

Rapeseed Breeding in Denmark

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At present, two private organisations are breeding rapeseed in Denmark, namely: MARIBO Seed, 14 Højbygårdvej, DK-4960 Holeby and DLF-Trifolium A/S's department Danish Plant Breeding Research Division, 31 Boelshøj - Højerupvej, DK-4660 Store Heddinge. Both companies are breeding winter and spring oilseed rape. Up to 1992, four private companies were breeding rapeseed in Denmark (Poulsen and Rahman 1993).

In 1993, Prodana Seed was purchased by DLF-Trifolium A/S who owned the Danish Plant Breeding A/S, now a Research Division under DLF-Trifolium A/S. The rapeseed programmes of Prodana Seed were therefore merged with the breeding programmes of Danish Plant Breeding A/S.

The Pajbjergfonden, who were also breeding spring oilseed rape, have stopped their rapeseed breeding programmes in 1993.

Breeding Objectives

The general breeding objectives have not been changed significantly since 1992 (for details see Poulsen and Rahman 1993). Double low quality, resistance to diseases, lodging resistance, earliness, high oil content etc. are still the common breeding objectives. However, recently, breeding objectives have been focusing on the development of rapeseed varieties of special fatty acid composition. One Danish bred high erucic acid (52% erucic acid) low glucosinolate ($< 15 \mu\text{mol/g}$ seed) spring rape variety, named INDUSTRY, is registered in United Kingdom. This variety is also accepted for registration in Denmark and will be registered early 1995. One more high erucic acid spring rape variety is in official trial in Denmark. Similarly, a high oleic low linolenic acid spring rape variety is in official trial in Denmark and is expected to be registered late 1995. The glucosinolate content of this variety is low. Also a high protein (28-30% protein in seed) spring rape variety of double low quality is in official trials in Denmark.

Breeding Methods

The traditional pedigree and single seed descent (SSD) methods and the doubled haploid technique are commonly used by the Danish breeders for variety development and hybrid breeding programmes (for details see Poulsen and Rahman 1993). However, recently, breeding programmes have been highly directed towards the development of hybrid varieties. Cytoplasmic male sterility and self-incompatibility are used for this purpose.

The first Danish bred winter rape hybrid, CANNON, is expected to be registered in Denmark early 1995. CANNON is developed using the Ogura CMS-system. The F₁ hybrid is male sterile (MS) as it lacks the restorer gene. The varietal association of CANNON is composed of a proportion of hybrid seeds and seeds of male-fertile pollinator varieties. This seed mixture ensures adequate male fertile pollinator plants in the field which pollinate the MS hybrid plants.

The effect of different proportions of pollinator seeds in the seed mixture on the yield of the mix-hybrid CANNON was investigated by replicated field trials in 1993-94. Four different seed mixtures were used (1) 85% CANNON + 15% pollinator, (2) 70% CANNON + 30% pollinator, (3) 55% CANNON + 45% pollinator, and (4) 40% CANNON + 60% pollinator. Pure CANNON (100% MS hybrid) was used for comparison. These MS hybrid plants were expected to be pollinated by the male fertile plants of the neighboring plots.

The trial locations were at (1) Holeby, Lolland, (2) Skælskør, Sjælland, and (3) Sejet, Jylland.

Table 1. Relative seed yield of CANNON, with different proportions of pollinators*

	Trial locations			Mean
	Holeby, Lolland	Skælskør, Sjælland	Sejet, Jylland	
100% CANNON	100a	100	100a	100
85% CANNON +15% poll.	99a	97	96a	97
70% CANNON +30% poll.	99a	94	98a	97
55% CANNON +45% poll.	101a	92	96a	96
40% CANNON +60% poll.	98a	87	96a	94
CERES	94a	88	101a	94
BRISTOL	78b	81	88b	82

* Mixture by seed number.

Values followed by the same letter are not significantly different, LSD 5%.

Data of the field trials show that the seed yield of CANNON mixed with up to 60% pollinator does not differ significantly from the pure hybrid CANNON. However, there was a tendency towards slightly reduced seed yield with the increasing proportion of pollinator seed.

It appears that up to 30% pollinator seed can safely be mixed with the hybrid seed of CANNON without a significant drop in seed yield of the varietal association.

Genetic Engineering/Biotechnology

MARIBO Seed has successfully transformed and regenerated both winter and spring oilseed rape with a gene for disease resistance. These genetically engineered plants (GMOs) will be evaluated in field trials in 1995. The same company has also developed Roundup tolerant spring rape lines for field evaluation in 1995.

Danish Rapeseed Varieties

The following Danish varieties are registered in different countries:

Variety	Breeder	Country
<u>Winter rape</u>		
CANNON*	MARIBO Seed	Denmark
FELIX	-	Denmark
GAZELLE	-	Denmark, United Kingdom
IMPALA	-	Denmark
SILEX	-	United Kingdom
CHANG	DLF-TRIFOLIUM	Denmark
HANSEN	-	Denmark, United Kingdom
OLSEN	-	Denmark
TAROK	-	Denmark, Belgium
<u>Spring rape</u>		
DAKINI	MARIBO Seed	Denmark
DERBY	-	United Kingdom
INDUSTRY**	-	Denmark, United Kingdom
JAGUAR	-	Denmark, United Kingdom, France
MARI	-	Canada
MARINKA	-	Denmark, United Kingdom
MIRO	-	Denmark
POLO	-	Canada
ATLAS	DLF-TRIFOLIUM	Canada, Denmark
BINGO	-	Denmark, United Kingdom, USA
CYCLONE	-	Canada
HELIOS	-	Denmark, United Kingdom, USA
LOGO	-	United Kingdom
NIMBUS	-	Denmark, United Kingdom
OLE	-	Denmark
OPTIMA	-	Denmark, United Kingdom, Morocco, Ireland
ORION	-	Denmark
PALLAS	-	USA
SCANA	-	Canada
SPOK	-	Denmark, United Kingdom
STAR	-	Denmark, United Kingdom
UNICA	-	Denmark, United Kingdom
VEGA	-	Denmark
IRIS	Pajbjergfonden	Denmark

* hybrid variety.

** high erucic acid, low glucosinolate variety.

Several winter and spring rape varieties are in official trials in Europe and North America.

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References

Poulsen M.H., Rahman M.H. 1993. Survey on Current Rapeseed Breeding in Denmark. GCIRC Bulletin, 9:34-36.