EARLY COMPETITION BETWEEN OILSEED RAPE AND *CONVOLVULUS ARVENSIS* IN ADDITIVE EXPERIMENTS

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ABSTRACT

Weeds can successfully compete with the cultivated plants, causing considerable reduction in crop quality and quantity. The majority of agricultural competition studies are based on the additive experiments. In the additive experiments two species are grown together, the density of the crop is maintained constant, while that of the weeds species is varied. We have investigated the effect of different weed density of *Convolvulus arvensis* on the early development of oilseed rape under glasshouse conditions. There were four oilseed rape in a pot and the *C. arvensis* densitiy varied between 0 and 10 plants/pot. Seventy days after the beginning of the experiment the biomass production (fresh and dry weight of the shoots) and nutrient uptake (nitrogen, phosphorus, potassium) each of oilseed rape and *C. arvensis* were determined. It was concluded, that the development of the rape plants was faster, as compared to that of the *C. arvensis* seedlings at the beginning of the vegetation period, therefore no considerable interspecific competition between the rape and weed plants was observed. Intraspecific competition between the *C. arvensis* seedlings was stronger, as the weed density increased.

Key words: competition, crop, field bindweed, weed

IZVLEČEK

ZGODNJA TEKMOVALNOST MED OLJNO OGRŠČICO IN NJIVSKIM SLAKOM (*Convolvulus arvensis*) V ADITIVNIH POSKUSIH

Pleveli lahko zelo uspešno tekmujejo z gojenimi rastlinami ter s tem povzročajo precejšnjo izgubo v kakovosti in količini pridelka. Večina raziskav o takšni tekmovalnosti temelji na aditivnih poskusih. V aditivnem poskusu dve rastlinski vrsti rasteta skupaj, gostota glavnega posevka ostaja nespremenjena, medtem ko se le-ta pri plevelih spreminja. V rastlinjaku smo preučevali vpliv različne gostote njivskega slaka na zgodnji razvoj oljne ogrščice. V vsaki posodi so bile štiri rastline oljne ogrščice, medtem ko je bila gostota njivskega slaka od 0 in 10 rastlin/posodo. Šestdeseti dan po nastavitvi poskusa smo izmerili prirast biomase (sveža masa in masa posušenih poganjkov) ter porabo hranil (dušika, fosforja in kalija) pri oljni ogrščici in njivskem slaku. Zaključili smo, da je bil v začetku rasti razvoj oljne ogrščice hitrejši od razvoja njivskega slaka in nismo opazili nobene znatne medvrstne tekmovalnosti. Znotrajvrstna tekmovalnost med sadikami njivskega slaka je naraščala, če se je povečevala gostota plevelov.

Ključne besede: tekmovalnost, pridelek, njivski slak, plevel

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1 INTRODUCTION

Weeds can successfully compete with the cultivated plants, causing considerable reduction in crop quantity and quality. The majority of competition studies between crops and weeds are based on addititve experiments. In these studies two species (crop and weed) are grown together. The density of the crop is maintained constant, while that of the weeds is varied (Varga *et al*. 2006).
Oilseed rape is one of the most important crop in Hungary under field conditions. Basic criteria for oilseed rape production is that fields must be kept free from different pests, pathogens and weeds, with special regards to perennial dicot weeds, because - except mechanical weed control - no convenient technology is available against them in cultures. When no suitable area is chosen for rape production or the weed control of the forecrop does not manage, field bindweed (*Convolvulus arvensis*) can cause problems (Hunyadi et al. 2000). *C. arvensis* is a vining perennial plant with adventitious buds on its root system, reproducing both vegetatively and to a lesser extent by seeds (Weaver and Riley 1982). The aim of our work was to investigate the effect of different weed density of *C. arvensis* seedlings on the early development of oilseed rape.

2 MATERIALS AND METHODS

Pot experiments under glasshouse conditions were set up in order to study early competition betwen oilseed rape and *C. arvensis* in an additive experiment. Plastic pots (45 cm in diameter) were filled with a soil mixture of sand (pH, 6.96; humus, 0.7 %) : peat (pH, 6.78; humus, 9.98 %) in a ratio of 1:1. Seeds of oilseed rape and *C. arvensis* were sown in pots. The following treatments (each in four replicates) were applied:

1. oilseed rape (4 plants pot^{-1})
2. oilseed rape (4 plants pot^{-1}) + *C. arvensis* (2 plants pot^{-1})
3. oilseed rape (4 plants pot^{-1}) + *C. arvensis* (4 plants pot^{-1})
4. oilseed rape (4 plants pot^{-1}) + *C. arvensis* (6 plants pot^{-1})
5. oilseed rape (4 plants pot^{-1}) + *C. arvensis* (8 plants pot^{-1})
6. oilseed rape (4 plants pot^{-1}) + *C. arvensis* (10 plants pot^{-1})

Seventy days after sowing the fresh and dry weight of oilseed rape and *C. arvensis* shoots were measured. The nitrogen (N), phosphorus (P) and potassium (K) content of the shoots were also determined. NPK content was determined after destruction with sulphuric acid by a photometer, while K content was determined by a flame photometer.

3 RESULTS AND DISCUSSIONS

It was demonstrated that oilseed rape seedlings have grown faster than *C. arvensis* seedlings at the beginning of the vegetation period, as can be seen from the data of biomass production (Table 1 and 2).
Fresh and dry weight of oilseed rape plants generally reduced in competition with *C. arvensis*, however, however significant reduction of *C. arvensis* on crop biomass production was observed at higher weed densities (see Tables 1 and 2).
Intraspecific competition between *C. arvensis* seedlings was strong as the weed density increased. Neither fresh nor dry weight of *C. arvensis* shoots in a pot did not change considerably, due to the changing weed density (see Table 1 and 2). Biomass production was the same, when weed density was 4 and 10 plants for a pot.

Table 1. The fresh and dry weight of oilseed rape and *C. arvensis* shoots for a plant

Treatments	Oilseed rape (g plant^{-1})		*C. arvensis* (g plant^{-1})	
	Fresh weight	Dry weight	Fresh weight	Dry weight
1	60.37±6.60	5.95±0.31	-	-
2	63.80±3.05	6.82±0.49	2.67±0.22	0.40±0.14
3	48.95±4.59	5.30±0.56	2.00±0.32	0.34±0.04
4	45.73±9.88	4.93±0.63	1.73±0.09	0.28±0.05
5	42.00±3.87	4.87±0.17	1.22±0.18	0.24±0.03
6	43.82±4.44	4.77±0.49	0.80±0.18	0.14±0.01
$LSD_{5\%}$	9.21	0.74	0.31	0.12

±standard error

Table 2. The fresh and dry weight of oilseed rape and *C. arvensis* shoots for a pot

Treatments	Oilseed rape (g pot^{-1})		*C. arvensis* (g pot^{-1})	
	Fresh weight	Dry weight	Fresh weight	Dry weight
1	241±26	23.8±1.2	-	-
2	255±12	27.3±1.9	5.34±0.42	0.80±0.28
3	197±18	21.2±2.3	8.00±1.30	1.45±0.23
4	183±29	19.7±2.5	10.38±0.57	1.68±0.28
5	168±15	19.5±0.7	9.76±1.51	1.92±0.21
6	175±18	19.0±1.9	8.00±1.82	1.40±0.12
$LSD_{5\%}$	36.6	2.95	1.86	0.38

±standard error

C. arvensis seedlings reduced NPK content of oilseed rape shoots as compared with the weed free control pots, when the nutrients was expressed in the percentage of dry matter content. Similar to the total biomass production, the effect of weed density on the total NPK content in a pot was not so strong (Figure 1). No considerable enhance in the NPK content of *C. arvensis* seedlings in a pot have been observed with the increasing weed density (Figure 2).

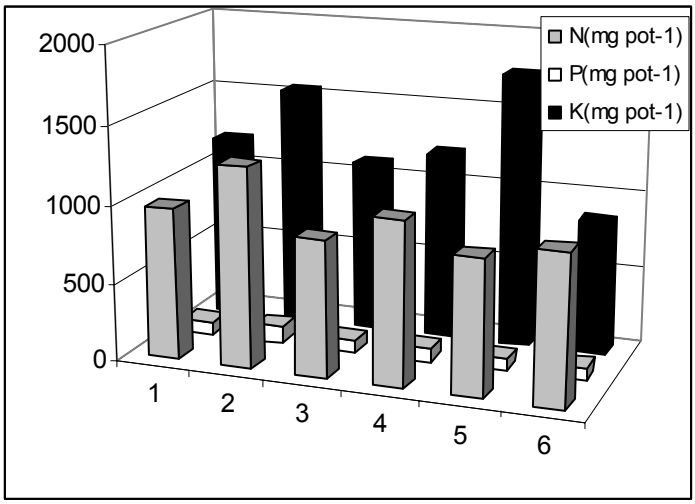

Figure 1. The NPK content of oilseed rape plants due to the treatments

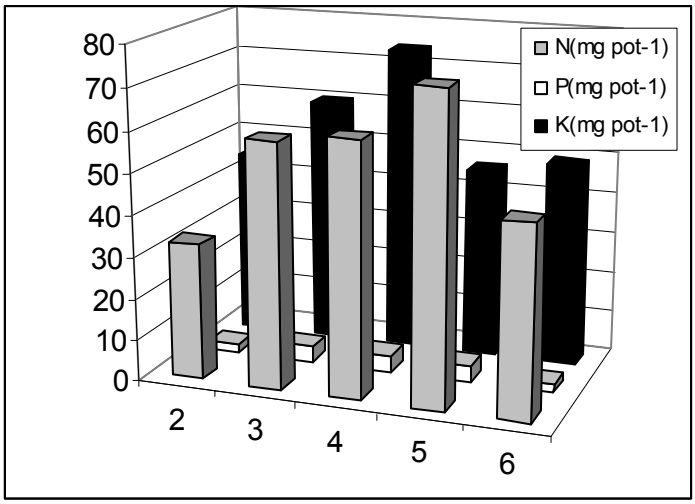

Figure 2. The NPK content of *C. arvensis* plants due to the treatments

4 CONCLUSIONS

Higher biomass and nutrient content of oilseed rape suggest, that its development is faster at the beginning of the vegetation period than that of *C. arvensis* seedlings. Competitive ability of *C. arvensis* is due largely to its extensive root system. Vegetative underground parts have a large amount of food reserves, as compared to that of seeds, therefore shoots sprouted from adventitious buds have more considerable competitive ability, than plants developed from seeds (Holm *et al*. 1977). Nevertheless *C. arvensis* seedlings succesfully compete with oilseed rape plants, as it can be seen from biomass production and nutrient content data. Competition for the nitrogen is especially strong similar to the results of the other authors (Berzsenyi and Lap 2005, Kovačević *et al*. 2006, Németh 2006). Beside interspecific competiton between crop and *C. arvensis*, intraspecific one between *C. arvensis* seedlings was also strong. Intraspecific competition between weed plants may be stronger than interspecific competition between crops and weeds (Kovács *et al*. 2006, Kazinczi *et al*. 2007).

More detailed and exact conclusions could be obtained from the results of field competiton studies, where the development both of the weeds and crops are observed during the whole vegetation period and yield data are also available (Varga *et al*. 2006). The effect of weed density on yield loss has been extensively studied (Naylor 1972, Dekker and Meggitt 1983, Farahbakhsh *et al*. 1987, Varga *et al*. 2000) and relations between weed density and yield loss are described with different type of functions (Berzsenyi 1979, Zimdahl 1980, Douglas *et al*. 1991). Under field conditions a lot of environmental factors - in close connection with each other - can influence interspecific competition between crops and weeds (Bleasdale 1960).

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