Canola

By Michael T. Kershaw

Canola, the term that is used to distinguish edible rapeseed oil, is the major oil crop in Canada, Western Europe and Asia. It is now drawing a major interest in the United States because of the movement towards a healthy lifestyle. In 1985 the U.S. Drug Administration labeled rapeseed off as "Generally Regarded as Safe" and since then United States imports of rapeseed off have risen to over 300 million pounds per year. In 1988 when the FDA approved the name "Canola" alone in product labeling, the final barrier was removed for widespread acceptance of this oil (2). The great interest in canola oil stems from its great nutritional qualities and its competitive cost compared to other vegetable oils. The interest in canola is not recent. As early as 2000 b.c. rapeseed was noted in ancient writings. This paper is going to cover the historical, economic, agricultural and taxonomic perspectives on this subject.

References to oilseed rape, called sarson. were found in ancient Sanskrit writings as early as 2000 b.c. (1). The variety *Brassica campestris* is thought to be the oldest variety of rapes and mustards grown in India. In China the use of rapeseed cultivation is cloudy. However, old Japanese literature indicates the rapeseed was introduced about 2000 years ago directly from china (1).

In Europe, populations of rape are reported in several different areas depending on the species. Turnip rape or *Brassica campestris* was more prevalent than *Brassica napus*, which was found in more restricted areas. The domestication of these two species occurred when the "weeds" in other fields were collected accidentally which happened to be rapeseed and value was found for these oily seeds. It is thought that rapeseed was cultivated in Europe to use for oil in places where the olive tree and poppy were unknown. Thus, it was never used by the Romans (5). Seeds from these two *Brassicas* have been found in very old German settlements in close proximity to millstones. The cultivation of rape in Europe supposedly occurred in about the thirteenth century. The oil was widely used in the latter part of the middle ages as lamp oil where it was later replaced by petroleum oils. Seeds were also used for illumination and soap making. Reports are conflicting but some reports say field cropping occurred as early as the 17th century. In Belgium the occurrence of rape started as an annoying weed until its oil began to be used. Then as of the 17th century it was the only country to grow rapeseed for crops. After that it spread to Germany. Linnaeus reported that rapeseed production occurred in small scales in the 1750's in Sweden (1). From there on the cultivation of rapeseed spread to Switzerland, Poland and

Russia and then northward to Denmark and Sweden. In the nineteenth century rapeseed production declined because of the appearance of mineral oil for illumination. Carl Linnaeus, the famous botanist reported speaking to a farmer about the growing conditions. The description goes like this: " the soil should be of good humus although poorer soils can be used when fertilized, well cultivated and drained. The soil should be turned over four to five times year as to become loamy and free of weeds. Sowing is to be performed between the 25th of July and the 10th of August using six cups of rapeseed per acre". (5)

Presently, there is extensive production of rapeseed in Chile. Prior to World War II, the only South American country to produce rapeseed was Argentina.

With the outbreak of World war II, the production of rapeseed was markedly changed in several places of the world. In Europe the production between 1948-1952 was four times greater than it was between 1934 and 1938 (l). The increased production was owed to the shortage of edible oils but after it was here the great qualities it had as an oil made it stick. This lead to its increased production in Asia and Canada.

Although rapeseed was not widely grown in the United States, it has been here for quite a while. In the 1940's, demand drastically increased for the rapeseed oil which was used as a lubricant for steam engines in ships and locomotives. It was also used as forage for livestock but up to this point it was not used for human consumption (3).

Oil from traditional varieties of rapeseed is not edible to humans because of the erucic fatty acid. Research has shown that high contents of this causes heart abnormalities. With this in mind , Canadian plant breeders worked to develop a strain of rapeseed that lacked the erucic acid. The first variety "Oro" was released in 1968. Soon many strains with less than 5% erucic acid were produced. This now opened the door for rapeseed oil to be used in margarines, shortening, mayonnaise and cooking oils. This successful program put Canada on the map as a leader in rapeseed oil production and development. Thus the name Canola was derived from "Canada Oil". In addition to the erucic acid, glucosinolates are also present in rapeseed meal. These caused a bad taste and nutritional problems. Such problems were goiters and depressed growth. Finally, the geneticists bread varieties that were both low in erucic acid and glucosinolates. These varieties are known an "double low" or "double zero" because of the lack of the two compounds. However, the high erucic acid rapeseed (HEAR) still has market. It is used in the production of cosmetics and toiletries, plastics, lubricants, lacquers, detergents, pharmaceuticals and others. These newer varieties contain about 40-60% erucic acid whereas the conventional rapeseed only contained 20-40% (3).

There are two main classifications of oilseed rapes *Brassica campestris* variety *oileifera* and *Brassica napus* variety *oileifera*. Although they are separate species they are generally grouped under the names rapeseed or rape. These species are the major modem commercial varieties used in farming today (6). These rapes have a somewhat lengthy tap root with many horizontal laterals branching off. This crop is usually grown as an annual but when grown as a perennial the root system is generally much more penetrating. Rape is well branched. However this branching is dependent on population diversity or

proximity. This also affects the height in which it starts branching. The stems are usually round and upright and usually green but turning yellowish with an increase in age. Stem heights vary but are 80-150 cm in most areas. However, they have been known to grow as high as 250 cm in Victoria Australia. But, this made the crops difficult to harvest, therefore dwarf varieties quickly became popular in that area.

The leaves of the rapeseed plant are dark green, pinnate on the lower and lanceolate, sessile and clasping the stem. The two species are distinguished phenotypically in the field once the stem elongates by the small difference in how close the leaves clasp the stem. As for *B. campestris*, the upper leaves clasp the stems closely and are auriculate. The *B. napus* variety is distinguished by only the lower leaves clasping. On the main stem the number of leaves can be between five and twelve on spring sown to forty or more on autumn sown. The inflorescence is originated from the terminal end of the main stems and branches. These carry very bright yellow flowers. Flower numbers can be influenced by many factors such as variety climate and farming techniques. The number of flowers on one plant may be from 12-25. Although this sound like a lot it produces more flowers than pods and generally 65-70 percent of these flowers become pods and the rest are discarded. Low temperatures are generally what causes flowering in winter sown rape. This period may last from 3-5 weeks or longer. Flowering length has been thought to influence yield careful planning is needed when planting the crop as to ensure a proper time for flowering.

A common loss of yield is caused by loss or destruction of buds. Hail and insects are a major cause bud loss. The major insects that cause this bud loss are pollen beetles and seed weevils. The rapeseed fruit consists of a pod that is long and narrow, approximately 5-10 cm in length. These consist of two carpels divided by a false septum which when mature shatters. The characteristics of the pods, Barry widely from thick walls, number of carpels and shattering or non shattering. Surprisingly enough is the fact that several different pod types may be found on one plant. These pods may contain fifteen to forty small round seeds that are about 1-2.5 mm long. Often the seed coat is rough and pitted. These seeds are dark brown to black in color. The protein content of these seeds range from 10-45% and the oil content ranged from 30-50%. Some strains have been reported to having 60% oil content. This off that was liberated was dark in the crude form but when refined it turns to a light yellow that resembles sunflower oil. This species contains little endosperm. The embryo is made up of cotyledons which are conduplicate. These are oil and protein rich strains which are much like the aleurine cells that lie just under the seed coat. The rapes' center part of the seed consists of meristematic tissue. This is where the epicotyl, hypocotyl and the radicle originate. The rapeseeds addressed in this paper, for the most part is temperate. Initially, rapeseed was grown in the northern and southern hemispheres where the climate was of this type. However, with all of the selective breeding of rape, it has become more and more adapted to wider ranges of climates. Its range as a cultivated crop includes Canada, United States, Europe, Asia, the former Soviet Union, China, Japan, India, South America, Australia, South Africa and many other smaller countries. It is even grown in some higher elevations in the tropics.

This plant requires a modest amount of rainfall of about 450-500 mm during the flowering stage. It is postulated that anything over 700 mm would be harmful to the crop because of water logging of fungal infection. It has been found that rape is tolerant when it comes to salinity of the water. Finally, it is

found that the crop does better in well drained fields with aerated soils (l).

This crop is also able to withstand a great range of photoperiod length. There has been rape grown above the arctic circle during periods of 24 hours of daylight and also grown in areas with 8-10 hours of light.

One of the great things about rape is that it can be grown in a wide range of soil types. Rape has been grown in heavy clay, volcanic ash and even fight sandy type soils. Almost any soil type may be used except those that crust over or as mentioned earlier those that are soggy or water logged. The pH of the soil is variable as well and can range from 5-8. Basically, most experts say that soil that is good enough for wheat, is good enough for rape.

Fertilizers are used to increase the yields of rape. Organic manure and chemical fertilizers all are useful in increasing yield. It has been found that the phosphorous and potassium need in rape is generally the same as for that of wheat or other field crops. However, rapes need for nitrogen is much greater than for most crops. The most important thing about fertilizer use is the time of application. Other important nutrients are calcium, sulfur and boron.

Harvest of rapeseed is sometimes a tricky affair. The plant is ready for harvest when the pods and stern become yellow and the seeds very dark. These seeds rattle in the pod when shaken. The moisture of these seeds should be about 15%. The date of harvest like anything else varies but in generally 85-125 days for spring rape and 180-240 days for winter rape. The reason one must be careful in harvest is that there is a window of about one week where the rape ripens and must be harvested for the greatest yield. Many times this crop is wind rowed to avoid shatter loss. This is not as easy as it sounds because rape tends to bunch up after it is cut which makes it difficult to combine. Windrowing is best done when the seed pods are yellow halfway up the stalk and the seeds are a chocolate color.

Because the high oil content and small seed size, rape must be handled quickly and carefully during its drying and storage. Rapeseed must be dried before storage. After this they may be used for oil production or meal. The reasons this crop is increasing in demand is because of its oils' high nutritional value. This in addition to its cost competitiveness with other leading vegetable oils. The American Heart Association has recommended a reduction in saturated fat intake into the diet because of direct links between this and chronic heart disease. Canola oil is the lowest in saturated fat of any oil on the market. It only contains 6% saturated fat and is high in monounsaturated fat. This is 50% less saturated fat than corn oil (6). In fact the most popular low saturated fat oil is called Puritan oil. Which is 100% canola oil. Its unique quality as stability in heat and light in addition to its bland flavor make it perfect for products which cannot tolerate flavor that is carried through from the cooking oil.

In addition to the LEAR oil, products from HEAR oil are also important. These include rubber, plastics and lubricants.

With all of this positive information its easy to see shy many people believe that rapeseed crops could be very profitable in the future. The U.S. currently imports 90% of its needs of rapeseed. This leaves the

door wide open for farmers to incorporate this crop into their rotation. In Canada the growth has already occurred at a great rate. In 1950 the whole country cultivated 40,000 acres of rape. In 1988 it was estimated that 5.7 million acres were being cropped with rape (3). With the nutritional demands of this nation along with the many new varieties that are being selected for the Midwestern climate and soil, this crop has the potential to become a new variable in the American farmers formula for success.

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