COMPETITION BETWEEN GREEN PEA AND ITS SUMMER ANNUAL WEEDS

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Abstract

Most weed species can take up nitrogen and potassium from soil at a higher degree than crop plant living in association with it. Nutrient concentration in dry matter of plants indicates nutrient requirement.

In our experiment we are looking for the answer how distributed nitrogen, phosphorus and potassium uptaken from soil among pea and its weeds. Pot competition experiment was carried out among pea and its four weeds under glasshouse condition. The additive experimental methods were used. The experimental weeds were wild mustard (Sinapis arvensis L.), redroot pigweed (Amaranthus retroflexus L.), common lambsquarters (Chenopodium album L.) and barnyardgrass (Echinochloa crus-galli (L.) P.B.). The competition of weeds was examined in three densities: 5 plants/pot, 10 plants/pot, 15 plants/pot. Plants were grown 6 weeks after germination. After this the fresh and dry weight of pea's and weed's shoots were measured. From dried plant samples the nitrogen, phosphorus and potassium content was also determined. Every examined density of weed's increasing encouraged pea to grow on a larger rate too. So the pea successfully competed with weeds. In every treatment a much larger quantity of dry matter was constituted from pea than weed. The growth rate of weed species was not uniform, S. arvensis grew the quickest, and at the end of the experiment it covered the most of the pot's surface. Weeds mostly decreased the nutrient content of green pea through the intensive nutrient uptake. S. arvensis hindered strongest the intensive nutrient uptake of crop plants. E. crus-galli reduced slightly the nitrogen uptake of pea.

Key words: Green pea, annual needs, dry matter, nitrogen, phosphorus and potassium uptake

INTRODUCTION

A strong competition is going on between weeds and crop plants for nutrients, and that is the most critical factor in the first period of the vegetation. Plants compete mainly for the sufficient amount of macronutrients, for nitrogen, phosphorus, and potassium. Most weed species can take up nitrogen and potassium from soil at a higher degree than crop plant living in association with it.

The nutrient of plants dry matter indicates nutrient requirement of plants. The nutrient content of plants is affected by environmental factors. Among them, the nutrient content of soil is substantial; however this content depends on fundamentally the biological characteristics of plant species and variety.

Dhima et al. (2005) investigated the effect of nitrogen supply on interspecific competition between wild mustard (*Sinapis arvensis* L.) and wheat, barley and triticale. The presence of wild mustard, until harvest,

reduced dry weight of wheat and triticale by 31 and 26 %, respectively, while the corresponding reduction for barley was only 1.5 %. Grain yield of wheat and triticale was reduced too. As well as the wild mustard presence reduced total N content of wheat and triticale by 20 %.

Wall et al. (1991, 1996) determined the competitive effect of wild mustard on two field pea cultivars. For both cultivars, 20 wild mustard plants/m^2 reduced yields by 2 to 35%.

The percentage N and P content in spring barley did not change influence of increasing levels of nitrogen and phosphorus when they grew in competition with weeds (Andreasen et al. 2006). *S. arvensis* had a larger uptake of phosphorus than spring barley; in spite of the fact that the dry weight of spring barley was remarkably larger.

Varga et al. (2000) examined the competition between maize and barnyardgrass (*Echinochloa crus-galli* L.), and established, that 26 weed plants reduced seed yields by 44.77 % compared with herbicides treated control.

Radics et al. (1985) studied the competitive effect of wild oat (*Avena fatua* L.) and wild mustard (*Sinapis arvensis* L.) on spring barley. Lehoczky (2002) researched the effect of early competition between barnyardgrass (*Echinochloa crus-galli* (L.) P.B.) and maize on the nutrient uptake. According to Kádár et al. (2003) above 100 kg ha $^{-1}$ nitrogen dose pea covering decreases and weed covering increases. With improving phosphor-supply pea and weed covering increase as well.

In our experiment we are looking for the answer how distributed nitrogen, phosphorus and potassium uptaken from soil among pea and its weeds, besides how influence the amount of uptaken nutrients the increase of weeds density.

MATERIALS AND METHODS

Pot competition experiment was carried out among pea and its four weeds under glasshouse condition. The additive experimental methods were used, where the density of crop plant is constant and of the weeds are varied. The sowing of plants was happened on 28th February 2006 into pots containing 1.9 kg dry soil. The experimental weeds were wild mustard (*Sinapis arvensis* L.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarters (*Chenopodium album* L.) and barnyardgrass (*Echinochloa crus-galli* (L.) P.B.). Wild mustard is early summer annual weed; the other three are late summer weeds. In each pot, six early ripening 'Karlos' variety pea plants were cultivated. The competition of weeds was examined in three densities: 5 plants/pot, 10 plants/pot, 15 plants/pot. From weed-seeds 100 pieces were sowed. After germination the number of weeds

were controlled in each species with thinning. Weedless pots containing only pea were used as control. In four replications were worked, so there were 52 pots altogether.

Table 1

Characteristics of experimental soil

humus %	2,05
pH $_{(H2O)}$	7,26
pH $_{(KCL)}$	6,48
mineral N (mg kg $^{-1}$)	24,08
Al-P_2O_5 (mg kg $^{-1}$)	241,19
Al-K_2O (mg kg $^{-1}$)	244,24

The experimental soil was "Ramman" brown forest soil from Keszthely. The plants used only the nutrient of the soil (Table 1.), above the pea could collect a little nitrogen from the air, fertilizer was not got out. The watering occurred daily according to request and every week once on the basis of weight, up to 60 percent of the soil's maximum water capacity. Plants were grown 6 weeks after germination. After this the fresh and dry weight of pea's and weed's shoots were measured. From dried plant samples the nitrogen, phosphorus and potassium content was also determined.

RESULTS AND DISCUSSIONS

Dry matter

The dry matter of pea control grown alone was 3.31 gram per pot, in which 6 plants were grown (Figure 1.). The greatest dry matter formed in the *E. crus-galli* 5 plants/pot treatment, similarly to *C. album* 15 plants/pot, *E. crus-galli* 15 plants/pot, *S. arvensis* 15 plants/pot treatments. Every examined density of weed's increasing encouraged pea to grow on a larger rate too. So the pea successfully competed with weeds. In every treatment a much larger quantity of dry matter was constituted from pea than weed. The strongest competitor was *S. arvensis.* This weed species constituted the largest dry matter in comparison with the other weed species and pea also. This can be explained with the fact that life form of weed, developmental time, and environmental claim of wild mustard come the nearest of pea in the course of its vegetation. At the end of the experiment wild mustard was in stock-leaf stadium, the second largest dry matter provider was barnyardgrass in 3-5 leafy stadium, while with very small dry mass *A. retroflexus* and *C. album* were in seed-leaf – two-leaf stadium. So the developmental time of the latter ones straggled far behind from pea. In the critical early developmental period therefore they have not proved to be

major competitors. Their role changes at the end of the vegetation period of pea, in the second weedy period, because by that time these weeds mostly catch up the pea in growing so they prove to be a serious competitor.

In our experiment the effect of weeds were examined on the change of nutrient content of pea, moreover the nutrient content of weeds as a function of densities.

The nutrient content of pea was influenced in different ways by several weed species and its densities. Weeds with intensive nutrient uptake mostly reduced the nutrient content of crop plants. This was remarkably influenced by the growing vigour of weed species. The nutrient content and competitive ability of the slender growing *A. retroflexus* and *C. album* were rather moderate.

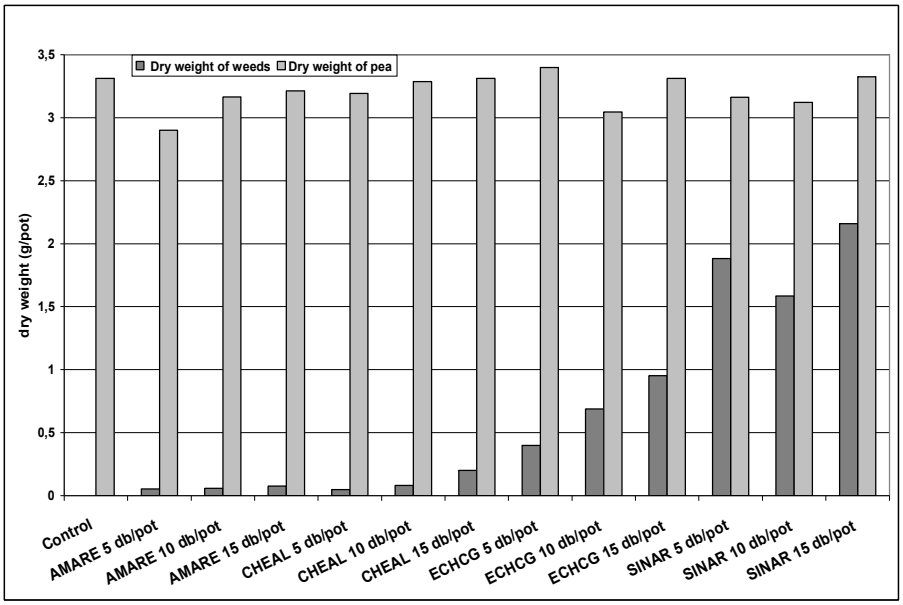

Figure 1. Dry matter of pea's and weed's shoots

Nitrogen uptake

The nitrogen content of weed-free grown pea was on the average 2.59 % in dry matter (Figure 2.), which due to *S. arvensis* plants reduced at the largest extent –with 0.5 %- on the effect of interspecific competition. 5 and 10 *S. arvensis* plants caused significant difference in nitrogen nutrient content, at the same time the nitrogen concentration of weed increased at similar rate. So in consequence of competition with wild mustard the nitrogen uptake of pea was hindered. *E. crus-galli* reduced slightly the nitrogen uptake of pea, we observed a small change on the effect of *C. album*, while the nitrogen uptake of weeds changed at a larger extent, mainly common lambsquarters, which is generally known as nitrogen

demanding weed species, here the highest nitrogen content was measured during the treatment containing five plants.

Except the *A. retroflexus* 15 plants/pot treatment, when the nitrogen content of pea was increased by 0.6 % in dry matter, in harmony with this the nitrogen content of *A. retroflexus* decreased at a similar extent. In the competition for nitrogen pea appeared stronger. Pea was able to obtain nitrogen in little amount by means of the nitrogen collection of root-nodule, although in the pots the nodule-formation was not major like in the field.

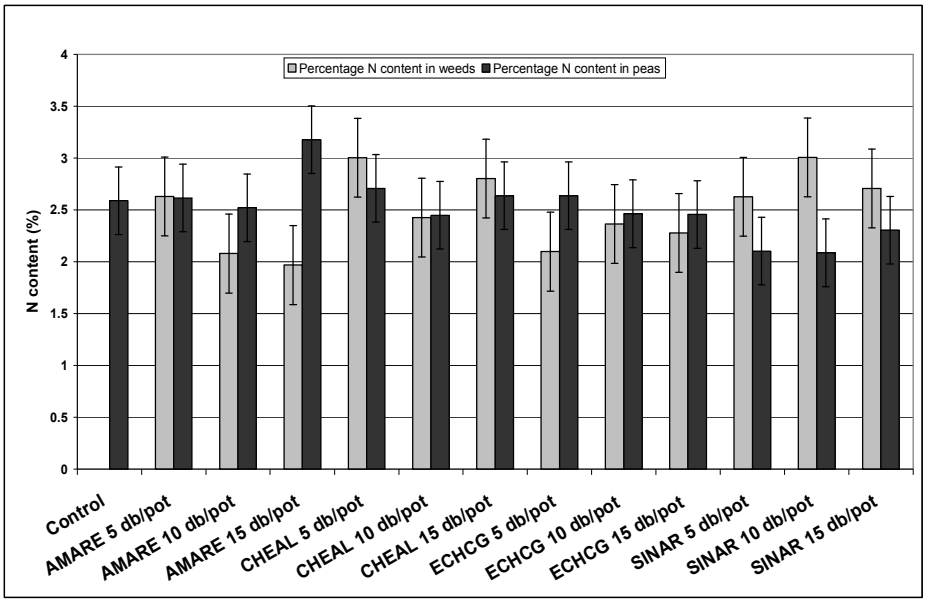

Figure 2. Percentage N content in pea's and weed's shoots

Phosphorus uptake

The phosphorus concentration was 0.63 % in the shoots of the weedless control pea (Figure 3.). The intensive nutrient uptake of weeds in every treatment decreased the phosphorus content of pea. *S. arvensis* with the smallest density (5 plants) caused the greatest competitor, while the phosphorus content of crop plant decreased to 0.46 % almost with a quarter. Similar decreases were observed due to *A. retroflexus* 5 plants/pot treatment. In a larger density of *S. arvensis* (10 respectively 15 plants/pot) in consequence of intraspecific competition the amount of uptaken phosphorus by pea increased a little in comparison with this.

The phosphorus content of examined weed species changed completely differently as a function of densities. In case of *A. retroflexus* it decreased, and in case of *C. album* it increased on the contrary with this, It

was the highest for *E. crus-galli* 10 plants/pot density, and for *S. arvensis* it hardly changed.

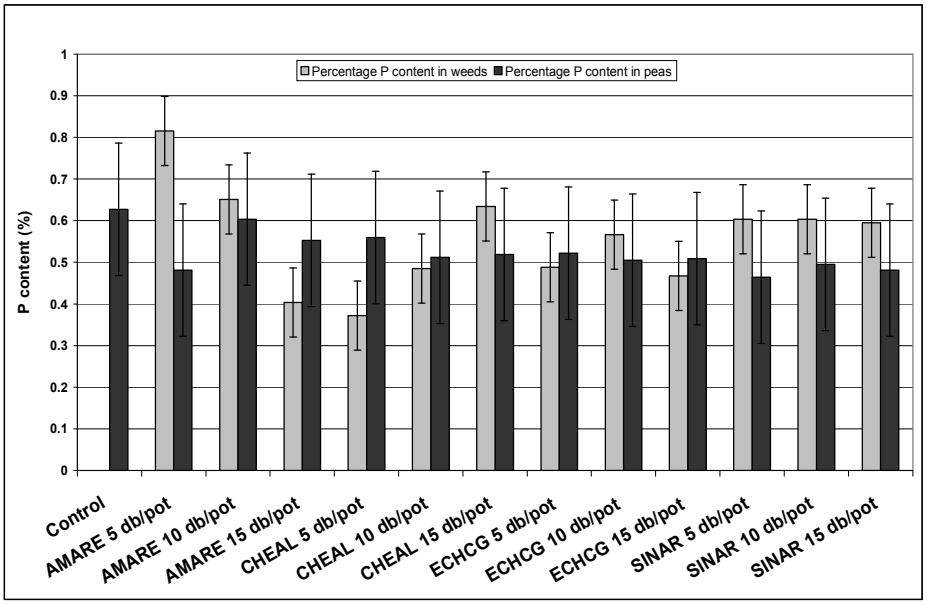

Figure 3. Percentage P content in pea's and weed's shoots

Potassium uptake

The potassium concentration of weedless grown pea was 1.62 % (Figure 4.). In our experiment the measured numerical values of phosphorus and potassium were similar to previous results of Debreczeniné (1994) and Nádasyné (1999). The dry matter of weeds contained more potassium than pea had. The competition of weeds reduced the potassium content of pea to the greatest extent *S. arvensis*, while the potassium concentration of this weed species was high. The highest potassium concentration were measured in the shoots of *S. arvensis* and *E. crus-galli*, its amount practically did not influence the density. Especially high concentrations were measured in 5 plants/pot treatment. *A. retroflexus* took up remarkably less potassium than this, and its measurement decreased with the increase of plant number.

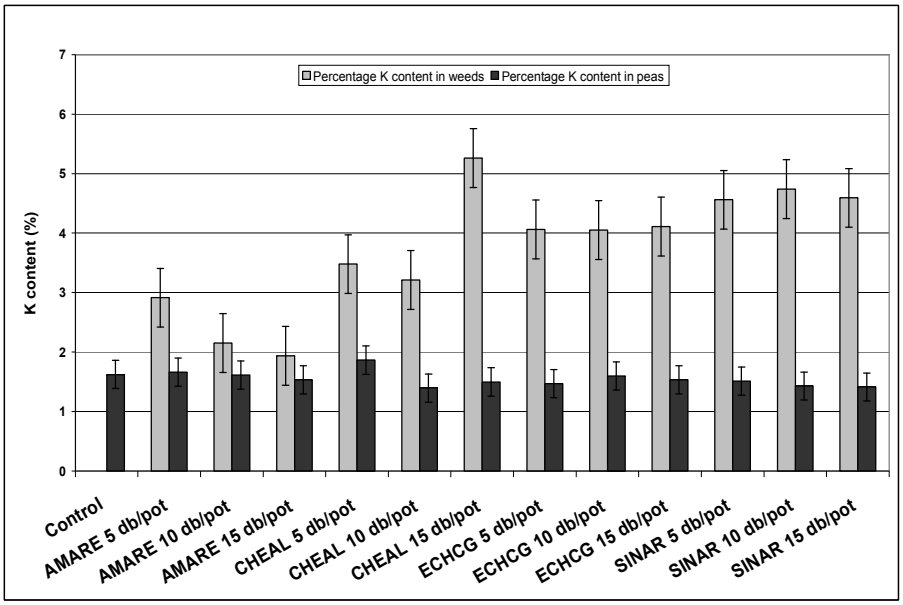

Figure 4. Percentage K content in pea's and weed's shoots

CONCLUSIONS

The different weed species and its density influenced the nutrient content of pea in a different way. The growth rate of weed species was not uniform, *S. arvensis* grew the quickest, and at the end of the experiment it covered the most of the pot's surface. *E. crus-galli* grew well too. We observed slender growth by *A. retroflexus* and *C. album* plants, which had an effect on its biomass production. It follows from this that nutrients uptake and competition ability was rather moderate.

Weeds through intensive nutrient uptake mostly decreased the nutrient content of green pea. *S. arvensis* hindered strongest the intensive nutrient uptake of crop plants. The phosphorus and potassium content of wild mustard didn't influence its density.

The nitrogen, phosphorus and potassium content of *A. retroflexus* reduced with increased density, so it has an intraspecific competitive effect.

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