POTENTIAL AREAS OF RAPESEED PRODUCTION IN THE UNITED STATES

D. L. Auld and K. A. Mahler

Dept. of Plant, Soil and Entomological Sciences
University of Idaho, Moscow, Idaho 83843 USA

Abstract

A series of coordinated winter rapeseed (Brassica napus L. spp oleifera (Metzg.) Sinsk. f. biennis) cultivar trials have been maintained at several locations throughout the United States since 1980. These trials were established to: 1) determine geographical areas of adaptation; 2) determine the effect of different environments on fatty acid composition and glucosinolate concentration; and 3) identify cultivars adapted at each test location. Winter rapeseed can be grown as a commercial oilseed crop in two major areas of the United States. The Pacific Northwest, which includes the states of Idaho, Oregon, and Washington, has historically grown 2,000 ha of industrial winter rapeseed. In this area, winter cultivars of B. napus such as Jupiter and Jet Neuf produce seed yields of 2 to 4 MT/ha. The largest potential production area is the Southeast, which includes the states of Texas, Oklahoma, Kansas, Arkansas, Mississippi, Alabama, Georgia, South Carolina, North Carolina, West Virginia, and Virginia. Most winter rapeseed in the Southeast will be grown as a winter annual in a double crop rotation with warm season annuals. In this climate many true biennial cultivars do not fully vernalize, which delays flowering and reduces seed yield. Breeding lines obtained from crosses between spring and winter cultivars which do not have long vernalization requirements have produced seed yields of 1 to 2 MT/ha in this area. Spring rapeseed can be grown in the northern tier of states in a few limited areas which have cool climates and adequate summer moisture.

The United States Food and Drug Administration requirements of less than 2% erucic acid in Low Erucic Acid Rapeseed oil (LEAR) can be met by most cultivars currently grown in North Europe. Production of 'Canola' quality cultivars which have less than 30 μmoles per g of defatted meal has been encouraged to allow rapeseed meal to compete with domestically produced soy meal. Individuals who would like to enter cultivars in these trials or obtain annual summaries should contact the authors. The combination of adapted cultivars and appropriate crop management techniques should allow the United States to become a major producer of rapeseed.

Introduction

Rapeseed (*Brassica napus* and *B. campestris*) is the third largest source of vegetable oil in the world. In 1987, an estimated 15.6 million hectares of this crop will produce in excess of 20 million metric tons of seed (6). During the next decade, the production of rapeseed in the United States will increase dramatically unless limited by depressed markets for all oilseed crops and/or political barriers imposed by existing oilseed crop marketing associations. The benefits of including rapeseed in the crop rotation will earn this crop the respect of growers in those areas where it is both environmentally and economically adapted. The high oil content, high protein meal, and unique fatty acid composition of "Canola" quality rapeseed will insure its acceptance by export and domestic processors assuming it can be produced at a competitive price. Increased awareness on the importance of both essential fatty acids and monounsaturated fatty acids in human diets should enable "Canola" oil to capture an increasing share of the U.S. retail sales of vegetable oil. The application of biotechnology to rapeseed as a model species will allow innovative concepts in plant design and rapid improvements in crop quality to be introduced to American Agriculture. However, the full potential of rapeseed will only be realized if all facets of this infant industry work cooperatively to insure the production and marketing of this crop grow at equivalent rates.

Benefits in Crop Rotations

Rapeseed as either a full season biennial, a winter annual, or as a spring annual is adapted to many areas of the continental U.S. (4). As cultivars are developed which combine resistance to the triazine herbicides with high levels of winter hardiness, it may be possible to grow winter rapeseed in much of the midwestern corn belt. Production of rapeseed will result in expanded crop rotations which will reduce problems associated with weeds, diseases and insect pests of other crops included in the crop rotation. Diseases such as Sclerotinia white mold which have extremely broad host ranges may increase and need to be carefully monitored in rotations which include other susceptible crops (5). The registration of the extensive arsenal of herbicides used on rapeseed in Europe and Canada would provide growers unique tools to control both perennial and annual weeds. The use of selective herbicide resistance in commercial cultivars would also allow growers to control the wild mustards historically associated with the production of rapeseed.

Winter rapeseed also provides an excellent tool to reduce soil erosion during the fall and winter months when much of our farm land lays exposed and vulnerable to water and wind erosion (5). The strong tap root of this crop will also help break up plow pans, resulting in increased aeration and water penetration in many of our agricultural soils. The use of winter rapeseed as either a fall or spring sown cover crop offers growers new alternatives to protect and improve their soils while meeting the requirements of the current U.S. farm program.

Crop Quality

Winter rapeseed produces more vegetable oil per acre than any other cool-season adapted oilseed crop (1). The oil content of fully matured spring and winter rapeseed are usually greater than 40 and 44%, respectively (5). This high oil content gives rapeseed an advantage in export markets in which oil rather than high protein meal is the most lucrative product. The oil from "Canola" quality cultivars contains approximately 62% oleic acid which is considered to be an excellent fatty acid for inclusion in human diets (2). This combined with low levels of saturated fatty acid and good levels of linolenic acid (an omega 3 fatty acid thought to be essential in human diets) makes "Canola" a premium grade edible vegetable oil.

The meal residue that remains after the extraction of oil from "Canola" quality cultivars (less than 30 μmoles per gram of defatted meal) has had excellent acceptance by animal operations both in the Pacific Northwest and in Canada (2). This meal compares favorably with soybean meal for most usages due to its high protein content and low level of fiber.

Application of Biotechnology

Rapeseed is uniquely adapted to modification using both conventional breeding techniques and a full array of recently developed techniques. The ability of rapeseed to be tissue cultured allows researchers to derive single cells necessary for recombinant DNA incorporation, fusion of protoplasts, cytoplasmic substitutions and development of somaclonal variants. The ability to regenerate entire plants from anthers and microspores facilitates more rapid varietal development and provides the single cells necessary for the application of modern gene technology to haploid and dihaploid tissue. These characteristics combined with the extensive germplasm resources available in the Cruciferae species will allow the rapid development of commercial cultivars with a broad range of adaptation and economic characteristics. The development of commercial hybrids of "Canola" quality rapeseed will enable growers to achieve even higher yields. The development of selective herbicide resistance will allow separation of different classes of rapeseed (industrial vs "Canola") and will improve weed control in commercial crops.

Economics and Marketing

Historically, oilseed crops have been most profitable when grown in areas producing feed grains. Production on land capable of producing higher value crops, requires that rapeseed be used as a rotational crop, produce extremely high yields, and/or be subsidized as is currently done in the European Economic Community. In the Pacific Northwest, winter rapeseed will be most economically competitive in dryland areas with wheat yields following fallow of less than 3135 kilograms per hectare (3).

This crop can also be grown profitably in areas with supplemental irrigation if established following harvest of a grain crop or if more lucrative crops cannot be grown in the rotation. On highly productive dryland areas availability of sufficient summer fallow to establish significant acres of rapeseed is dependent upon a government program which limits the area of crop production. In high value irrigated regions rapeseed will probably not be grown as a commodity for economic reasons. However these same areas may offer excellent sites for the production of high value, hybrid seed crops.

The more marginal cereal producing areas of the lower plains states and the Southeastern U.S. may also be potential production areas for winter rapeseed (4). In much of these areas winter rapeseed can be grown as a double crop in a rotation with warm season annuals. Any significant increase in production will require decreases in the cost of production and/or an increase in the price of rapeseed which is currently at an all time low. Due to the growing world surpluses of all oilseeds, including rapeseed, it is unlikely that price increases will occur in the near future. Continued optimization of crop production practices to reduce the cost of production offers the greatest promise for the near future.

Future Needs

A significant base of crop production information has been accumulated by the three land grant universities in the Pacific Northwest. This combined with cultivars recently developed at the University of Idaho and/or introduced from Europe allow growers the opportunity to produce high quantity "Canola" and improved industrial rapeseeds. Experience gained over the past several years in production, harvesting, storage and transporting rapeseed provide a reservoir of knowledge which would allow increased production of rapeseed.

Improvements are needed in both marketing and regional processing before the full potential of rapeseed can be realized. Initial marketing efforts should concentrate on producing high quality rapeseed for export to whole seed markets in the Orient as well as Canadian and domestic oilseed processing plants which are currently operating at less than full capacity. Establishment of a history of producing several hundred thousand acres of rapeseed in the Pacific Northwest could eventually encourage the development of regional processing and refining facilities.

In areas of the Southeastern U.S. where winter rapeseed can be grown as a double crop, introduction of a successful rapeseed industry is more dependent upon economics and development of adapted cultivars. With minimal modifications, those plants currently processing peanuts and cottonseed can extract the oil from rapeseed. However, double crop cultivars which mature before the end of May must be developed before rapeseed production in this area will be profitable. Such double crop cultivars will produce lower seed yields than full season cultivars but

will allow growers to produce an oilseed crop when the land has historically laid fallow. Successful production of double crop rapeseed will also require the development of a comprehensive set of production guidelines for this region. Total acreage of winter rapeseed could exceed several million hectares if sufficient markets can be found.

Increased production of rapeseed in our country has great potential if our agricultural industry can work cooperatively in this endeavor. Production of rapeseed should be encouraged only in those areas where it is both biologically adapted and economically competitive. Care should be taken that cultivars with proven quality are grown using appropriate production practices to optimize a farmers potential profit. Growers should be encouraged to produce this crop only under direct contract or for assured markets during its initial development. Growers and processors should work actively with regulatory agencies to insure guidelines are adopted and enforced to insure U.S. grown "Canola" and industrial rapeseed are of premium quality. We must all work together to educate the American consumer of the potential benefits associated with using "Canola" oil in their diets. Only through the expansion of markets for the processed oil and meal can increased production of rapeseed for either industrial or edible purposes be encouraged. Only through the active participation by all aspects of the Agricultural industry will the full potential of rapeseed be realized in this country.

References

1. Auld, D.L. and R.L. Bettis. 1982. Vegetable oil production of three crop species in the Pacific Northwest. In The potential of vegetable oil as an alternate source of liquid fuel for agriculture in the PNW. pp. 1-10. Univ. of Idaho Misc. Series No. 73.

2. Auld, D.L. and K.A. Mahler. 1987. Bridger and Cascade winter rapeseed varieties. Univ. of Idaho Current Info. Series No. 801.

3. Davis, B. 1986. Rapeseed: Cost of production for dryland eastern Washington. In Proceedings of the 1986 PNW Winter Rapeseed Production Conference. pp. 143-151.

4. Mahler, K.A. and D.L. Auld. 1986. National winter rapeseed variety trial 1985-86. Univ. of Idaho Misc. Series No. 98.

5. Murray, G.A., D.L. Auld, L.E. O'Keeffe, and D.C. Thill. 1984. Winter rape production practices in northern Idaho. Univ. of Idaho Exp. Stn. Bulletin No. 634.

6. Oilseeds and Products, World Oilseed Situation and Market Highlights. USDA. Foreign Ag. Service Circular. FOP 12-86.