soon as the soil is warm enough, is a recommended weed control strategy.

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Diseases and Pests

More than 50 different viruses, bacteria, fungi and insect pests are known to affect the hemp crop. However, hemp's rapid growth rate and vigorous nature allow it to overcome the attack of most diseases and pests.

As the acreage of industrial hemp and alternative disease hosts increases in a given area, the population of disease or pest organisms will tend to increase. The following pests have been noted in hemp fields in Ontario. *Botrytis cinerea* (grey mold) and *Sclerotinia sclerotiorum* (white mold) are common molds affecting industrial hemp. Sclerotinia also affects edible beans, canola and sunflowers. It has been found on more than 10% of plants where industrial hemp followed canola. Sclerotinia spores (sclerotia) may be spread by combines, other harvesting equipment and straw. Fusarium, the pink mold found on corn and wheat, has been seen on the roots of hemp plants. The effect that an additional host crop will have on the viability of these crops may not be known until industrial hemp is grown more intensively in bean and canola-growing areas.

Figure 8: *Botrytis cinerea* head blight of hemp.

Figure 9: *Sclerotinia sclerotiorum* stalk mold on hemp.

European Corn Borer has affected some stands in southern Ontario and grasshoppers have done some damage to hemp crops in Northern Ontario. Bertha Army Worm (*Mamestra configurata*) has been a pest in Manitoba and could find its way to industrial hemp crops in northwestern Ontario.

Other diseases and pests have been identified, with varying degrees of severity, in other provinces.

No pesticides or fungicides are registered for use on hemp in Ontario. Crop rotation would appear to be a good cultural practice to avoid disease build-up until more is known about hemp's susceptibility to disease organisms. A 4-year rotation is recommended. Do not grow hemp on the same fields following canola, edible beans, soybeans or sunflowers.

Wind and hail damage can be significant to the industrial hemp crop. Tall plants with lots of upper leaf mass can be bent quite easily by mid-to late-summer storms. Broken plants will recover partially if not broken too low. This results in significant variability in plant height and maturity at seed harvest time. Small plants damaged by hail in 1996 recovered quickly and developed quite normally if they were not severed below the first node. Weather stresses may result in higher THC levels in the remaining crop.

Bird damage has been severe in some areas of Ontario and Manitoba. Significant losses in grain yields up to the entire crop have been reported.

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Harvesting Fibre Hemp

Air dry stem yields in Ontario have ranged from 2.6-14.0 tonnes of dry, retted stalks per hectare (1-5.5 t/ac) at 12% moisture. Yields in Kent County have averaged 8.75 t/ha (3.5 t/ac). Northern Ontario crops averaged 6.1 t/ha (2.5 t/ac) in 1998. Researchers feel earlier planting, optimum production management and more suitably adapted varieties can result in higher yields.

Approximately one tonne of bast fibre and 2-3 tonnes of core material can be decorticated from 3-4 tonnes of good quality, dry retted straw.

Yield of fibre depends on both the stalk yield per hectare and the fibre content of the stalk. Varieties differ in the amount of actual fibre they contain, and on the ratio of bast fibre to core materials (hurds). Dioecious varieties originating in southern Europe give the highest stalk yields. Further processing may be required to attain the quality of fibre needed for some end uses.

For textile applications, cut hemp in the early flowering stage or while pollen is being shed, but before seed sets. Fibre that is cut after seed harvest will have lignified considerably and is usable only in some non-woven industrial fibre applications. In dioecious varieties, the male plants die back after shedding pollen. This results in lower fibre yields if the straw is cut after grain has matured.

Figure 10: Cutting hemp with a sickle-bar mower.

On small acreages, good quality sickle-bar mowers and hay swathers have been used to cut hemp. Frequent plugging has been a constant problem with this equipment. It is important to keep knives sharp and in good repair at all times. As acreage increases, more sophisticated equipment may have to be imported or developed.

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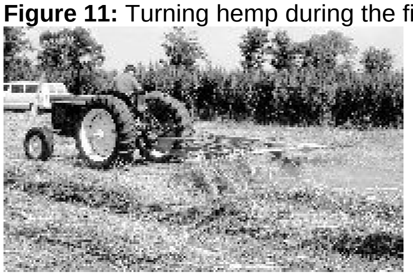
Retting and Turning

Retting is the process of beginning to separate the bast fibres from the hurds or other plant tissues. It is done in the field, taking advantage of the natural elements of dew, rain and sun, or under controlled conditions using water, enzymes or chemicals. The method chosen depends on the end use to which the fibre will be put. Suitable industrial processes for water and chemical retting have not been developed.

Figure 11: Turning hemp during the field retting process.



Successful field retting requires a delicate balance of nightly dews and good daytime drying conditions. The southern Ontario climate may dictate that field retting be done no earlier than the end of July in order to assure adequate dew conditions. Planting date and selection of variety are factors in predicting a suitable harvest date.

The length of the retting process is critical for optimum fibre yield and quality. It normally takes 21-28 days to complete, but dry August weather with low dew conditions may necessitate longer retting periods. Occasionally, the process may take as little as 14 days.

The windrows are turned vigorously once or twice with a tedder or rake to facilitate even retting of the windrow and to knock the leaves off the stems. It is important that the retting process be complete before baling, so that the fibres reach the desired colour, and do not rot or discolour in storage. In wet conditions, a third turning may be necessary. Excessive leaves left on the stems will hinder drying and may cause the straw to contravene the regulations under the Controlled Drugs & Substances Act.

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Baling and Storing

Baling can be done with any kind of baler. Large round, soft-core balers may be most satisfactory in allowing bales to dry more quickly in storage. For some industrial processes, the buyer may require a uniform large, square bale to fit into the processing system. This may present a challenge in preventing spoilage if the bales are stored for later delivery, because square bales are packed more tightly, allowing less air passage, than round bales. Sisal or hemp twine must be used to tie bales because polyester and plastic twines become contaminants in the processing of hemp fibres.

Bales must be stored indoors under dry conditions to stop the retting process before the fibres become rotted. Stalk moisture should be less than 15% at time of baling, and should continue to dry to about 10%. No observations have been made to date on bales stored under plastic, but experience with hay storage indicates that moisture would be wicked up from the ground and some spoilage would take place unless the bales are separated from the bare ground. This often occurs even on deep gravel floors indoors. Hemp straw also absorbs air moisture quite readily.

Figure 12: Large round bales of retted hemp stalks.

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Grain Harvesting Followed by Fibre Harvesting

When industrial hemp is grown for both grain and fibre, it is necessary to re-cut the tall stalks after combining. A combine can be modified to perform both functions at the same time by mounting a sickle-bar mower under the header to operate close to the ground. It is expected that, as markets for grain and fibre begin to differentiate, dual harvesting will cease to be a common practice. Growers of small acreages will most likely continue to combine and cut stalks as 2 separate operations.

If straw is to be harvested after combining, it is important that the weather conditions must also be suitable for drying the stalks for baling. Fall weather conditions in Northern Ontario would not normally be suitable because of poor drying conditions. The fibre from the mature stalks after grain harvest will be lower in quality and high in lignin. Such fibre would be suitable for manufacturing into composites, non-woven mats, particleboard, and possibly for pulping.

Combining Grain Hemp

Combining hemp provides a special challenge to both the combine and the operator. In tall varieties, large quantities of plant material are put through the combine. Hemp straw contains very tough fibres that tend to wind around moving parts. Fine fibres work into bearings, causing friction that can lead to bearing breakdown and combustion. These factors cause heavy machinery wear, high maintenance costs and a great deal of time loss and frustration on the part of the operator. Early grain varieties such as Fedora 19, FIN314 and Fasamo are shorter and easier to combine.

Industrial hemp seed is harvested when the seed begins to shatter. At this optimum harvest time, about 70% of the seeds are ripe and about 22-30% moisture. Later combining results in increased grain losses due to shattering, bird damage and lower quality grain. Mature fibres tend to wrap more tenaciously around moving parts on the combine.

Raising the cutting blade to about 1 metre (40 in.), or as high as the header will cut effectively, reduces the amount of material entering the combine. With shorter varieties use a "closer to normal" header position. The header knife must be kept sharp at all times to minimize winding of fibres on the sickle bar. Replacing the slatted feeder conveyor with a belt helps reduce the amount of fibre that winds on the feeder shaft. Exterior rotating shafts and pulleys that may come in contact with stalks should be protected when harvesting taller varieties.

Proper setting of the combine improves the yield and quality of the grain and reduces wear on the combine. Experiment with ground speed, concave openings, air and cylinder speeds. The following settings are suggested for conventional combines: cylinder speed at 250 rpm, fan speed at 1070 rpm, 1/8-inch sieve and 3/8-inch chaffer, concave set tight. Run feeder housing chain loose in the corn position and close the pre-cleaner. Lower the beater grate, remove the curtains and install a speed-up kit for the beaters. Individual combine operators might find different settings work for their machines. Rotary combines seem to be less satisfactory for harvesting hemp grain because of a tendency to plug more readily.

Reported grain yields in Ontario have ranged from 300 to 1300 kg/ha at 12% moisture, after harvesting and cleaning. Higher yields may be possible as varieties and production technology improve.

Some "volunteer" hemp will likely appear in the fall or spring following the hemp crop. These plants are illegal and must be destroyed before being discovered by local drug enforcement authorities. Thorough cultivation or seedbed preparation is effective.

Figure 13: Combining short grain hemp varieties.

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Economics of Production

Costs of production vary with individual circumstances. Small acreage. low yields, age and cost of equipment used, cost of land and alternative uses for the land all contribute to the cost of producing a tonne of hemp straw or grain.

The value of the straw varies according to its demand in the market place. Factors such as fibre length, fineness, colour and the demand for a specific quality of fibre affects the farm-gate price. These qualities are influenced by the variety of industrial hemp, the maturity of the plants, conditions during retting and quality of storage. Yield of straw affects both costs and returns per hectare.

The price of hemp straw varies according to the individual market place. Contracts have been offered to growers, but it is not known if the price offered was representative of the true market value. There are no reliable price or quality indicators in Ontario at the present time. Actual prices paid to the grower have ranged from $70-$180 per tonne, depending on quality and intended use. Persons considering industrial hemp as a cash crop are advised to secure a contract with a reliable firm before investing in the crop.

Grain markets have been slightly more active, and prices have been noted between $0.45-$0.55 per pound while markets were being expanded unhindered. Interference by U.S. customs with sales to U.S. markets in 1999-2000, and the loss of a major contractor in Western Canada in the same period has created much uncertainty in the hemp grain marketplace.

The following budgets are based on a minimum of 4 hectares (10 acres) and one variety per plot. Cost items such as global positioning, THC sampling and testing are on a "per plot" basis. Travel costs for the certified sampler will be expressed on a "per trip" basis. Seedbed preparation is considered to be the same as for direct-seeded alfalfa, and seedbed costs are adapted from OMAFRA Publication 60, Crop Budgets 2000. For fertilizer application and harvest costs refer to the OMAFRA Guide to Custom Farmwork and Short-Term Equipment Rental.

These budget outlines are intended to be a guide only. Growers should complete their own budgets using actual cost assumptions.

For more information on hemp and crop production, visit the OMAFRA web site.

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Table 4. Industrial Hemp - Costs and Returns per Acre

Land Rent

Operating Expenses	Fibre Only	Grain Only	Grain & Fibre	Your Budget
Seed $9.90/kg. 40 & 20lb./ac	180	90	90	
Fertilizer 11-52-0 @ 70 kg/ha Urea @200 kg/ha 0-0-50 @ 100 kg/ha	106	106	106	
Fertilizer Application (Custom)	7	7	7	
Herbicide				
Pesticide				
Fuel 29L at $0.55	16	16	16	
Repairs, Maintenance and Depreciation	20	20	20	
Crops Insurance Premiums	20	12	14	
Police Security Check	5	5	5	
Global Positioning	10	10	10	
THC Sampling and Testing	40	40	40	
Harvesting	15 Swather and Mowing	60 Combining	15 Swather and Mowing	
Raking/tedding: 2 passes @ $10	20		20	
Baling (Custom)	53		27	
Trucking (Grain = $12/t, Straw = $17/t)	51	4	30	
Straw Storage 7 sq. feet per bale	45		23	
Grain Drying $0.30 per lb.		24	24	
Grain Storage				
Stalk Shredding		10		
Consulting/Labour				
Interest in Operating: *10% for 6 months*	29	20	25	
Total Operating Expenses	**617**	**424**	**532**	

Revenue

Operating Expenses	Fibre Only	Grain Only	Grain & Fibre	Your Budget
Expected Yield, Fibre___t @ $___				
Expected Yield, Grain___lbs. @ $___				
Yield per Acre: Fibre 3.0 t @ $170	510			
Fibre: 1.5t @ $120			180	
Grain: 800 lbs. @ $0.50		400	400	
Total Revenue	**510**	**400**	**580**	

Breakeven Points (B/E)

Operating Expenses	Fibre Only	Grain Only	Grain & Fibre	Your Budget
Price needed at 3.0 t straw yield	$206/t			
Yield needed if straw price at $120/t	5.1 t			
Yield needed if straw price at $90/t	6.9 t			
Price needed if grain yield at 800 lbs.		0.53/lb.		
Yield needed if grain priced at $0.50/lb.		848 lb.		
Yield needed if grain priced at $0.45/lb.		942 lb.		

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Related Links

- Health Canada - Industrial Hemp
- List of Approved Cultivars
- Publication 75, Guide to Weed Control
- Publication 811, Agronomy Guide for Field Crops

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