

EFFECT OF NPK FERTILIZATION AND LIMING ON THE GROWTH OF WHITE MUSTARD VARIETIES

László FODOR¹ – Béla KADLICSKÓ²

¹ Károly Róbert College, Department of Environmental Management and Agronomy, 3200 Gyöngyös, Mátrai str. 36, Hungary, E-mail: lfodor@karolyrobert.hu

² KRF, Fleischmann Rudolf Research Institute, 3630 Putnok, Bajcsy-Zs. str. 42, Hungary, E-mail: frki.putnok@matavnet.hu

Introduction

Mustard is considered as an alternative crop plant in Hungarian agriculture. Its growing area varies between 10-30 thousands hectares, which depends mainly on mustard seed market. There are three types of mustard derived from two different species: white or yellow mustard (*Sinapis alba*), brown mustard (*Brassica juncea*), oriental mustard (*Brassica juncea*). All of these species are grown as a cash crop in the word. Among these, white mustard is the most common type cultivated in Europe and also in Hungary. It is usually cultivated for seeds, green fodder crop and green manure. Mustard seeds are primarily used in the condiment and food industries in the form of either seed or oil (Horváth 2001, Szabó – Fodor 2005).

This crop is commonly produced in rotation with small grain crops (cereals). Small grain crops following mustard in rotation will usually yield better than following small grains. Mustard has a good adaptability to different conditions (climate, soil, etc.). It has a partial drought tolerance. Most soil types are suitable for mustard production, but the soil of the seedbed should be firm and fairly level (Fodor 2004, Szabó 2004, Szabó et al. 2005).

Because of its short vegetation period, mustard requires a large amount of available forms of nutrients in soil. It generally responds well to nitrogen and phosphorus additions with optimum yield. Potash is rarely needed to increase mustard yields (Kádár – Földesi 2000). Soil tests should be used to determine nutrient need. The fertilizer guide recommends 50 kg N, 25 kg P₂O₅ and 40 kg K₂O of 1 t expected seed yield. A general recommendation or maintenance application is 80 kg N, 60 kg P₂O₅ and 30 kg K₂O fertilizer per hectare (Antal 2000).

Methods

The field experiment was initiated at Research Station of Fleischmann Rudolf Research Institute, Putnok, in 2003. The soil at the experimental site is a mildly acidic chernozem brown forest soil (pH_(H2O) = 5,65). The dominant mineral particles are clay and silt. The soil textural class is clayey – loam. The average humus content of the cultivated layer is 2,1 %. The soil profile contains no CaCO₃ at al. The soil can be characterized with medium nitrogen supply as well as medium – good phosphorus and potash supply.

The studied factors in the experiment were the following: variety, soil improvement (liming) and NPK fertilization (Table 1). The experiment was designed as a randomized block with 4 replications. The netto plot size was 32,4 m². NPK fertilizers (ammonium-nitrate, super phosphate, potassium-chloride) and the lime powder were added to plots before seeding (28.03.) and were mixed into the soil with seedbed preparation. The Mikramid foliar fertilizer was sprayed before flowering (20.05.) as 5 % fertilizer solution in dose of 9 kg ha⁻¹.

Table 1. Treatments of the field experiment

Main factors	Treatments
I. Varieties	1.) Budakalászi sárga, 2.) Tilney
II. Liming (CaCO_3)	1.) 0 kg ha^{-1} , 2.) 1 t ha^{-1} , 3.) $4,5 \text{ t ha}^{-1}$
III. Fertilization	1.) $\text{N } 40 + \text{P}_2\text{O}_5 40 + \text{K}_2\text{O } 30 \text{ kg ha}^{-1}$ 2.) $\text{N } 80 + \text{P}_2\text{O}_5 60 + \text{K}_2\text{O } 30 \text{ kg ha}^{-1}$ 3.) $\text{N } 120 + \text{P}_2\text{O}_5 80 + \text{K}_2\text{O } 30 \text{ kg ha}^{-1}$ 4.) $\text{N } 80 + \text{P}_2\text{O}_5 60 + \text{K}_2\text{O } 30 \text{ kg ha}^{-1} + \text{Mikramid}$

The weather of the vegetation period was drier and warmer than usually. Lack of precipitation and low temperature were characteristics in the seeding time. From the second half of April a long warm period followed the winter. The precipitation of April – May – June did not reach the half of the average of the previous 100 years. There was an unusual drought in the second half of May and June (Table 2).

Table 2. Monthly precipitation and monthly mean temperature in the mustard growing season (Putnok, 2003)

	January	February	March	April	May	June
Precipitation (mm)	40,7	33,1	3,6	23,2	70,9	14,6
Temperature ($^{\circ}\text{C}$)	-4,8	- 6,1	3,9	10,0	16,2	21,0

Results and conclusions

Because of lack of precipitation and unusual drought in the vegetation period, the effect of fertilization and liming was influenced unfavourably in the experiment. Only the differences between two studied varieties could be observed in the beginning of growing season. Effects of different NPK doses on the stand development could be seen at the end of flowering and at the beginning of seed formation. The yield and the main characteristics of studied varieties in different treatments are presented in the table 3. The increasing nitrogen and phosphorus supply increased the yield of both varieties on the lime treated as well as untreated plots. The reaction of Budakalászi sárga on the increasing nutrient supply was better than in case of other variety. The Mikramid foliar fertilizer (NPK treatment 4.) resulted grain yield excess only on the lime untreated plots. Liming improved the efficiency of NPK fertilizer supply.

Table 3. Results of mustard agrotechnics field experiment

Code of treatments	Plant height (cm)	Branches per plant	Bottom pod from the soil surface (cm)	Grain yield (t ha ⁻¹)
111	118,5	5,5	57,6	1,60
112	117,3	5,6	61,8	1,71
113	113,8	6,1	56,7	1,86
114	115,0	5,6	55,3	1,62
211	89,5	5,5	48,9	1,53
212	92,8	6,0	48,3	1,69
213	93,8	6,2	35,7	1,78
214	91,0	6,5	43,5	1,74
121	120,3	6,2	59,4	1,70
122	116,8	6,2	57,0	1,79
123	119,3	5,1	58,7	1,92
124	118,5	5,2	57,0	1,76
221	90,8	5,3	45,8	1,44
222	92,5	6,3	46,2	1,51
223	89,3	6,1	39,9	1,67
224	90,3	5,5	47,8	1,38
131	119,3	5,3	61,4	1,32
132	121,0	6,5	56,3	1,47
133	125,3	6,0	63,8	1,67
134	122,8	5,7	54,4	1,61
231	92,5	7,3	45,9	1,57
232	97,5	5,0	45,7	1,64
233	93,3	8,0	47,3	1,75
234	96,8	6,9	48,2	1,62

Effect of main factors (varieties, liming and fertilization) on the yield and the characteristics of mustard plants in the average of other treatments can be studied in the table 4. Budakalászi sárga gave significantly more grain yield than Tilney. Positive effect of the liming (4,5 t ha⁻¹ CaCO₃) on the yield formation could be observed, but it was not proved statistically. Increasing fertilizer doses of nutrition treatments resulted significant yield excess.

Table 4. Effects of treatments: main factors in average of other treatments

Main factors and treatments	Plant height cm	Branches per plant	Bottom pod from the soil surface (cm)	Grain yield	
				t ha ⁻¹	LSD 5 %
I. Variety					
1.) Budakalászi sárga	119,0	5,7	58,3	1,74	0,09
2.) Tilney	92,5	6,2	45,2	1,54	
II. Soil improvement					
1.) Control	103,9	5,9	51,0	1,61	0,19
2.) 1 t ha ⁻¹ CaCO ₃	104,7	5,7	51,4	1,58	
3.) 4,5 t ha ⁻¹ CaCO ₃	108,5	6,3	52,8	1,72	
III. Fertilization					
1.) NPK 1	105,1	5,8	53,2	1,52	0,05
2.) NPK 2	106,3	5,9	52,5	1,64	
3.) NPK 3	105,8	6,2	50,3	1,77	
4.) NPK 2 + Mikramid	105,7	5,9	51,0	1,63	

References

- Antal, J. (2000): Növénytermesztők zsebkönyve. Mezőgazda Kiadó, Budapest.
- Fodor, L. (2004): Some agronomic aspects of white mustard (*Sinapis alba*) production. Proc. of the III. Alps-Adria Scientific Workshop (Ed.: Hidvégi Sz. – Gyuricza Cs.) Akaprint, Budapest. 178-182.
- Horváth, Z. (2001): A mustár. In: Alternatív növények termesztése (Szerk.: Radics, L.). Mezőgazdasági Szaktudás Kiadó, Budapest. 94-117.
- Kádár, I. – Földes, D. (2002): A mustár (*Sinapis alba* L.) műtrágyázása csernozjom talajon I. Növénytermelés. Agroinform Kiadóház. 437-488.
- Szabó, L. (2004): A mustár termesztésének környezetvédelmi jelentősége. IX. Nemzetközi Agrárökonómiai Tudományos Napok. KRF, Gyöngyös, CD kiadvány, ISBN: 963 214 313 2.
- Szabó, L. – Fodor, L. (2005): Mustár fajtakísérlet eredményei. Gazdálkodás, XLIX. évf. 13: 74-78.
- Szabó, L. – Fodor, L. – Tóth, Cs. (2005): Development of Environmental friendly mustard production. Proc. Innovation and utility in the Visegrad Fours. Vol. 2-3: 415-420.
- Kádár, I. (2004): Szennyvíziszap-adagok hatása a növény (*Triticum vulgare* L.)-talaj rendszer néhány mikrobiológiai és biokémiai tulajdonságára (Impact of sludge treatments on some microbiological and biochemical properties of plant (*Triticum vulgare* L.)-soil system. – in *Hungarian*). Agrokémia és Talajtan. 53. 3-4. 331-342 pp
- Svetková, K.; Henselová, M.; Morvová, M. (2005): Effects of a carbonization product as additive on the germination, growth and yield parameters of agricultural crops. Acta Agron. Hun. 53. (3). 241-250 pp
- Tanács, L., Matuz, J., Gerő, L., Petróczi, I.M. (2005): Effect of NPK Fertilizers and Fungicides on the Quality of Bread Wheat in Different Years. Cereal Res. Commun. 33 (2-3): 627-634 pp