

CULTIVATION TECHNIQUE IN RAPE AND TURNIP RAPE

(A survey of results of investigations at the Department of Plant Husbandry)

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INTRODUCTION

The cultivation of oil crops was negligible in Sweden before World War II, mainly because of problems with parasites and great losses at harvest when using binders but naturally also because of the fact that vegetable oils could be easily imported. During wartime the cultivation increased owing to imports of oils almost completely ceasing. After the war, when vegetable oils again could be imported from abroad the farmers had access to chemicals for control of oil crop parasites and the number of combines, more or less necessary for a successful oil seed production, increased rapidly in suitable areas of Sweden. The situation for oil crop cultivation in Sweden obviously was different to the pre-war situation.

During the war and some years after, different species of interest for oil seed production in Sweden (winter rape, winter turnip rape, spring rape, spring turnip rape, white mustard) were tested and developed but after some years rape and turnip rape dominated Swedish oil crops. Spring sown as well as autumn sown types were cultivated. Cultivation of the two species and the two types of the species within the same area caused however problems with parasites. For that reason and because of the higher yielding capacity of the autumn sown types, these soon dominated Swedish oil crops during a period up to the late 1960s' with winter rape especially in the south and winter turnip rape in the northern part of the area suitable for oil crop cultivation in Sweden. Over the last ten years the cultivation of spring sown oil crops (flax, safflower, sunflower, camelina and crambe, brown mustard, poppy) has increased considerably mainly in the northern part of the oil crop area, where there have been problems with the overwintering of autumn sown oil crops. The cultivation of spring sown oil crops has now reached such proportions that we must again expect increasing problems with parasites where spring sown and autumn sown types are cultivated within the same areas.

The interest in oil crops shown by Swedish farmers depends on the normally very good effect the oil crops have as break crops in the cereal dominated crop rotations of many areas in Sweden. The good effect has been clearly demonstrated in experiments at the Department of Plant Husbandry at the Swedish University of Agricultural Sciences (Table 1).

As oil crops thus may be regarded as new crops for Sweden there was very little known about cultivation techniques for oil crops under Swedish conditions 30 years ago. Great efforts have however been made in many places to make oil crop cultivation more reliable, and the efforts have been very successful.

Among investigations carried out at the Department of Plant Husbandry can be mentioned; testing of different prospective species for oil production, official variety testing, studies of the hardiness and winter survival of winter rape and winter turnip rape in relation to growth habit, seeding time, seed amount and row spacings. The increase of the cultivation of spring rape and spring turnip rape that started ten years ago was to a great extent a result of very important investigations and experiments

concerning the best seeding time, seed amount, row spacings, harvesting time and harvesting technique for the spring sown oil crops. The right combination of these factors has made the oil crops much more competitive with other crops because of the effects on quantity as well as quality of the yield.

In the following will be given some examples of results from the above mentioned activities and investigations at the Department of Plant Husbandry.

TABLE 1

YIELD OF DIFFERENT CROPS AFTER SPRING RAPE OR SPRING TURNIP RAPE AS PRECEDING CROPS

Crops	Preceding crop	Yield rel. values
Winter wheat	Winter wheat	100
"-	Spring rape or turnip rape	126 1)
Spring wheat	Spring wheat	100
"-	Spring rape or turnip rape	142 2)
		121 3)
		111 4)
Barley	Barley	100
"	Spring rape or turnip rape	110 5)
		111 6)

- 1) Average of 31 experiments in Götaland and Svealand
- 2) Average of 7 experiments in south Sweden on fields infested with Heterodera avenae
- 3) Average of 14 experiments in south Sweden on fields not infested with Heterodera avenae
- 4) Average of 12 experiments in Middle Sweden
- 5) Average of 12 experiments on light soils in south Sweden
- 6) Average of 17 experiments on medium heavy soils in Middle Sweden.

SPECIES

As already mentioned different prospective species were tested during the nineteen forties. Besides rape and turnip rape also white and brown mustard, safflower, camelina, crambe, sunflower, poppy and flax were tested. Most of the tested species were very soon found to be of little interest at that time under Swedish conditions and rape and turnip rape came to dominate the Swedish oil crop cultivation. Flax was however cultivated to the middle of the sixties and white mustard has been cultivated to varying extent up till today. During the last few years investigations have again been performed with the intention to introduce sunflower, poppy, flax and crambe among crops cultivated in Sweden.

OFFICIAL VARIETY TESTING

The Department of Plant Husbandry is responsible for the official variety testing. New varieties are normally tested during a 3 year period in different areas of Sweden before it is decided if the new variety can be accepted or not for the Swedish market. Quantity and quality of the yield are determined but also a number of important agronomic characters. For winter rape and winter turnip rape the overwintering capacity is of great importance.

HARDINESS AND WINTER SURVIVAL

As oil crops are relatively new crops for Sweden it has been important to get a better adapted material for cultivation than was available from the beginning. The breeders have also been very successful in that connection, but the influence of the cultivation technique is still very important for e.g. the overwintering of the fall sown oil crops. Important investigations were performed at the Department of Plant Husbandry during the nineteen fifties. (For details see Torssell, Bengt: Hardiness and Survival of Winter Rape and Winter Turnip Rape. - Växtodling 15. Uppsala 1959.) The figures in Table 2 can illustrate the great damages to the fall sown oil crops during the overwintering period in comparison with those for winter wheat.

TABLE 2

HARVESTED ACREAGE OF WINTER RAPE, WINTER TURNIP RAPE AND WINTER WHEAT IN SWEDEN DURING THE PERIOD 1945/46 - 1969/70 IN PER CENT OF ACREAGE SOWN

Winter rape	82 %
variation between years	16-99
variation between counties	55-91
Winter turnip rape	68 %
variation between years	18-94
variation between counties	42-84
Winter wheat	93 %
variation between years	74-100
variation between counties	87-97

DATE OF SOWING

The date of sowing is of great importance for a good result also when cultivating oil crops. The influence of seeding time is demonstrated by the figures in Table 3. As can be seen from the figures rape is much more susceptible to late sowing than turnip rape.

TABLE 3

EFFECT OF DATE OF SOWING ON YIELD OF CRUDE FAT

Date of sowing	Crude fat	
	Content, % of DM	Yield, rel. values
Winter rape (Östergötland)		
Aug. 10	44.3	100
Aug. 20	44.2	81
Sept. 1	38.0	34
Winter turnip rape (Östergötland)		
Aug. 10	44.9	100
Aug. 20	45.4	91
Sept. 1	44.4	80
Spring rape		
Early sowing	40.5	100
2 weeks later	39.4	78
4 weeks later	38.1	53
Spring turnip rape (Central Sweden)		
Early sowing	41.1	100
2 weeks later	40.8	84
4 weeks later	40.6	62

ROW SPACE

From very detailed investigations it is obvious that there can be a great influence of the row spacing on the quantity and quality of the yield of oil crops. The effect can be illustrated by the figures in Table 4.

The effect of the row space is greater in the northern districts where oil crops can be grown in Sweden, and it is especially valid for winter turnip rape and the spring sown oil crops. See Table 5.

There is also an interaction between row space and date of sowing. At late sowing narrow row spaces are more superior to the wider ones.

TABLE 4

EFFECT OF ROW SPACING ON YIELD AND SEED QUALITY OF WINTER RAPE (1969-1977),
SPRING RAPE (1969-1973) and spring turnip rape (1969-1973)

	Row space, cm		
	12	24	48
Winter rape			
Crude fat, % of DM	44.5	-	44.5
yield, rel. values	101	-	100
Chlorophyll content, ppm	25	-	26
Spring rape			
Crude fat, % of DM	45.5	45.3	44.8
yield, rel. values	114	109	100
Chlorophyll content, ppm	35	35	42
Spring turnip rape			
Crude fat, % of DM	43.0	42.7	42.1
yield, rel. values	120	112	100
Chlorophyll content, ppm	30	32	33

TABLE 5

EFFECT OF ROW SPACING ON YIELD OF WINTER RAPE AND WINTER TURNIP RAPE
IN DIFFERENT AREAS OF SWEDEN

	Row space, cm		
	12	24	48
Winter rape			
Malmöhus län	96	97	100
Södra Götaland (M. län excluded)	98	100	100
Norra Götaland	103	103	100
Winter turnip rape			
Södra Götaland	108	105	100
Norra Götaland	109	103	100
Svealand (Central Sweden)	119	115	100

SEED RATE

As expected the seed rate also has a great influence on the yield of the oil crops. There is also an interaction between seed rate and row space as can be seen from Table 6 which gives as figures from investigations with spring rape and spring turnip rape. The effects have been much greater in the eastern districts of Sweden than in the western districts.

TABLE 6

EFFECT OF SEED RATE AND ROW SPACING ON YIELD OF CRUDE FAT.
REL. VALUES

Seed rate	Row space, cm			Mean
	12	24	48	
Spring rape				
5	108	106	100	100
10	117	111	102	105
20	116	111	98	103
Mean	114	109	100	
Spring turnip rape				
4	116	110	100	100
8	122	113	101	103
16	119	111	97	100
Mean	120	112	100	

HARVESTING TIME AND HARVESTING METHOD

Both the crude fat content of the seed and the seed size have reached their maxima already at relatively early stages of ripeness. To avoid scattering - especially in the south of Sweden - the farmers normally thresh their oil crops after swathing. By doing so they also reduce the chlorophyll content of the oil and the content of free fatty acids but they can also cause a reduction of the fat content of the seeds as the fat is broken down when the crop is lying in the field before threshing.

CLOSING REMARKS

Results from many weed control experiments at the Department of Plant Husbandry have also been very important for making oil crop cultivation possible and profitable in Sweden. Such investigations are going to be presented at the conference by statsagronom Birger Granström and försöksledare Gunnar Gummesson.

The cultivation technique is also important when changing from cultivating varieties with high erucic acid content to varieties with a very low content or no erucic acid at all. Results from such an investigation are presented at the conference by statsagronom Anders Bengtsson, docent Ingvar Ohlsson and agronom Ingemar Tegnell.

The figures just presented in this paper are only a few examples of results from investigations concerning cultivation technique performed at the Department of Plant Husbandry at the University of Agricultural

Sciences, Uppsala during the last 40 years. But I think they are enough to demonstrate the wide field of activities at the department and the importance of the cultivation technique for reaching a good result when cultivating oil crops. The different investigations discussed have in detail been presented in many publications mainly by statsagronom Anders Bengtsson and docent Ingvar Ohlsson at the experimental division for crop production on arable land at the department.