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Some Morphologic Traits of Winter and Spring Oat Genotypes *(Avena sativa L.)*

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Abstract: Two years trial was carried out on the property of Small Grains Research Centre in Kragujevac. Six winter and six spring oat genotypes were investigated. The next traits: plants height, panicle lenght, ear number in panicle, grain number in panicle and grain weight in panicle were studied. Those morphologic traits influence the yield of grains. The standard cultivars were Vranac for winter and Slavuj for spring oat genotypes.

The winter genotypes had more plants height, more panicle lenght and more ears in panicle,but spring genotypes had more grains in panicle. The grains weight per panicle was the almost same for both.

The correlations beetwen the plants height and the panicle lenght were possitive and statistically significant.

These traits were influenced by climatic and genetic factors while the winter genotypes were more susceptible to enviromental conditions then the spring genotypes.

Key words: grain, morphologic traits, oat, panicle, spikelet, spring genotypes, winter genotypes.

Introduction

The productivity is trait influenced by many parameters and their relations. Some morphologic traits influence the grain yield directly or indirectly. It is characteristic for oat as for all other small grains.

Increasing plant height influence increasing lodging susceptible. So there is correlation between height and breakage plant (Miržinski et al, 1966). Lodging can decrease the grain yield for even 40% (Moule, 1964).

The panicle is the flower form of oat. According to panicle lenght all oat genotypes can be divided into two groups : genotypes with short (to 19cm) and

long panicle (above 19cm) (Moule, 1964). The panicle lenght vary in consequence of enviromental conditions (Miržinski et al, 1966), sowing date (Dardić et al, 1988), infection by different viruses (Herrmann,1996).

The spikelet is panicle part. According to spikelet number in panicle all genotypes can be divided into two groups: genotypes with less (32,8-42,00) and more spikelets in panicle (55,10-59,80). More spikelets in panicle can be result of earlier sowing (Moule,1964).The oat's trait is having more then one grain in spikelet in more moisture conditions. It frequently appears in winter (Miržinski et al, 1966) and grainnude oat genotypes (Maksimović and Perović, 1997).

The grain number in panicle is indicator genotype's productivity (Georg et al, 1989). The correlation's coefficiant beetwen these two traits is 0,614 - 0,670 (Moule, 1964).

The dependence the oat productivity of the grain weight per panicle is significiant. In this case, duration of vegetative period realize indirectly effect on grain yield (Fedorova, 1990). The grain weight per panicle is influenced by climatic factors: average temperature, the sum temperatures above 5°C and insolation (Pirjo, 1990). All these factors depende of duration of vegetative period.

The investigation was carried out in order to determine variability of morphologic traits in winter and spring oat genotypes. It would be contribution to oat selection, espeeeally facultative winter genotypes.

Material and method

The exploration was carried out during 1995/96. and 1996/97. in Small Grains Research Centre in Kragujevac. The cultivar Vranac (control) and lines: L-2/1-95, L-3/2-95, L-5/1-95, L-6/1-95 and L-6/8-95 were sowed in winter term. The cultivar Slavuj (control) and lines: L-3/20-93, L-8/15-93, L-11/13-96, L-1/1-95 and L-1/2-95 were sowed in spring term.

The field micro trial was set up on smonitza (Vertisol). The sowing rate was 500 kernels / m^2. The cultivars and lines were sowed in 5 repetitions, on elementary plot $5m^2$ with interspace between the plots 0,20m and between the blocks 1m. The winter sowing was performed after optimum term (3. and 17.XI) while the spring sowing was performed in optimum term (18. and 3.III). The same agrotehnical tretments were aplicated during the whole investigation.

The traits were determined by standard treatments. The obtaining experimental results were processed by two factorial analysis of variance. The LSD test was used to determine significiance of the differences between genotypes. The interrelation of the examined traits was analysed by correlation method (Hadživuković,1979, Šolak,1992).

Environmental conditions

The average month's temperature in vegetative period 1995/96. and 1996/97. varied from 0,3°C (January, 1996.) to 21,6°C (July, 1996.) relatively to from 1,0°C (January, 1997.) to 21,1°C (July, 1997.) (Tab. 1). The average temperatures were less in the first investigation year, espeeeally in winter's months. Nevertheless, it wasn't limitting factor for winter genotypes development.

The oat require high moisture amounts. The critical period is from jointing to heading. The average month's percipitation amount varied from 14,3mm (January 1996.) to 98,9mm (May 1996.) relatively to from 25,3mm (January 1997.) to 81,1mm (July 1997.). During vegetative period almost the same percipitation amounts were registered.However, the percipitation distribution was unsuitable for oat in 1997., espeeeally in forming and filling grain.

Tab.1. Meteorologic factors (temperature, percipitation) in vegetative period 1995/96. and 1996/97.

month	average month temperatures		average month percipitation	
	1995/96.	1996/97.	1995/96.	1996/97.
XI	3,8°C	9,2° C	46,6mm	69,4mm
XII	2,1°C	1,2° C	53,5mm	30,4mm
I	0,3°C	1,0° C	14,3mm	25,3mm
II	0,4°C	4,5° C	52,5mm	39,4mm
III	2,0°C	5,3° C	55,5mm	30,5mm
IV	12,1°C	6,9° C	48,8mm	63,6mm
V	17,8°C	16,9° C	98,9mm	38,0mm
VI	20,6°C	20,9° C	37,8mm	53,8mm
VII	21,6°C	21,1° C	27,3mm	81,1mm

Results and discusion

The plant height of winter genotypes varied from 94,40cm to 125,00cm, but spring ones from 91,00cm to 104,20cm (Tab.2). The winter genotypes had more average plant height (110,80cm) then spring (95,90cm).

Tab.2. The plant height of winter and spring oat genotypes (cm) in micro trial in 1995/96. and 1996/97.

Winter genotype	year		X for genotype	Spring Genotype	year		X for Genotype
	1995/96.	1996/97			1996.	1997.	
Vranac	107,70	109,40	108,20	Slavuj	97,60	93,00	95,30
L-2/1-95	111,00	109,20	110,10	L-3/20-93	95,80	91,20	93,50
L-3/2-95	116,80	125,00	120,90	L-8/15-93	98,00	93,00	95,50
L-5/1-95	94,40	112,40	103,40	L-11/13-93	98,60	92,80	95,70
L-6/1-95	108,60	112,40	110,50	L-1/1-95	99,40	91,00	95,20
L-6/8-95	111,40	111,80	111,60	L-1/2-95	104,20	95,80	100,00
X for year	108,20	113,40	110,80	X for year	99,00	92,80	95,90
F test (year) 32,61 ++		LSD (genotype) 0,05=3,362 0,01=4,491		F test (year) 33,25++		LSD (genotype) 0,05=3,713 0,01=4,960	

The high significiant differences were found among winter genotypes and among investigation years. Statistically significiant differences weren't find among spring genotypes, but high significiant differences were between years.

The weather conditions caused variability of plant height either winter or spring genotypes. The both group expressed common values for plant height, according to literature, from 80-120cm (Rosić and Bajić, 1989). The more plant height of winter genotypes influenced the more sensitivity to lodging, especcally L-3/2-95. It was emphasized in second investigation year when unsuitable climatic conditions were in grain filling and maturing stage (extremlly percipitation).

The panicle lenght of winter genotypes varied from 20,46cm to 32,05cm and spring genotypes from 18,64cm to 22,69cm (Tab.3). The winter genotypes had more average panicle lenght (25,94cm) then spring ones (21,15cm).

Tab.3. The panicle lenght of winter and spring oat genotypes (cm) in micro trial in 1995/96. and 1996/97.

Winter genotype	year		X for genotype	Spring Genotype	year		X for Genotype
	1995/96.	1996/97.			1996.	1997.	
Vranac	20,93	24,25	22,59	Slavuj	22,19	21,61	21,90
L-2/1-95	20,46	22,38	21,42	L-3/20-93	21,23	20,43	20,83
L-3/2-95	29,55	27,96	28,75	L-8/15-93	20,72	20,94	20,83
L-5/1-95	22,84	28,08	25,46	L-11/13-93	21,82	21,16	21,49
L-6/1-95	26,27	27,13	26,70	L-1/1-95	18,64	20,04	19,34
L-6/8-95	32,05	29,37	30,71	L-1/2-95	22,69	22,28	22,49
X for year	25,35	26,53	25,94	X for year	21,22	21,08	21,15
F test (year) 4,19		LSD (genotype) 0,05=2,018 0,01=2,695		F test (year) 0,28		LSD (genotype) 0,05=0,936 0,01=1,251	

The significiant differences were among winter genotypes and these weren't between years. It could be espied average shorter panicles in winter genotypes in first investigation year, when the sowing was done later, after optimum term. This notice is in accordiance with literature dates (Dardić, 1988) about sowing date influence on panicle lenght and ears number in panicle. The similar dates obtained in spring genotypes. The climatic factors, allthough different during vegetation, didn't influence variability of panicle lenght neither winter nor spring genotypes.

The spikelets number in panicle varied from 41,69 to 58,2 in winter genotypes and from 39,86 to 52,93 in spring genotypes (Tab.4). The winter genotypes had more value of this parameter (50,33) then spring ones (46,84).

Tab.4. The spikelet number in panicle of winter and spring oat genotypes in micro trial in 1995/96. and 1996/97.

Winter genotype	year		X for genotype	Spring Genotype	year		X for Genotype
	1995/96.	1996/97.			1996.	1997.	
Vranac	58,52	53,00	55,76	Slavuj	47,81	39,86	43,83
L-2/1-95	58,17	50,70	54,43	L-3/20-93	49,39	43,95	46,67
L-3/2-95	48,00	42,84	45,42	L-8/15-93	48,21	44,24	46,22
L-5/1-95	43,33	44,78	44,05	L-11/13-93	47,57	41,30	44,43
L-6/1-95	58,09	51,54	54,81	L-1/1-95	46,54	48,80	47,67
L-6/8-95	53,29	41,69	47,49	L-1/2-95	52,93	51,46	52,19
X for year	53,23	47,42	50,33	X for year	48,74	44,93	46,84
F test (year) 14,60++		LSD (genotype) 0,05=5,303 0,01=7,084		F test (year) 6,71++		LSD (genotype) 0,05=5,126 0,01=6,848	

The expressed differences were significiant among winter genotypes and high significiant between years. The significiant differences weren't among spring genotypes, but ones were noted down between years.

The more grains in spikelet was characteristic for winter genotypes and it's in accordiance with carlier investigations (Miržinski et al, 1966). The weather conditions had effect on spikelet number in panicle. More spikelets in panicle winter and spring genotypes 1996. can be explained by suitable climatic factors in that year.

The grain number per panicle varied from 72, 98 to 109,53 in winter genotypes and from 91,76 to 107,67 in spring genotypes (Tab.5). In average, winter genotypes had less (88,74), but spring ones had more grain number in panicle (99,70).

Tab.5. The grain number in panicle of winter and spring oat genotypes in micro trial in 1995/96. and 1996/97.

Winter genotype	year		X for genotype	Spring Genotype	year		X for Genotype
	1995/96.	1996/97.			1996.	1997.	
Vranac	82,03	90,93	86.48	Slavuj	107,38	93,83	100,60
L-2/1-95	90,73	90,71	90,72	L-3/20-93	107,67	101,87	104,77
L-3/2-95	83,92	82,62	83,27	L-8/15-93	91,76	99,57	95,66
L-5/1-95	72,98	75,98	74,48	L-11/13-93	102,37	94,53	98,45
L-6/1-95	109,53	83,06	96,29	L-1/1-95	95,37	99,02	97,19
L-6/8-95	105,04	97,34	101,19	L-1/2-95	100,36	102,67	101,51
X for year	90,70	86,77	88,74	X for year	100,82	98,58	99,70
F test (year) 4,01		LSD (genotype) 0,05=7,941 0,01=10,608		F test (year) 0,82		LSD (genotype) 0,05=8,633 0,01=11,532	

The high significiant differences were noted down among winter genotypes and weren't noted down between years. Statistically significiant differences weren't observed neither spring genotypes nor years.

The climatic conditions didn't express influence on this trait, but spring genotypes were more uniform and more stabile in relation to winter ones. The spring genotypes had average less spikelets number in panicle. These genotypes didn't have more then one grain in spikelet.. So it could be expected spring genotypes will have less grain number in panicle in relation to winter ones. On the contrary, spring genotypes had more grain number in panicle. It can be explained by appearance of great number sterile spikelets in winter ones caused by unduetime sowing.

The grain weight per panicle varied from 2,94g to 3,60g in winter genotypes and from 2,73g to 3,39g in spring ones (Tab.6). The both groups had almost the same average value of this parameter (3,22g in winter and 3,12g in spring genotypes).

Tab.6: The grain weight per panicle in winter and spring oat genotypes (g) in micro trial in 1995/96. and 1996/97.

Winter genotype	year		X for genotype	Spring Genotype	year		X for Genotype
	1995/96.	1996/97.			1996.	1997.	
Vranac	3,26	3,35	3,30	Slavuj	3,39	3,30	3,35
L-2/1-95	3,20	3,18	3,19	L-3/20-93	3,33	3,24	3,29
L-3/2-95	3,11	3,14	3,12	L-8/15-93	3,07	3,06	3,07
L-5/1-95	2,94	3,03	2,98	L-11/13-93	3,29	3,17	3,23
L-6/1-95	3,26	3,16	3,21	L-1/1-95	2,78	2,73	2,75
L-6/8-95	3,60	3,43	3,51	L-1/2-95	3,12	3,04	3,08
X za god.	3,23	3,21	3,22	X za god.	3,16	3,09	3,12
F test (year) 0,03		LSD (genotype) 0,05=0,233 0,01=0,312		F test (year) 1,07		LSD (genotype) 0,05=0,295 0,01=0,394	

The statistically significiant differences among genotypes and between years weren't as in winter so in spring genotypes.

Weather conditions' variability during the investigation didn't influence variability of grain weight per panicle among genotypes. Many authors emphased influention of this trait by climatic factors (Pirjo,1990, Ustinova, 1990), but genetic factors have great influence, too (Pawlowski et al, 1996).

The correlation among examinated traits. Testing significiant of correlation coefficiants for the pairs of examinated traits by t-test next results were obtained (Tab. 7).

Tab. 7. The correlation coefficiants for the pairs of examinated traits in micro trial in 1995/96. and 1996/97.

trait	plant height	panicle lenght	ear number in panicle	grain number in panicle	grain weight per panicle
plant height	*	0,782	0,361	–0,483	0,172
panicle lenght	*	*	– 0,027	– 0,236	0,369
ear number in panicle	*	*	*	– 0,048	0,060
grain number in panicle	*	*	*	*	0,214
grain weight per panicle	*	*	*	*	*

- moderate correlation between plant height and spikelet number in panicle (0,361),
- panicle lenght and grain weight per panicle (0,369) and plant height and grains number per panicle (-0,483) and
- high significiant interdependence plant height and panicle lenght (0,782).

Other correlations were without statisticcaly significiant.

Conclusion

On the basis of obtained results analyses the following may be concluded:

1. The winter genotypes expressed high significiant differences in plant height and grain number per panicle and significiant ones in panicle lenght and spikelet number in panicle. The panicle lenght expressed high significiant variability in spring genotypes.

2.Varietal among genotypes, influenced by climatic factors, was high significiant for plant height and significiant for spikelet number in panicle as in winter so in spring genotypes.

3.The spring genotypes showed greater stabile of studdied traits in relation to winter ones and yielded identical results during investigation.

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NEKE MORFOLOŠKE OSOBINE OZIMIH I JARIH GENOTIPOVA OVSA *(Avena sativa L.)*

- originalni naučni rad -

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Rezime

U dvogodišnjem ogledu, izvedenom na Oglednom polju Centra za strna žita u Kragujevcu, ispitivano je 6 ozimih i 6 jarih genotipova ovsa. Proučavane su sledeaće osobine : visina biljaka, dužina metlica, broj klasuića u metlici, broj zrna u metlici i težina zrna po metlici. Navedene morfološke osobine direktno ili indirektno uslovljavaju prinos zrna. Standardna sorta za ozime genotipove bila je sorta Vranac, a za jare sorta Slavuj.

Ozimi genotipovi su imali veću visinu biljaka, veću dužinu metlica i veći broj klasića u metlici, a jari veći broj zrna u metlici. Obe grupe genotipova su imale skoro istu vrednost težine zrna po metlici.

Koreļacija između visine biljaka i dužine metlica bila je pozitivna i statistički visoko značajna.

Ispitivane osobine su bile uslovljene i klimatskim i genetskim faktorima. Ozimi genotipovi su bili osetljiviji prema uslovima spoljašnje sredine u odnosu na jare.