

**IMPACT OF SOME MIXTURES BETWEEN FOLIAR FERTILIZERS AND  
ANTIGRAMINACEOUS HERBICIDES ON THE SOWING PROPERTIES OF THE  
DURUM WHEAT SOWING-SEEDS**

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**ABSTRACT**

The research was conducted during 2010 - 2012 on pellic vertisol soil type. Two-factor field experiment was carried out with durum wheat cultivar Deyana (*Triticum durum var. valenciae*). Factor A included no treated check and 3 foliar fertilizers - Humustim – 1 l/ha, Lactofol O – 8 l/ha, Masterblend (20-20-20) – 3.5 kg/ha. Factor B – included weed, no treated check and 4 antigraminaceous herbicides - Foxtrot 69 EB (fenoxaprop-ethyl) – 1 l/ha, Axial 050 EC (pinoxaden) - 900 ml/ha, Topic 080 EC (clodinafop) - 450 ml/ha, Traxos 045 EC (pinoxaden + clodinafop) – 1.20 l/ha.

Tank mixtures of herbicide Foxtrot with organic foliar fertilizer Humustim and complex foliar fertilizers Lactofol O and Masterblend decreases germination energy of the durum wheat seeds and increases waste grain quantity. Tank mixtures Humustim + Foxtrot, Lactofol O + Foxtrot and Masterblend + Foxtrot not increase lab seed germination. Tank mixtures Humustim + Foxtrot decrease length of coleoptile. Investigated foliar fertilizers, antigraminaceous herbicides and tank mixtures of herbicides Axial one, Topik and Traxos not proved influence on lengths of primary roots and coleoptile and also waste grain quantity. There is antagonism of combined use by antigraminaceous herbicide Foxtrot with three foliar fertilizers Humustim, Lactofol and Masterblend. The grain yield increase in compared to alone application of the preparations is only 0.6 - 0.9 %. There is an additive effect by tank mixtures of fertilizers Humustim, Lactofol and Masterblend with antigraminaceous herbicides Axial, Topic and Traxos. The highest grain yields are obtained by these tank mixtures.

**Key words:** *durum wheat, foliar fertilizers, herbicides, grain yield, sowing properties*

**INTRODUCTION**

Herbicides will remain in future agriculture effective means of weed control as part of integrated control therefore there is need for research to optimize their use (Bassi et al., 2002; Kudsk and Streibig, 2003; Campagna and Rueegg, 2006). The experience of their widespread use shows how important it is borne in mind all the factors that determine the effective application of these complex organic compounds. The main accent in the study of herbicides in durum wheat crops is on their performance against the dominant weeds, selectivity in relation of culture and their influence on the grain quality as regards the use as a raw material in the food industry (Hallgren, 1993; Tewari et al., 1993; Orlando, 1994; Baerg et al., 1996; Panwar et al., 1996; Kumar and Singh, 1997; Rapparini et al., 2004; Hassan et al., 2006; Buczek et al., 2007).

A part of the grain, however, is used as a seed for sowing. The realization of the biological potential of durum wheat is closely related to the creation of well-topped and highly productive crops that require high-quality seeds. The question of the influence of herbicidal use in the seed production on the quality of the obtained durum wheat seeds has not yet been elucidated.

Considering these achievements, we set the aim of this investigation to establish the influence of some foliar fertilizers, antigraminaceous herbicides and their tank mixtures on sowing properties of the durum wheat seeds and the quantity of waste grain.

**MATERIALS AND METHODS**

The research was conducted during 2010 - 2012 on pellic vertisol soil type. Two-factor field experiment was carried out with durum wheat cultivar Deyana (*Triticum durum var. valenciae*). The experiment was conducted under the block method, in 4 repetitions; the size of the crop plot was 15 m<sup>2</sup>. Factor A included no treated check and 3 foliar fertilizers - Humustim – 1 l/ha, Lactofol O – 8 l/ha, Masterblend (20-20-20) – 3.5 kg/ha. Factor B – included weed, no treated check and 4

antigraminaceous herbicides - Foxtrot 69 EB (fenoxaprop-ethyl) – 1 l/ha, Axial 050 EC (pinoxaden) - 900 ml/ha, Topic 080 EC (clodinafop) - 450 ml/ha, Traxos 045 EC (pinoxaden + clodinafop) – 1.20 l/ha.

Complex fertilizers Lactofol O and Masterblend contain nitrogen in amide, ammonium and nitrate forms, easily absorbable phosphorus and potassium, trace elements, amino acids, physiologically active substances, and organic fertilizer Humustim - potassium salts of humic acids and fulvic acids. Both complex foliar fertilizers differ mainly in the nature of the complexing agent – in Lactofol O it is lactic acid, and in Masterblend it is ethylene-diamine-tetra-acetic acid (EDTA).

All of foliar fertilizers, herbicides and their tank mixtures were treated in tillering stage of the durum wheat with working solution 200 l/ha. Mixing was done in the spray tank. Due to investigated herbicides have not antibroadleaved effect the control of broadleaved weeds in all variants was done with the herbicide Secator OD at 100 ml/ha.

The grain gained after every variant was cleaned through a sieve with holes size 2.2 mm and the quantity of the waste grain was defined (siftings). All version seeds for sowing were defined for their germination energy and lab seed germination. It was studied intensity of early growth of seeds, expressed by the length of primary roots and coleoptile definite on the eighth day after setting the samples. Each index was determined in two repetitions of the year. Averages in each of the years of experience were used as repetitions in mathematical data processing were done according to the method of analysis of variance.

### RESULTS AND DISCUSSION

One of the important conditions for obtaining a normal crop and a good harvest is the use of quality seeds. Apart from the high-yield cultivar which is resistance to diseases and pests, it must have the necessary sowing properties, the main of which are high germination energy and seed germination. Germination energy is one of the most important characteristics of the sowing properties of the seed. The low germination energy is the reason for slower development of primary roots and coleoptile after seed germination and is associated with later germination in field conditions, less tempering of plants and a higher risk of frost in the winter. Its lead to lower grain yields. The obtained results show that the treatment of the durum wheat with tank mixtures of antigraminaceous herbicide Foxtrot with organic foliar fertilizer Humustim and with complex foliar fertilizers Lactofol O and Masterblend during tillering stage of durum wheat lead to decrease in the germination energy (Table 1). Analysis of variance, in which the years have taken for replications, shows that these decreases are mathematically proven.

Germination is the most important index who characterizing the sowing properties of the seed. At low laboratory germination sowing should be done with higher sowing rate, which increases the cost production. Laboratory germination of the seeds at all variant during the three years of study above the requirements of the standard for over 85% germination, although in different years account for some variation of its values. This is the positive effect of their use, because it is not necessary to increase the sowing rate (in kg/ha) and the cost of necessary seeds. Tank mixtures Humustim + Foxtrot, Lactofol O + Foxtrot and Masterblend + Foxtrot seed germination is unproven increase seed germination than alone treatments of foliar fertilizers Humustim, Lactofol O and Masterblend. The durum wheat seeds germinate normally by influence of the tank mixtures of herbicide Foxtrot with the three foliar fertilizers, although the initial rate of development is lower due to lower germination energy. Foliar fertilizers, antigraminaceous herbicides and tank mixtures of Axial, Topic and Traxos increase the indexes germination energy and seed germination. This means that they help for joint and fast germination of the durum wheat sowing-seeds.

The obtained results for germination energy and seed germination are a prerequisite continue to investigate the effect of stimulators, herbicides and their tank mixtures on initial intensity of the

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growth of seeds, expressed by the length of roots and coleoptiles. It was found that the length of coleoptiles of durum wheat is decreased by combinations between herbicide Foxtrot with foliar fertilizer Humustim. The decreasing is proven by analysis of variants. These tank mixtures does not influence on length of primary roots. Combination Humustim + Foxtrot difficults young plants developments, reduces their resistance to cold and increase risk of frost damages during winter months. Other tank mixtures between investigated foliar fertilizers and antigraminaceous herbicides stimulate the growth of the length of primary roots and coleoptiles of the durum wheat and recommended for use in seed production crops of durum wheat.

**Table 1:** Sowing properties of the seeds (mean 2010-2012)

Variants		Germinative energy, %	Germination, %	Length, cm		Waste grain, %
Foliar fertilizers	Herbicides			Coleoptile	Root	
-	-	86,0	89,5	9,3	11,6	14,2
	Foxtrot	87,5	94,0	10,1	12,7	13,2
	Axial	87,0	94,0	10,0	13,0	13,4
	Topic	86,0	93,5	10,5	12,9	13,9
	Traxos	86,5	92,5	10,9	12,6	13,8
Humustim	-	90,0	93,5	12,7	13,8	13,6
	Foxtrot	82,0	94,5	9,2	11,3	15,9
	Axial	92,5	98,5	13,0	16,5	13,7
	Topic	91,0	97,5	13,3	15,0	11,3
	Traxos	90,5	96,0	13,1	14,8	10,4
Lactofol O	-	90,5	94,0	12,0	14,1	13,8
	Foxtrot	82,0	95,5	12,0	14,2	16,1
	Axial	91,5	94,0	12,3	15,6	13,8
	Topic	92,0	97,0	12,5	16,2	11,2
	Traxos	91,5	96,5	13,0	15,0	13,9
Masterblend	-	91,0	93,5	12,6	15,7	10,9
	Foxtrot	82,5	95,5	12,7	15,9	15,5
	Axial	94,0	98,5	13,5	16,9	13,8
	Topic	93,5	96,0	11,1	14,0	14,0
	Traxos	92,0	96,0	11,8	15,0	12,3
LSD 5%		3,6	3,0	2,4	3,4	2,0
LSD 1%		5,1	4,5	4,3	5,8	4,8
LSD 0,1%		6,9	6,4	6,7	7,7	6,8

At the evaluation of the sowing characteristics we have to consider not only the characteristics of the sowing seeds but also the quantity of the waste grain (siftings) which are gained at the

preparation of these seeds. Bigger quantity screenings lead to higher cost of the seed and reduce the economic effect of seed production of durum wheat. Tank mixtures of herbicide Foxtrot with foliar fertilizers Humustim, Lactofol O and Masterblend lead to increasing in the quantity of waste grain. Foliar fertilizers, antigraminaceous herbicides and tank mixtures of Axial, Topic and Traxos with the three foliar fertilizers lead to decreasing in the quantity of waste grain. Differences between them and untreated check are mathematically proven.

Decreases in the values of germination energy and laboratory seed germination, changes in the intensity of the initial growth, expressed by the length of the root and coleoptile at germination and changes in the quantity of waste grain under the influence of the combination between foliar fertilizers and antigraminaceous herbicides are explained by the depressing effects on growth and development of the durum wheat during its vegetative period.

**Table 2: Grain yield (2010-2012)**

Variants		2010		2011		2012		Mean	
Foliar fertilizers	Herbicides	kg/ha	%	kg/ha	%	kg/ha	%	kg/ha	%
-	-	4300	100	4106	100	4567	100	4324	100
	Foxtrot	4584	106,6	4393	107,0	4891	107,1	4623	106,9
	Axial	4618	107,4	4439	108,1	4932	108,0	4663	107,8
	Topic	4623	107,5	4434	108,0	4941	108,2	4666	107,9
	Traxos	4644	108,0	4459	108,6	4969	108,8	4691	108,5
Humustim	-	4472	104,0	4303	104,8	4767	104,3	4513	104,4
	Foxtrot	4605	107,1	4069	99,1	4946	108,3	4540	105,0
	Axial	4752	110,5	4439	108,1	5015	109,8	4735	109,5
	Topic	4739	110,2	4434	108,0	5033	110,2	4735	109,5
	Traxos	4773	111,0	4476	109,0	5074	111,1	4774	110,4
Lactofol O	-	4506	104,8	4320	105,2	4814	105,4	4547	105,2
	Foxtrot	4644	108,0	4114	100,2	4987	109,2	4582	105,9
	Axial	4696	109,2	4483	109,2	4955	108,5	4711	109,0
	Topic	4709	109,5	4521	110,1	4969	108,8	4733	109,5
	Traxos	4739	110,2	4480	109,1	5024	110,0	4748	109,8
Masterblend	-	4494	104,5	4295	104,6	4928	107,9	4572	105,7
	Foxtrot	4687	109,0	4196	102,2	4942	108,2	4608	106,6
	Axial	4801	111,6	4488	109,3	5015	109,8	4768	110,3
	Topic	4730	110,0	4480	109,1	4992	109,3	4734	109,5
	Traxos	4700	109,3	4444	108,3	4956	108,5	4700	108,7
LSD 5%		229	5,3	219	5,3	221	4,8		
LSD 1%		273	6,3	260	6,3	262	5,7		
LSD 0,1%		328	7,6	311	7,6	313	6,9		

To make a full evaluation of the sowing properties needed to establish not only the quality of seeds, but also the quantity of grain which will be received this seeds. Data for the influence of foliar fertilizers, antigraminaceous herbicides and their tank mixtures on grain yield (Table 2) show that the lower yield is obtained in untreated and weed check. At alone application of herbicides Foxtrot, Axial, Topic and Traxos grain yield increases because the weeds are destroyed. The increase is at least by Foxtrot - 6.9 %, and the highest by Traxos - 8.5 %. The increasing of grain yield is biggest at the herbicide Traxos because it is controlled at a large number of graminaceous weeds including *Bromus arvensis*. The reason for the effective control of *Bromus arvensis* at Traxos is synergism in combination of active substances - pinoxaden and clodinafop. Herbicides Axial and Topic which containing respective only pinoxaden and clodinafop cannot control this graminaceous weed. Herbicide Foxtrot except against *Bromus arvensis* is ineffective against *Lolium multiflorum* and *Lolium temulentum*.

Alone application of organic foliar fertilizer Humustim and complex foliar fertilizers Lactofol O and Masterblend increases grain yield because they stimulate the growth and development of durum wheat. The increase ranged from 4.4 % by Humustim to 5.7 % by Masterblend. Alone application of foliar fertilizers lead to less increase than alone application of antigraminaceous herbicides due to available graminaceous weeds neutralize some of the positive effects. At all of variants, the fight against annual and perennial broadleaved weeds is done with antibroadleaved herbicide Secator which was treated 10 days after treatment of the investigated preparations.

It is established manifestations of antagonism by concurrent use of antigraminaceous herbicide Foxtrot with three foliar fertilizers Humustim, Lactofol O and Masterblend. The grain yields are unproven higher than those at the alone application of these preparations. The increase in grain yield is only 0.6 % to 0.9 %. The mixing of foliar fertilizers Humustim, Lactofol O and Masterblend with the other three antigraminaceous herbicides Axial, Topik and Traxos not lead to antagonism. They have an additive effect. At these tank mixtures grain yield and herbicidal effect is equal to the total effect of these fertilizers and antigraminaceous herbicides. The increase of grain yield is the bigger in tank mixture Humustim + Traxos. The increase is 10.4 % or 445 kg/ha mean for the investigated period.

### CONCLUSION

Tank mixtures of herbicide Foxtrot with organic foliar fertilizer Humustim and complex foliar fertilizers Lactofol O and Masterblend decreases germination energy of the durum wheat seeds and increases waste grain quantity.

Tank mixtures Humustim + Foxtrot, Lactofol O + Foxtrot and Masterblend + Foxtrot not increase lab seed germination.

Tank mixtures Humustim + Foxtrot decrease length of coleoptile.

Investigated foliar fertilizers, antigraminaceous herbicides and tank mixtures of herbicides Axial one, Topik and Traxos not proved influence on lengths of primary roots and coleoptile and also waste grain quantity.

There is antagonism of combined use by antigraminaceous herbicide Foxtrot with three foliar fertilizers Humustim, Lactofol and Masterblend. The grain yield increase in compared to alone application of the preparations is only 0.6 - 0.9 %.

There is an additive effect by tank mixtures of fertilizers Humustim, Lactofol and Masterblend with antigraminaceous herbicides Axial, Topic and Traxos. The highest grain yields are obtained by these tank mixtures.

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