# Some Information About Oil Crop Cultivation in Sweden

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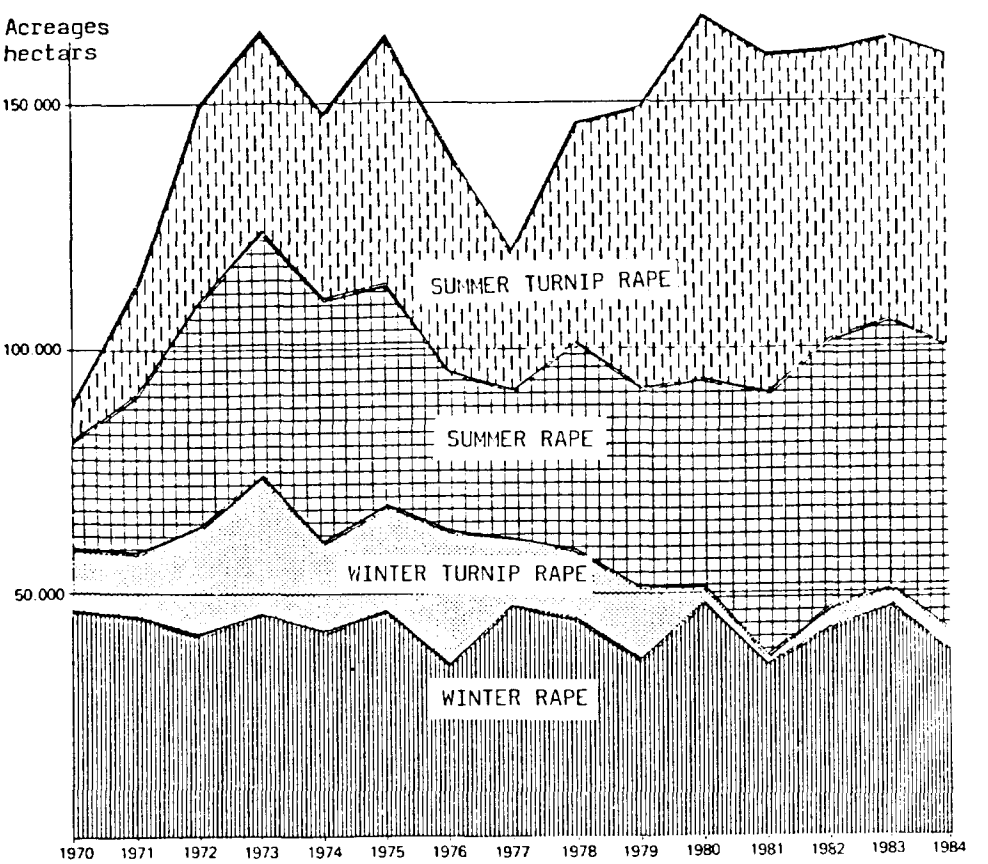
## Cultivated acreage and yield

The Swedish oil crop acreage has varied around 160.000 hectares during the last decade with a marked drop only in 1977 (Fig. 1). The harvested acreages in 1983 and 1984 are given in Table 1. The drop in the winter rape and winter turnip rape acreage in 1984 was caused by bad sowing conditions in the autumn of 1983 and severe damage during the following winter. The data given for 1985 are of course preliminary but the acreages of winter-sown crops have been reduced by about 7 per cent due to winter damage. Please note, however, the increased acreage of double low summer rape to more than 90 per cent of this crop's acreage in 1985.

Fig. 1 – The acreages of the different Swedish oil crops during the period 1970-1984



A survey of seed yields and oil contents of different Swedish oil crops in 1983 and 1984 is given in Table 2. The seed yield figures have been adjusted to a water content of 18 per cent, this level being the basis for the payment to the farmers. The oil content is given as per of dry matter. The farmers' price for seed with a low erucic acid content and a normal glucosinolate content was in 1984 2:50 Swedish crowns per kg at a water content of 18 per cent and an oil content of 45 per cent of the dry matter. In 1983 the double low cultivars yielded 4 per cent lower than the low erucic acid cultivar Niklas. However, the results of all the practical farm cultivations in 1984 showed that the double low cultivars Topas and Hanna outyielded the single low Niklas by 3 per cent. This depended, at least partly, on less severe attacks of *Sclerotinia* on the double low cultivars Topas and Hanna than on Niklas.

Table 1 – Oil crop cultivation in Sweden during the period 1983-1985

| Cultivated crops | Hectars | | |
|---|---|---|---|
| | 1983 | 1984 | 1985 |
| Winter rape | 47.700 | 38.000 | 51.000 |
| Winter turnip rape | 3.600 | 500 | 2.000 |
| Summer rape, 0-type | 44.900 | 26.800 | 4.000 |
| " " 00-type | 10.400 | 36.700 | 42.000 |
| Summer turnip rape | 56.300 | 61.000 | 65.000 |
| Total sum | 162.900 | 163.000 | 164.000 |

Table 2 – Average yields for Swedish oil crops in 1983 and 1984

| Cultivated crops | Seed yield kgs/ha | | Oil content % of dry mat. | | Chlorophyll content ppm | |
|---|---|---|---|---|---|---|
| | 1983 | 1984 | 1983 | 1984 | 1983 | 1984 |
| Winter rape | 3.190 | 3.150 | 45.8 | 45.1 | 26 | 17 |
| Winter turnip rape | 2.160 | 1.900 | 45.5 | 46.8 | 14 | 18 |
| Summer rape, 0-type | 1.960 | 2.100 | 46.0 | 44.7 | 12 | 17 |
| " " 00-type | 1.850 | 2.110 | 46.8 | 45.7 | 15 | 18 |
| Summer turnip rape | 1.680 | 1.930 | 44.9 | 44.4 | 7 | 11 |

Table 3 – Cultivars of oil crops cultivated in Sweden in 1985 (from a compilation of official results prepared by A. Bengtsson)

| Cultivars | Type | Oil yield | | Winter hardiness | Stalk stiffness |
|---|---|---|---|---|---|
| | | Kgs/ha | Rel. value | | |
| *Winter rape :* | | | | | |
| Sv Jupiter | 0 | 1.230 | **100** | 85 | 59 |
| WW Emil | 0 | | 91 | – 7 | + 6 |
| Ring. Jet Neuf | 0 | | 98 | – 5 | + 18 |
| *Winter turnip rape :* | | | | | |
| Sv Rapido III | | 850 | **100** | 87 | 65 |
| Sv Per | 0 | | 100 | – 2 | + 6 |
| | | | | Days to ripening | |
| *Spring rape :* | | | | | |
| Sv Niklas | 0 | 900 | **100** | 131 | 71 |
| Sv Topas | 00 | | 94 | ± 0 | + 3 |
| WW Hanna | 00 | | 96 | + 1 | – 4 |
| *Spring turnip rape :* | | | | | |
| Sv Tyko | 0 | 800 | **100** | 108 | 58 |
| WW Emma | 0 | | 98 | – 1 | ± 0 |

The dominating cultivar of winter rape is clearly Svalöf's Jupiter. Compared to other cultivars marketed in Sweden, Jupiter has the highest mean oil yield and the best winter hardiness (Table 3). This has been very effectively demonstrated in the trials during the last winter. In the southern part of Scania, which in general has a mild winter, the lodging resistant French cultivar Jet Neuf can be used.

This year the most frequently cultivated spring rape cultivars are Topas from Svalöf and Hanna from Weibulls. Based on an average of trials grown in several years, the oil yield of the double low cultivars is 4-6 per cent lower than that of the formerly most cultivated single low cultivar Niklas.

The cultivars of spring turnip rape are Svalöf's Tyko and Weibull's Emma, both with normal glucosinolate content.

### Double low cultivars of summer rape

In order to stimulate the cultivation of double low cultivars of summer rape the farmers price for seed of such cultivars has been set higher than that for seed of single low cultivars (Table 4). To be characterized as a double low cultivar the glucosinolate content in the defatted meal must not exceed 30 micromoles. In Sweden the seed used for planting may not have a higher glucosinolate content than 20 micromoles, when analysed according to the gaschromatographic sulphatase method. On the other hand, seed produced for oil production has been paid as a double low, even if the glucosinolate content has been as high as 40 micromoles during the introduction stage. The glucosinolate content is controlled in the harvest from all farmers cultivating double low cultivars. In 1983 the average glucosinolate content in the harvested seed was 32 micromoles, in 1984, however, not more than 19 micromoles.

Table 4 – The prices set on single and double low spring rape seed in Sweden

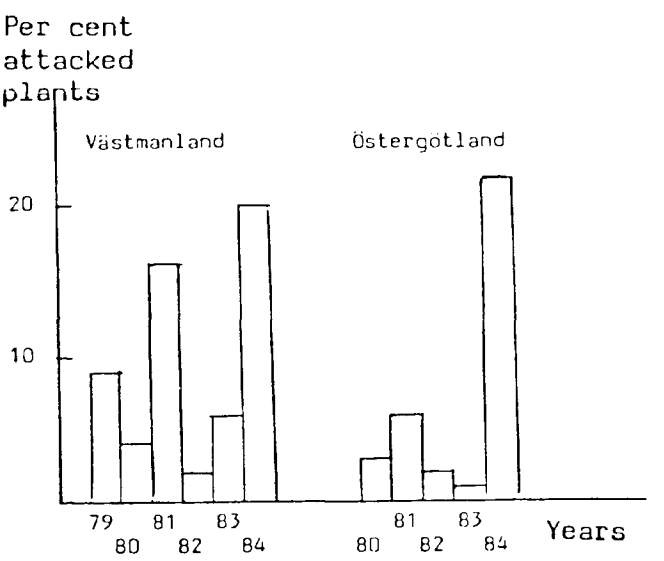
| Year | Price per kg in Swedish crowns | | Price difference in crowns |
|---|---|---|---|
| | 0-type | 00-type | |
| 1983 | 2:32 | 2:47 | + 0.15 |
| 1984 | 2:50 | 2:70 | + 0.20 |
| 1985 | | | + 0.15 |

In order to get a view of the stability of the double low cultivars the glucosinolate content has been analysed in the seed used for sowing as well as in the harvest from the observation plots performed at the Swedish Seed Testing Institute in a field free from volunteer plants. The analyses of the glucosinolate content have been performed with the gaschromatographic method. The average glucosinolate content of 28 pairs of analyses has been 12 micromoles both in the seed used for sowing and in the harvested seed samples. So, in Sweden marketed cultivars of spring rape have a low, stable glucosinolate content. An increased glucosinolate content in the harvested seed must therefore depend on volunteer plants or intermixtures of cultivars with a high glucosinolate content.

### Diseases

The most harmful fungal parasites attacking oil crops in Sweden are *Sclerotinia, Verticillium, Phoma* and *Plasmodiophora.* The attacks from these parasites have shown a tendency to increase during the last decades. The frequency of attacks of the different diseases have been investigated by the Swedish Oil Plant Growers Association in connection with the department of Plant and Forest Protection at the Swedish University of Agricultural Sciences. Naturally the extent of the attacks varies between areas and between years. Fig. 2 illustrates the attacks of *Sclerotinia sclerotiorum* in two different areas in the year period from 1979-1984. The attacks were particularly severe in 1984. Within areas, with an average of 20 per cent attacked plants, there are quite a number of fields to be found where more than half of the plants have been attacked. There is a wide variation in degree of attack between different fields even within a comparatively restricted

Fig. 2 – Attacks of *Sclerotinia* in two areas during different years



area, which is shown in Table 5. Differences in crop rotation might have had a decisive influence on the degree of attack in these cases. By collecting data regarding cultivation practices for different fields there might be a possibility to find the connections between different cultivation practices and disease attacks.

Good effects can be obtained against *Sclerotinia* by spraying with 1.5 litres of Ronilan per hectare when the rape field is flowering (Table 6).

During the strong *Sclerotinia* attacks in 1984 the treatment with Ronilan resulted in a yield increase of 450 kg seed per hectare. With a seed price of 2:50 crowns/kg this represents an increased income of 1,125 crowns/ha. The Ronilan treatment, including the costs for the chemical preparate and for the spraying, and taking into consideration the damage caused in the field in connection with the spraying, can be calculated to a cost of around 700:crowns/ha. In fields with strong attacks in 1984 the Ronilan treatment would have been profitable. The attacks are, however, not so severe that a routine spraying can be recommended. An important task for the Institute for Plant and Forest Protection is therefore to prepare a prognosis system which can be the basis for an advisory service to the farmers regarding the expected attacks of *Sclerotinia*.

In 1984 the attacks of *Sclerotinia* were more severe on Niklas than on Hanna and Topas. It is not definitely proved if these differences depend on real differences in resistance, but we hope that it will be possible to select at least less susceptible cultivars.

Table 5 – The development of attacks of *Sclerotinia* in different fields of spring rape in 1984

| Field number | Per cent attacked plants | | | |
|---|---|---|---|---|
| | 20/7 | 26/7 | 1/8 | 15/8 |
| 1 | 2 | 9 | 10 | 25 |
| 2 | 2 | 5 | 8 | 6 |
| 3 | 0 | 0 | 0 | 1 |
| 4 | 0 | 0 | 0 | 1 |
| 5 | 4 | 6 | 8 | 9 |
| 6 | 16 | 26 | 27 | 25 |
| 7 | 11 | 10 | 15 | 24 |
| 8 | 5 | 14 | 13 | 11 |
| 9 | 4 | 9 | 11 | 15 |
| 10 | 1 | 6 | 9 | 6 |
| 11 | 21 | 25 | 26 | 26 |
| 12 | 2 | 0 | 0 | 2 |
| Mean value | 5.6 | 9.2 | 10.6 | 12.6 |

Table 6 – The effects of Ronilan treatment in summer rape in 1983 and 1984

| | 1983 8 trials | | 1984 10 trials | |
|---|---|---|---|---|
| | Untreated | Treated with Ronilan | Untreated | Treated with Ronilan |
| Seed yield, kgs/ha | 2.210 | 2.250 | 2.440 | 2.890 |
| " " rel. value | **100** | 102 | **100** | 118 |
| Oil yield, kgs/ha | 884 | 895 | 961 | 1.149 |
| " " rel. value | **100** | 101 | **100** | 120 |
| *Sclerotinia* attacks in % | 2 | 0 | 25 | 2 |

*Verticillium dahliae* is most common in Scania and the western part of Östergötland, where an intense oil crop cultivation has been going on for a long time. The fungus causes premature ripeness of the attacked plants. The chemicals so far tested have not been effective against *Verticillium*. As is evident from Table 7 there are clear cultivar differences in resistance against *Verticillium*.

Table 7 – Cultivar differences regarding *Verticillium* resistance. One trial in 1984

| Cultivar | Verticillium attacks in % |
|---|---|
| Jupiter | 30 |
| Emil | 28 |
| Jet Neuf | 35 |
| Elvira | 66 |
| WW 948 | 6 |

In certain years, root injuries have been a problem in winter oil seed crops. An investigation was carried out during 1983 at the department for Plant and Forest Protection, in order to investigate the present situation and the causes of these root injuries. The results from agar test showed that 82 per cent of the plants with the discolouration in the hypocotyls and roots were infected by *Verticillium dahliae*. The results from the field studies indicate that the fungus infects the plants already in the autumn and that the number of infected plants increases during the growing season.

*Phoma lingam* is spread in a relatively low frequency in the oil crop fields in whole Sweden, but the fungus does not cause the same severe damage in Sweden as in many other parts of Europe. This depends probably partly on differences in aggressiveness between different isolates of the fungus and the Swedish form seems to be less aggressive. Since we have a close association between damage by *Phoma* and attacks for instance of flea beetles or cabbage stem weevils, the weaker attacks of Phoma in Sweden may also depend on fewer attacks by larvae of these insects. There are clear differences in resistance between cultivars and the relatively good resistance of Jet Neuf is well known.

*Plasmodiophora brassicae* is most common in western Sweden, where the fungus renders rape cultivation impossible in many fields. Resistance breeding is under way, but no resistant cultivars are so far available for cultivation. The Oil Plant Growers Association financially supports the *Plasmodiophora* investigations being performed at the department of Crop Genetics and Breeding at the Agricultural University in Svalöv. At this institute Mats Gustafsson and Thomas Bryngelsson have been able to prove an exchange of DNA-material between the host plant and the fungus. It is most likely that the fungus has acquired the satellite DNA from the host, as it probably has been a selective advantage for the fungus to include the satellite DNA during its evolution. To our knowledge, this is the first time that exchange of genetic material between two eukaryotic, unrelated organisms has been observed and this is certainly a challenge to a still deeper understanding of the host-parasite interaction.