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Report on rapeseed breeding, agronomy and plant protection, and product uses in Britain, 1985

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Breeding

There are five different oilseed rape breeding programmes in the UK. Four of these, Twyfords Seeds Limited, Banbury; Nickerson RPB Limited, Rothwell, Lincoln; Dr R.L. Thomas, Banbury (Nickersons RPB Limited and Cundy and Sons Limited, The Old Vicarage, Thriplow, Cambridge are agents); and Charles Sharpe and Company Limited, Sleaford, Lincolnshire, are in the private sector and it is possible that the programme at the Plant Breeding Institute (PBI), currently under the Government Agricultural and Food Research Council, will be privatised soon. Three of these programmes (R.L. Thomas, Nickerson and PBI) had their own varieties in National List Trials (NLT) in 1984/5, but these varieties all had a high glucosinolate content.

Seed of the doubled haploid line of the PBI winter rape, Mikado, formerly line 79/95, that was added to the 1985 NIAB Recommended List in the provisional category in 1984, was multiplied successfully by farmers on contract to the National Seed Development Organisation (NSDO), in spite of wet weather at harvest. About 600 tonnes of certified seed were sold by United Agricultural Merchants Ltd and the Kenneth Wilson Group, who were appointed by NSDO to market the variety in the UK. Mikado occupied about 20 percent of the 330,000 ha of rapeseed sown in the UK for harvest in 1986.

Another doubled haploid line of winter rape, 79/20, yielded well in its first year of NLT and has been included in the Agricultural Development and Advisory Service/Recommended List Trials as well in its second year. This is a tall, vigorous, high glucosinolate variety, that had yielded particularly well on light land in Institute trials.

With the EEC statement of intent that from the 1990/91 marketing year only low glucosinolate seed will qualify for a crushing subsidy, all breeders are intensifying their programmes to breed new low glucosinolate varieties. However, Dr J.G. Bowman, Nickerson RPB Ltd, continues also to breed for low erucic acid, high glucosinolate lines and believes that recurrent selection in this material is capable of making quite considerable improvements in performance. In the UK, he expects the gap in performance between the high and low glucosinolate types will widen considerably. High yielding, high glucosinolate lines will be used by backcrossing as the main means of improving the performance of low glucosinolate types. The first of their low glucosinolate lines will not be available until about 1990 or 1991.

At the PBI, emphasis has been put by Mr W.G. Hughes and Mr P. Capitain on combining high yield and good disease resistance with high oil content and low glucosinolate content. Anther culture has been used to obtain homozygous diploid lines from eleven F_1 hybrids, thought to have high potential. A total of 2289 embryoids were produced at the PBI and a similar number from the same crosses at the John Innes Institute, where they were part of an investigation into the influence of genotype and other factors on the production of embryoids from microspores (Dunwell *et al., Journal of Experimental Botany 36,* 1985). From these, 822 plants were grown to maturity at the PBI, and following spontaneous doubling or colchicine treatment, selfed seed was obtained from 230 of these plants. A limited number of these (20 lines) produced sufficient seed for yield assessment in a replicated yield trial or in observation plots (33 lines). Although limited in number, the results were promising, and following multiplication of seed stocks during 1984/85, 192 of these lines have been sown for yield assessment in replicated trials at one or more sites during 1985/86.

At the PBI, preliminary experiments were carried out by Dr P.L. Newman to inoculate flowering plants with ascospores of *Sclerotinia sclerotiorum* in the glasshouse. These have confirmed the French findings that some Japanese lines of *B. napus* may be more resistant to this disease than are European varieties since they produce smaller and fewer le-

sions. Further evaluation is required to determine if this apparent resistance will be useful in the field.

Culture filtrates of *Alternaria brassicicola* were found by Dr Mary MacDonald and Dr D.S. Ingram, Botany School, University of Cambridge, Downing Street, Cambridge, to be phytotoxic to secondary embryoids of *B. napus* spp. *oleifera.* The culture filtrates were partially purified, and added to tissue culture media to produce a selection medium. Different secondary embryoid lines of *B. napus* were found to differ in their sensitivity to the selection medium, and it was possible to select secondary embryoid lines which showed increased resistance to the selection medium. Some plants regenerated from secondary embryoids were found to be more resistant to the pathogen than were seed grown plants of the same cultivar, although there was no correlation between sensitivity to the selection medium and susceptibility to the pathogen.

Screening of commercial cultivars and crop studies have shown that virus can reduce yields drastically (Dr J.A. Walsh, National Vegetable Research Station (NVRS), Wellesbourne, Warwick CV35 9EF). Tests have revealed which cultivars are least affected and have led to the identification of immunity to turnip mosaic virus (TuMV) and resistance to cauliflower mosaic virus (CaMV) in oilseed rape. Lines of oilseed rape which were immune to the NVRS isolate of TuMV were tested against four other strains of TuMV and found to be immune. Crosses between immune, hypersensitive and susceptible lines have been made by Dr K.F. Thompson and W.G. Hughes(PBI, Cambridge) and F_2 seed produced. Plants from F_2 seed will be screened against TuMV to determine the nature of the inheritance of immunity. The stability and heritability of resistance to CaMV is also being studied.

Research on the epidemiology of viruses infecting oilseed rape has shown that they overwinter in oilseed rape and will infect horticultural crops including vegetable brassicas and lettuce.

Agronomy and Plant Protection

Final estimates by the Ministry of Agriculture, Fisheries and Food (MAFF) gave mean yields for rapeseed of 3.44 tonnes/ha from 269,000 ha in the UK in 1984 resulting in a record yield of 914,000 tonnes. Rainy, windy weather delayed the harvest in 1985 and reduced yields by losses from shedding of seed. First estimates of mean yields by MAFF were 3.09 tonnes/ha from 296,000 ha totalling 915,000 tonnes, but traders suggested 818,000 tonnes from 285,000 ha at 2.85-2.90 tonnes/ha (Green Europe, November 1985).

The new low glucosinolate German variety, Ariana, was added to the NIAB Recommended List of winter rape varieties for 1986; it was provisionally recommended in the special category where a variety with low glucosinolate content is required. The French variety, Jet Neuf, the main variety for several years in the early 1980's, reaching 80-90 percent of the rape acreage, was no longer recommended. From 1983, yields of Jet Neuf dropped, relative to the French varieties Rafal and Bienvenu, and it became progressively more susceptible to light leaf spot, *Pyrenopeziza brassicae.* The German variety, Korina, and the French fairly low glucosinolate variety, Darmor, previously provisionally recommended for general and special use respectively, were also removed from the List. Recommendation for general use was continued for Bienvenu and Rafal while Mikado continued to be provisionally recommended for general use.

For 1985/86 Bienvenu is the main variety grown with probably 65-70 percent of the 330,000 ha sown, with between 20 and 25 percent for Mikado in its first year in commerce and Rafal taking nearly all the remaining area. Establishment was often poor with low, variable populations in a dry autumn. Later germinated seedlings were often killed in a month of hardweather in February, so up to 20 percent of the area sown to winter rape may have been ploughed-in.

Mrs S. Ogilvy and Miss J. Bevis, High Mowthorpe Experimental Husbandry Farm, North Yorkshire, reported on work on autumn nitrogen, late season wheelings, harvesting techniques and time of swathing.

Autumn Nitrogen

In ten trials over nine years the application of nitrogen in the autumn has had no effect on yield overall, averaging 99 percent of the yield from the nil autumn N treatment. In two years some yield responses were seen, but only at suboptimal spring nitrogen dressings. The response therefore appeared to be to additional nitrogen, and not the timing of that nitrogen.

Visual responses of increased leaf cover in the autumn have been noted where autumn nitrogen has been applied, particularly at high (80 kg/ha) rates. These were not as a result of higher dry matter production, and were transitory. Spring plant sizes and populations were not affected by autumn nitrogen dressings.

Late Season Wheelings

Over two years yield losses due to wheeling the crop in order to apply pest or disease control chemicals or desiccants have been assessed. Losses were highest at the post flowering timing, and lowest at the mid flowering timing. Wheeling the crop again at the desiccation timing caused little additional damage. Crop height had a considerable influence on the level of losses. The high clearance machine was less damaging than the conventional tractor, but differences were only substantial in a tall crop. Using the high clearance machine losses were reduced by using existing tramlines in standing crops.

Harvesting Techniques

Six years trials have shown that choice of harvesting technique must take account of the exposure of the site to winds. Whilst results in calm years at High Mowthorpe (Yorks) have been very similar to those at Boxworth (Cambs) and Bridgets (Hants) EHFs, and in Eastern Region (Norfolk), they have been dramatically different in windy years. Winds exceeding 11 knots during the period between the date of swathing and combining have resulted in pod shatter and seed losses in all standing crops. The desiccant Reglone (diquat) worsened this tendency, but there were few differences between Roundup (glyphosate), direct combined or Spodnam DC (di-l-p-menthene) treatments. Swathing resulted in yield bonuses averaging 0.95 t/ha over Reglone treatment in windy years, and even in the wet harvest of 1985 did not result in chitting of seed.

Delaying harvest until 2 weeks after the usual timing for swathed or desiccated crops (seed at 15 percent moisture content/85 percent dry matter) resulted only in slight further losses despite continuing high winds in 1985. Analysis of meteorological data for north eastern England suggests that approximately half the area of OSR in the region is exposed to these winds. The long term weather records show that at High Mowthorpe EHF 11 knot winds occur during the swathing to combining period in one year in three, on average.

Time of Swathing

Two years trials show that the optimum time to swath is closely linked to crop growth stage, as defined by seed colour. In both years maximum or near maximum yield was achieved at all swathing dates where seed in the bottom pods was brown, in middle pods was reddish brown, some green, and in top pods was green, turning brown (GS 6,5, Sylvester-Bradley). Swathing before this crop stage resulted in lower yields and oil contents. Swathing after this crop stage resulted in lower yields due to pod shatter and seed losses during swathing.

Mr D. Morgan, Department of Applied Biology, University of Cambridge, Pembroke Street, Cambridge, is working on analysis of the factors that regulate seed numbers per pod in spring rape. This involves a detailed study of ovule numbers, pollination, fertilisation and early pod development in flowers and pods throughout the plant. He is also analysing the factors that regulate the growth, development, senescence and shattering of pods. Particular emphasis is placed on the role of plant growth substances and a paper on the influence of auxins on pod senescence and shattering is in the press.

Dr P.J.W. Lutman, Long Ashton Research Station, Long Ashton, Bristol BS18 9AF, reports that research into weed control in oilseed rape over the last three years has concentrated on the effects of weeds on the growth and yield of oilseed rape. Some work on the tolerance of rape to herbicides and on the control of cleavers (*Galium aparine*) has also been done. The results from the competition studies indicate that, despite dramatic reductions in crop growth in the autumn, final seed yield is often unaffected by weed competition. It appears that the crop is able to compensate for poor autumn growth during the following spring and summer. The later the crop is drilled, the greater the effects of weeds. As a result of this work, the need for very early weed control is being questioned. Further detailed work on the recovery of the crop from growth inhibition caused by weeds is in progress.

Bayer UK Ltd, Agrochem Division, Eastern Way, Bury St Edmunds, Suffolk IP32 7AH (Mr T.J. Martin) are continuing their work with RSW 0411, a growth regulator (see bibliography, Hack *et al.* 1985) and will be examining the role of new fungicides on oilseed rape.

Collaborative work on nematode problems affecting oilseed rape is in progress between Dr K Evans, Rothamsted Experimental Station and Dr G.W. Storey, Luton College of Higher Education, Park Square, Luton LU1 3JU. Germplasm has been screened for resistance to the brassica cyst nematode, *Heterodera cruciferae*, and to the beet cyst nematode, *H. schachtii* while the development of the brassica cyst nematode on oilseed rape plants has been studied and the effects of nematicides determined in the field (see bibliography).

Product Uses

MAFF data was supplied by Dr R.V. Crawford, Bibby Edible Oils Ltd, Liverpool. A total of 640,000 tonnes of rapeseed was crushed in the UK in 1985; this was half of the total oilseeds crushed - 1,280,000 tonnes. 217,000 tonnes of refined deodorised rapeseed oil was produced compared with a total of 661,000 tonnes of refined vegetable oils. The total edible oils/fats refined was 1,001,000 tonnes. Thus rapeseed oil was 33 percent of the total vegetable oils refined and 22 percent of total oils and fats refined. In addition 52,000 tonnes of refined rapeseed oil was imported from Europe. Adding this to the UK production of refined rapeseed oil would give a total usage of refined rapeseed oil of 269,000 tonnes, about 25 percent of the total supply of refined edible oils and fats.

The eating quality of pork from pigs, fed on low glucosinolate rapeseed meal, was not adversely affected at feeding levels likely to be used in commercial practice. This conclusion was reached by Dr T.L.J. Lawrence, University of Liverpool, Veterinary Field Station, Leahurst, Neston, Wirral L64 7TE, in collaboration with Dr E. Dransfield and colleagues at the Meat Research Institute, Bristol. Castrate and gilt pigs were raised to 90 kg liveweight on diets containing rapeseed meal, up to a level where 64 percent of the crude protein content was derived from low glucosinolate rape meal from the Canadian variety, Tower.

Mr R. Smithard, Department of Agricultural Biochemistry and Nutrition, Faculty of Agriculture, University of Newcastle Upon Tyne NE1 7RU, reported that in studying ways of treating rapeseed, one treatment, not an extraction, brought about a 30 percent reduction in glucosinolates as measured by Heaney and Fenwick's microcolumn method or by HPLC of desulphoglucosinolates. It is not yet known whether this treatment has any effect on nutritional value.