

OILSEED CROPS PROGRAM
OF THE
DEPARTMENT OF AGRICULTURE

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A Case Study
for the
Science Council of Canada's
Study on Public Awareness
of Science and Technology

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Final Report

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OILSEED CROPS PROGRAM

History

Canada's major oilseed crops are flax, rapeseed, mustard, sunflower and soybean. Flax has been grown commercially in Canada for over 60 years. In the early 1950s, there was a concerted effort to find a marketable oilseed that could be grown on the Prairies. Rapeseed and mustard were first grown commercially for use as food in the mid-1950s. Sunflower and soybean production had become important about six years earlier. Interest in rapeseed dates back to the early days of the Second World War when traditional sources of lubricating oil were cut off, including European and Asiatic supplies of rapeseed oil. As well, the advent of pesticides and herbicides killed off weeds which, although a nuisance, could nevertheless be processed to yield some oil for lubrication. Notwithstanding the importance of the other oilseeds, the present study will focus exclusively upon the evolution of public awareness regarding rapeseed.

Research on each oilseed crop proceeded independently at the Department of Agriculture for many years, as a collection of regional and local activities. Around 1969, these activities were integrated into an oilseed crop program involving three federal departments (Agriculture, National Health and Welfare, and Industry, Trade and Commerce), eight provincial governments, numerous trade or producer organizations and university faculties.

The purpose of the oilseeds program is closely related to the role of Agriculture Canada. The program fosters research into rapeseed, as well as the other oilseed crops. It aims to improve the efficiency of production and the adaptability and quality of oilseed crops.

The Department of Agriculture was established by an Act of Parliament in 1886. While the BNA Act (1867) gave concurrent powers of legislation respecting agriculture to both the Dominion parliament and provincial legislatures, it provided that, in cases of conflict, Dominion legislation would prevail.

Efficient production (i.e. high yields and reduced losses) is necessary for the oilseed crushing industry to maintain profit margins while offering reasonable prices to growers. High product quality is needed to protect or increase domestic and export markets for oilseeds, oil and meal. The means to these ends are the development of the best possible strains of seed and the adoption of the most up-to-date techniques of crop management.

The oilseeds program now encompasses the total production package. A major part of Agriculture Canada's efforts is aimed at producing a seed with the desired characteristics. The farmer is given all possible assistance to enable him to make a profit. The Department advises him on time of seeding, use of fertilizers, irrigation, weed control, insect control and disease control. Furthermore, the Department supports engineering research to reduce losses and determines the moisture levels of seed during storage.

In fiscal year 1978-79, the federal commitment to the oilseeds program involved a total expenditure of some \$3,801,000, including \$162,000 on contracts. Some 48.4 professional man-years at 14 establishments carried out research into production, protection and utilization of oilseed crops, the bulk of it being devoted to rapeseed.

Rapeseed

In recent years, there has been a major increase in rapeseed cultivation. The market has expanded rapidly as growers, extractors and refiners have learned how to handle the crop and produce high quality products. Rapeseed is now firmly established as Canada's third most valuable grain crop, after wheat and barley.

Research on rapeseed processing and utilization has resulted in rapeseed oil becoming the most widely used edible oil on the domestic market in Canada, accounting for some 40 percent of the total vegetable oil consumed in the country. In addition, rapeseed meal has found wide acceptance for many classes of livestock and poultry. Rapeseed now supports a greatly expanded vegetable oil-extraction industry in Western Canada and contributes substantially to Canadian foreign exchange earnings.

The bulk of Canada's rapeseed crop is exported. The large increase in rapeseed exports has been achieved through a vigorous education and sales campaign, improvement in seed quality, and the development of supply continuity. In 1968,

the Rapeseed Association of Canada (RAC)¹, the producers' organization, initiated its market development program and chose Japan as the main focus of attention. A Japan Rapeseed Council was formed as the counterpart of the RAC, headed by the President of Nichiyuren, a cooperative group of small crushers. Close ties were also developed between the RAC, the Japan Oilseed Processors Association and the Import - Export Traders Association. Missions were sent to Japan which succeeded in initiating research programs that have resulted in the greater use of rapeseed meal in livestock and poultry feeding. The Rapeseed Association of Canada worked closely with government authorities in Canada to have Japanese tariff levies against Canadian rapeseed first reduced and then abolished altogether. In 1971, the Japanese Government completely liberalized trade in rapeseed and quota restrictions were removed. In Canada's conversion to the production of low erucic acid varieties of rapeseed, the processing industry in Japan not only gave encouragement but tangible assistance. As a result of all these efforts, Japan has consistently been the main importer of Canadian rapeseed.

Other large markets are the European Economic Community, India and Bangladesh. As a result of promotion efforts, markets in other countries have also been established. Missions have been sent abroad and seminars were conducted by Canadian scientists.

Rapeseed has greatly improved its competitive position in the world oilseed market in the past decade. Although still

¹ At its annual general meeting of March 12, 1980, this organization changed its name to Canola Council of Canada (CCC). This study covers a period when it was still known as the Rapeseed Association.

lagging far behind soybeans, sunflowers and groundnuts (peanuts) in volume of production, rapeseed has been steadily increasing its share of international trade in vegetable oils. In 1964 rapeseed accounted, in oil equivalent terms, for only 3.3 percent of total world net exports of soft oils, while by the early 1970s, the amount had risen to between 9 and 12 percent. Canada has been a substantial contributor to this rapid growth (about 20.5 percent of the total world rapeseed production).

The federal government has been concerned with developing rapeseed technology, safeguarding foreign markets, as well as protecting the health of Canadians. In the process, it has had to monitor the crop and create and heighten public awareness. As well as providing assistance to the Canadian rapeseed crushing and processing industry, the federal government has established and enforced high standards. Because of these efforts, Canada's rapeseed crop has acquired an international reputation for excellence.

PROBLEMS IN RAPESEED DEVELOPMENT

Erucic Acid

The erucic acid scare of 1970 cast serious doubt on the safety of using rapeseed oil in human food. Laboratory tests had revealed injurious effects on rats fed high levels of rapeseed oil in their diet. Certain compounds present in erucic acid tend to build up around the body organs, including the heart, before being fully used up as an energy source. Eventually, the body develops enzymes which break them down,

but medical authorities nevertheless feared that their buildup might have negative effects, especially in children, before the body could respond with enzymes. As well, they feared that erucic acid might contribute to heart lesions. These indications led scientists of the Department of Health and Welfare, which is responsible for establishing national health codes and standards, to recognize the potential danger to health and to recommend conversion to the production of low erucic varieties of rapeseed. Consequently, a voluntary agreement was arranged between the government and the rapeseed industry to limit the erucic acid content to 5 percent in food production, effective December 1, 1973.

A 1973 survey by the Grain Research Laboratory of the Canadian Grain Commission indicated that 71 percent of the samples tested showed 5 percent or less erucic acid, while an additional 13 percent ranged from 5 to 9 percent. Now, virtually all rapeseed grown in Canada is almost free of erucic acid -- it is in the 1 - 1.5 percent range. (In contrast, European scientists were aiming in 1978 to reduce the erucic acid of their rapeseed to 10 percent.) Partly as a result of the advanced state of its oilseeds technology, Canada has continued to maintain markets abroad, and Canadian farmers have a sure market for their rapeseed production.

There are two varieties of rapeseed grown in Canada, *Brassica campestris* and *Brassica napus*. The erucic acid has been eliminated from both of them. For this reason, no region of the country is at a disadvantage in marketing its rapeseed crop and regional economic disparities are minimized.

The Canadian conversion to low erucic acid varieties was achieved in only two years without the use of formal regulations or subsidies. The changeover was probably one of the most extensive ever made in a cultivated crop within such a short span of time. Though the yields dropped initially, the conversion went ahead anyway. Now, better strains of low erucic acid rapeseed are available with improved yields.

Glucosinolates

Glucosinolates have always been a problem as they have a bad effect on livestock and poultry. Because of their sulphur content, the glucosinolates give a certain taste and odor to food. They also interfere with thyroid functions, disrupt the metabolism of animals, and reduce feed efficiency. Government research found that the difficulties would be alleviated if water was not added during hydrogenation.

Glucosinolates are present in mustard, turnip, cabbage, brussel sprouts, as well as in rapeseed. The glucosinolates give the vegetables their particular flavour. Nonetheless, as a result of government research, glucosinolates have been bred out of rapeseed in the last three or four years. Sixty percent of the 1978 rapeseed crop was low in glucosinolates, up from 30 percent in 1977. Thanks to the development of rapeseed low in glucosinolates, it is now possible to remove the previous restrictions on the use of this oilseed in animal diets. The restrictions had kept its consumption down to the lowest amount, without regard to the animal or to its stage of maturity. Now, the only limitation is the economic one and not a nutritional one.

Other Issues

More recently, the Saskatoon Research Station has focussed its attention on producing a yellow-coated seed hull. This yellow seed would have less hull and more oil. It should also provide feed formulators with greater flexibility because rapeseed would no longer be identifiable and so would help overcome the residual fear some farmers have against the use of rapeseed in feed. As of 1978, the yellow-coated seed hull was found only in the Brassica campestris variety. The Research Station has been working for some time on the napus variety to develop a similar yellow-coated seed so as to keep both varieties uniform, but the problem has yet to be solved.

Canada is also attempting to change the fatty oil content of rapeseed; that is, reduce the linolenic acid which is blamed for the short shelf-life of rapeseed oil and the loss of taste. At present, linolenic acid constitutes about 10 percent of the oil. The Department would like to reduce this to about 4 percent. It would also like to raise the linoleic acid content. The occurrence of these two acids is linked, so there are technical difficulties in lowering one type of acid and raising the other.

At the same time, Agriculture Canada is attempting to make rapeseed meal fit for human consumption. Rats fed on rapeseed meal had problems during pregnancy. A compound in the meal caused zinc deficiency. Moreover, the meal created problems for sows which were lactating and having young ones.

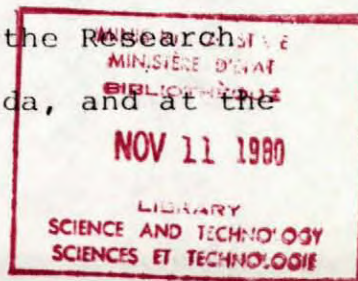
Both problems have been overcome. Nonetheless, some problems remain to be solved before rapeseed meal can be used for human consumption. Even in animal feed, rapeseed meal still causes problems. For instance, chickens fed on rapeseed and meal have less energy and more fiber than if they were fed on soya.

Finally, rapeseed is vulnerable to a number of diseases that can reduce yields severely under environmental conditions that foster their spread. Disease severity varies with time and place. It can also be significantly moderated by farming practices such as crop rotation, weed control, and use of healthy seeds. The increasing incidence and severity of diseases, particularly Sclerotinia and Blackleg, have caused Agriculture Canada to initiate concerted efforts to develop resistant seed varieties and to explore the use of other control agents and measures such as chemicals and cultivation practices.

TECHNOLOGY TRANSFER - PUBLIC AWARENESS

Some Basic Facts

The focus for federal research efforts in oilseeds is the Agriculture Canada oilseed crops program. Information regarding federal research is exchanged through written reports, attendance at scientific or ad hoc interdepartmental meetings, i.e. meetings of the Interdepartmental ad hoc Committee on Codex Alimentarius, meetings of the Research Committee of the Rapeseed Association of Canada, and at the



"Club of Five" meeting of ADMs chaired by Dr. A.B. Morrison (NH&W) where Agriculture, Consumer and Corporate Affairs, Fisheries and Oceans, Environment, and Industry, Trade and Commerce are represented at the ADM level. Mr. Gaëtan Lussier, the Deputy Minister of Agriculture Canada, has also convened informal meetings with trade associations at which CCA, NH&W and IT&C representatives were present.

Due to the recent restructuring of Agriculture Canada's planning system, particular emphasis is being placed on the processing, distribution and retailing sectors. Effective transfer of technology from government laboratories to the farmer increases the farmer's awareness of the Department of Agriculture's program and is one means to ensure that departmental goals are achieved and policies implemented. The choice of a suitable technology transfer - public awareness mechanism is largely contingent on the nature of the particular area of research. If it needs to be transferred to the farmer, which is very often the case, the extension system is used.

Because of the distribution of powers under the BNA Act, the traditional working arrangement has been that extension services, involving the transmission of scientific information to farmers, are largely left to the provinces. When the results of a research project are significant, what needs to be done to get these results applied is almost self-evident. Bulletins

on recent discoveries are very often prepared by federal scientists and then distributed through agricultural representatives, who are provincial extension service agents well-known in their locality. These agricultural representatives bring the relevant information to the attention of individual farmers and often provide valuable advice as well. The bulletins are also available directly from federal research stations, federal field officers, regional libraries and the Department of Agriculture in Ottawa. In addition, provinces at times publish their own bulletins or publications, which describe federal scientific discoveries in agriculture, as there is considerable consultation, communication and cooperation between the two levels of government in agriculture. Likewise, university agricultural departments occasionally invite the public and farmers to visit their facilities and experimental fields ("field days") and they also issue their own bulletins. Beyond this, private publications exist which provide information to farmers. Radio stations in rural areas often have their own agricultural reporters who, most often at their own initiative, interview federal scientists. The chemical industry (producers of fertilizer, pesticides and herbicides) and farm machinery people often provide valuable advice to the farmer. At times, farmers themselves approach federal scientists directly and discuss their problems. As a result, both the federal scientists and farmers are aware of each others difficulties and technology transfer - public awareness is not a problem.

Technology transfer from government laboratories to the farm is very well organized. Certain regional co-op members from the universities and the provinces test the seed that has been developed by Agriculture Canada. The tests are conducted two years in a row in 8 to 38 different locations. Then, a decision is made whether to retain or to reject that particular strain of seed. If the seed is retained, it is subjected to a further three years of tests. After these tests, the best cultivars (strains of seed that persistently maintain their characteristics) are licensed through the Food Production and Marketing Branch. Finally, the seed is passed on from Agriculture Canada and multiplied commercially under strict government supervision. Government officials inspect the seed before it is labelled "pedigree" (i.e. certified as to the quality of its properties).

The Public

There may be some question as to the definition of the public in the context of Canada's rapeseed program. It can be held that the rapeseed public includes any or all of the following groups: crushers, pedigree seed growers, feed formulators and producers, export shippers, farm machinery manufacturers, feed-users as well as farmers. Agriculture Canada has adopted the so-called total-production package outlook, and has been assisting all of the above groups,

either directly or indirectly. It would appear, then, to be appropriate to view the target public as the rapeseed industry which is composed of all individuals in the private sector who are involved in agribusiness connected with rapeseed.

It could be argued that the rapeseed public also includes the consumer of rapeseed products since research has been performed successfully to breed out compounds contained in rapeseed which were judged harmful to health. If the consuming public is to be persuaded to accept rapeseed products, it will have to be brought up-to-date on these developments. In fact, there is little evidence so far to suggest that the general public, as consumer of rapeseed oil, shortenings and margarine, is much aware of federal research into rapeseed. For that matter, most members of the general public are not even aware of what products contain rapeseed. There appears to be a public bias in favour of corn oil and margarine made of it, and in fact, the public is even willing to pay a certain premium for these products.

Formal and Informal Contacts

The interaction between Agriculture Canada and the oilseed crops industry has been quite extensive. Whenever a crop has an industrial use, the Department has a close liaison with industry. Besides frequent ad hoc or indirect contacts by way of provincial governments, Agriculture Canada meets annually with the Rapeseed Association of Canada, the seed growers

and the crushers. At these meetings, the characteristics of the seed available are discussed. This enables Agriculture Canada to monitor the properties of new strains under processing and to identify related problems. These can thus be solved without the need for costly crushing plant trial runs of two or three days, at 100 tons of seed a day. As a tradition of frankness in discussion has been built up, companies are candid in admitting the difficulties which they are experiencing. The government forewarns them about possible problems to give them more lead time to adjust operational procedures.

Agriculture Canada follows up on complaints and tries to determine the reasons for them. A specific example of government research efforts aimed to assist industry is the development of a yellow-coated seed hull. As previously noted, this yellow seed has the advantage of having less hull and more oil. Most importantly, it provides feed formulators with greater flexibility as rapeseed varieties are no longer identifiable.

Cooperation between Agriculture Canada and the oilseeds public is mutual and private companies make a significant contribution in varietal development.

Agriculture Canada enjoys a close relationship with the Rapeseed Association of Canada which represents the growers, crushers, shippers, feed manufacturers, as well as governments of the Prairie provinces. The budget of the Association is

supported to a large extent by the federal government. The Association makes recommendations while Agriculture Canada sets the program. The Rapeseed Association has its own research committee which talks with Agriculture Canada Research Stations regularly. Informal ties between the Rapeseed Association and the federal government are very strong. Contacts are frequent and, as the rapeseed industry is small, people interact well. Dr. Allan Earl, then Research Coordinator of the Rapeseed Association,² has praised the federal government and declared that it has been very cooperative.

Interaction with the Farmer

A major concern of the Research Stations of Agriculture Canada is the need to promote technology transfer - public awareness to the end client, the farmer, as the purpose of the work of the Stations is to help the farmer in his agricultural practices. As already mentioned, station officials participate in growers' meetings, write articles, prepare bulletins, and talk on radio and television programs. Although there is considerable variation, on the average scientists spend a couple of days a year explaining better agricultural practices

² Dr. Earl has since become the Executive Director of the Canola Council of Canada.

to farmers. Occasionally, scientific papers on rapeseed are published. On the occasion of "field days", the Saskatoon Research Station shows movies that have been made by the Rapeseed Association. At the Morden Research Station, farmers are always welcome and an information officer can usually help them or refer them to someone who can. Because of all these contacts, new seed varieties are not difficult to introduce; however, the growing of new crops, such as soybeans on the Prairies, would need a more elaborate introduction.

In the case of rapeseed, Agriculture Canada research stations pass information to interested groups who then disseminate it to the farmers. For instance, the Saskatoon Station supplies information to the Rapeseed Association, the producers' organization, which publishes a monthly newsletter. The Morden Station supplies information to the publication, Manitoba Agricultural Agronomists, of the Manitoba Agricultural Services Co-ordinating Committee. The Saskatoon Station prepares information bulletins which are sent to a limited list of agricultural representatives who distribute them in turn to farmers in their locality. Furthermore, the Saskatoon Research Station and the Grain Research Laboratory take part in the annual meetings of the Rapeseed Association. Thus, by a variety of means, agricultural advances resulting from federal research efforts reach the farmer.

In the case of rapeseed, the public is also made aware of technological advances by means of example. The select seed growers (i.e. the growers of pedigree seed) are spread across the country. These growers are farmers themselves. The neighbours see what the growers are doing and, hence, are more receptive to new developments.

Joint Ventures and Contracting-Out

There is some contact and cooperation between the federal government and individual companies in specific matters that affect product quality and ultimately increase public awareness. For instance, one company, Cargill, is supporting a person at the Morden Research Station who is conducting research on sunflowers. In turn, the Research Station is performing tests on sunflowers for the company. Similarly, the Grain Research Laboratory of the Canadian Grain Commission is in direct contact with industry and adapts monitoring reports to industry's needs.

Another area of potential interaction between the federal government and companies, which eventually heightens public awareness by involving the public in government research, is contracting-out. In rapeseed, the government has spent comparatively little on contracting-out in relation to total

expenditures. More precisely, during the 1977-78 fiscal year, the most recent period for which figures are available, the federal government's spending on the rapeseed and mustard component of the oilseeds program amounted to \$1,797,400 in-house, but only \$75,000 in contracts. Although contracting-out could promote greater public awareness and cooperation, there are difficulties in using this approach. Unlike an engineering project, there are specific problems in fixing precise goals in rapeseed research within a specific time frame. Some federal research establishments claim that the lack of money prevents them from contracting-out work. Most importantly, however, the private sector possesses little scientific capability in such areas as plant breeding and crop management. In fact, the companies associated with oilseed crops have gone to considerable trouble to contract-in their research requirements with federal establishments.

PERCEPTION OF EFFECTIVENESS OF TECHNOLOGY TRANSFER-
PUBLIC AWARENESS

As noted earlier, agriculture is a jurisdiction shared by the federal and provincial governments. The traditional working arrangement is such that extension services are regarded as a provincial responsibility. From all indications, however, it appears that both the federal government and the rapeseed public are very satisfied. The federal government authorities closely involved with the oilseed crops program think that the present system is working very well and that it would be quite difficult to envisage another method which would be more

successful. From the rapeseed public's viewpoint, there is a feeling that Agriculture Canada scientists are dedicated and sensitive to the public's needs. Both Dr. Allan Earl, when he was Research Coordinator of the Rapeseed Association of Canada, and Mr. Ken Sarsons, Chief Executive Officer, CSP Foods Limited, have indicated that industry is happy with the work of Agriculture Canada research establishments.

The only note of caution seems to arise on the issue of international cooperation and competition. Some concern has been expressed by the oilseeds public about the disclosure of findings of Canadian scientists which may prevent Canada and its rapeseed industry from securing maximum benefit from Canadian research discoveries.

Overall, the mix of formal - informal consultations and information exchanges appears to be working well and, at times, the work of government research scientists is ahead of the farmers' or industry's anticipated needs. As evidence of the excellent relationship, within two years 71 percent of all the rapeseed samples tested in Canada showed 5 percent or less erucic acid while an additional 13 percent showed from 5 to 9.9 percent. Such a quick conversion to low erucic varieties, without recourse to formal regulation and despite an initial drop in yields, indicates great public confidence in Canadian research in rapeseed, a concerned and enlightened attitude on the part of the rapeseed public, as well as the effectiveness of the technology transfer - public awareness mechanism.

The government appears to be reasonably aware of and sensitive to the consuming public's potential concerns (agreeable taste of rapeseed products, longer shelf-life of rapeseed oil, etc.). All the same, to the best of our knowledge there has been no general consumer-oriented public information campaign which might enlarge the market for rapeseed and rapeseed products.

