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Response of Wheat to Seed Dressing with Humus and Foliar Potassium Fertilization

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ABSTRACT

Growing demand for wheat grain with optimal technological parameters results in looking for the possibilities of accurately meeting the plant needs. Environmental conditions in the surroundings of germinating grains can be improved by application of humic preparations. Qualitative features of grain can be also changed by foliar application of potassium, which is the activator of enzymes catalysing synthesis of proteins. The aim of the study was to assess the effect of seed dressing with Humistar (12% of humic acids, 3% fulvic acids) and foliar application of Drakar (31% K_2O, 3% N) on the spring wheat yield and qualitative features of the grain, namely, 1,000 Kernel Weight (TKW), Hectolitre Mass (HM), Grain Glassiness (GG), Falling Number (FN), total Protein Content (PC), Wet Gluten content (WG) and Sedimentation Value (SV). The experiment was established in the randomized blocks design in a soil classified as Mesic Typic Hapludalfs. The effect of the applied preparations on yield was non-significant, but it was favourable for grain quality. Application of Humistar resulted in an improvement of TKW, HM, GG, PC, WG and SV as compared with the control. Results of the application of Drakar were similar to Humistar in affecting HM, WG and SV, and in the case of PC, the result was even better. The effect of Drakar on GG, although favourable compared to the control, was smaller than after the application of Humistar. Seed dressing with Humistar or foliar potassium fertilization with Drakar are agrotechnical methods that can improve the qualitative features of milling wheat grain.

Keywords: Grain yield, Humic substances, Technological parameters.

INTRODUCTION

Growing demand for wheat grain with high indexes of technological usefulness has resulted in conducting comprehensive research work. The range of studies includes not only factors affecting the yield, but also grain quality traits. These traits determine grain usefulness in mill and bread industries. The reason for such research is also a dynamic progress of breeding resulting in the introduction of new improved cultivars into use. Supplying nutrients by fertilization is one of essential factors enabling the improvement of some grain quality parameters. Relationships between mineral fertilization (particularly with nitrogen) and the yield and values of technological features of cereal grain and flour are relatively well known (Ducsay and Ložek, 2004; Modhej *et al*., 2008; Knapowski *et al*., 2009, 2010; Ralcewicz *et al*., 2009; Zeidan *et al*., 2010; Sheibani and Ghadiri, 2012;

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Tadayon *et al*., 2012, Mohammadi *et al*., 2013), whereas there is little data concerning the effect of artificially introduced humic substances on these features. Humic substances determine the physical, chemical, and biological properties of soil, and thus they indirectly affect the plant growth and development (Verlinden *et al*., 2009). They can also exert direct influence already from the early stages of germination (Szczepanek and Wilczewski, 2011). Plant response depends on the humus source of origin and the related chemical composition, as well as on the molecular mass (Muscolo *et al*., 2007; Marino *et al*., 2008). The amount of the applied compounds may also be of great importance. Humic substances applied in small doses, particularly fractions with a low molecular mass, have a stimulating effect on plant growth (Asik *et al*., 2009). Processes of growth and development affect not only the amount of generated biomass of yield but also its quality traits. Therefore, according to Nardi *et al*. (2002), complex studies concerning the effects of humic substances application in crop production are necessary. In recent years, foliar application of potassium in wheat has also been applied more frequently. It plays an essential role in carbohydrates and protein production by plants and regulates water uptake and turgor of plant cells. Cereal crops well supplied with potassium utilize the soil reserves of water more efficiently and are more resistant to drought. This element is intensively accumulated in cereal plants in the initial period of their growth, and then it is used in fast development phases. Optimal potassium fertilization activates enzymes affecting better utilization of nitrogen by plants, which consequently increases the amount of protein and gluten in grain and has a favorable effect on the value of falling number (Maathuis, 2009; Grzebisz *et al*., 2013).

Looking for agricultural factors that improve wheat yield quality is essential for the optimization of grain production for consumption. It may be supposed that apart from the known factors affecting technological parameters of grain (e.g. nitrogen fertilization), also the application of preparations based on humic substances that support cultivation or foliar potassium fertilization will have the effect on the quality of obtained yields. The aim of this experiment was to evaluate the effect of seed grain dressing with humic substances and foliar potassium application on the traits of grain and flour of spring wheat cv. Monsun. Moreover, we aimed to find the relationships between the quality parameters in conditions of application of the tested preparations.

MATERIALS AND METHODS

Research material was the grain of common wheat (*Triticum aestivum* L.) *cv.* Monsun derived from the one-factorial, field experiment conducted in 2006–2008 in the Kuyavian-Pomeranian region (17^{o} 35 E; 53^{o} 09 N). The soil in the experimental site was classified as Mesic Typic Hapludalfs (Soil Survey Staff, 2010) and was characterized (according to the assessment of Polish soil abundance in available P, K and Mg by Lipiński, 2005) as having a very high content of available P (173 mg kg^{-1}), high content of available K (185 mg kg^{-1}) (both determined with Egner-Riehm method), very high content of available Mg (93.3 mg kg^{-1}) (determined with Schachtschabel method) and neutral reaction (pH in KCl 6.71). The experiment was established in the randomized complete block design with 4 replications, and the harvest area of the plots was 16.6 m^{2}. Preparations with trade names of Humistar (H) and Drakar (D) were used in the experiment. Humistar is a humic preparation in the liquid form with black color and acid reaction, containing 12% by weight of humic acids and 3% of fulvic acids. It is an extract from Leonardite - a highly oxidized form of brown coal from Canada (Verlinden *et al*., 2010). Grains dressed with a fungicide (tiuram+carbendazim) were mixed with

Humistar for 5 minutes in a seed dresser. This made it possible to cover the seed material with that preparation in a dose of 1 L per 50 kg of grain. Drakar is a potassium fertilizer in the form of liquid, containing 31% K_2O and 3% N. It was applied on leaves at two rates of 2 L ha^{-1} each (the first was applied before flowering in the middle of June, and the second 2 weeks later. Also, both preparations were applied together (H+D) in the way described above. The effects of these applications were compared with the control.

Grain of spring wheat 'Monsun' was sown in the first half of April. Phosphorus (21.9 kg P ha^{-1}) and potassium (66.4 kg K ha^{-1}) were applied in autumn, before performing winter plowing. The first rate of nitrogen (60 kg ha^{-1}) was applied pre-sowing, whereas the second (50 kg ha^{-1}) at the shooting stage. Protective measures against weed infestation, pests, and diseases were performed throughout the experiment as required. Wheat harvest was performed at the full maturity stage in the first half of August.

The obtained grain yield from the plots was adjusted to the constant humidity of 15%. From each plot, representative grain samples were collected for determination of quality features i.e. 1,000 Kernel Weight (TKW), Hectolitre Mass (HM), Grain Glassiness (GG), Falling Number (FN, according to Hagberg method), total Protein Content (PC, using Kjeldahl method), Wet Gluten content (WG), and Sedimentation Value (SV, according to Zeleny method).

Results of the study were subjected to statistical analysis, using the analysis of variance, and boundary differences were determined according to Tukey's test at significance level P= 0.05. To determine connections and relationships between the obtained values of tested features of spring wheat, the results were subjected to analysis of simple correlations and linear regression.

Distribution of temperature and rainfall show high variability of weather conditions during the field research. Rainfall during the growing season, in two of the three years of field studies (in 2006 and 2007), was higher than the long-term average (Table 1). The year 2008 was characterized by the 16.9 mm lower rainfall the long-term average (1980-2008). Average temperatures in the period from March to August were much lower (in 2006 and 2008, respectively, 0.5 and 0.2°C) or higher (about 0.5°C in 2007) than the long-run average. Sielianinow hydrothermal coefficient calculated for each month in the study also confirms the wide variety of weather conditions,

Table 1. The meteorological conditions at the experimental site.

Month	Average temperature (°C)				Rainfall (mm)				Hydrothermal coefficient (K) [a]		
	2006	2007	2008	1980-2008	2006	2007	2008	1980-2008	2006	2007	2008
March	-1.0	5.4	3.1	2.7	21.9	55.2	53.5	35.0	-	-	-
April	7.8	9.0	8.0	8.3	60.4	16.6	40.0	29.6	2.60	0.62	1.67
May	12.8	14.2	13.7	14.0	67.4	83.5	13.8	47.4	1.70	1.90	0.32
June	17.2	18.2	17.3	16.8	14.6	111.7	19.6	67.6	0.28	2.05	0.38
July	22.6	18.0	18.9	19.1	28.5	88.9	65.0	70.7	0.41	1.59	1.11
August	17.4	18.1	17.7	18.6	163.9	29.4	101.3	59.8	3.04	0.52	1.85
Mean/Total	12.8	13.8	13.1	13.3	356.7	385.3	293.2	310.1	2.48	1.66	1.81

[a] Hydrothermal coefficient according Sielianinow, assume the following limits**:** K< 0.4: extremely dry conditions; 0.4< K< 0.7: Very dry conditions; 0.7< K< 1.0: Dry conditions; 1.0< K< 1.3: Fairly dry conditions; 1.3< K< 1.6: Optimal conditions; 1.6< K< 2.0: Relatively damp conditions; 2.0< K< 2.5: Damp conditions; 2.5< K< 3.0: Very damp conditions, 3.0< K: Extremely damp conditions. not calculated for the average month temperatures below 7°C (Skowera 2014)

from extremely dry (June 2006, May and June 2008), through the optimal (July 2007) to extremely wet (August 2006).

RESULTS AND DISCUSSION

Yield and Physical Parameters of Grain

Grain Yield (GY) of spring wheat varied in the years of the study (Table 2). The smallest GY was obtained in 2008, where May and June conditions were extremely dry. In 2007, however, heavy rainfalls in these months created favorable conditions for yield. The GY obtained in 2006 was 31% smaller than in 2007, mainly due to rainfall deficit in June and July (Table 1). The obtained relationships confirmed the effect of climatic conditions in the growth period on wheat GY, as described by other authors (Sanjari Pireivatlou and Yazdansepas, 2008; Najafian *et al*., 2010, Jug *et al*., 2011; Tadayon *et al*., 2012, Gaj *et al*., 2013). According to Woźniak and Staniszewski (2007), precipitation shortage at the stages of earing, flowering, and grain setting has a particularly negative effect on (GY) and its quality. Application of the tested chemicals did not have significant effect on (GY). Seed grain dressing H, fertilization D and combined application of preparations (H+D) resulted in only a slight increase in GY in relation to the control, on average in multiyear by 2.5, 2.1, and 2.0%, respectively. Shahryari and Mollasadeghi (2011) after the application of humic preparations obtained an increase in wheat GY by as much as 44%. The low yield levels in the study of these authors indicates considerably worse cultivation conditions and explains a different response compared with that obtained in the present study. Also, Shahryari *et al*. (2009), Turgay *et al*. (2011) and Arabi *et al*. (2002) report a positive effect of humic substances and foliar potassium fertilization on wheat GY.

One-Thousand Kernel Weight (TKW) of the tested wheat cultivars was higher in comparison with the results presented by Kołodziejczyk *et al*. (2009) and Jug *et al*. (2011), but lower in relation to the values obtained by Shahryari and Mollasadeghi

Table 2. Yield and physical parameters of wheat grain.[a]

Characteristics	Year	Treatment				Mean
		Control	Humistar	Drakar	H+D	
Grain Yield ($GY, t ha^{-1}$)	2006	5.64a	5.74a	5.70a	5.68a	5.69
	2007	8.16a	8.26a	8.24a	8.30a	8.24
	2008	4.46a	4.70a	4.70a	4.62a	4.62
Mean		6.08a	6.23a	6.21a	6.20a	6.18
1000 Kernel Weight (TKW, g)	2006	33.7b	37.5a	34.9b	35.4ab	35.4
	2007	45.8a	47.5a	46.4a	47.0a	46.7
	2008	44.0a	45.5a	44.7a	45.3a	44.9
Mean		41.1c	43.5a	42.0bc	42.6ab	42.3
Hectolitre Mass ($HM, kg hl^{-1}$)	2006	74.65a	75.28a	75.50a	75.28a	75.18
	2007	76.88a	76.63a	76.53a	76.95a	76.74
	2008	75.78a	76.15a	76.35a	76.23a	76.13
Mean		75.77b	76.02a	76.13a	76.15a	76.02
Grain Glassiness (GG, %)	2006	53.3b	69.0a	62.0a	63.3a	61.9
	2007	57.5b	68.0a	62.5ab	63.5ab	62.9
	2008	80.8a	86.0a	82.0a	84.0a	83.2
Mean		63.8c	74.3a	68.8b	70.3b	69.3

[a] values followed by the same letter within particular rows are not significantly different at the 0.05 level according to the Tukey's test

(2011). TKW was differentiated in the years of the study - the highest in 2007 and lower by as much as 24.2% in 2006, which indicates a strong effect of the weather conditions on this grain feature. Similar conclusions are presented in the studies by other authors (Arabi *et al*., 2002; Sanjari Pireivatlou and Yazdansepas, 2008; Kołodziejczyk *et al*., 2009; Jug *et al*., 2011). The applied preparations determined TKW (F= 12.75, variation coefficient 12.20%). Significant average increase in TKW after the application of H and H+D in relation to C was shown in the long-term period, but there was no effect of D alone. Shahryari and Mollasadeghi (2011) did not observe the effect of humic fertilizers on TKW, whereas Arabi *et al*. (2002), applying foliar potassium fertilization to wheat, found a significant increase in the value of this feature.

One of the evaluated quality parameters of grain is Hectolitre Mass (HM), whose value above 76 kg hL^{-1} suggests its high plumpness and evenness, and consequently, high flour yield. HM of spring wheat 'Monsun' was moderately high and relatively stable in the years of the study (Table 2). Kołodziejczyk *et al*. (2009) observed higher HM values (77.9-82.5 kg hL^{-1}) in their study. Analysis of the obtained results showed a small but statistically significant effect of the studied preparations on HM (F= 8.69, variation coefficient 1.13%). Grain dressing H, foliar spraying D, as well as application of H+D in spring wheat cultivation resulted in an increase in HM in relation to C. It ranged from 0.25 kg hL^{-1} in treatment H to 0.38 kg hL^{-1} in treatment H+D. According to Bulut *et al*. (2013), the application of organic fertilizers contributed to an increase in HM from 78.3 to 80 kg hL^{-1}. The greatest effect on this trait was obtained after the pre-sowing use of cattle manure (10 t ha^{-1}) and organic fertilizer (BioFarm Company) in a dose of 1.5 t ha^{-1}, whereas the application of 650 kg ha^{-1} Leonardite (the raw material for Humistar production) did not improve the HM value.

Grain Glassiness (GG) is a quality feature of wheat allowing for initial conclusions about its technological usefulness. Analysis of variance of the obtained results showed that GG significantly depended on the applied preparation. Its highest value was observed for grain collected from the treatment where the seed material was dressed with Humistar (Table 2). It was significantly lower in treatments D and H+D, and the lowest in C.

Technological Parameters of Spring Wheat

Falling Number (FN) is a technological parameter informing about the activity of *α*-amylase in cereal grain. It determines the technological and storage usefullness of the studied material. The average value of FN from 3 years of the study stayed on a high level (Table 3). Similarly, relatively high *FN* values of wheat flour were found in the studies by Knapowski *et al*. (2010) and Bulut *et al*. (2013). Preparations used in spring wheat cultivation did not have a considerable effect on the technological parameters in question. Different results were obtained by Bulut *et al*. (2013), where the use of natural fertilizers in wheat cultivation contributed to a significant increase in (FN) values in relations to the control. The literature data show that the activity of α-amylase is determined mainly by the weather conditions and genetic properties of the cultivar (Woźniak and Staniszewski, 2007; Ralcewicz *et al*., 2009; Denčić *et al*., 2011).

One of the most essential criteria for evaluation of wheat baking value is Protein Content (PC). It is genetically determined, but it can be also largely modified by environmental and agricultural factors (Ralcewicz *et al*., 2009; Knapowski *et al*., 2010; Zeidan *et al*., 2010; Denčić *et al*., 2011; Jug *et al*., 2011). PC in the grain of wheat cultivars cultivated now stays within the range of 111-153 g kg^{-1} DM (Woźniak and Staniszewski, 2007; Akçura, 2011;

Table 3. Technological parameters of wheat grain.[a]

Parameter	Year	Preparation				Mean
		Control	Humistar	Drakar	H+D	
Falling Number (FN, s)	2006	490b	512a	487b	488b	494
	2007	477a	507a	480a	488a	488
	2008	437a	364a	424a	392a	404
Mean		468a	461a	463a	456a	462
Protein Content (PC, g kg^{-1})	2006	106a	107a	111a	106a	108
	2007	108a	110a	108a	110a	109
	2008	125a	129a	129a	129a	128
Mean		113c	115b	116a	115b	115
Wet Gluten content (WG, %)	2006	29.6a	31.2a	29.9a	29.8a	30.1
	2007	27.4b	29.2a	29.0a	29.2a	28.7
	2008	25.3a	27.5a	26.6a	27.4a	26.7
Mean		27.4b	29.3a	28.5a	28.8a	28.5
Sedimentation Value (SV, cm^3)	2006	34.8cd	40.9a	38.3b	36.4bc	37.6
	2007	34.9b	39.3a	37.5ab	37.9a	37.4
	2008	33.8a	34.0a	35.0a	34.5a	34.3
Mean		34.5c	38.0a	36.9ab	36.3b	36.4

[a] Values followed by the same letter within particular rows are not significantly different at the 0.05 level according to the Tukey's test.

Bulut *et al*., 2013). Thus, the PC obtained for the studied cv. 'Monsun' was relatively low (Table 2). The applied preparations significantly affected the amount of PC in grain (F= 8.22, variation coefficient 8.29%). The application of H and H+D together resulted in a significant increase in PC in grain as compared with C. A similar relationship of increased protein concentration in wheat grain in relation to the control after the use of organic and potassium fertilizers was obtained by Bulut *et al*. (2013) and Gaj *et al*. (2013). In the study by Bulut *et al*. (2013), among other things, fertilization with cattle manure and Leonardite had a significant effect on the value of this trait. PC was highly positively correlated with GG and negatively with GY, FN, WG and SV (Table 4), which does not correspond with the results obtained by Ralcewicz *et al*. (2009) and Denčić *et al*. (2011), where positive correlations were found for those relationships. Akçura (2011), however, obtained a positive correlation between PC and SV and a negative correlation with GY. The linear regression equations calculated allow for the assumption that an increase in wheat GG e.g. by 20%, may increase the amount of PC in grain from 13.62 (C) to 21.4 g kg^{-1} DM (H) (Figure 1).

Amount of wet gluten content in wheat grain, similarly to the study by Ducsay and Ložek (2004), remained at the average level (Table 3). This was higher than that obtained by Gaj *et al*. (2013) i.e. 25.2%, but lower than in the study by Ralcewicz *et al*. (2009) i.e. 32.8% and Denčić *et al*. (2011), i.e. 29.8%. Analysis of variance showed that WG in the grain of spring wheat *cv*. 'Monsun' increased significantly after the application of the studied preparations (F= 15.07, variation coefficient 6.06). In the treatment H, the value of the trait in question was higher by as much as 1.9 % compared with C. Significant increase in WG in relations to the control (by 2.8 pp) was also observed by Bulut *et al*. (2013), using pre-sowing fertilization with Leonardite in wheat cultivation. Also, the use of D, as well as the application of potassium fertilization in the study by Gaj *et al*. (2013), and the combined application of D+H, had a positive effect on WG in grain.

Table 4. Values of significant correlation coefficients between some traits of wheat.

Parameter	GY	TKW	HM	GG	PC	WG	FN	SV
	Control				Humistar + Drakar			
GY	-	ns	ns	-0.66**	-0.56*	ns	0.60*	0.69**
TKW	ns	-	0.65**	ns	ns	ns	ns	ns
HM	0.54*	0.77***	-	ns	ns	ns	ns	ns
GG	-0.63*	0.60*	ns	-	0.93***	n.s.	-0.91***	ns
PC	-0.66**	0.56*	ns	0.93***	-	-0.65**	-0.80***	-0.54*
WG	ns	-0.74***	ns	-0.75***	-0.79***	-	ns	0.79***
FN	ns	-0.61*	ns	-0.85***	-0.82***	0.76***	-	ns
SV	ns	ns	ns	ns	ns	ns	ns	-
	Humistar				Drakar			
GY	-	ns	ns	-0.59*	-0.77***	n.s.	n.s.	n.s.
TKW	ns	-	ns	ns	ns	ns	ns	ns
HM	ns	0.84***	-	ns	ns	ns	ns	ns
GG	-0.71***	ns	ns	-	0.94***	-0.65**	-0.83***	ns
PC	-0.59*	ns	ns	0.91***	-	-0.71***	-0.73***	-0.58*
WG	ns	-0.76***	-0.57*	-0.60*	-0.75***	-	0.66**	0.85***
FN	0.68**	ns	ns	-0.96***	-0.95***	0.75***	-	ns
SV	ns	ns	ns	-0.76***	-0.85***	0.87***	0.88***	-

*, ** and ***: Significant at $P \leq 0.01$; 0.05 and 0.001 probability level, respectively. ns: Non significant.

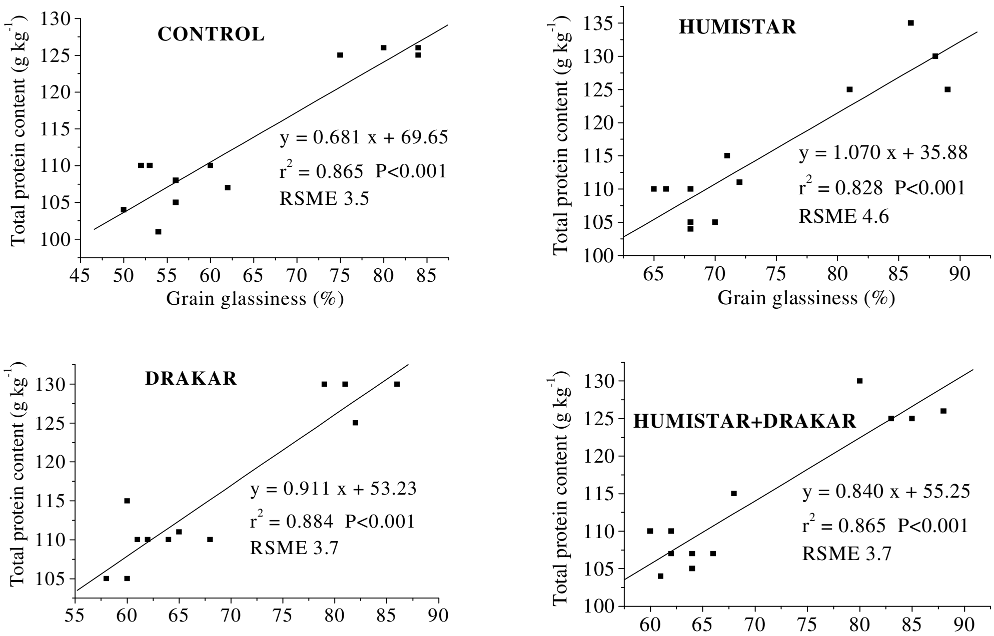

Figure 1. Relationship between averages of 2006-2008 grain glassiness and protein content of wheat.

The average Sedimentation Value (SV) of flour in the studied spring wheat (Table 3) allows classifying it into the group of quality cultivars (boundary values 34-47 cm^3) according to the classification of COBORU given by Podolska and Sułek (2003). It was found that the applied preparations significantly modified the (SV) value (F=

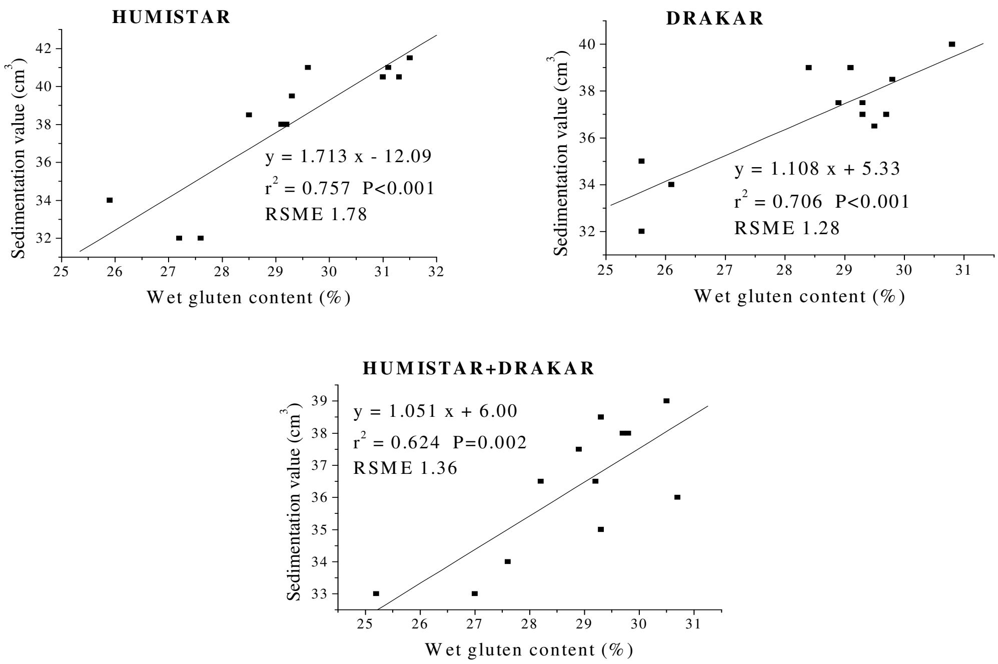

Figure 2. Relationship between averages of 2006-2008 wet gluten content and sedimentation value of wheat.

20.80, variation coefficient 6.01%). Only in 2008, which was characterized by precipitation deficit in May and June, no effect of the studied factor on this feature was achieved. The average value of *SV* from the 3 years of the study was the highest after the application of H, significantly lower in treatment H+D and the lowest in C. Favorable and significant effect of natural fertilizers on the feature in question was indicated by Bulut *et al.* (2013). In their study the increase in *SV* after the application of Leonardite, organic manure and cattle manure in relation to the control amounted to: 11.6, 12.8, and 16.1%, respectively. In the present study, also foliar application of D and combined use of H+D had a favorable effect on *SV*. Similarly to the study by Ralcewicz *et al.* (2009), the analysis of correlation and the calculated linear regression equations show a positive relationship between *SV* and WG in grain (Table 4, Figure 2).

Seed dressing with the humic preparation Humistar, foliar application of the potassium fertilizer Drakar, or combined application of those preparations, resulted in a significant improvement of most quality parameters of wheat. Means of (HM, GG, PC, WG, SV) values for the three years of this study on each of those treatments were significantly higher than in the control. Moreover, the use of Humistar and H+D together resulted also in statistically proved increase in TKW, as compared with the control, and such an effect was not found after foliar spraying with Drakar. No effect of the combined use of both tested preparations on the qualitative parameters (TKW, HM, FN, WG) of wheat was observed in comparison with the effect of using each of the preparations separately.

The study did not prove a significant effect of the Humistar and Drakar on spring wheat grain yield. However, favourable effect of Humistar or Drakar on the technological value of grain justifies the use of those preparation in milling wheat cultivation.

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واکنش گندم به پوشش بذر با هوموس و برگپاشی با کود پتاسیم

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چکیده

تقاضای روزافزون برای دانه گندم با خواص فناوری بهینه منجر به پژوهش به منظور امکان یابی برای تامین نیازهای این گیاه شده است. شرایط محیطی پیرامون بذر در حال سبز شدن را می توان با کار برد مواد هوموسی بهبود بخشید. نیز، با توجه به این که کود پتاسیم فعال کننده آنزیم های کاتالیزر ساخت پروتئین است می توان صفات کیفی دانه را با پاشیدن این کود روی برگ ها تغییر داد. هدف پژوهش حاضر ارزیابی اثر پوشش بذر با ماده هیومی استار(حاوی ۱۲٪ هیومیک اسید و ۳٪ فولویک اسید) و برگپاشی با کودی به نام دراکار (Drakar،حاوی ۳۱٪ اکسید پتاسیم K_2O و ۳٪نیتروژن) روی عملکرد و صفات کیفی دانه گندم بهاره بود. این صفات عبارت بودند از وزن هزار دانه، جرم هکتولیتر

(HM)، شیشه ای بودن دانه(GG)، تعداد ریزش (Falling number, FN)، کل محتوای پروتئین(PC)، گلوتن تر (WG)، معیار ته نشینی (SV). طرح آزمایش بلوک های تصادفی بود و روی یک خاک رده بندی شده به نام مزیک تیپیک هاپلودالفس (Mesic Typic Hapludalfs) اجرا شد. نتایج نشان داد که مواد به کار رفته در آزمایش اثرمعنی داری روی عملکرد نداشت ولی روی کیفیت دانه تاثیر مفیدی داشت. کار برد هیومی استار موجب بهبودTKW, HM, GG, PC, WG و SV در مقایسه با تیمار شاهد شد. استفاده از کود دراکار نتیجه مشابهی با هیومی استار روی HM، WG، و SV داشت و در مورد PC نتایج بهتر هم بود. نتیجه کود دراکار روی GG هرچند در مقایسه با شاهد مناسب بود اما اثرش کمتر از موردی بود که بعد از مصرف هیومی استار به کار رفته بود. نتیجه گیری کلی این بود که پوشش بذر ها با هیومی استار یا کود پاشی برگی با کود پتاسیم دراکار روش های اگروتکنیکی هستند که می توانند صفات کیفی آسیاب کردن دانه گندم را بهبود بخشند.