THE EFFECT OF THE POTASSIUM SOURCES OVER THE FIELD TOMATO PRODUCTION

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Abstract

Following some experiments, it has been confirmed the fact that the most efficient potassium source is the one coming from KNO3, and also the one that originates from organic fertilizers. This efficiency is reflected not only upon the obtained production, but also upon the ripening and the coloring of the tomato fruits. Potassium is also an all-important element for the fertilizing technology in intensive tomato crops, playing a part in the balancing of the azoth functions.

Key words: fertilization, potassium sources, the efficiency of the anion associates, tomatoes.

INTRODUCTION

Although, for a long time, potassium has been considered a “forgotten element”, it regained its place in the majority of fertilization programs. Potassium is a macro element deeply involved in the synthesis and the transportation of the carbohydrates and the ascorbic acid in fruits, having a role also in the balancing of the growth functions of the azoth, of the fertilization with azoth and phosphor solely, and having also benefic effects over the quality of agrarian an horticultural production (Kraus, 1997; Hinsinger, 2002). Moreover, potassium assures a balanced growth of cultures, the K/N ratio determining the forming of a vigorous radicular and functional system.

Potassium deficiency is identified by less than 1% total potassium concentration in leaves. Such a situation is to be found in the crops growing in sandy soils, or in soils having a large concentration of clayed minerals with a high capacity o fixing this cation (Borlan, 2000). Potassium excess, a rare occurrence, determines magnesium deficiency (as a cationic antagonism) and sometimes boron deficiency.

In order to prevent the appearance of potassium nutrition deficiency, especially in intensive fertilization systems, on the basis of soil and plant analysis, it had been decided the applying of such an element on soils with a lower content of 270 ppm K-mobil (AL) (Borlan, 2000; Ciofu et al., 2003).

MATERIAL AND METHODS

The experiments have been done on field tomato grown cultures, on five experimental lots in Oradea.

On the witness experimental lot, fertilization was done only with azoth and phosphor, and on the other experimental lots, mineral complex fertilizers were used, but also organic fertilizers. Regarding soil and plant maintenance, things have been done the same way on the five experimental lots, using the methods recommended by the field growth technology.

We studied the differentiate effect of different potassium sources (mineral and organic), applied on a soil with a lower content of 270 ppm K-mobil (AL).

The phaeozem soil was preserved and fertilized with compost and organic fertilizers, in accordance with the established protocol. (table 1.).

The mobile potassium (accessible, changeable) from the soil, was dosed in ammonium acetate-lactate (Egner- Riehm- Domingo) (K-AL), by flame photometring.

The potassium in leaves was determined by flame photometring of the dissolvent in the ash.

Table 1.

Potassium sources of mineral and organic derivation applied to the field grown tomatoes.

No. Var.	Soil fertilization version	Dose Kg/ ha
1.	Witness	$N_{120}P_{120}K_0$
2.	NPK (KCl)	$N_{120}P_{120}K_{120}$
3.	NPK (K_2SO_4)	$N_{120}P_{120}K_{120}$
4.	NPK (KNO_3)	$N_{120}P_{120}K_{120}$
5.	NP + 30 t/ ha dung	$N_{120}P_{120}$ + 0,6%K in dung

RESULTS AND DISCUSSION

For these experiments it is necessary a profound study on potassium applying, related with the effects of potassium over production, and also over the ripening and even coloring of the fruits, the efficiency being analyzed in relationship with the tomatoes response to different sources of potassium (Table 2, fig.1).

Table 2

The differential effect of potassium sources applied to field cultivation of tomatoes

No. var.	Soil fertilization version	Dose Kg/ha	Production		
			t/ha	Difference	Difference meaning
1	Witness	$N_{120}P_{120}K_0$	42,78	-	-
2	NPK (KCl)	$N_{120}P_{120}K_{120}$	45,92	3,14	*
3	NPK (K_2SO_4)	$N_{120}P_{120}K_{120}$	47,88	5,10	*
4	NPK (KNO_3)	$N_{120}P_{120}K_{120}$	49,78	7,00	**
5	NP + 30t/ha dung	$N_{120}P_{120}$+0,6%K in dung	52,92	10,14	***

LSD 5% 2.50
LSD 1% 5.50
LSD 0.1% 8.60

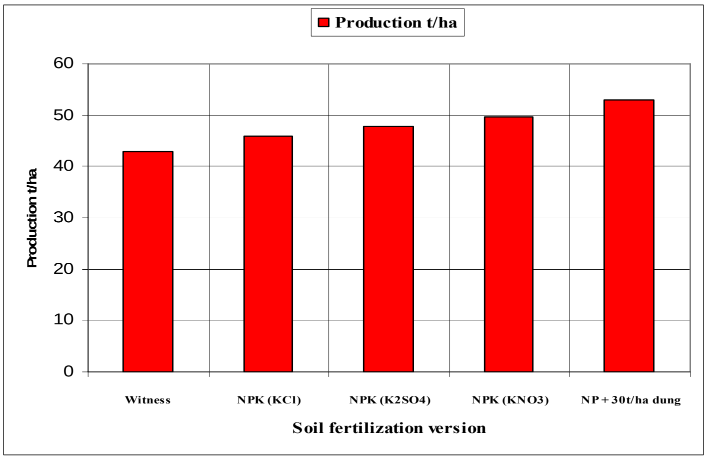

Figure 1:The differential effect of potassium sources applied to field cultivation of tomatoes

The differentiation of the effects of applying potassium appears in this case, seen as anion associates, and because of this, the conclusion is confirmed – tomatoes are situated in the category of horticultural cultures sensitive enough to the Cl^-. The potassium resource that comes from K_2SO_4 is more efficient, because is has an anion that plants tolerate much better (SO_4^{2-}) (Table 3).

Table 3

The influence of potassium sources on the mobile soil and plant forms

No. var	Soil fertilization version	K-AL ppm to soil	K_t % to plant (leaves)	Number	
				Inforescences	Fruits
1	Martor	260	2,85	12,9	38,9
2	NPK (KCl)	290	2,93	13,7	42,3
3	NPK (K_2SO_4)	280	2,88	14,7	44,8
4	NPK (KNO_3)	310	3,12	15,0	46,1
5	NP + 30t/ha dung	300	3,08	16,1	48,3

However, the most active potassium nutrition is realized in the case of potassium resource that comes from KNO_3 (the role of the NO_3^- anion being conclusive), as the one coming from the organic fertilizer (in this case also, the K-NO_3^- interaction is also beneficial).

The result is that, the efficiency of using potassium, as an all-important element in the tomato fertilization technology is most necessarily connected to its role in balancing the azoth functions, and the inter-relationship N-K must be seen as being reciprocal. This observation becomes evident, if we take into consideration the effect of applying the two elements, and mostly the potassium, depending on the associate anion.

CONCLUSION

Subsequent to our research, from the point of view of the anion associates efficiency in the sustenance of the potassium effect, the field grown tomatoes, the nitrate anion (NO_3^-) is more active and with weaker results than the chlorine (Cl^-), so the efficiency is thus approached: $NO_3^- > SO_4^{2-} > Cl^-$. So, because of the role and the effect potassium has, the action of the "pair" anion is more significant because of the presence of NO_3^-, than the action of any other known ions, applied frequently (SO_4^{2-}, Cl^-). This being the context, the synergist N/K effect can have a more real explanation, from the point of view of the effectiveness of ionic reciprocity – K^+/NO_3^- (mentioned by Bergmann, 1992, also).

REFERENCES

1. Avarvarei I., Velicica Davidescu, R. Mocanu, M.Goian, C. Caramete, M. Rusu, 1997, Agrochimie, Ed. Sitech, Craiova;
2. Borlan Z., 2000, Potasiul-nutrient indispensabil pentru producția şi calitatea legumelor. International Potash Institute / Basel;
3. Borlan Z., Cr. Hera, Aurelia Ghidia, I. Pasc, Gh. Condei, L. Stoian, Eugenia Jidav, 1982, Tabele şi nomograme agrochimice, Ed. Ceres, Bucureşti, 174-177;
4. Borlan Z., Cr. Hera, D. Dornescu, P. Kurtinecz, M. Rusu, I. Buzdugan, Gh. Tănase, 1994, Fertilitatea şi fetilizarea solurilor (Compendiu de Agrochimie), Ed. Ceres, Bucureşti;
5. Borlan Z., Hera C., 1984, Optimizarea agrochimică a sistemului sol-plantă, Ed. Academiei Republicii Socialiste România, 150;
6. Budoi G., 2000, Agrochimie I, Solul şi Planta, Ed. Pedagogică, R.A. Bucureşti, 238-252;
7. Ciofu R., Nistor Stan, Victor Popescu, Pelaghia Chilom, Silviu Apahidean, Arsenie Horgoş, Viorel Berar, Karl Fritz Lauer, Nicolae Atanasiu, 2004, Tratat de legumicultură, Ed. CERES, Bucureşti,136-142, 147-148, 617-633;
8. Popa A.G., 2007, Optimizarea agrochimică a sistemului sol–plantă în tehnologia de cultivare în spații protejate a tomatelor, Teză de doctorat , Cluj–Napoca;
9. Rusu M, V. Munteanu, N. Meteş, J. Jancu, 1988, Probleme ale optimizării agrochimice a solurilor sub influența măsurilor agrochimice, Analele ICCPT, vol.LVI, 261-267;
10. Hinsinger P., 2002, Potassium, in Encyclopedia of Soil Science, Marcel Dekker, Inc. New-York, USA, 1035-1039;
11. Rusu M., 1993 – Agrochimie vol.II, Tipoagronomia, Cluj-Napoca, 198-210;
12. Rusu M., Marilena Mărghitas, I. Oroian, Tania Mihăiescu, Adelina Dumitraş, 2005, Tratat de Agrochimie, Ed. Ceres, Bucureşti;
13. Rusu M.,1991, Agrochimie vol.I Tipo Agronomia, Cluj-Napoca.