

COMPETITION EFFECT OF SOME WEED SPECIES ON THE YIELD OF WINTER OILSEED RAPE.

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Introduction

Weeding is one of the most important factors determining yield of winter rape. Mostly competitive for winter rape are weed species overgrowing rape plants such as: *Matricaria inodora*, *Anthemis arvensis*, *Galium aparine*, *Centaurea cyanus*, *Apera spica-venti*, *Agropyron repens* and volunteer rye. Less competitive seem to be weed species not overgrowing rape plants. To this group belong the following weed species: *Stellaria media*, *Viola arvensis*, *Veronica* sp., *Lamium* sp., *Capsella bursa-pastoris*. According to Lutman (1984) and Word and Askew (1984) grass weeds, and particularly volunteer cereals are more competitive for rape plants than broad leaf weeds (up to 100 plants per one square meter), except of *Galium aparine*, has no effect on the yield of winter oilseed rape.

In Polish climatic conditions there exist considerable risk of damages on rape plantations as the result of freezing, though the state of rape plants at the beginning of winter period is very important. That is also why early weed control is of high importance. On the plantations, where high number of weeds, especially of volunteer cereals, occurs, rape plants in autumn period are overgrown, their growing point is placed over soil surface being exposed to low temperatures. On damaged plantations, where number of rape plants is reduced as the effect of freezing, weeds in the spring develop very intensively and they are highly competitive for rape plants. This factor is not so high importance in western countries, where the winters are not so severe as in Poland (Lutman, Dixon 1985, Orson 1984, Regnault 1985). Therefore it can be concluded that in Polish climatic conditions all weed species are competitive for rape plants, especially in the case of their mass appearance.

Materials and methods

In 1969-1986 in Agricultural Experimental Station in Winnagóra every year two experiments on weed control in winter rape using new herbicides, were carried out. Experiments were made applying randomized units in 4 or 5 replications on loamy sand soil containing about 1,5% of organic matter. As forecrops cereals (more often rye) or peas were used. Rape was sown in third decade of August in the amount of 6-8 kg of seeds per one ha. The size of plot amounted to 20-30 m². For weed control in separate years various herbicides containing the following active ingredients were applied: trifluralin, TCA, benazolin, metazachlor, tebutam, napropamid, fluazifop-butyl, alloxidum-sodium, sethoxydium, haloxyfop-ethoxyethyl, quizolofop-ethyl, alachlor, 2-chloropicolin acid (DCP), carbetamid, dimefuron, propachlor, dimetachlor. Herbicides were applied in various dosages with knapsack sprayer "SANO" or plot sprayer "GLORIA". In each experiment one plot was untreated and on one plot weeds were controlled by hoeing. Weeding as well as rape plant numerousness were estimated in the spring after the start of vegetation. So high number of experiments (34 during 17 years) carried out in one Experimental Station, where every year 12-16 combinations of herbicides were applied, allowed to chose the plots of various weeding with several weed species. For the analysis such the plots have been included, where one weed species amounted to 90% of the whole weeding. Data obtained are presented in Tables 1-3.

Results

In Polish climatic conditions weeds should be controlled in autumn period. Weeding, particularly with volunteer cereals is a factor determining overgrowing of rape plants, which are more susceptible to freezing. In the region of Great Poland (Wielkopolska) in winter rape plantations the following weed species occur most frequently: *Stellaria media*, *Viola arvensis*, *Veronica persicaria*, *Lamium purpureum*, *Lamium amplexicaule*, *Apera spica-venti*, *Anthemis arvensis*, *Matricaria inodora*, *Capsella bursa-pastoris*, *Centaurea cyanus*, *Papaver rhoeas*, volunteer cereals.

The occurrence of several weed species has different effect on winter rape yield than occurrence of one or two weed species. Results presented in Table 1. show that the occurrence per one m² of up to 40 weed plants belonging to several species had no significant effect on yield

decrease. Over 46 plants per one sq.m. however, considerably influenced yield decrease. Further increase of weeding over 65 plants per 1 sq.m. caused further yield decrease, but increase of weeding up to 100 plants per 1 sq.m. caused considerable yield decrease amounted to 30%.

It has been stated that considerable effect on rape yield was caused by the occurrence of such weed species as *Anthemis arvensis* and *Matricaria inodora* (Table 1) in the cases, where they were predominant weed species (up to 90% of whole weeding). These species germinate just in autumn, they are very aggressive overgrowing rape plants, though their competitive effect is very high. The occurrence of 20-40 plants belonging to these species per one sq.m. decrease rape yield by almost 11%. Further increase of weeding with those species caused considerable decrease of rape yield. The occurrence of 84-100 plants of *Anthemis arvensis* and *Matricaria inodora* per one sq.m. decreased rape yield by 40%, over 100 plants per one sq.m., however - by almost 50%.

In Poland almost 70-80% of winter rape is grown after cereals. One of most frequently used cereal forecrops - is winter rye. If volunteer rye occurs numerously, just in autumn it has negative effect on winter rape development. In the spring volunteer rye overgrown rape plants, though it is highly competitive. The effect of volunteer rye occurrence on winter rape yield is shown in the Table 2. Twenty to forty plants of volunteer rye per 1 sq.m. decreased rape yield by almost 13%. Higher weeding (up to 100 plants per 1 sq.m.) with volunteer rye caused statistically significant yield decrease. Weeding over 100 plants of volunteer rye per 1 m² did not cause further significant yield decrease.

Apera spica-venti is a weed species occurring in winter rape most frequently in the years rich in rainfalls or on the fields with moist soil. This species, similarly to volunteer rye, can overgrow rape plants, the competitive effect for rape is somewhat lower than this of volunteer rye. Data presented in Table 2 show that occurrence of 60 plants per m² of this weed caused the decrease of rape yield by almost 7%, but it was not statistically significant. Occurrence of over 65 plants of *Apera spica-venti* per 1 m², however, significantly decreased winter rape yield. Further development of weeding with this species caused further considerable yield decrease.

Viola arvensis and *Stellaria media* occur very frequently in rape plantations in Great Poland region, but they do not overgrow rape plants, though their competitive effect is not so high. Results pre-

sented in Table 3 show, however, that in the case of mass appearance they may be highly competitive for rape plants. In rape cultures, in general high nitrogen fertilization is applied (in Poland up to 200 kg/ha). Some weed species, in this number also *Viola arvensis* and *Stellaria media*, need high amounts of nitrogen. Though, in the cases of high nitrogen fertilization - these species will be competitive for rape plants. The occurrence of 40 plants of *Viola arvensis* and *Stellaria media* per 1 sq.m. had no effect on the yield of winter rape. Considerable yield decrease has been stated, when over 44 plants of *Viola arvensis* and *Stellaria media* occurred per 1 sq.m. Occurrence of 86-100 plants of these species per 1 sq.m. caused yield decrease by 15 %. Further development of weeding shows, that *Viola arvensis* is more competitive for winter rape than *Stellaria media*.

Conclusion

The results obtained have shown that *Anthemis arvensis*, *Matricaria inodora* and volunteer rye caused the highest yield decrease of winter oilseed rape. In the case of numerous occurrence of *Anthemideae* species or volunteer rye yield decrease amounted to 50 %. The competition effect of grass weeds as *Apera spica-venti* was high but not as high as in the case of above mentioned weeds. The decrease of yield of oilseed rape caused by *Stellaria media* and *Viola arvensis* was not so high but when the occurrence of these weeds was high the yield reduction was as high as 18 %. The competition effect on oilseed rape was higher in the case of *Viola arvensis* than *Stellaria media*.

References

1. Lutman P.J.W. (1984) The effects of weed competition on the growth and yield of oilseed rape. Aspects of Applied Biology 6. Agronomy, physiology, plant breeding and crop protection of oilseed rape 209-220.
2. Lutman P.J.W., Dixon F.L. (1985) The effect of the timing of control of grass weeds on the yield of oilseed rape. Proceedings 1985 British Crop Protection Conference - Weeds 1, 209-216.
3. Orson J.H. (1984) The effects of volunteer cereals in winter oilseed rape. ADAS results. Aspects of Applied Biology 6. Agronomy, physiology, plant breeding and crop protection of oilseed rape 179-184.

4. Regnault Y. (1984) The control of grass weeds in oilseed rape in France. Aspects of Applied Biology 6. Agronomy, physiology, plant breeding and crop protection of oilseed rape 285-290.
5. Ward J.T., Askew M.F. (1984) The control of annual grass and broad-leaved weeds in winter oilseed rape. Aspects of Applied Biology 6. Agronomy, physiology, plant breeding and crop protection of oilseed rape 239-250.

Table 1

EFFECTS OF WEED COMPETITION ON THE YIELD OF WINTER OILSEED RAPE

Weed density/m ²	Different weeds ^{xx} (58-72) ^x		Dominant weeds: Antar, Matin (61-74) ^x	
	yield (t/ha)	yield reduction (%)	yield (t/ha)	yield reduction (%)
0	3,21 a	-	2,87 a	-
20 - 40	3,06 a	4,8	2,56 b	10,8
46 - 60	2,83 b	11,8	2,31 c	19,5
65 - 80	2,65 c	17,4	1,93 d	32,8
84 - 100	2,52 c	21,5	1,72 e	40,1
above 100	2,26 d	29,6	1,46 f	49,1

Yield significantly different at the 95% level.

^x rape population (plants/m²)^{xx} dominant weeds: Steme, Vioar, Verpe, Lampu, Apesv, Antar, Matin, Cency, Capbp, volunteer cereals

Table 2

EFFECT OF VOLUNTEER RYE AND *APERA SPICA-VENTI* COMPETITION ON THE YIELD OF WINTER OILSEED RAPE

Weed density/m ²	Dominat weed volunteer rye (48-62) ^x		Dominat weed Apesv (56-64) ^x	
	yield (t/ha)	yield reduction (%)	yield (t/ha)	yield reduction (%)
0	3,22 a	-	3,06 a	-
20 - 40	2,91 b	12,7	2,98 a	2,6
45 - 60	2,53 c	21,4	2,85 a	6,9
65 - 80	2,26 d	29,8	2,53 b	17,3
86 - 100	1,94 f	39,8	2,25 c	26,5
above 100	1,76 f	45,3	2,03 d	33,7

Yield significantly different at the 95% level

^x rape population (plants/m²)

Table 3

EFFECT OF *VIOLA ARVENSIS* AND *STELLARIA MEDIA* COMPETITION ON THE YIELD OF WINTER OILSEED RAPE

Weed density/m ²	Dominat weed Vioar (52-67) ^x		Dominat weed Steme (57-68) ^x	
	yield (t/ha)	yield reduction (%)	yield (t/ha)	yield reduction (%)
0	3,21 a	-	3,02 a	-
19 - 40	3,03 ab	5,6	2,87 ab	5,0
44 - 60	2,93 bc	8,7	2,76 bc	8,6
65 - 80	2,81 cd	12,5	2,64 cd	12,6
86 - 100	2,73 cd	14,9	2,58 cd	14,7
above 100	2,62 d	18,4	2,55 d	15,6

Yield significantly different at the 95% level

^x rape population (plants/m²)