STUDY ON CULTIVATION OF WINTER RAPE IN THE MONOCULTURE

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Winter rape requires a relatively early sowing. In this connection the list of crops after which rape can be sown in a well-prepared seedbed, at observance of the agrotechnical sowing date, is poor.

The crop production intensification eliminates from cultivation some crops harvested at earlier dates. Other crops, instead, abandon the field later, due to application of high nitrogen fertilization rates and to the combines harvest. In this connection there are troubles with an appropriate preparation of the seedbed and sowing of seeds at an optimum date, what is just one of the basic factors of high yields of good quality. It created the necessity to verify in exact experiments the response of rape to the cultivation in the monoculture.

The respective investigations were started on the experimental field of the Warsaw Agricultural University at Chylice. In the period 1960-1974 the two-factor experiment was carried out, in which :

- the 1st factor was the rape cultivation system/in monoculture, in the 3-field crop rotation/,
- the 2nd factor was the fertilization applied every year / 1. unfertilized control, 2. farmyard manure 40 $t.ha^{-1}$, 3. farmyard manure 20 $t.ha^{-1}$, 4. mineral fertilization : N-120, P_2O_5-120, K_2O-160 $kg.ha^{-1}$, 5. mixed organic-mineral fertilization : 20 t of farmyard manure + 1/2 NPK/.

The experiment was established by the method of randomized blocks /cultivation system/ with subblocks/fertilization/ in 4 replications. The size of plots for harvest - 18 m^2.

Soil in the experiment consisted of heavy loamy sand underlain with light boulder loam. The arable layer thickness was 30-35 cm, the content of total N - 0.16%, of organic C - 1.55% of P_2O_5 - 10 mg and K_2O / the Egner-Riehm method/ - 8 mg per 100 g of soil, pH in KCl - 6.1, hydrolytic acidity - 5.4 m.e., sum of bases - 18.5 m.e. per 100 g of soil /the Kappen's method/.

Rape was sown over the whole area of the experiment in 1965, 1968 and 1971, i.e. in the 5th, 8th and 11th year of its duration and at that time the investigations were carried out.

Particular years of the investigations differed with the amount and distribution of atmospheric precipitations and the values of air temperature, the climatic conditions being optimum in not any case.

Fertilization	Rape cultivation system	Years		
		1965	1968	1981
1. Control	z	1.23	0.70	0.67
	m	1.46	0.78	0.61
2. Farmyard manure 40 t ..	z	2.23	1.52	1.72
	m	2.13	1.62	1.42
3. Farmyard manure 20 t ..	z	1.70	1.10	1.48
	m	1.85	1.22	0.90
4. NPK /120, 120, 160 /	z	2.69	1.76	2.19
	m	2.61	1.74	2.08
5. Mixed /farm. man 20 t + 1/2 NPK /	z	2.43	1.42	1.82
	m	2.45	1.56	1.76
LSD		n.s.	n.s.	0.12
Mean	z	2.07	1.30	1.58
	m	2.10	1.36	1.31
LSD		n.s.	n.s.	

Table 1 : Seed yields of winter rape cultivated in the crop rotation and in the monoculture, depending on fertilization /t.ha^{-1} /.

Remark : z – crop rotation ; m – monoculture

The yields obtained /table 1/ prove that rape yields maintained in the 5th and 8th year at same level as those cultivated in the monoculture, where as in the 11th year they were distinctly higher, the site value being modified by the fertilization. No differences in the yield quality measured by the weight of 1000 seeds /6.80 g, in 1965, 5.20 g in 1968 and 6.60 g in 1971/, in the per cent of fat /4.7-4.8%/ and of protein /3.2-3.4% of total N/ were found in particular years. At that a tendency to higher accumulation of the latter in seeds of rape cultivated in the monoculture was observed in every year.

In the growing season measurements of the number of plants per 1 m^2 were carried out in autumn and spring as well as the mass of tops and roots of 20 plants was determined. The results obtained proved that the density of plants after sprouting and in spring after hibernation did not depend on any of the factors under study, but, first of all on the weather course at the sprouting time, in winter and early in spring. After sprouting there were, on the average, 110 plants, in spring -92-95 plants in 1965, 70-75 plants in 1968 and 100-105 plants in 1971.

No differences were found, either, in the biomass of 1 plant /Table 2/.

Table-2 : The monoculture or crop rotation effect on the mass of tops and roots of plant in g /1965/.

Growth phase and determination date	Rape cultivation system	Tops		d.m. of roots in the layerte 30 cm
		fresh matter	dry matter	
Rosette - April 15	z	6.3	1.21	2.2
	m	6.7	1.50	2.2
Full flowering - May 5	z	17.0	2.12	4.60
	m	20.0	2.60	4.55
Pod formation start ..	z	35.0	4.00	–
May 19	m	44.0	5.70	

The effect of water extracts of soil taken at the time of the plant mass determination on the germination of seeds was estimated in the laboratory.

The results obtained /Fig. 1/. prove a lack of differences in the size of rootlets and germ treated with water extracts of soil from under the objects under study or from under wheat. Germs and rootlets of seeds germinated in water lengthened distinctly slower. The measurements were carried out in 72 hours after placement of the germinating seeds /when a rootled pierced the seed cover/. No differences were found, either, in the germination of seeds placed from the beginning in water extracts of soil from under the objects under study / rape cultivated in the monoculture, in the crop rotation and soil sown with wheat/.

In 1971, 1972 and 1973 the next cycle of 3 experiments, in which rape was cultivated on field once for 5 years /in the 5-field crop rotation: beets-barley-maple pea-winter rape-winter wheat/ or every 2, 3, 4 and 5 years. The investigations were carried out in the 5th year of the experiment, i.e. in 1976, 1977 and 1978.

The experiment was established by the method of randomized blocks in 3 or 4 replications. The size of plots harvest amounted, depending on the experiment, to 30-50 m^2. The fertilization of rape was equal, amounting to 180 kg N, 100 kg P_2O_5 and 200 kg K_2O per hectare. Soil was the same as in the previous experiment.

Particular years of the investigations differed with the weather course, which affected the level of the yields obtained. No significant differences in the yield magnitude were found in particular years /Table 3/.

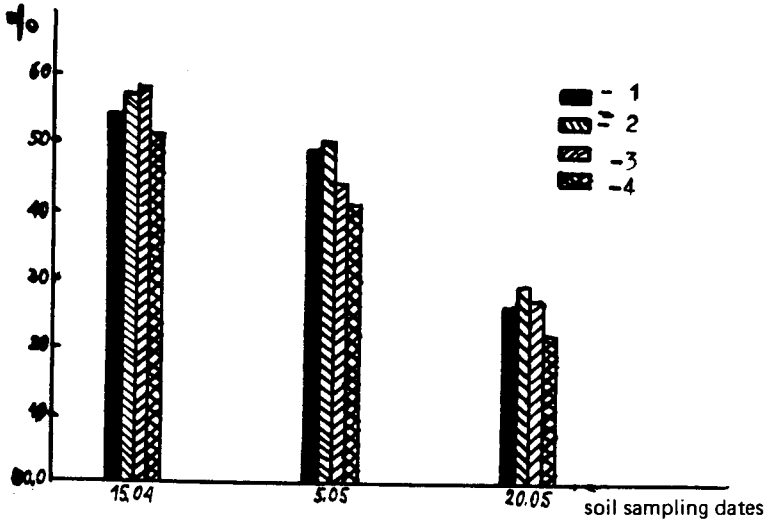

Fig. 1 : Effect of water extract of soil sown with rape /1, 2/ or winter wheat /3/ or in distilled water /4/ per the total length of rootlets and germs of winter rape.

Table-3 : Effect of the rape cultivation years on 1 field on the seed yield /t.ha^{-1} / and on the plant structure at the harvest time/mean for 1976, 1977, 1978 and 1981/.

Rape cultivation years on 1 field	Yield	Structure of 1 plant, air d.m. in g		
		roots	tops	seeds
5 years	2.17	12.6	15.9	4.6
4 years	2.14	12.3	14.7	4.0
3 years	2.14	13.4	14.8	4.2
2 years	2.27	13.5	16.0	4.7
1 year / in the crop rotation	2.37	14.6	18.4	5.3
LSD	n.s.	n.s.	1.8	n.s.

Only a certain tendency to a decrease of yields along with prolongation of the monoculture /cultivation on the same field from 1 year to 5 years/ was observed. The yield structure of 20 plants determined during harvest has proved an appropriate arrangement in all years of the study /Table 3/. Along with prolongation of the monoculture /from 2 to 5 years/ the biomass of 1 plant decreased due to a reduction of the mass of roots, tops and seeds.

The determinations of the density of plants in autumn and spring /Table 4/ proved that the effect of the factor studied depended on the weather conditions. In one year /1978/ better sprouting was found in the monoculture, but the hibernation was worse and the density of plants in spring lower. In the remaining years an opposite arrangement was observed : sprouting was worse, but the hibernation better and the final density of plants higher.

The seed quality estimation proved a lack of differences in the weight of 1000 seeds /5.10-5.60 g/ depending on year and the fat content /48-49%/. On the other hand, differences in the N, P_2O_5 and K_2O content occurred. Their trend was the same in all years of the investigations, and therefore only mean values are presented in Table 5.

The seeds of rape cultivated in the monoculture contained more nitrogen and less phosphorus and potassium.

The investigation results prove clearly that rape can be cultivated in a short-time monoculture without any risk of a decrease of the yield and of worsening of its quality. It was confirmed in the experiments carried out in other Poland's regions. A decrease of yields in the monoculture can be expected only under condition of application of lew fertilization rates and an ineffective weed control. Of that the weediness growth observed under the monoculture conditions can bear evidence /Table 5/.

Table 4 : Effect of the rape cultivation years on 1 field on sprouting and hibernation /plants m^{-1} /

Rape cultivation years on 1 field	Experiment No. and the investigation year							
	2 1977		3 1978		mean		1981	
5 years autumn ...	72		128		100		132	
spring		69		99		84		67
4 years autumn ...	73		128		100		127	
spring		70		92		81		69
3 years autumn ...	76		128		102		125	
spring		72		95		83		65
2 years autumn ...	78		119		99		143	
spring		77		90		83		76
1 year / in autumn crop rot	83		115		99		146	
spring		79		86		82		85

Table 5 : Effect of the rape cultivation years on the chemical composition of seed and the weediness degree in spring. /4-year mean/.

Rape cultivation years on 1 field	tot. N %	P_2O_5 %	K_2O %	d.m. of weeds in g. 1 m^{-2}
5 years	3.96	1.97	0.63	97
4 years	3.75	2.03	0.68	101
3 years	3.76	2.02	0.66	81
2 years	3.71	2.13	0.69	80
1 year /in crop rot /	3.68	2.16	0.72	60
LSD	n.s.	".20	0.07	–