

STUDIES REGARDING PHOSPHORUS AND POTASSIUM CONTENT OF JOHNSON GRASS IN DIFFERENT DEVELOPMENT STAGES

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Abstract: *The Johnson grass is adapted to a wide variety of pedo – climatic, climatic and biological conditions. In Romania Sorghum halepense still considered a problematic weed (Sarpe N., 2004) in some crop cultures. The Johnson grass damaging potential consist in his high competitivy to the crop plants in order to get nourishment, water and light (McWhorter, 1973). Based on these informations we have established as objective the quantification of phosphorus and potassium in Johnson grass in different growth stages, between BBCH 10 – BBCH 69 (emerging – blossom ending). In this interval the quantity of phosphorus and potassium was determined from rhizomes, stalk, leaves and panicle. The Johnson grass samples where gathered in zigzag way, the samples were placed in plastic bags and brought in the agrochemical laboratories of Agricultural Sciences am Veterinary Medicine of Banats University Timisoara. The chemical analyses were based on methods found in various papers (Radulov Isidora, 2004) where the potassium quantity is assessed trough emission spectrometry method where the intensity of K atoms emission under excitation on air – acetylene flame is measured. In order to determine the phosphorus quantity we used the colorimetric method based on the fact that the orthophosphoric acid anions present in the analysing solution react with molybdenum trioxide MoO₃, resulting phosphomolybdic hetero-polyacid. Following the studies we observe that the highest potassium percent (K₂O) 3,95% was present in growth stage BBCH 18 (8 leaves developed), the recorded values lay between 0,8 – 3,95%. The results obtained assessing P₂O₅ quantity do not exert significant fluctuation (0.3-1.0 mg), the highest value was recorded in growth stages BBCH 39 when the vegetative organs of Sorghum halepense achieved maximum development. Among analysed organs the inflorescence proved to have the highest potassium quantity (1,92%). The highest phosphorus quantity was achieved in rhizomes, sustaining the statement “the rhizomes are the energy deposit of species Sorghum halepense”*

Key words: *Sorghum halepense, fosfor, potasiu,*

INTRODUCTION

The invasive species are known as the main biodiversity threat. The high economical impact in agriculture places them in the first position among the damaging biotic factors. The Johnson grass is very competitive and invasive, is the most damaging weed of Romania in crop cultures, causing yield lose up to 80% of entire production, even 100% at a high infestation degree of maize crop. To the production Competitive capacity of Johnson grass adds production of allelopathic substance (dourine) which adversely affects germination of other plant species. In light of this information has undertaken this study aimed to determine the amount of phosphorus and potassium, present in Johnson grass plants in different growth stages. Research conducted by SINGH and col., 1973; NEWTON and col., 1985; BESSIN and col., 1990; BROWN și col, 1993, showed that invasive species *Sorghum halepense* compared to other grasses, have the highest phosphorus content. Studies on the content of nitrogen, phosphorus and potassium of the species *Sorghum halepense* made by PINTILIE in 1984 and in 2006 by

TOTH reveals the presence of 10.1 kg nitrogen, 2.8 kg phosphorus and potassium 14.3 kg / tone of dry matter.

MATERIALS AND METHODS

Phosphorus and potassium determinations were performed in different growth phases (BBCH) of Johnson grass. For this study we used unitary decimal code for wheat. The Johnson grass samples were gathered in zigzag way. Chemical analysis were carried out using existing methodology in literature (RADULOV ISIDORA, 2004), establishing the amount of phosphorus and potassium by colorimetric method.

Determination of phosphorus in leaves, stems, roots and inflorescences of Sorghum halepense was performed by colorimetric method based on the fact that the analyzed solution of orthophosphoric acid anions reacts with molybdenum trioxide (MoO_3), resulting phosphomolybdic hetero-polyacid.

Analyses were performed on fresh material, from each sample was weighed 5 g who mortar with animal charcoal for 10 minutes. They left to rest 15 minutes and was filtered. In The filtrate were determined the soluble forms of phosphorus compounds.

The calculation method of P_2O_5 :

$$\text{P}_2\text{O}_5 \text{ (mg/kg soil)} = \frac{a \times V \times 1000}{g \times v \times 1000}$$

where:

a – reading (μm);

V – solution volume (ml);

g – amount of substance taken in work (g);

v – work volume of extract taken (ml);

1000 – for 1 kg of plant material;

1000 – for transformation of μg in mg.

The amount of potassium in leaves, stems, roots and flowers of Johnson grass was determined by colorimetric method based on measuring the intensity emitted by excited K atoms in an air-acetylene flame. Working principle was the same as that used to determine phosphorus.

The calculation method of K_2O :

$$\text{K}_2\text{O} \text{ (mg/kg)} = \frac{a \times V \times 1000}{g \times 1000}$$

where:

a – reading in $\mu\text{g K}_2\text{O}$;

V – solution volume;

1000 – relation coefficient to 1 kg of material;

g – amount of substance (g);

1000 – transformation coefficient of μg in mg.

RESULTS AND DISCUSSIONS

In Table 1 are shown the values obtained for phosphorus and potassium content of whole Johnson grass plant in 17 phases of vegetation.

Variation of phosphorus in the plant was not very high (0,3 – 1,0), amount of phosphorus produced from Johnson grass plants is lower than that determined in corn and wheat, according to the literature (GOIAN and col., 1993). The greatest amount of phosphorus

was obtained during the development phase BBCH 39 (shoot at maximal length).

Potassium in plant fluctuated between 0,8% and 3,95%. The amount of potassium determined in Johnson grass plants was higher than the amounts determined in maize and wheat. Potassium content determined from millet plants (0.8 to 3.95) is so high compared to that of wheat (0,6-0,7) and maize (0,25-0,5), determines us to say that the superiority of this weed to these crop plants is given by this element, with very high importance in regulating the hydric regime and photosynthesis. Table 2 present potassium and phosphorus content of the Johnson grass leaves in different growth phases.

Table 1.

Potassium and phosphorus content in Johnson grass		
BBCH stage	K ₂ O (%)	P ₂ O ₅ mg
BBCH – 12 (two leaves/pairs)	3.66	0.5
BBCH – 13 (three leaves)	2.83	0.3
BBCH – 14 four leaves)	2.64	0.4
BBCH – 15 (five leaves)	1.19	0.5
BBCH – 16 (six leaves)	2.41	0.5
BBCH – 17 (seven leaves)	1.37	0.5
BBCH – 18 (eight leaves)	3.95	0.4
BBCH - 21 (first shoot visible)	2.90	0.7
BBCH - 22 (second shoot)	3.86	0.6
BBCH-39 (shoot at maximal length)	0.79	1.0
BBCH 40 (formation of vegetative mass start)	1.47	0.55
BBCH-50 (appearance of floral organs/earring)	0.95	0.74
BBCH-51- (flower buds visible)	0.86	0.5
BBCH-59 – (first petals visible)	0.96	0.6
BBCH – 61 (10 % flower/flowering plants(open)	1.11	0.65
BBCH – 63 (30 % flower/flowering plants(open)	0.90	0.7
BBCH – 67 (most petals have fallen/been dry)	0.8	0.40

Table 2.

Johnson grass leaf nitrogen content, protein, potassium, phosphorus, in different phases of vegetation		
BBCH stage	K ₂ O (%)	P ₂ O ₅ mg
BBCH-39 (shoot at maximal length)	1.78	0.5
BBCH 40 (formation of vegetative mass start)	1.33	0.5
BBCH-50 (appearance of floral organs/earring)	0.82	0.6
BBCH-51- (flower buds visible)	0.81	0.8
BBCH-59 – (first petals visible)	0.62	0.5
BBCH – 61 (10 % flower/flowering plants(open)	0.95	0.62
BBCH – 63 (30 % flower/flowering plants(open)	0.90	0.7
BBCH – 67 (most petals have fallen/been dry)	0.85	0.57

Tabelul 3.

The content of Johnson grass stalk in potassium and phosphorus in different phases of vegetation		
BBCH stage	K ₂ O (%)	P ₂ O ₅ mg
BBCH-39 (shoot at maximal length)	0.57	0.7
BBCH 40 (formation of vegetative mass start)	0.72	0.95
BBCH-50 (appearance of floral organs/earring)	0.91	0.6
BBCH-51- (flower buds visible)	0.49	0.86
BBCH-59 – (first petals visible)	0.80	0.4
BBCH – 61 (10 % flower/flowering plants(open)	0.59	0.55
BBCH – 63 (30 % flower/flowering plants(open)	0.73	0.5
BBCH – 67 (most petals have fallen/been dry)	0.65	0.55

Potassium in Johnson grass leaves ranged between 0,62% (growth stage BBCH 59) and 1,78% (BBCH 39). Potassium content in leaves decreases with plant maturation. Phosphorus in Johnson grass leaves showed values between 0.5 mg and 0.8 mg. The highest amount of potassium (0.91%) of the stalk was in growth stage BBCH - 50, the earing. Phosphorus play a very important role in the process of plant growth and after various studies found that stalk of Johnson grass contain to highest amount (0,95 mg P₂O₅) in the early vegetative mass formation. At the appearance of petals and flowering growth stage the amount of phosphorus in the Johnson grass stalk decreases, the lowest value being 0.4 mg (table 3).

From table 4 can notice the large amount of phosphorus recorded in rhizomes (1,0 mg P₂O₅), in growth stage BBCH 61. Rhizomes in growth stage of developing petals have the lowest content of potassium and phosphorus.

Table 4.

The content of Johnson grass rhizomes in potassium and phosphorus in different phases of vegetation

BBCH stage	K ₂ O (%)	P ₂ O ₅ mg
BBCH-39 (shoot at maximal length)	1.47	0.9
BBCH 40 (formation of vegetative mass start)	1.42	0.6
BBCH-50 (appearance of floral organs/earring)	1.08	0.84
BBCH-51- (flower buds visible)	1.20	0.81
BBCH-59 – (first petals visible)	0.31	0.45
BBCH – 61 (10 % flower/flowering plants(open))	0.95	1.0
BBCH – 63 (30 % flower/flowering plants(open))	1.19	0.72
BBCH – 67 (most petals have fallen/been dry)	1.39	0.6

In growth stage BBCH 51, the floral buds become visible, has been obtained the largest amount of potassium (2,54%).

Regarding phosphorus content of the inflorescences, no high variations were observed (0,5-0,7 mg).

Table 5.

Potassium and phosphorus content in Inflorescence in various stages of vegetation

BBCH stage	K ₂ O (%)	P ₂ O ₅ mg
BBCH 40 (formation of vegetative mass start)	1.14	0.62
BBCH-50 (appearance of floral organs/earring)	0.73	0.7
BBCH-51- (flower buds visible)	2.54	0.6
BBCH-59 – (first petals visible)	2.25	0.5
BBCH – 61 (10 % flower/flowering plants(open))	2.38	0.7
BBCH – 63 (30 % flower/flowering plants(open))	1.05	0.7
BBCH – 67 (most petals have fallen/been dry)	1.300	0.7

In figures 1 and 2 are presented results obtained on potassium and phosphorus content of the analyzed organs.

From figure 1 shows that the lowest potassium content (0.68%) was obtained from stalk. Following chemical analysis carried of the inflorescence showed the highest amount of potassium (1.92%).

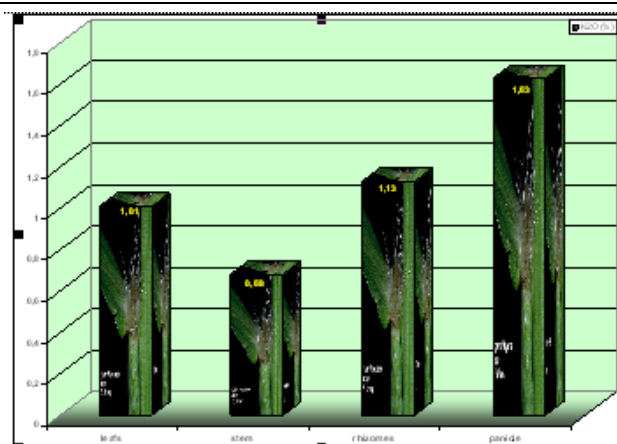


Figure 1. – Graphic presentation of potassium content of Johnson grass leaves, stems, rhizomes and panicles

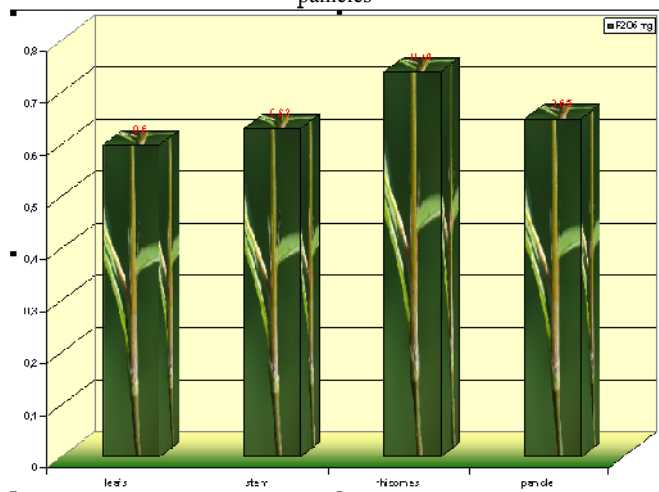


Figure 2. – Graphic presentation of phosphorus content of Johnson grass leaves, stems, rhizomes and panicles

Rhizomes were characterized through the highest phosphorus content with an average 0.74 mg, what leads us to support the claim that rhizomes provide the necessary substances and energy supply for some biological processes. From studies carried show that Johnson grass leaves contain the lowest average amount of phosphorus.

CONCLUSIONS

Potassium content determined from Johnson grass plants ranged from 0.8 to 3.95% was higher than that recorded by wheat (0,6-0,7%) and maize (0,25-0,5%). Because potassium is known as a macroelements that enhances the ability of plants to absorb water, and to resist to cold and drought we can say that high levels of potassium leads to the superiority of the weeds to crops. The phenophase BBCH 18 showed the greatest amount of potassium (3,95%).The

conducted studies showed that the panicle contains the largest amount of potassium while the stalk recorded lowest value.

The highest amount of phosphorus, obtained from Johnson grass organs, was in rhizomes, this result supporting the statement "rhizomes are energy deposits of invasive species *Sorghum halepense*". Phosphorus is found in Johnson grass plants in small amounts in growth stage BBCH 59 (first visible petals)

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