PRELIMINARY EXAMINATION OF THE UPTAKE OF VARIOUS FORMS OF NITROGEN AT EARLY GROWTH STAGES OF COMMON RAGWEED

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Introduction

Common Ragweed (*Ambrosia artemisiifolia*) is present in the whole territory of Serbia. At the beginning of its occurrence on non-agricultural land, no control measures were undertaken, thus enabling ragweed to turn from naturalized into invasive weed species (Vrbničanin et al., 2004, 2008)

In order to shed light on the phenomenon of ragweed's competitiveness and invasiveness, preliminary investigation of nitrogen uptake at early stages of plant growth was carried out and presented in this paper.

Materials and Methods

- The soil used in the study was the degraded chernozem, fertilized with NPK at the rate of 150 kg/ha.
- The common ragweed was investigated at two growth stages – when the first and the second pair of leaves were developed, while the growth of oat seedlings was interrupted at the occurrence of the above development stages of ragweed.
- The soils in which ragweed and oats were grown were analyzed for the content of ammonium and nitrate, as well as pH value. Ammonium-N and nitrate-N in soil were determined using the Kjeldahl method, while soil pH was measured in 1:2.5 water solution by pH meter.
- The whole ragweed and oat plants were dried at 105° C and pulverized into a homogenous plant material, and then analyzed for the content of nitrogen and carbon using the CNS analyzer (Vario model EL III ELEMENTAR Analysasysteme GmbH, Hanau, Germany).

Results

The experiment revealed considerable differences in soil composition, especially in **content of ammonium-N.**

The lowest concentration of ammonium was observed in soil where the ragweed was grown, particularly in the phase when the second pair of leaves developed; it was 0.17 mg/kg, which is a significant statistical difference in comparison to 3.5 mg/kg that was determined for soil where the oats were grown

VARIETIES OF ANALYZED SOIL	NH4 – N (mg/kg)
CONTROL Non-fertilized soil	10.5
CONTROL Soil fertilized with 150 kg/ha N, P_2O_5,K_2O	24.5
Soil in which the **ragweed** was grown until the first pair of leaves developed	1.25 b
Soil in which the **ragweed** was grown until the second pair of leaves developed	0.17 a
Soil in which the **oats** were grown (until the phase coinciding with development of the first pair of leaves in ragweed plants)	3.5 c
Soil in which the **oats** were grown (until the phase coinciding with development of the second pair of leaves in ragweed plants)	4.8 c

- The results for the **nitrate content** in soil are quite different from ammonium ones.
- The highest nitrate concentration (56.58 mg/kg) was recorded in soil where the ragweed with the first pair of leaves was growing.
- The soil where the oats were grown showed constantly low level of nitrate, 23.92 mg/kg and 23.75mg/kg .
- The values for soil where ragweed was grown until development of the second pair of leaves were much smaller (19.27 mg/kg) and statistically similar to oats-related results.

VARIETIES OF ANALYZED SOIL	NO3- N (mg/kg)
CONTROL Non-fertilized soil	29.75
CONTROL Soil fertilized with 150 kg/ha N, P_2O_5,K_2O	73.5
Soil in which the **ragweed** was grown until the first pair of leaves developed	56.58a
Soil in which the **ragweed** was grown until the second pair of leaves developed	19.27 b
Soil in which the **oats** were grown (until the phase coinciding with development of the first pair of leaves in ragweed plants)	23.92 b
Soil in which the **oats** were grown (until the phase coinciding with development of the second pair of leaves in ragweed plants)	23.75 b

- The **soil pH values** (in water solution) showed statically significant differences among analyzed soil samples.
- The lowest pH value was found in soil where ragweed was grown, in the phase of the first pair of leaves development (7.63).
- This value significantly increased in the phase when the second pair of leaves developed (7.7), but it still remained below the level recorded for oats (7.74 in both measurements). The measurement results showed statistically important differences.

VARIETIES OF ANALYZED SOIL	pH
CONTROL Non-fertilized soil	7.7
CONTROL Soil fertilized with 150 kg/ha N, P_2O_5,K_2O	7.6
Soil in which the **ragweed** was grown until the first pair of leaves developed	7.63 a
Soil in which the **ragweed** was grown until the second pair of leaves developed	7.7 c
Soil in which the **oats** were grown (until the phase coinciding with development of the first pair of leaves in ragweed plants)	7.74 b
Soil in which the **oats** were grown (until the phase coinciding with development of the second pair of leaves in ragweed plants)	7.74 b

- The **content of nitrogen** in ragweed with the first pair of leaves developed was much higher than in oat plants in the same development phase, while in the phase when two pairs of leaves were developed, this value was lower in ragweed than in oats.
- The **content of carbon** in plant material varies between two development phases in which this parameter was observed: it increases in case of ragweed and decreases in case of oats.

VARIETIES OF ANALYZED PLANT MATERIAL	N %	C %
Ragweed with the first pair of leaves developed	3.29 bc	34.17 ab
Ragweed with the second pair of leaves developed	2.68 c	39.13 b
Oats (in the phase coinciding with the development of the first pair of leaves in ragweed)	1.55 a	36.81 b
Oats (in the phase coinciding with the development of the second pair of leaves in ragweed)	3.81 b	30.98 a

Discusion

- In contrast to other plant nutrients nitrogen may be taken up in form of a cation as NH_4^+ or an anion as NO_3^-.
- Uptake rates are determined mainly by the physiological need of the plants and not so much by the fact whether the source is a cation or an anion (Mengel et al. 1983). Many species display preference for NH_4^+ over NO_3^- including those of forest trees (Marchner et al. 1991) and grasses (Mengel and Kirkby 2001). Plants with high bio mass yield (rice, trees) are inclined to use ammonium as a source of nitrogen and from the results of this study it could be concluded that ragweed in early development stages exhibits the same property.

- That enables ragweed to gain advantage, i.e. since the ammonification process in soil in early spring is not intensive, the uptake of ammonium form of nitrogen enables ragweed to use up the most of available nitrogen from soil.

- On the other hand, nitrate adsorption can be reduced due to increased content of ammonium ions (Minotti et al. 1969) and uptake of ammonium ion is not influenced by nitrate ion (Mengel and Viro 1978).
- Inclusion of ammonium-N into further organic compounds does not have impact on reduction processes that utilize plant's energy necessary for its growth.

- The experiment has also shown for ragweed that, after using up the available reserves of ammonium, its uptake of nitrate-N rapidly increases.
- Such behavior only enhances competitive advantage of ragweed over other plants in uptake of this nutrient and clearly shows that ragweed has high capacity to activate nitrate reductase, since it is one of the factors that affect uptake of nitrate from soil (Aslam et al. 1992).
- **This shows that ragweed is a plant capable of "choosing" the source of nitrogen, since uptake of nitrate poses no problem for this species.**

- The pH values of soil also confirm the conclusion on increased uptake of ammonium-N.
- Ammonium uptake is associated with a pH decrease in the nutrient solution and NO_3^- uptake with an increase of the pH (Roco, and Mengel, K. 2000).
- The values obtained in this study indicate that pH of the soil in which ragweed was grown is much lower than pH of soil where oats were grown.
- The pH value increases as the plant grows, which is probably the result of the fact that, after using up the available ammonium-N, and since ammonification processes are not happening quickly enough to produce that form of nitrogen for its further growth, the plant switches to nitrate-N.

- The analysis of carbon content in plant material showed that in the phase of the first pair of leaves development the nitrogen level was higher in oats, while in the phase when the second pair of leaves developed, concentration of nitrogen was higher in ragweed.
- This is explained by the presumption on accumulation of energy for plant's intensive growth and propagation.

Conclusion

- Common ragweed preserves the energy for assimilation of nitrogen into amino-acids due to avoidance of nitrogen reduction process.
- The occurrence of energy accumulation is confirmed by the increased content of carbon in common ragweed with two pairs of leaves developed.
- The above are preliminary results, but they indicate that one of the properties of common ragweed that make it highly invasive could be its capacity to absorb ammonium at early stages of growth, which speeds up its development.

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Merci pour votre attention