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THE OUTLOOK FOR FUTURE RAPESEED PRODUCTION IN THE WORLD

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Projections usually are launched from a historical perspective. The early history of rapeseed has been interestingly portrayed by Appelqvist and Ohlson (1972). Wijsman (1970) reviewed the production and export trends of recent years, during which rapeseed emerged as a significant commodity in the world oilseed trade. Wijsman also referred to the many factors that affect export markets, including dependability of supply, grower subsidies, storage, transportation, tariffs, increasing per capita consumption of edible oils and population growth. These factors and others remain relevant today but will not be emphasized in this presentation.

Rapeseed production or utilization, at internationally significant levels, now involves more than 30 countries. These include France, West Germany, Italy, The Netherlands, Belgium-Luxemburg, The United Kingdom, Ireland, Denmark, Sweden, Chile, Poland, East Germany, Bulgaria, Yugoslavia, Hungary, Switzerland, Czechoslovakia, Norway, Canada, Japan, Bangladesh, India, Pakistan, Ethiopia, China, Taiwan and Finland. Several other countries in Africa and South America as well as Australia, Spain and Mexico also have shown interest in rapeseed production.

Following World War II there was steady if not phenomenal growth in the production of rapeseed (Table 1). An annual export trade of about 800,000 metric tons (M tons) of rapeseed oil developed, following which there has been a period of 7 or 8 years of relatively static world rapeseed production. While some countries increased their rapeseed production, a notable exception was Japan which has almost ceased to be a rapeseed producer. Twenty-five years ago Japan produced over 300,000 M tons of rapeseed but now relies heavily on imports to meet its domestic requirements.

DEMAND PROJECTIONS FOR RAPESEED OIL

World production of fats and oils in 1970 was 41.1 million M tons and was estimated at 54.8 million M tons for 1980 (Anon., 1971). A recent estimate of the 1978 supply (production and carryover) is 54 million M tons (USDA, 1977); ahead of the FAO estimate due mainly to substantial increases in soybean, palm, cottonseed, sunflowerseed, rapeseed and olive oils. However, the rapeseed oil production trend over the early part of this decade has been somewhat static, with world production between 2.4 and 2.7 million M tons (USDA, 1976) and likewise net exports of rapeseed oil have ranged between 640 and 880 thousand M tons.

Further anticipated increases in production of edible oil crops, such as palm and soybeans, may exert downward pressure on the market price for all oils, including rapeseed oil. However, this effect may be ameliorated somewhat in the case of rapeseed due to the recent significant changes in the composition and nutritional quality of rapeseed.

There is growing scientific opinion that the concern voiced about erucic acid in 1970 at the International Conference on Rapeseed has been largely resolved. Credit is due largely to the eminently successful work of plant breeders. Research continues on long chain fatty acids in several edible oils. However, in recent studies on the low erucic acid rapeseed oils increasing emphasis has been given to fatty acid ratios, blends of fats or oils, dietary fat levels and dietary interrelationships between fatty acids and other nutrients as being important factors in fat metabolism.

The erucic acid content of commercially grown rapeseed now being processed in certain countries is below 2% and many other countries are making this conversion to low erucic acid cultivars as soon as possible. Such fatty acid changes in the oil imply that the low erucic acid types of rapeseed oil are much different from the 'traditional' rapeseed oils from several points of view, including composition, processing and nutritional value. The arguments for giving the low erucic acid oil a new name to differentiate it within the trade are thus understandable, since it is argued that there is more quality difference between the old and new kinds of rapeseed oil than there is between low erucic acid rapeseed oil and certain other commonly used edible oils.

DEMAND PROJECTIONS FOR RAPESEED MEAL

Rapeseed meal is utilized almost entirly for supplementing protein in cereal grain diets for livestock and poultry. Livestock numbers and the use of grain for feed continue to show upward trends in most countries, although the heavy users of feed grain, the U.S.A. and the U.S.S.R., show marked annual fluctuations in response to price and crop conditions (Anon., 1977). Approximately half (450 million M tons) of the world's annual production of grain is fed to livestock in the developed countries. About 90 % of this is coarse grains, 50 % of which is corn (maize) and 27 % is barley (USDA, 1977).

Based on world human population growth and conservatively assuming no increases in per capita consumption of meat, dairy products and eggs, it may be concluded that steadily increasing quantities of feed grains and protein supplements will be required in the foreseeable future. Of course in the long run if the demand for wheat increases, coarse grains could become relatively less plentiful and more expensive. However, as feed grain becomes more expensive it also becomes more important economically to ensure that animal rations are properly balanced with respect to protein and other nutrients that may be inadequate in the basal feed ingredients.

In addition to the indicated need for more high protein meal for feeding to more animals, the competitive position of rapeseed meal is improving. Research has demonstrated that properly processed rapeseed meal can effectively replace some or all of the soybean meal traditionally used in many feed formulations. In practice, feed manufacturers have tended to use less rapeseed meal than research has indicated as being satisfactory. The recently developed low glucosinolate cultivars have further improved the nutritional quality and the image of rapeseed meal. For most feed uses it is now possible for rapeseed meal to enter the formulations strictly on a nutrient content basis. Thus metabolizable energy, protein or amino acid content and unit cost will be the major determinants.

World production of high protein meals for 1978 has been projected at 78.2 million M tons (soybean meal equivalent) (USDA, 1977), that is 17 % above the 1977 volume and 7 % above the 1976 volume, largely due to new areas of palm and soybeans coming into production. Calculation of the rapeseed meal share at 6 % of this tonnage equals 4.7 million M tons, compared to 4.16 and 3.94 million M tons actually produced in 1976 and estimated for 1977 respectively (USDA, 1976; Anon., 1971).

With appropriate merchandizing and expanded production the potential exists for significant increases in the use of rapeseed meal, especially in those countries where rapeseed is grown and processed and more particularly if the conversion to low glucosinolate cultivars allows better penetration of rapeseed meal into the poultry and swine feed markets.

PROSPECTS FOR EXPANSION OF RAPESEED PRODUCTION

Rapeseed thrives in the temperate zone under conditions favorable to the growing of barley and oats and where adapted cultivars of soybeans, sunflowers or other oil crops are usually not available. Thus rapeseed provides several countries the opportunity to produce a substantial portion of their domestic requirements for edible oil. In Canada, rapeseed oil comprized 37 % of the edible oil used in 1976 and occasionally the percentage has been higher. About a third of the rapeseed produced in the world enters the export market and Canada is the major exporter. It can be concluded that most rapeseed-producing countries view this crop as an essential part of their agricultural industry and food production program and take deliberate action to ensure its well-being. It may be observed that Spain, Australia and several South American countries are actively exploring their potentials for rapeseed production.

An important factor in rapeseed production is farmer interest and financial health (to cope with high costs and risks). Weather, weeds, insect pests and diseases make rapeseed production a higher risk operation than the growing of wheat or coarse grains. To maintain regional production rapeseed farmers must remain convinced that extra benefits are likely to accrue to them through some favorable combination of yield, price, earlier cash returns or other factors. More land in various parts of the world could be devoted to rape production, given the necessary economic incentives. However, good farming practice, involving use of appropriate rotations, suggests a practical maximum proportion of rape cropping in most areas. There are no obvious signs now that the demand for rapeseed oil will increase such as to test seriously the land base production potential of the world rapeseed industry. On the other hand, there may be increasing attention devoted to maximizing the yield/hectare through improved technology and cultural methods designed to overcome production constraints.

PROSPECTIVE IMPROVEMENT IN RAPESEED OIL

The history of the commendable research, in several countries, of the rapeseed breeders who developed the low erucic acid cultivars is well known. The replacement of erucic acid (C 22:1) largely with oleic acid (C 18:1) in rapeseed oil by genetic manipulation has resulted in an oil comparable in physical properties with soybean oil. These two oils occupy prominent and about equal positions among edible oils used in Canada. Against this background of research and experience, the acceptability and trade image of rapeseed oil of low erucic acid type should improve as such oil becomes more widely available. Among future achievements the plant breeders may eventually succeed in developing a rapeseed oil containing more linoleic acid (C 18:2) and less linolenic acid (C 18:3) thereby further enhancing both the nutritional value of the oil and its stability towards oxidation.

PROSPECTIVE IMPROVEMENT IN RAPESEED MEAL

In a number of countries, significant progress has been made toward the development of low glucosinolate cultivars. Canadian experience indicates that customers for rapeseed meal actively seek low glucosinolate meal and price differentials have appeared in the trade reflecting this preference over conventional meal. One may predict that similar trends will evolve elsewhere as low glucosinolate meal becomes available and as local research demonstrates its superiority in animal feeds.

While the reduction achieved in glucosinolates in the meal has great nutritional significance there are still some glucosinolates present, including indoleisothiocyanate which was only recently found to exist at what may be nutritionally important levels in rapeseed (McGregor, 1978). Hopefully plant breeders will effect further improvements in this regard but in the meantime it remains important to emphasize that appropriate conditions of temperature, time and moisture be used in the processing of rapeseed to ensure non-hydrolysis of glucosinolates, inactivation of the enzyme myrosinase and minimal damage to amino acids. Apparently cooking at 100°C, with seed containing at least 8 % moisture, for 10 to 15 minutes may approximate the minimum conditions, but higher temperatures and longer periods may decrease the availability of certain amino acids, especially lysine (Finlayson, 1977).

The lower metabolizable energy and crude protein values of rapeseed meal relative to soybean meal are part of the reason for the typical price differential between these two high protein meals. These quality differences reflect the comparatively high crude fiber and hull content of rapeseed meal. This may be relatively unimportant for ruminants and partly or full-grown swine fed high energy cereal grains but for poultry young pigs and other animals requiring high energy diets this fibre level is usually a disadvantage.Studies on dehulling of rapeseed meal have indicated up to 30 % improvement in metabolizable energy values for chickens resulting from the use of an air-classified, low hull fraction of rapeseed meal. Smaller advantages occurred with pigs.

Two problems arose with the low-hull fractions. The consistency or fine texture (resulting from fine milling) was objectionable to chickens and, secondly, the glucosinolate concentration in this fraction was higher than in the original meal. It has been suggested that pelleting may resolve the texture problem and the use of low glucosinolate meals would largely resolve the glucosinolate problem. Consequently, it may be assumed that some method of dehulling could result in a product containing at least 45 % crude protein (%N x 6.25) and 2000 to 24000 kcal. metabolizable energy/kg meal for chickens and about 3600 kcal DE/kg meal for pigs.

As an alternative to fibre reduction through processing, plant breeders are optimistic that cultivars containing lower percentages of hull will be developed. These cultivars may have yellow seed coats, a trait that may have trade advantages.

An active area of research interest pertains to the possible adverse effect of rapeseed meal on the hemorrhagic liver syndrome in laying hens. It was found that high glucosinolate meals aggravate the problem and that certain strains of hens were more susceptible to the disorder. Another area of interest is the issue of "fishy eggs" and again the strain of hen (brown egg layers) is involved and it is thought that sinapine in rapeseed may be indirectly responsible through microbial degradation in the cecum of the hen (Clandinin et al., 1977). These factors are constraints on the use of rapeseed meal as a major replacement for soybean meal in layer diets. Solutions can be expected to these problems, following which rapeseed meal may play a much more significant role in the feeding of laying hens.

In summary, it is evident that world rapeseed production has plateaued in recent years, with modest increases in some countries being offset by Japan's demise from rapeseed production. However, the potential markets for edible oil and for rapeseed meal are increasing in accord with increasing human population and food animal numbers. Historically the major markets for oil and meal have been in those countries producing and processing the seed, where rapeseed may have the greatest competitive advantage and where policies provide incentives for increased independence in meeting the national demand for edible oils.

With the advent of low erucic acid cultivars the resultant rapeseed oil has become more competitive and more interchangeable with other edible oils, thus presenting an optimistic outlook for the oil. Similarly, in those countries interested in using rapeseed meal for poultry and swine, in addition to its use for ruminants, the advent of low glucosinolate meal has been a very beneficial advance. One must conclude that rapeseed production is a highly viable industry, that research programs will continue to yield production and product quality improvements and that the future provides the opportunity to capture an increasing share of both oil and meal markets, with improved rapeseed products to merchandize.

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TABLE 1

WORLD RAPESEED PRODUCTION (THOUSAND METRIC TONS)

Countries	1938-39	1958-59	1968-69
Europe, N. and S. America, Australia	480	1370	3057
Asia*	3323	2423	2710
Canada	-	173	417

*China, India, Pakistan: includes mustard. China estimates revised down in mid-1950's.
U.S.S.R. not included (Anon., 1958-1970).