A new clubroot resistant variety in winter oilseed rape

Dr. Martin Frauen,
Norddeutsche Pflanzenzucht Hans-Georg Lembke KG, Hohenlieth

Clubroot (*Plasmodiophora brassicae*) is a soilborn disease which causes severe problems in some restricted growing areas of winter oilseedrape in Europe. This soilborn disease damages the root development, many plants are destroyed before and during winter, remaining plants are heavily affected on standing power and on seed yield, even total yield losses are possible. Heavy infections are observed especially under humid and warm soil conditions. Farmers try to control this disease by increasing the pH-level which is not very efficient, the best disease control is to interrupt the cultivation of rapeseed and other crucifers for 8 to 10 years. In Germany we estimate to have about 40.00 to 50.000 hectares or even more which are contaminated by *Plasmodiophora brassicae* and cannot be used for rapeseed cultivation.

There are some genetic resistances against *Plasmodiophora brassicae* available in the rapeseed (*Brassica napus*) germplasm, e.g. the fodder rapeseed variety „Sparta“ is known as partial resistant and the Swedish winter oilseedrape „Tosca“ is known as resistant. A lot of different races or pathotypes are a specific problem for the breeding of clubroot resistance, a resistance should cover as much as possible of these pathotypes. Since 1987 within the RAPOOL-Ring organisation there have been carried out several research projects in order to develop new resynthesized rapeseed lines with high and broad clubroot resistances using new resistance sources from the basic species *B. rapa* and/or *B. oleracea*. Most of this work was done by Dr. Elke Diederichsen and Prof. Dr. Maria D. Sacristán at the FU Berlin. The timetable of the project clubroot resistance is shown in table 1.

Table 1: Rapool-Project „Clubroot Resistance“

1987 - 1990	basic research on clubroot resistance at Institute for Applied Genetics, FB Biology, FU Berlin (Prof. Dr. M. D. Sacristán, Dr. E. Diederichsen)
1989 - 1990	Rapool-Ring / AiF-Project „Resynthesis of Amphidiploid Brassica-species by Embryoculture for Producting Clubroot Resistant Lines“
1990 - 1995	crosses with adapted 00-varieties, production of DH-lines by NPZ- and SU-Biotec-Lab and testing for resistance
1992 - 1994	Rapool-Ring / AiF-Project „Identification of Biochemical and Molecular Markers for the Selection of Clubroot Resistance in Brassica“
1996 - 1997	test combinations of sterile motherlines (MSL-system) with resistant DH-lines
8/1998	application of the hybrid variety NPZ 9808 for official test in Germany and UK
12/2000	registration of MENDEL (NPZ 9808) in UK
12/2001	registration of MENDEL in Germany (expected)

A dominant resistance gene from *B. rapa ssp. rapifera* has been used for creating a resistant *B. napus* resynthetic line, which has been crossed and backcrossed with adapted double low varieties. In order to speed up the programme the use of double haploid technique has been carried out. All resistant lines have been selected for double low quality and good agronomic performance (table 2).

Table 2: Genetic material used for breeding clubroot resistant variety MENDEL

Source of resistance:	resynthetic-rapeseed „1543“ (ECD-04 x ECD-15 3)
	ECD-04: B. rapa ssp. rapifera (resistent)
	ECD-15: B. oleracea var. acephala cv. Verheul
Cross:	(Falcon x „1543“) x Falcon
DH-lines:	total n=3437 (NPZ-lab + SU-lab)
	selection for resistance in greenhouse, in the field
	selection for 00-quality
	selection for agronomic performance
Test hybrids	with MSL004C and MSL007C
Selected fatherline	Bl. 6431/96

Due to the dominant inheritance of the new resistance we developed directly hybrid varieties. Several hybrid test combinations based on sterile MSL-motherlines („Male Sterility Lembke“) have been produced, tested for clubroot resistance under field conditions and for agronomic performance. One fatherline with high combining ability (Bl.6431/96) has been selected and the hybrid variety NPZ 9808 has been applied for official test in Germany and UK. In December 2000 this variety named MENDEL has been national listed in UK, national listing in Germany is expected for December 2001.

Table 3 shows the agronomic performance of the hybrid variety MENDEL in comparison to other hybrids and op-varieties.

Table 3: Performance of the clubroot resistant hybrid variety MENDEL
(NIAB, 1999 and 2000 NL trials)

Variety (type)	rel. yield	oil content %	height cm	stem stiffness	stem canker
Apex (op)	97	44,1	151	6.8	5
Excort (op)	103	44,0	159	5.4	7
Pronto (H)	104	43,4	164	7.0	4
Synergy (CHL)	101	43,6	166	7.5	4
Mendel (H)	103	43,9	162	7.8	7

Parallel to the official variety test field trials on farms have been carried out in 2000/01; all these trials have shown a good and efficient clubroot resistance under different field condtions. First commercial marketing of the variety MENDEL has been started in autumn 2001.
Due to the dynamic of the shift of new pathotypes the growing of MENDEL is recommended on infected fields only and not as precaution against clubroot under disease free conditions.

Literature

Diederichsen, E., 1992: Kombination verschiedener Resistenzen gegenüber *Plasmodiophora Brassicae Wor*. in resynthetisierten Formen von amphidiploiden *Brassica*-Arten. Diss., Freie Universität Berlin, 172 S.