# INVESTIGATION OF BULGARIAN WINTER BARLY VARIETIES UNDER CONDITION OF CENTRAL SOUTHERN BULGARIA

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**Abstract**

*In the period 2005-2009 at the experimental field of Cotton and durum wheat research institute experiments with winter barley, cultivars Aheloy, Vesletz, Panagon, Hemus, Emon, Kaskadior, Obzor and Korten was carried out. The varieties was test under the dry condition of vertisols (Central Southern Bulgaria), norms of fertilization N10 P8, after precursor sunflower. The results showed that from two-row barley variety Emon and six-row variety Aheloy 2, was receive the high yields*

**Key words:** *Barley, Varieties, Yield.*

## 1. INTRODUCTION

During the past years in different ecological regions in Bulgaria were tested the high numbers of barley cultivars. `The obtaining results determined theirs ecological plasticity and productivity within due limits of regions (Penchev at al. 1985, 2002; Tonev at al 1992, 2008; Valcheva 2000).

Designation of research were influence of environment under growth, development and productivity of the new winter two-row and six-row barley varieties under the condition of Central South Bulgaria.

## 2. MATERIAL AND METHODS

The investigation was carry out in the 2005-2009 period in the field of Cotton and durum wheat research institute under type of soil Pelic Vertisols. The soil was characterized with high water capacity, low permeability of water and high sorption capacity - 35-50 meq/100 g. Mass of soil capacity was 1.1-1.2 g/cm3, specific gravity was 2.4-2.5 and humus contents – 2.3-3.1%.

Total nitrogen content in the soil plough layer was 0.1%, available phosphorus (P2O5) was 4.9-5.8 mg/kg and exchangeable potassium (K2O) - 22.3-28.0 mg/kg. Sowing was accomplish in 20X–10XI period with 400-420 germination seeds. Was tested the next barley cultivars: two-row varieties – Emon, Kaskadior, Obzor and Korten; six-row varieties – Aheloy, Vesletz, Panagon and Hemus. Obtaining yields was workable under ANOVA. Were track out interactions between levels of yields and crop density and structural elements of spike. All varieties are winter barley, as six-row cultivars are for grain fodder and two-row cultivars are for brewery (Valcheva, 2000).

## 3. RESULTS AND DISCUSSION

The growth and development of barley varieties in the course of years spend under different meteorological conditions (Table 1).The dates show that the first year are characterize whit very good circumstances in the time of germinate, humid springtime and optimum temperature and humidity regime in the time of phases from milk development to ripening. The second year of study (2005-2006) was characterized as humid and dry. By reason of set in dry condition in the Mart-April period was not set sufficiency number of spices, what decreased the yields of tested barley cultivars. The next year was the very unsuitable – mild, for a long time with deficit of precipitation of 148 mm for the period X–VI.

The period 2007-2008 were characterized as average in relationship of temperature and humid – whet 96 mm more then norm (Table 1). The last year of study (2008-2009) was mild and dry – with prolonged spring drought, 197mm less precipitations for the X-VI period and 126 mm less rainfalls for IV, V and VI.

Table 1. Sum of temperature and precipitations in the course of barley vegetation

| Years | Months | | | | | | | | | Σ | Σ | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | X | XI | XII | I | II | III | IV | V | VI | X-VI | X-III | IV-VI |
| Mean month sum of temperature ΣT 0C | | | | | | | | | | | | |
| 1928-2007 | 397 | 211 | 60 | 2 | 53 | 184 | 343 | 519 | 622 | 2391 | 907 | 1484 |
| 2004-2005 | 433 | 235 | 58 | 63 | 21 | 184 | 361 | 550 | 587 | 2492 | 994 | 1498 |
| 2005-2006 | 357 | 158 | 64 | -20 | -3 | 226 | 362 | 512 | 600 | 2256 | 782 | 1474 |
| 2006-2007 | 433 | 214 | 56 | 153 | 111 | 230 | 351 | 579 | 693 | 2820 | 1197 | 1623 |
| 2007-2008 | 407 | 160 | -5 | -75 | 90 | 292 | 385 | 521 | 636 | 2411 | 869 | 1542 |
| 2008-2009 | 412 | 236 | 127 | -3 | 75 | 197 | 357 | 569 | 648 | 2618 | 1044 | 1574 |
| Precipitations - mm | | | | | | | | | | | | |
| 1928-2007 | 38 | 49 | 54 | 42 | 36 | 37 | 45 | 63 | 65 | 429 | 256 | 173 |
| 2004-2005 | 19 | 24 | 78 | 35 | 46 | 31 | 18 | 50 | 73 | 374 | 233 | 141 |
| 2005-2006 | 45 | 44 | 45 | 31 | 50 | 50 | 67 | 19 | 33 | 384 | 265 | 119 |
| 2006-2007 | 17 | 22 | 31 | 37 | 13 | 50 | 19 | 53 | 39 | 281 | 170 | 111 |
| 2007-2008 | 74 | 135 | 49 | 57 | 1 | 12 | 66 | 36 | 95 | 525 | 328 | 197 |
| 2008-2009 | 8 | 11 | 11 | 71 | 35 | 49 | 17 | 16 | 14 | 232 | 185 | 47 |

On Table 2 are carry out the biometric indexes of barley cultivars average of five years (Baker et all, 1998).

Table 2. Biometric characterization (mean for the 2005 – 2009)

| Varieties | Plant height, cm | Spike length, cm | Weight of 1000 grains, g | Weight hectoliter, kg | Protein contents, % |
|---|---|---|---|---|---|
| Aheloy | 95.3 ± 1.7 | 6.9 ± 0.4 | 37.1 ± 0.2 | 66.5 | 12.9 |
| Vesletz | 91.2 ± 2.8 | 6.5 ± 0.8 | 38.2 ± 0.3 | 69.3 | 12.8 |
| Panagon | 88.6 ± 2.3 | 7.0 ± 1.0 | 35.0 ± 0.9 | 68.9 | 11.9 |
| Hemus | 85.4 ± 2.1 | 6.8 ± 1.0 | 32.1 ± 0.4 | 69.7 | 12.0 |
| Emon | 86.3 ± 1.7 | 6.9 ± 0.8 | 31.7 ± 0.4 | 68.5 | 12.1 |
| Kaskadior | 88.8 ± 1.6 | 7.5 ± 0.7 | 33.8 ± 0.6 | 68.8 | 12.3 |
| Obzor | 88.7 ± 1.9 | 7.0 ± 0.6 | 36.0 ± 0.9 | 65.7 | 11.8 |
| Korten | 79.4 ± 2.3 | 8.8 ± 0.7 | 39.1 ± 0.7 | 67.9 | 11.8 |

The plant heath varied from 79.4 to 95.3 cm. During the all period with the highest stem was characterized the Aheloy cultivar, but with the shortest – Korten.

The length of spikes ranged between 6.5 – 8.8 cm like large spike formed the Korten variety. The weight of 1000 grains and hectoliter weight are specific indications of barley varieties and accepted values between 33.8-39.1(g) and 65.7- 69.3 (kg). Protein contents is within the borders 11.8-12.9%. The statistic distinctions between cultivars on these indexes by the years not accounted.

Grain yields of different varieties changed the results by years. During the 2004-2005 period the best yield formed variety Korten (Table 3). In the 2006 and 2007 years the best results were received from Emon cultivar. From selfsame variety good yields was obtained in 2005 and 2008 years. It is worth noting that in the course of unsuitable 2007 year the Emon variety realized the high yield. The mean results for the period (2005-2009) showed that from this variety was obtained a proven statistic data (Table 3).

Table 3. Grain yields from the barley varieties for the 2005 – 2009 period

| Varieties | | Yields by years – kg/da | | | | | Mean for 5 years | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2005 | 2006 | 2007 | 2008 | 2009 | kg/da | ± D | % |
| Aheloy | | 493.4 | 328.8 | 238.3 | 322.7 | 269.6 | 330.6 | 14.4 | 104.5 |
| Vesletz | | 479.1 | 339.2 | 204.6 | 332.0 | 207.8 | 312.5 | -3.7 | 98.8 |
| Panagon | | 474.4 | 359.2 | 172.5 | 282.3 | 176.2 | 293.0 | -23.2 | 92.7 |
| Hemus | | 543.5 | 310.2 | 270.0 | 365.4 | 241.4 | 346.1 | 29.9 | 109.5 |
| Emon | | 572.3 | 414.8 | 250.0 | 361.7 | 226.7 | 365.1 | 48.9 | $115.5^{++}$ |
| Kaskadior | | 485.0 | 320.3 | 139.6 | 322.7 | 359.4 | 325.4 | 9.2 | 102.9 |
| Obzor | | 570.2 | 339.8 | 117.9 | 368.7 | 233.5 | 226.0 | -90.2 | $71.5^{00}$ |
| Korten | | 614.9 | 389.2 | 143.3 | 256.7 | 251.7 | 331.2 | 15.0 | 104.7 |
| Average | | 529.2 | 350.2 | 192.0 | 326.5 | 245.8 | 316.2 | - | 100.0 |
| GD | 5.0 % | 30.2 | 51.4 | 20.0 | 46.1 | 15.1 | 33.5 | 33.5 | 10.6 |
| | 1.0 % | 41.2 | 70.0 | 27.2 | 62.8 | 20.6 | 44.3 | 44.3 | 14.0 |
| | 0.1 % | 55.5 | 94.4 | 36.7 | 84.7 | 27.7 | 57.2 | 57.2 | 18.1 |

The good results were obtained from varieties: Hemus, with 9.5% more then standard; Korten – with 4.7% over, Aheloy – with 4.5% more and Kaskadior – with 2,9% more then average of try. Variability, shows in kilograms per decare, is from -90.2 to 48.9 in comparison with average data (Table 3).

The sowing parameters and structural elements of yield determine barley productivity (Baker et all, 1998). Its optimum mutual dependency and combination be able to described by correlation coefficients – Table 4. The grain yield is within height positive correlations with productive tillering, ear productive stems, plants height, ear's length and mass of 1000 grains. To a not inconsiderable degree of positive correlation was marc between productive tillering, productive stems, plants height, and ear's length. It was observed negative statistical subjections between the level of yield and its structural elements and hectoliter mass. The mass of 1000 grains is in negative correlation string with plant height. The dates from table 4 show that on the average five-years period determinant factors for formed of yields exerted influence number of productive stems per m2, ear's length and mass of grains.

Table 4. Correlation between the yield and the yield' structural parameters of barley cultivars

| ±r | Productive tillering | Productive stems | Plants height | Ear's length | Grains in a spike | Mass of 1000 grains | Hectoliter mass |
|---|---|---|---|---|---|---|---|
| Grains yield | .89** | .91*** | .75* | .86** | .68 | .93*** | .43 |
| Productive tillering | - | .95*** | .68 | .88** | .51 | .83** | -.77* |
| Producing stems | | - | .78* | .92*** | .70 | .80** | -.81** |
| Plants height | | | - | .67 | .46 | -.48 | .40 |
| Ear's length | | | | - | .77* | .88** | -.83** |
| Grains in spike | | | | | - | .76* | -.63 |
| Mass of 1000 g | | | | | | - | -.55 |

Note: Statistical significance of "r" ( *, **, ***) at 5.0, 1.0 and 0.1 %.

## 4. CONCLUSIONS

From all tested barley cultivars, average for five-years period, the best results and high yield realized the Emon variety – with 15.5% more then average of experience. The summarized long-year data and the pointed differences by years, in the conditions of leached smolnitza (*Pelic Vertisols*) of the Central South Bulgaria, characterized with different meteorological conditions; the calculated mathematical-statistical relations help for successful planning of the barley's part in intensive and moderate cultivation systems.

The yields of barley is with high positive correlation conditions with productive tillering, ear productive stems, plants height, ear's length and mass of 1000 grains.

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