GCIRCBUL14*25

Minutes of the Technical Committee Plant Breeding

Gerhard RAKOW

AAFC Research Station, 107 Science Place, Saskatoon, Sask.S7N OX2 Canada

Dr. R.K. Downey, chairperson of the Technical Committee Plant Breeding of GCIRC, chaired this session and indicated that the objective of the deliberations of the group would focus on recent breeding achievements with special emphasis on the development of new oilseed species and the release of genetically modified varieties. Reports were given for the following countries, developments in several other producing countries and regions were coverec in symposiums and other meeting sessions

1. Australia

Dr. Greg Buzza reported on the Australian canola crop. A total of approximately 400,000 ha of the summer annual form of *Brassica napus* was grown during the last winter season. This is a significant increase in acreage over the previously grown 100,000 ha a few years ago. The reason for the increase in *B. napus* acreage were low prices for wheat, and also a reduction in wool prices. Wheat was planted on 12 million ha. Herbicide tolerant varieties are of great importance in Australia. There was a significant increase in the acreage planted to triazine tolerant (TT) varieties despite their 30 % lower yield and 3 % lower seed oils content. There is now a greater range in maturity available in new *B. napus* varieties. Low linolenic acid varieties are under development. Genetically modified varieties with tolerance to Round-up herbicide, the PGS hybrid seed production system and development of high lauric acid (12:0) varieties are also being developed. There is no breeding work conducted on *B. rapa* in Australia. *Brassica juncea* canola quality varieties will be of great importance for Australia when developed, because of their greater heat and drought tolerance, shatter resistance and resistance to blackleg disease compared to B. napus.

2. United States of America

Dr. Mati Sovero of Calgene reported on the canola crop in the USA. Canola in the US is grown in the Pacific Northwest, the Northern Plains of Minnesota and in Alabama and Florida. Canola acreage increased over the years; 1994 = 97,000 ha, 1995 = 145,000 ha, 1996 = 139,000 ha and 1997 = 261,000 ha. Production of high laurate (12:0) *B. napus* was as follows ; 1996 = 10,000 ha, 1997 = 47,000 ha. Production in the South-East of 24,000 ha is exclusively high laurate *B. napus*. Research and interest into the development of high laurate *B. napus* started in 1985 because of highly fluctuating prices for coconut oil the traditional source for high laurate oils. Lauric acid is used in the detergent industry.

Some research highlights :

- 1986-87 work on Cuphea to develop this species for specific mid-chain fatty acid types
- 1988 discovery of 12:0 ACP in the California bay tree
- 1989 purification of ACP enzyme
- 1990 completed cDNA
- 1991 first construct produced
- 1992 best *B. napus* lines produce 40 % lauric acid
- 1994 doubled haploid lines produced from crosses, FDA approval

3. United Kingdom (UK)

Dr. Glen Hughes presented the report. Mr. S.P.J. Kightley of NIAB Cambridge is responsible for canola variety testing in the UK. Winter annual forms of *B. napus* are the dominant oilseed *Brassica* types grown in the UK. Restored hybrids based on the MSL hybridization system yield well. Compared to the check variety Apex = 100 %, the hybrids

Artus and Pronto from NPZ-Germany, yielded 114 % and 113 %, respectively. The composite hybrid Synergy (80 % non-restored hybrid mixed with 20 % pollinator plants), co-developed by NPZ-Germany and INRA-France, yielded 113 % in experimental plots. There is some concern that the yield of composite hybrids is overestimated in variety tests because of abundant pollen from fertile, open pollinated varieties in those tests. In commercial fields with composite hybrid varieties much less pollen is available for pollination, and as a result, yields might be low under certain environmental conditions. More research is needed on composite hybrid varieties.

One summer rape polima cms hybrid, Superol, yielded 110 % of checks. It was found that heterotic effects for seed yield in summer rape hybrids were lower than those for winter rape hybrids. It seems that the longer growing season of winter rape allows better utilization of potential heterotic effects. There is some production of summer turnip rape in Scotland. There is 18,000 ha of high erucic acid production. Some linseed is also grown but no sunflowers are grown.

4. People's Republic of China

Dr. T. D. Fu presented the report. *Brassica* oilseed production in China is comprised of 80-85 % *B. napus*, 10-15 % *B. rapa* and 5-10 % *B. juncea*. Winter rape is grown in the Yangtze and Yellow River valleys; in the North-East of China, *B. rapa* and *B. juncea* are grown. The canola breeding research in China has two main objectives a) development of double low (canola quality) varieties and b) development of hybrid varieties. During the period 1981-95, 43 new varieties have been developed; all of these varieties are of the zero erucic acid and 17 of the 43 varieties are of the double low (canola quality) type. This means that a substantial portion of the Chinese *Brassica* oilseed crop is now of canola quality. There is a total of 1.5 million ha of hybrid rapeseed grown in China. In 1996, hybrids had a 20 % yield advantage over open pollinated varieties. It is expected that by the yyear 2003, one half of the *Brassica* oilseed crop would be planted with hybrid varieties. The average yield of canola in China is 750-800 kg/ha which is low, yields in the North-West average 1,500 kg/ha.

5. Poland

Dr. Krzymanski presented the report. The last two winters in Poland were very hard. Winter hardiness in *B. napus* canola is the most important factor for the production of winter rape. Double low varieties of *B. napus* have insufficient levels of winter hardiness for Polish growing conditions.

6. Canada

Dr. Rakow presented the report. *Brassica napus* breeding research focuses on the development of yellow-seeded forms in the species. Yellow-seeded forms have higher oil, higher protein and lower meal fibre contents than black-seeded forms, and yellow-seeded varieties of *B. napus* will therefore set a new level of quality for the Canadian canola crop. *Brassica rapa* varieties grown in Canada are already yellow-seeded. Yellow-seeded, low linolenic acid (< 3 %) *B. napus* lines have been developed, and also lines that have a very low content of alkenyl glucosinolates

(< 1 µmole per 1 g of seed). Research in *B. juncea* in Canada towards canola quality types in this species has resulted in the development of first lines. These lines yielded 20 % more seed than *B. napus* and were highly resistant to blackleg disease. Their oil contents were 3 % lower than *B. napus*. Recent research produced lines that are basically free of allyl (sinigrin) glucosinolate and have a *B. napus* like fatty acid composition, two requirements for the acceptance of *B. juncea* canola as a canola crop in Canada.

Canola breeding in Canada is primarily conducted by private industry groups. The major players are Pioneer Hi-Bred, Zeneca Seeds, Limagrain Genetics, AgrEvo-PGS and Svalöf-Weibull. Major emphasis is on *B. napus* breeding. The 1997 Variety Recommendation List for Saskatchewan lists 57 *B. napus* and 21 *B. rapa* varieties. Transgenic herbicide tolerant *B. napus* is now commercially grown; the varieties are tolerant to glyphosate (Round-up Ready) or glufosinate-ammonium (Liberty Link). It is projected that in 1997 up to 25 % of the *B. napus* acreage in Canada could be sown to herbicide tolerant varieties.

Hybrid varieties of *B. napus* are under development and is the major focus of private breeding firms. Two *pol* cms based hybrids

are on the market, they are Hyola 401 from Zeneca Seeds and AC H102 from Agriculture Canada in Saskatoon. In *B. rapa*, the concept of synthetic varieties has been researched and it was found that synthetic varieties have a 10% yield advantage over open pollinated varieties in this species. Microspore culture is now extensively used in *B. rapa* for the development of inbreds as parents for hybrid varieties. Major advances have also been made towards increasing oil content in *B. rapa*, and the development of «zero» glucosinolate strains.

Discussion

Dr. Röbbelen, Göttingen, asked if high oleic acid will be considered a major oil quality characteristic for canola oil or if the present fatty acid composition is satisfactory. There was no general consensus on this and opinions varied.

Dr. Rakow, Saskatoon, responded that he believes that, at least for Canada, two fatty acid profile types might be required in the market place. High oleic, low linolenic acid canola oil would be the preferred oil for frying and baking applications, while the standard canola oil with 60 % oleic, 20 % linoleic and 10 % linolenic acid would be used as salad oils. The market for these two types of oils are of approximately equal size.