



Original article

## Analaysis of Impotant Indices in New Bulgarien Hybrids Linzi and Deveda <sup>1</sup>

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### Abstract

Hybrids Linzi and Deveda are conventional hybrids and created at Dobroudzha Agricultural Institute, General Toshevo, Bulgaria. They are the last hybrids for our new sunflower selection. A structural analysis on important biometric indices related to the production potential of sunflower hybrids Linzi and Deveda and their parental lines was done. The data were analyzed by dispersion analysis, regression and correlation. The indices 1000 seed weight (g), kernel and husk (%), oil content in kernels and oil content of seed (%) were studied. The mathematical models clearly demonstrated that a correlation was established between the investigated indices. They have a strong influence on the productivity of these two hybrids.

**Keywords:** Sunflower, Hybrid, Dispersion analysis, Regression, Correlation.

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## INTRODUCTION

Sunflower is the main oil crop in Bulgaria. It occupies a stable position among the products used for production of plant oils. During the last years, a significant increase of sunflower plots was observed. Therefore, the newly developed sunflower hybrids has to be distinguished by high and stable productive potential in different climatic conditions and resistance to abiotic and biotic stress factors (Drumeva et al., 2001; Nenova et al., 2012)

The aim of our investigation was to determine the relations between important characters, useful for applied breeding purposes with significant role in production of high-yielded hybrids with ecological plasticity for growing in different climatic conditions in different regions of Bulgaria and abroad. Attainment of that purpose was carried out by investigation of the newly registered sunflower hybrids Linzi and Deveda.

### Material and Methods

The investigation was carried out in Dobrudzha agricultural institute, near General Toshevo. The conventional hybrids Linzi, Deveda and two randomly chosen hybrids were included (Fig. 1 and 2). The standards were the sunflower hybrids NK Brio and LG 5662. The sunflower hybrid Deveda was created in Dobrudzha agricultural institute. It is a single interlinear hybrid. The mother line 217A was also created in DAI. The father N102R was obtained by the method of induced parthenogenesis combined with embryo culture from experimental hybrid 154x102. In 2014 hybrid Deveda was included in uniform competitive trial (UCT) after two-years testing in competitive trials. It showed an average yield from two repetitions -4240.7 kg/ha, which was 6.6% higher than the mean standard. The seed oil content was 51.7%, and content of protein - 27.1%. In 2015 and 2016 it was tested by the Executive agency for variety testing, field inspection and seed control and it's yield was 3420 kg/ha from four plots in the country, which level an yield with the mean standards NK Brio and LG5662. In 2017 it was confirmed and included in the Official list of hybrids in the country /Order of Minister of agriculture, food, and forestry, № 12-2 from 07.04.2017/. Hybrid "Linzi" is single cross hybrid, developed on the method of interlinear hybridization /217A x 99R/. The maternal line 217A was obtained by crossing of experimental hybrid N:72 and line 246, created from Russian cultivars, self-pollination and selection. The mother line was characterized with good general and specific combining ability. It is resistant to broomrape, race G, middle resistant to phoma and alternaria, middle susceptible to phomopsis. During the last several years it was a maternal component of newly registered hybrids Veleka, Vokil, Vyara, Deveda and etc. The paternal component of hybrid "Linzi" is the branched line-restorer of fertility 99 R. That line was obtained using the method of induced parthenogenesis from the experimental hybrid 132x98, self-pollination and selection. It is resistant to downy mildew, race 731 and resistant to broomrape, race G. It is middle resistant to phomopsis and alternaria, resistant to phoma. In 2017, the Patent Office issued the certificate №11125P2 for the hybrid.



**Figure 1.** Hybrid Linzi



**Figure 2.** Hybrid Deveda

The follow characters were included in the investigation: plant height (cm), kernel content (%), 1000 seeds weight (g), seed yield (kg/da), seed oil content (%) and vegetation period (days). The investigation was carried out in four regions of the country – two regions in North-East Bulgaria and two in South part of Bulgaria.

The follow statistical methods for analyzing of experimental data were applied: descriptive statistical parameters, analysis of variance (ANOVA), regression, correlation and path- analyses.

The ANOVA model was as follows:  $Y_{ijk} = Y. + G_i + R_j + E_{ijk}$ ,

where  $G_i$  is the factor – genotype,  $R_j$  is the factor – region and  $E_{ijk}$  is the error of the trial (Miliken and Johnson, 1989, Cornelius and Crossa, 1999).

The data were analysed using SPSS 21.0 and BIOSTAT 7.0.

## Results and Discussion

**Table 1.** Mean values and variation coefficients of the studied characters for the hybrids, included in the study

Hybrids	Yield		Oil		Veg. per.		1000 weight		Kernel		Height	
	M	VC%	M	VC %	M	VC %	M	VC%	M	VC%	M	VC%
NK Brio	361	35	48	6.04	121	6.5	53.8	14.6	72.2	3.5	159	12.6
LG5662	322	28.9	44.6	5.91	126	4.7	71.4	13.8	67.5	3.5	163	14.7
Hybrid 1	338	31.6	45.1	6.56	120	4.4	55.1	13.2	74	12.2	148	12.3
Hybrid 2	316	40	49.6	7.4	118	5.3	55.5	11.5	76	1.7	144	12.3
Deveda	341	47	52.2	7.8	117	10.1	46.5	7.5	76.6	4.7	148	12.8
Linzi	331	41	52.7	6.2	115	6.3	64	14.5	77.2	5.4	161	15.6

Table 1 presented the mean indices (M) and the variation coefficients of the studied characters per regions. The valuation of variation coefficients showed significant variation of seed yield of the studied hybrids per regions. The most stable was the genotype LG5662, and the susceptible was the reaction of Deveda. The same conclusion was valid for the character oil in the kernel. For the characters - vegetation period /days/ and kernel content (%), the studied hybrids showed stability and the most

significant was that for the hybrid Deveda. For the character 1000 seed weight, the more stable was hybrid Deveda and the susceptible was the reaction of NK Brio. For the character plant height, the studied hybrids reacted equally to the conditions of different regions. More susceptible was the reaction of hybrids Linzi and LG 5662.

**Table 2.** Analysis of variance – Mean of squares (MS) of studied characters

Characters	Genotypes	Regions	Error
Seed yield (kg/da)	862.2	11395***	911.7
Veg. period (days)	59.9*	284.3***	15.1
1000 seed weight (g)	305.3***	238.4***	23.0
Kernel content (%)	53.4*	35.2	18.2
Seed oil content (%)	42.9***	63.0***	1.4
Plant height (cm)	264.0**	2417.9***	37.3
df	6	3	18

\*-p<0.05; \*\*-p<0.01; \*\*\*-p<0.001

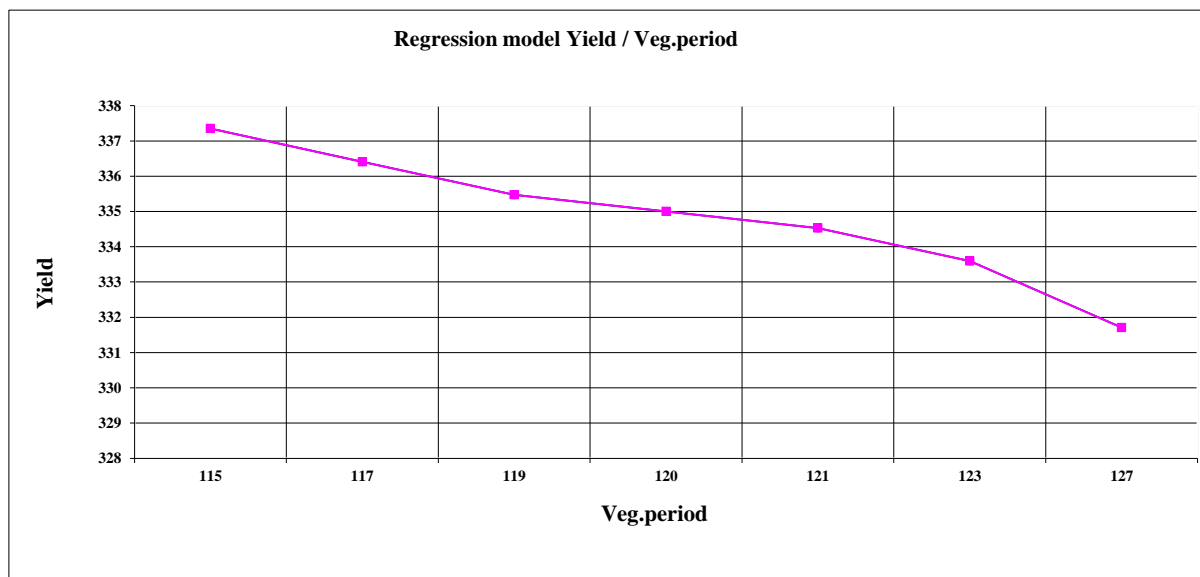
Table 2 presented the results from the carried dispersion analysis. There was no statistically proved difference of genetic potential on the character seed yield between the studied hybrids. Strong influence of conditions of different regions was established. That result gave the opportunity to prepare some recommendations and to point the best hybrid for each region to be sown. The influence of conditions of the region were with the highest statistical authenticity proved with the exception for the character kernel content (%), which was not influenced by the conditions of the region. The studied hybrids were demonstrated different genetic potential on the characters: vegetation period, 1000 seed weight, kernel content, oil content and plant height. That fact was statistically proved on different levels of authenticity.

**Table 3.** Correlation and path coefficients

Indices	Yield	Oil	Veg.Per.	1000 seeds weight	Kernel	Path coef
Oil(%)	0.038					0.17
Veget.period	-0.122	-0.852 <sup>c</sup>				-0.59
1000 seeds weight	-0.485 <sup>a</sup>	-0.392 <sup>a</sup>	0.535 <sup>b</sup>			0.72
Kernel(%)	0.0078	0.813 <sup>c</sup>	-0.975 <sup>c</sup>	-0.607 <sup>c</sup>		0,01
Plant height(cm)	0.194	-0.144	0.365 <sup>a</sup>	0.718 <sup>c</sup>	-0.550 <sup>b</sup>	0.64

The results of applied correlation and path-analyses were presented in Table 3. The obtained results showed, that seed yield correlate negatively to the character 1000 seed weight. That fact could be explained with the great variation of productivity per regions. The precise study of correlation between seed yield and other studied characters was applied the path-analysis. The evaluated path – coefficients proved strong positive indirect effect on yield of the characters 1000 seed weight and plant

height as well the negative effect of the character vegetation period /days/. The character oil content in the kernel /%/ is directly proportional to kernel content /%/ and inversely proportional to the character vegetation period. Statistically was proved the negative value of the character 1000 seed weight. The character vegetation period correlates positively to the characters 1000 seed weight and plant height and it was in negative correlation to the character kernel content /%/. The character 1000 seed weight correlates positively to plant height and negatively to kernel content /%/. The character kernel content /%/ logically correlates negatively to plant height.



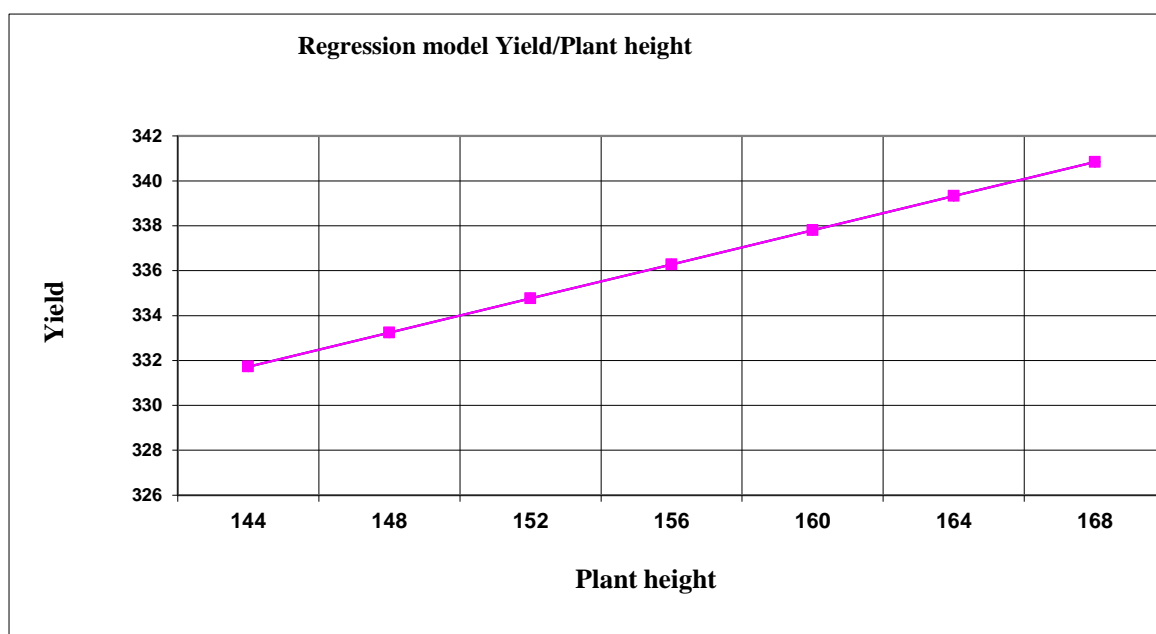
**Figure 3.** Regression model Yield / Veg.period

With aim to present in detail the connection between yield and the studied characters was applied the linear regression analysis. The results were presented in Table 4.

**Table 4.** Regression models between seed yield and the studied characters,  $y=ax+b$

Yield (y)	Type of model
Veget. period (days) (x)	$Y=0.46x + 391.4$
1000 seed weight (g) (x)	$Y=-0.87x + 385.7$
Kernel content (%) (x)	$Y=0.03x + 332.7$
Seed oil content (%) (x)	$Y=-0.05x + 339$
Plant height (cm) (x)	$Y=0.38x + 276.7$

The obtained results of the applied regression analysis showed that the strong direct effect on the productivity was observed in the characters vegetation period and plant height. The negative effect was determined for the character 1000 seed weight (Fig.3 and 4).



**Figure 4.** Regression model Yield/Plant height

### Conclusions

The obtained results of the applied regression, correlation and path-analyses proved the complicated interactions between studied characters in sunflower. The influence of every regions, distinguished by different meteorological conditions effected on the seed yield and therefore it is necessary to choose the hybrids, which were in charge of ecological conditions of a region for resistance to abiotic and biotic stress factors.

### REFERENCES

- Cornelius, L. and J. Crossa (1999). Prediction assessment of shrinkage estimators of multiplicative model for multi – environment cultivar trials. *Crop Sci.*, 39, 998-1009.
- Drumeva, M., N.Nenova and E. Penchev (2011). Investigation of some seed characteristics among sunflower lines and hybrids. *Agric. Sci. Tech.*, 3(3) 199-202.
- Miliken, A. and E. Johnson (1989). *Analysis of Messy Data. Nonreplicated Experiments* (2nd Edition), New York. Chapman & Hall, Vol. 2.
- Nenova, N., E. Penchev, M. Drumeva (2012). Biochemical investigations on sunflower lines (*Helianthus annuus* L.) and their hybrid combinations. *Agric. Sci. Techn.*, 4(3), 193-195.