THE INFLUENCE OF POTASSIUM FERTILIZERS APPLIED ON DIFFERENT NP BACKGROUNDS ON SUNFLOWER YIELD AND SEED POTASSIUM CONTENT IN PRELUVOSOIL CONDITIONS FROM NORTH – WEST OF ROMANIA

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Abstract
In Romania was elaborated since 1968 a stationary long term field experiments with fertilizers and lime in all the Agricultural Research and Development Stations belongs to Agricultural Research and Development Institute from Fundulea.
The experiments was set up using a unitary scheme for searching the evolution of soil fertility and the influence of fertilizers and lime rates on level and quality yield of different crops.
In this paper are presented the research results regarding the influence of potassium fertilizers applied, on different NP backgrounds on sunflowers yield level and seeds potassium content in the period of 2008-2010, in preluvosoil conditions from Agricultural Research and Development Station Oradea.
The presented research data has shown that in this soil condition potassium fertilizers applied in rates of 80 kg K_2O in different NP background give the best results, regarding the spores yield obtained and seeds potassium content.

Key words: sunflower, preluvosoil, potassium, yield, seed K% content

INTRODUCTION

Sunflower is a deep rooted crop that responds to fertilizer applications most when soil nutrient level is low. Profitable sunflower production requires adequate soil fertility based on soil tests. Nitrogen (N) is the most yields – limiting nutrient unless, some times, high residual nitrate level exist. Phosphorus (P) is the next most limiting nutrient. Levels of available potassium (K), sulfur (S) and micro-nutrients generally are sufficient for sunflower production in most Romanian soils. Nitrogen fertilizer rates recommendations based on soil testing will be adequate for most soils with 1% to 1.5% organic matter (Samuel, 2003, 2009). For soils having less than 1% organic matter, the producer should add some nitrogen (20-30 kg/ha) above recommended rates and for soils over 2% organic matter, he should subtract 20 kg/ha of nitrogen. (Dahnke, 1994)

Crop response to applied phosphorus is most likely on soils with low and medium levels of extractable phosphorus. When soil tests are below 15 ppm, a producer can expect yield increases from phosphorus fertilizer application (Hera et al, 1989).

Placement of phosphorus fertilizers is important in sunflower production (Schatz, B. et al., 1999). Band application at planting is the most efficient placement method for phosphorus and recommended rates for row applications are half that of broadcast (Pereyra and Valetti, 1994).

Most Romanian soils have enough amounts to potassium fertilizers have been reported (Ciobanu, 2007). Recommended potassium rates related to soil test values are establish in relation with type of plant and previously NPK fertilizers rates applied (Dahnke, 1994, Vrânceanu, 2000).

Even though sunflower has been cultivated for hundreds of years, professional growers are still discovering new methods for increasing output and improving the overall quality of the crop (Sala, F. et al., 2010). Plus, as new uses for the by products of sunflowers (seeds, oil etc) are developed, the crop acreage has increased (Angelova, M. et al., 2003).

This paper present the influence of potassium fertilizers applied on different NP backgrounds on sunflower yield and seed potassium content.

MATERIAL AND METHOD

The research data presented in this paper was obtained at A.R.D.S. Oradea, in long term yield experiments with fertilizers, set up since 1974.

The factors researched were the potassium and NP rates applied:

a. potassium rate: K_0, K_{40}, K_{80}, K_{120}
   like KCl applied in autumn
b. NP rates: N_0P_0; $N_{80}P_{40}$; $N_{80}P_{80}$; $N_{160}P_{80}$.
   (N was applied like ammonium nitrate, in spring
   P was applied like superphosphate, in autumn)

The plant rotation utilized in field experiments was sunflower-winter wheat-corn-winter wheat. In field experiment was determined the influence of fertilizers applied on sunflower kernels yield and was made statistically interpretation of yield differences obtained between different treatments.

RESULTS AND DISCUSSION

The experimental results obtained in 2008-2010 are presented in table 1 and in figure 1.

In the case of N_0P_0 background in the lack of potassium application was obtained 13.8 q/ha sunflower kernels, and if 40 kg K_2O/ha was applied on this background was obtained 15.4 q/ha, and the largest yield (16.2 q/ha) was obtained when the potassium rate applied was 80 kg K_2O /ha.

If the K rate is bigger than 80 kg K_2O/ha, the yield level does not increase significant.

In the case of $N_{80}P_{40}$, background, without K fertilizers the yield level was 20.4 q/ha. If on this background was applied 40 kg K_2O/ha yield

obtained was 22.6 q/ha, and the bigger yield 24.2 was realized in variants fertilized with 80 kg K_2O/ha.

In $N_{80}P_{80}$ background in plots unfertilized with potassium the yield obtained was 24.2 q/ha. In the variants fertilized with 80 kg K_2O/ha the yield level was 28.4 q/ha and in the variants treated with 120 kg K_2O/ha the yield level was 29.3 q/ha. Only in case of this background the rate of K_{120} determined a significant increase of yield level.

In the case of $N_{160}P_{80}$ background in plots unfertilized with K this level of yield was 24.8 q/ha, and when 40 kg K_2O/ha was applied the yield level is 27.4 q/ha.

The bigger yield level was 29.3 q/ha and was obtained in the plots fertilized with 80 kg K_2O/ha. Increasing the potassium rate at 120 kg K_2O/ha the yield level is insignificant decreasing.

The average yield spores obtained because of K application on those four NP backgrounds are taking values between 7.4 and 12.3%. The bigger yield spores were obtained in the case of plots fertilized with 120 kg K_2O/ha, but the differences comparative with the plots fertilized with 80 kg K_2O/ha are insignificants.

The maximum yield level, in average of those years, 29.3 q/ha was obtained in the plots fertilized with $N_{160}P_{80}K_{80}$ or with $N_{80}P_{80}K_{120}$.

Table 1

Influence of NP x K fertilizers on sunflower yield in preluvosoil conditions from Oradea (2008 – 2010)

Fertilization levels		Yield q/ha				Average		Difference	
		K_0	K_{40}	K_{80}	K_{120}	q/ha	%	q/ha	%
N_0P_0		13,8	15,4	16,2	16,3	15,4	100	-	-
$N_{40}P_{40}$		20,4	22,6	23,6	24,4	22,8	148	7,4	48
$N_{80}P_{80}$		24,2	26,9	28,4	29,3	27,2	177	11,8	77
$N_{160}P_{80}$		24,8	27,4	29,3	29,2	27,7	180	12,3	80
Average	q/ha	20,8	23,1	24,4	24,8				
	%	100	111	117	119				
Difference	q/ha	-	2,3	3,6	4,0				
	%	-	11	17	19				

	NP	NPxK
LSD 5%	2,14	3,58
LSD 1%	2,71	5,10
LSD 0,1%	3,59	6,25

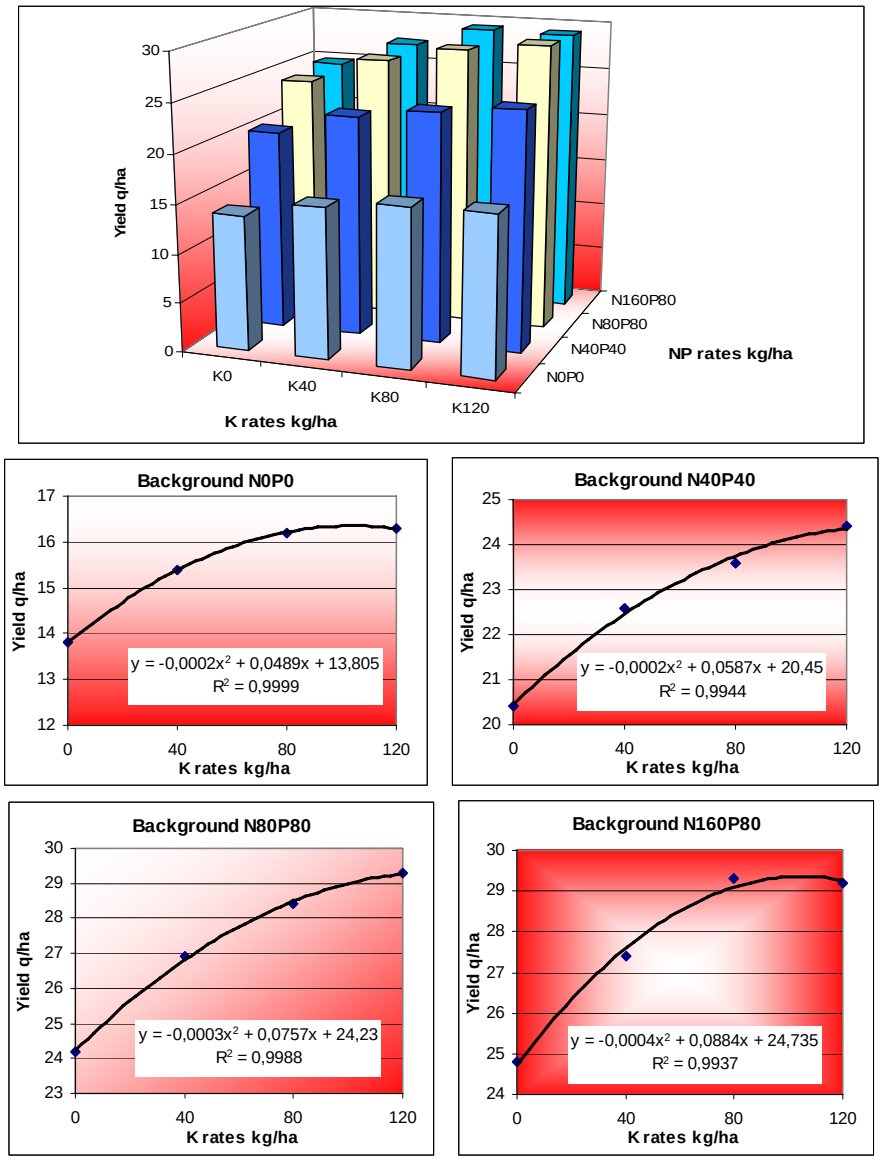

Fig. 1. Influence of NP x K fertilizers on sunflower yield in preluvosoil conditions from Oradea (2008 – 2010)

Seed K% content of sunflower is presented in table 2 and in figure 2.

The seed K% content of sunflower is positively influenced by NP background the maximum values being registered in the case of fertilized variants with $N_{80}P_{80}$.

In unfertilized variant with K was achieved a 0.91 K% seed content. Increasing of K rate over this level, lead to increases of seed K content at 0.97 K% in fertilized variant with 80 kg K/ha, then decrease at 0.95 K% in the fertilized variant with 120 kg K/ha.

Seed K% content of sunflower is increasing in the same time with increasing of K rate until 80 kg K/ha, in all NP backgrounds, in average being achieved a maximum 10% yield spore.

Table 2

Influence of NP x K fertilizers on seed K% content of sunflower in preluvosoil conditions from Oradea (2008 – 2010)

K rates		K content (%)				Average		Difference	
		N_0P_0	$N_{80}P_{40}$	$N_{80}P_{80}$	$N_{160}P_{80}$	K %	%	K %	%
K_0		0,75	0,85	0,91	0,89	0,85	100	-	-
K_{40}		0,85	0,91	0,92	0,92	0,90	106	0,05	6
K_{80}		0,90	0,92	0,97	0,95	0,94	110	0,09	10
K_{120}		0,92	0,95	0,95	0,91	0,93	109	0,08	9
Average	K %	0,86	0,91	0,94	0,93				
	%	100	106	109	108				
Difference	K %	-	0,05	0,08	0,07				
	%	-	6	9	8				

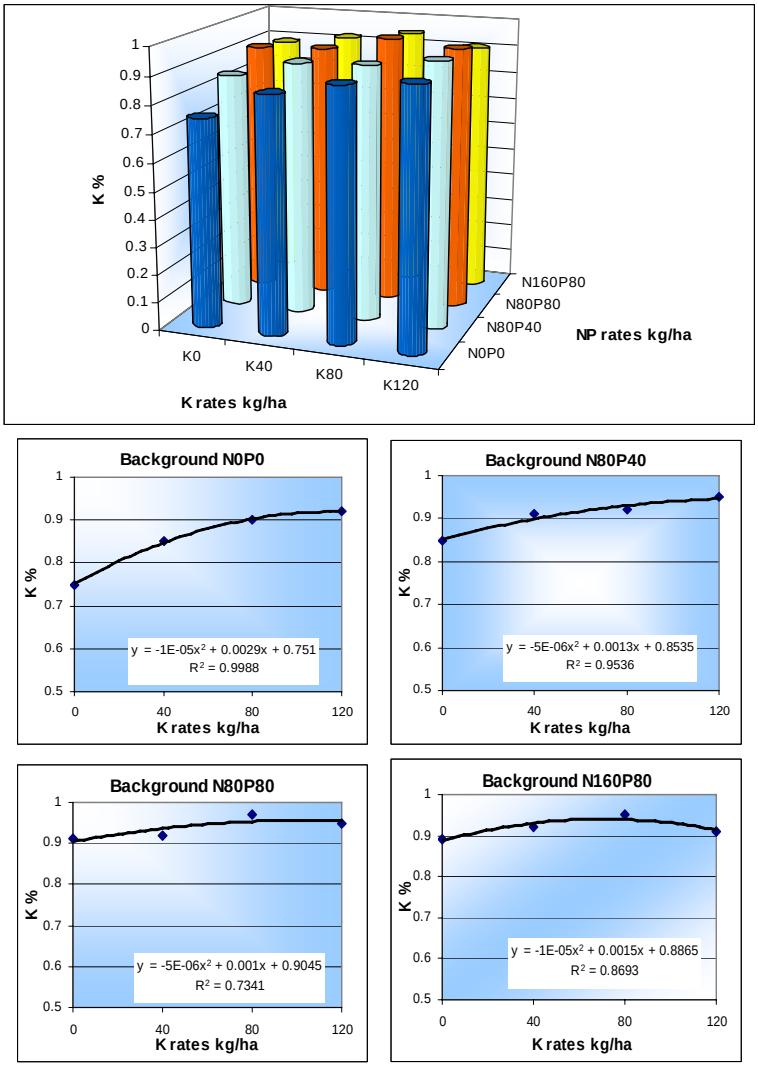

Fig. 2. Influence of NP x K fertilizers on seed K% content of sunflower in preluvosoil conditions from Oradea (2008 – 2010)

CONCLUSIONS

The establishing of optimum fertilizers rates which will lead to high level and good quality of yield is necessary to set up long term field experiments for each plant in different pedoclimatic conditions.

The long term field experiments set up at Agricultural Research and Development Station Oradea lead to obtaining of some conclusions very useful for agricultural practice and research too.

In average for those three experimental years (2008-2010) the yield spores due to potassium application on different NP backgrounds are ranging between 2,3 and 4,0 q/ha.

The bigger yield level 29.3 q/ha was obtained in the case of plots fertilized with $N_{80}P_{80}K_{120}$.

The most economic average yield spores 3.6 q/ha was obtained in plots fertilized with 80 kg K_2O, which represent a yield increasing with 17%.

The results obtained has shown that in preluvosoil conditions from N-W Romania potassium fertilizers application at sunflower lead to a significant yield increasing and the value of K rate recommended is depending of NP background utilized.

The seed K % content registered an obvious in the $N_{80}P_{80}$, background, where in the lack of K_{20} application the are an 0.91% K content, reaching at 0.97 K% when applied 80 kg/ha K_{20} (respectively a 10% spore in K% seed content).

REFERENCES

1. Angelova, M., D. Georgiev, L. Glogova, 2003, Investigation of the different correlation between the precipitation and the content of nitrogen, phosphorus and potassium in the sunflowers stalks. Scientific conference, Stara Zagora, vol. 1, Agrarian sciences, part 2, Crop science, pp.103-116.
2. Bhowmik, N.N., Sarkar, R.C., Raul, N.M., 1994, Response of sunflower to phosphorus and potassium application. Indian Agriculturist, 38 (2), 141-143
3. Ciobanu Gh., 2007, Agrochimia îngrăşamintelor. Editura Universităţii din Oradea.
4. Dahnke, W.C., 1994, Fertlizer recommendations. In: Sunflower production, NDSU Ext. Service, Ext. Bulletin 25, pp. 11 – 12.
5. D. C. Lewis, T. D. Potter and S. E. Weckert, The effect of nitrogen, phosphorus and potassium fertilizer applications on the seed yield of sunflower (*Helianthus annuus* L.) grown on sandy soils and the prediction of phosphorus and potassium responses by soil tests.Nutrient Cycling in Agroecosystems, Volume 28, Number 2, 185-190
6. Hera C., M. Tianu, G. Eliade, 1990, Contribution of nitrogen from soil and fertilizer to sunflower transformation in trials with ^{15}N. Symp. IAEA Vienna, 139.
7. Mihaela Claudia Ungureanu, Valeriu Tabără , 2010, Researches concerning the yield capacity of three hybrids of sunflower (Helianthus annus) in conditions of Timişoara, Research Journal of Agricultural Science,Vol 42, No 1.
8. Pereyra, V.R, O.F. Valetti, 1993, Production de girasol, manual para productores del sudeste bonaerense. Balcarce; cerbas, INTA, pp. 140
9. Sala F., I. Radulov, F. Crista, A. Berbecea, 2010, The correlation between the fertilization system and yield for the sunflower crop, Research Journal of Agricultural Science, 42 (3), pp. 296-301.
10. Schatz, B., B. Miller, S. Zwinger, and B. Henson, 1999, Response of sunflower to Nitrogen Fertilizer Proceedings of the 21st Sunflower Research Worksop, Forgo, ND, 14-15 January 1999, pp. 193-197.
11. Suzer S., 1998, Effect of different forms of nitrogen fertilizers, rates and application times on sunflower yield and yield components. Proceedings 2nd Balkan Symposium On Field Crops, Novi Sad, Yuhgoslavia, Vol.II, 219 - 223
12. Vrânceanu A.V., 2000, Floarea soarelui hibridă. Ed. Ceres Bucureşti.