Production and Utilization of Rapeseed in Canada[1,2]

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Abstract

Production of rapeseed began in Canada in 1942 mainly in response to a demand for an industrial lubricating oil. Favorable response in agricultural production stimulated interest in developing a rapeseed industry to supply a domestic requirement for vegetable oils, an alternate crop for agriculture and an export commodity. Seeded acreages recently increased rapidly to around four million acres and Canada has become a major exporter of rapeseed.

Rapeseed production began in Canada in 1942 as a wartime emergency measure. The oil was required mainly as an industrial lubricating oil for reciprocating steam engines with a major demand from naval craft. It was also a potential source of an edible vegetable oil. Two samples of rapeseed introduced were given "variety" names of "Argentine" and "Polish" which were indicative of the country from which the seed originated. It was established later that these belonged to the *Brassica napus* and *Brassica campestris* species respectively. The Argentine "variety" was used in a selection program to produce the first variety Golden which had improved agronomic characteristics, seed yield and oil content.

The oil was extracted by expeller equipment and quality was measured by iodine value and viscosity as required in the British Admiralty specifications for a marine engine lubricant. The oil extracted from "Argentine" seed readily met the specifications whereas some samples of "Polish" oil had iodine values above the specified range. Rapeseed was grown to yield the oil and the meal was a byproduct with dubious nutritional quality and consequently a low priced commodity. The cessation of hostilities and subsequent rapid conversion of steam to diesel power drastically reduced the market for rapeseed oil. This factor and the limited market demand for rapeseed meal due to nutritional deficiencies resulted in a drastic acreage reduction in Western Canada.

An assessment of rapeseed in Canada indicated two interesting aspects. First, that rapeseed production in Western Canada fitted readily into the farming operation in terms of crop rotation, machinery requirements, seeding and harvesting. Rapeseed production could be assured if markets could be developed for rapeseed oil and oilseed cake and there was a feeling that production could be competitive to wheat. Secondly, it was well established that rapeseed oil was extensively used in many other areas of the world as an edible oil for human consumption. It was felt that production of a domestic vegetable oil would benefit the Canadian agricultural economy and the Canadian edible oil industry by offering an alternative to imported vegetable oils. A potential existed both for production and domestic consumption but the farmer required some assurance of a market and the processor some assurance of a steady and continued supply of raw product. This situation resulted in a moderate impasse which was in part resolved by a wheat surplus wherein the farmers turned to rapeseed as an alternate crop and created the necessary supply.

A domestic market for rapeseed oil was initiated in the salad and cooking oil trade and was successfully accepted due in part to increased Canadian immigration of peoples with a traditional usage of liquid oils. The Canadian industry experimented with rapeseed oil for the production of margarines and shortenings but encountered problems in hydrogenation, color and stability. Subsequent increases in consumption were heavily dependent on price of crude rapeseed oil and improved oil quality.

An integrated research program involving Canadian farmer producers, universities, government laboratories and industry led to new varieties of rapeseed, improved cultural practices and modifications in oil extraction. The quality of both the rapeseed oil and meal steadily improved leading to increasing domestic acceptability and consumption. The increased domestic consumption was matched by increasing export demand and today rapeseed is a major agricultural crop in Western Canada.

The initial rapeseed was produced in the Prairie Provinces of Alberta, Saskatchewan and Manitoba and acreage expansion has been in the same agricultural area although production is being tested in Eastern Canada. The environmental factors of frost free period (growing period) and rainfall control rapeseed production in Western Canada. It should be pointed out first that the extreme severity of winter weather mitigates against production of winter rapeseed, e.g., rapeseed which is planted in the late fall, germinates, produces plants that winter and resumes growth the succeeding spring for late summer harvest. As a consequence Canadian rapeseed is produced by planting in the spring with harvest completed in the same calendar year or is designated as spring type.

A map of Western Canada (Fig. 1) shows the division into areas based on growing or frost free period ranging from 60–140 days. As expected, the frost free periods show a general decrease from south to north with some isolated areas within the general divisions. While moisture and soil zones are not

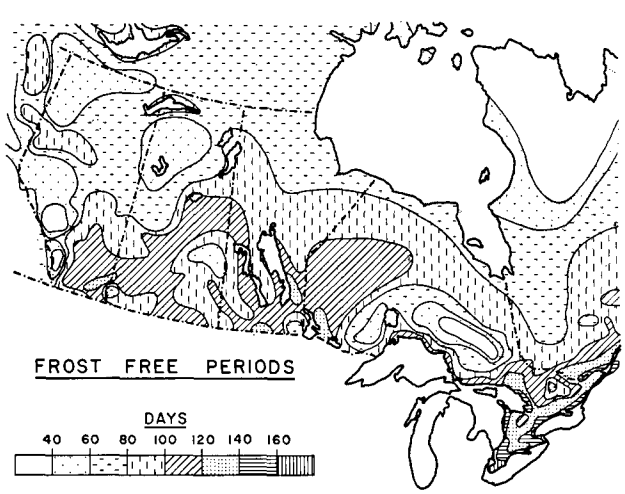

FIG. 1. Map of Canada showing the variation in frost free (growing) periods.

[1] One of 9 papers presented at the Symposium, "Cruciferous Oilseeds," ISF-AOCS World Congress, Chicago, September 1970.
[2] NRCC No. 12260.

TABLE I

Some Comparative Characteristics of Two Rapeseed Species Grown in Canada

Property	Rapeseed Types	
	Argentine *B. napus*	Polish *B. campestris*
Oil content, %	40–47	36–43
I.V.	93–106	102–114
Wt./1000 K (g)	1.2–2.0	.9–1.5
Chromosomes 2N	38	20
Maturity	same as wheat	2–3 weeks earlier
Yield, lb./acre	700–3000	25% less

shown on the map, rapeseed production is favored in the more northern areas due to moisture availability. In terms of frost free period there are two general areas, 80–100 days and 100–120 days, and this characteristic governs the type of rapeseed grown in Western Canada.

Some of the characteristics of the two rapeseed species are given in Table I and one major difference is days to maturity. The *Brassica napus* requires a maturity time similar to wheat or is in the 100–120 day frost free period. Varieties of *Brassica campestris* mature in less time and consequently would be favored in the 80–100 day growing areas (Fig. 1). The rapeseed production areas shown in Figure 2 for the crop year 1968–69 are concentrated in the northern half of each of the western provinces. On the basis of data in Table I and Figure 1 the production would be expected to be derived mainly from varieties of the *Brassica campestris* species, and in fact 75–85% of the Canadian rapeseed is made up of varieties of this species.

The data in Table 1 shows that the yield and oil content of varieties from the Brassica napus species are generally higher than those of the other species. However the production of these varieties, while favored from the agricultural standpoint, is limited by the environmental factors. In addition the shorter maturing varieties are favored in some crop rotation systems especially for weed control. Progress has been made in the plant breeding program to reduce the days to maturity for varieties of *B. napus* to expand the use of these varieties.

The production of rapeseed has had a varied pattern over the past 25 years. Acreage increased steadily from 3000 acres in 1943 to 80,000 in 1948 and fell to 400 acres in 1951, which corresponds with the termination of industrial markets discussed in the foregoing section. Development of an export market and a domestic market led to a production expansion to 600,000 acres in 1957. Annual production for the past ten years presented in Table II shows production at a similar level until 1965. Acreage showed a marked increase for a four year period reaching a

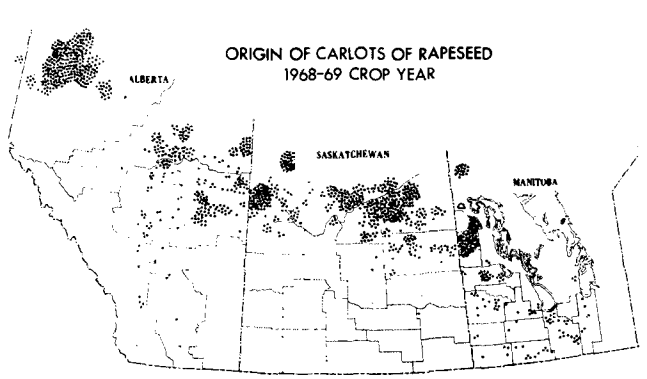

FIG. 2. Map of Alberta, Saskatchewan and Manitoba showing the areas of rapeseed production.

TABLE II

Production and Domestic Consumption of Canadian Rapeseed and Products

Year	Acreage, million acres	Production, million bu.	Crush million bu.	Oil, million lb.	Meal 000 tons
1960	0.8	11	0.2	4	3
1961	0.7	11	1.0	17	15
1962	0.4	6	1.3	24	20
1963	0.5	8	1.6	31	24
1964	0.8	13	1.6	31	23
1965	1.4	23	2.2	42	32
1966	1.5	26	3.7	73	54
1967	1.6	25	5.0	99	71
1968	1.0	19	5.2	104	74
1969	2.0	37	6.9	141	98
1970[a]	3.8	75	8.5	173	120

[a] Estimates.

level of two million acres in 1969 and nearly doubled in the present year. These last increases are in part a reflection of the surplus wheat situation. Production is a direct reflection of the seeded acreage and has increased by a factor of between six and seven over the ten year period.

The domestic crush of 200,000 bushels in 1960 increased steadily for the ten year period to over 8 million bushels in the present year representing an increase by a factor of 40. The initial domestic consumption as a liquid oil has been amplified by increasing usage in the production of margarine and shortenings and total oil consumption is a direct reflection of the crush. The production of rapeseed meal parallels the oil, and the meal has enjoyed a growing acceptance as a protein supplement. While the domestic crush of rapeseed has increased rapidly it is obvious that over 80% of the annual production has entered the world export market in the form of seed.

The initial domestic consumption of rapeseed oil was in the form of a liquid oil for use as a salad and cooking oil. Some advantages were found over other oils in higher flash point due to the presence of the long chain fatty acids eicosenoic and erucic. Improvements in the oil quality factors such as color and stability made rapeseed oil more competitive to other oils. The use of rapeseed oil in margarines and shortenings would be anticipated to replace soybean oil on the basis of fatty acid composition since both oils have similar levels of linolenic acid. As mentioned before, improved quality factors, especially those leading to ease of hydrogenation, led to increased consumption of rapeseed oil in margarines and shortenings. The other major difference between soybean and rapeseed oils is the long chain fatty acids which have been claimed to improve some physical properties of the manufactured products.

The consumption of rapeseed oil in domestic edible products is given by product (Table III) for the past four years and compared to soybean oil. The total rapeseed oil consumption has increased over the four year period with the main increase as a salad

TABLE III

Consumption of Rapeseed and Soybean Oils Byproducts, Millions of Pounds

Oil	1966	1967	1968	1969[a]
Rapeseed oil				
Margarine	[b]	36	33	21
Shortening	38	39	46	25
Salad oils		27	38	29
Total	102	102	117	75
Soybean oil				
Margarine	58	54	51	31
Shortening	65	71	70	47
Salad oils	30	29	25	11
	153	154	146	89

[a] Seven months.
[b] Not separated according to product.

oil. During the same period the use of soybean oil as a salad oil has decreased although it has maintained the level of consumption in shortenings. The totals for the two oils indicate rapeseed oil consumption has increased at the expense of soybean oil. In 1969 rapeseed oil accounted for 28% of total vegetable oils in Canada and for 21% of the total fats and oils. It is obvious that rapeseed oil is now firmly established as a major component in the Canadian fats and oils economy.

The foregoing discussion has been concerned with the production and consumption of the commercial rapeseed oils that contain the long chain fatty acids eicosenoic and erucic acids. The Canadian development of zero erucic rapeseed oil (Canbra oil) is illustrated by the following: 1961, first report of rapeseed plants producing zero erucic oil (Canbra oil); 1964, 55 k seed ⟶ oil for laboratory evaluation; 1965, 136,000 k seed ⟶ oil for commercial evaluation; 1966, 570,000 k seed ⟶ commercial evaluation five tank cars oil; 1967, 4,000,000 k seed – – 60 tank cars of oil. Production was increased to provide oil for commercial evaluation as a liquid oil and for use in margarines and shortenings. The Canbra oils contain similar levels of palmitic, stearic and linolenic acids when compared to the erucic containing rapeseed oils. The eicosenoic and erucic acids are replaced by increased oleic and to some extent linoleic acids. The Canbra oils offer a yield advantage over soybean oil when the oils are partially hydrogenated to similar triene acid levels and winterized to yield a liquid salad oil. Commercial production of rapeseed to yield Canbra oil may be complicated by isolation requirements for production, storage and transportation, and at present would be anticipated to be on a contract basis.

The production and utilization of rapeseed in Canada has made rapid progress especially during the last five years and is now firmly established both in terms of production and utilization. Since rapeseed production in Canada has been primarily regarded as an alternative crop to wheat, the future could be anticipated to depend at least in part on the future for wheat. The present and the foreseeable future tend to assure continued rapeseed production. Research progress is being made on elimination of glucosinolates and reduction of fiber content, and success in these areas would place rapeseed in a more favorable position in the world market.

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