

Studies Regarding Identification of Quality Parameters of Homologated Corn Hybrids in NW Transylvania

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Received: 15 July 2013; Accepted: 29 August 2013

Abstract

The characterization of physico-chemical point of view characteristics of 20 corn hybrids differ vegetation period, rigor and ecological plasticity. The ecological material have studied from the homologated hybrids collection in a research center for crop production. Analysis were effectuated for determinating: moisture, weight test, 1000 kernels weight, crude protein, fat, ash, cellulose and neazotate extractables content on cariopse samples from 2011 crop year.

Keywords: hybrids, maize, quality, oil and protein content.

1. Introduction

Maize, *Zea mays L.* is one of the most diverse grain crops found in nature and one of the most widely cultivated cereals in the world [1]. In 2009, worldwide corn production (817 million tonnes) had surpassed that of wheat (682 million tonnes) and rice (678 million tonnes). The world is now facing the major challenge of providing food security for an ever growing world population, when there are no new areas available for agricultural production [2].

Besides, that the attention should be paid to the quality of kernel itself, chemical composition, mainly it we take into consideration one of the most important maize uses in developed countries as livestock feed [3].

The international demand for quality parameters of corn hybrids such as oil, protein, carbonhydrates and starch is increasing because of technological and nutritional reasons [4,5].

The aim of the study was to compare the quality of corn hybrids cultivated in north-western of Transylvania by studing the variability of there biochemical compounds.

2. Materials and Methods

2.1. Materials

The sampling was made from the grain mass harvested in to 2011. Laboratory tests were performed on whole corn flour obtained by grinding the grins with the laboratory mill. The physical-chemical quality tests were conducted in food quality control laboratory, Department IPA of UASVM Cluj-Napoca.

In this study were analyzed samples of HST 129, Turda 165, Turda 213, Turda Star, Turda Favorit, Turda Mold 188, HST 132, HD 115, Elan, Turda 215, Turda 100, Turda SU 181, HS 105, HST 128, HST 131, Saturn, Turda 201, HST 133, Turda 145 and Turda 200 which was used as control sample.

2.2. Moisture content determination

The protocol used was based on the method prescribed by SR EN ISO 6540/2010. The moisture content was determined by drying a test portion at $130 \pm 2^\circ\text{C}$ in an oven at atmospheric pressure, until practically constant mass is reached. The moisture content is expressed in percent.

2.3. Crude protein content determination

Protein content was determined by available nitrogen in sample by Kjeldhal, method SR EN ISO 20483/2007. One gram sample was digested in 20 ml sulphuric acid, at 400°C using copper sulfate and potassium sulfate as catalyst mixture. Digested sample was distilled using 33-35% NaOH. Nitrogen is converted to ammonia, which is distilled and titrated with 0.1 N HCl to estimate the protein content. The amount of protein was calculated by multiplying % N by 5.7.

2.4. Fat content determination

Crude fat was extracted with petroleum ether by a Soxhlet apparatus. After extraction, the beaker with the residue was then dried in a hot air oven to evaporate the petroleum ether and then is weighed. The fat content is calculated from the difference between the initial sample weight and the weight of the dried residue after extraction. The results are expressed as percentage (%) of total fat (SR EN ISO 6492:2001).

2.5. Ash content determination

Samples (5 g) are taken in triplicate in crucibles. These were burnt on hot plate and then paced in an electric muffle furnace at 550-600°C for 6 hours. After cooling the crucibles to room temperature, the residue left (ash) in the crucible was weight. (SR EN ISO 2171:2010).

2.6. Cellulose content determination

All nutritional components of the sample, except pulp, are solubilised by boiling successively with sulfuric acid solution and sodium hydroxide. The residue is filtered, dried and weighed ash. How was working according to SR EN ISO 6865:2002.

2.7. Determination of neazotate extractive substances

These substances are determined solely by calculation formula: $SEN(\%) = 100 - (U\% + PB\% + GB\% + Cel.B\% + Cen.B\%)$

Where: SEN (%) – neazotate extractive substances; U% - moisture content, PB % - crude

protein; GB % - fat content; Cel.B % - crude fiber; Cen.B % - crude ash.

2.8. Statistical analysis

Each determination was carried out on three separate samples and analysed in triplicate and results were then averaged. The Duncan Test was used in order to determine if there are significant differences between the hybrids means.

3. Results and Discussion

All the results were compared with Turda 200 hybrid used as control sample.

Table 1. The moisture content of 20 hybrids of corn

Hybrids	Moisture (%)	Significance
Turda 200	11.27	Mt.
HST 129	11.47	ns
Turda 165	11.83	***
Turda 213	12.47	***
Turda Star	12.77	***
Turda Favorit	12.10	***
Turda Mold 188	11.73	***
HST 132	12.53	***
HD 115	12.20	***
Elan	12.30	***
Turda 215	12.87	***
Turda 100	12.90	***
Turda SU 181	12.40	***
HS 105	12.10	***
HST 128	13.10	***
HST 131	12.57	***
Saturn	12.27	***
Turda 201	11.70	***
HST 133	11.43	ns
Turda 145	11.53	*

The significance of effect: ns not significant, * significant positive, *** very significant positive
 $DL_{5\%} = 0.24\%$ $DL_{1\%} = 0.32\%$ $DL_{0.1\%} = 0.42\%$

Results of the present study showed that the moisture content of between 11.27 % - 13.10 % of the flour was within recommended limits. Variants analysis semnification between hybrids and moisture content reveals a not significant differences at HST 145 (11.45%) are a different significant positive. Statistically the other values hybrids are very significant (Tab. 1). In similar studies with maize flour, Batool et al. [6] and Aydin et al. [7] observed moisture content with the range 9-13%.

Moisture content of flour ranges from 11-14% [8] but the stipulated limit is 15% (WFP, 2012). Ntuli et al. [8] and Mahmood [9] reported that moisture content of maize varieties depend largely on the genetic makeup and is also influenced by the agronomic and climatic conditions.

Table 2. The protein content of 20 hybrids of corn

Hybrids	Protein (%)	Significance
Turda 200	7.57	Mt.
HST 129	7.36	00
Turda 165	7.50	ns
Turda 213	9.94	***
Turda Star	7.66	ns
Turda Favorit	8.96	***
Turda Mold 188	8.25	***
HST 132	7.82	***
HD 115	8.37	***
Elan	10.21	***
Turda 215	7.89	***
Turda 100	9.35	***
Turda SU 181	8.68	***
HS 105	9.36	***
HST 128	6.40	000
HST 131	7.06	000
Saturn	9.55	***
Turda 201	7.80	**
HST 133	6.79	000
Turda 145	7.56	ns

The significance of effect: ns not significant, ** significant distinct positive, *** very significant positive, ⁰⁰ significant distinct negative, ⁰⁰⁰ very significant negative
 DL_{5%} = 0.14 % DL_{1%} = 0.19% DL_{0,1%} = 0.24 %

Regarding protein content were statistically significant differences (Tab. 2). The protein content from hybrids HST 128 (6.40%) and HST 133 (7.06%) is very significant negative as against control sample. Eleven of the twenty hybrids studied had very significantly positive values. The results were compared to the literature. Values reported by Amer, Khalil, Zoueil and Masellam (1986) for Egyptian varieties and were near to range reported by Manoharkumar, Gerstenkorn, Zwingelberg and Bolling (1978) for German varieties. Fageer et al. [10] reported values higher than 8.9-11.2%.

The corn has a bigger fat content than the other cereals. Turda 145 (4.66%) and Turda 213 (4.44%) stood by the high fat content.

Table 3. The oil content of 20 hybrids of corn

Hybrids	Oil (%)	Significance
Turda 200	4.18	Mt.
HST 129	3.52	000
Turda 165	4.23	ns
Turda 213	4.44	***
Turda Star	3.20	000
Turda Favorit	4.18	Mt.
Turda Mold 188	4.00	000
HST 132	3.80	000
HD 115	3.95	000
Elan	3.88	000
Turda 215	3.95	000
Turda 100	3.76	000
Turda SU 181	3.59	000
HS 105	3.71	000
HST 128	3.54	000
HST 131	3.59	000
Saturn	3.63	000
Turda 201	3.42	000
HST 133	3.35	000
Turda 145	4.66	***

The significance of effect: ns not significant, *** very significant positive, ⁰⁰⁰ very significant negative
 DL_{5%} = 0.06 % DL_{1%} = 0.08% DL_{0,1%} = 0.11 %

Table 4. The ash content of 20 hybrids of corn

Hybrids	Ash (%)	Significance
Turda 200	1.49	Mt.
HST 129	1.42	000
Turda 165	1.39	000
Turda 213	1.42	000
Turda Star	1.43	00
Turda Favorit	1.38	000
Turda Mold 188	1.35	000
HST 132	1.49	Mt.
HD 115	1.36	000
Elan	1.33	000
Turda 215	1.31	000
Turda 100	1.49	Mt.
Turda SU 181	1.45	0
HS 105	1.46	ns
HST 128	1.48	ns
HST 131	1.34	000
Saturn	1.44	0
Turda 201	1.43	00
HST 133	1.34	000
Turda 145	1.41	000

The significance of effect: ns not significant, ⁰ significant negative, ⁰⁰ significant distinct negative, ⁰⁰⁰ very significant negative
 DL_{5%} = 0.03 % DL_{1%} = 0.04% DL_{0,1%} = 0.06 %

Turda Favorit (4.18%) hybrid has the same value as the control sample. The grain of modern maize hybrid contains about 4 % oil [5,11].

Data regarding ash contents of different maize varieties is given in Tab. 4. The results were similar to those in the literature. Grajales-García [12] and Méndez-Montealvo et al. [13] reported the range values for ash content to vary between 1.1 to 1.7 %.

Table 5. The cellulose content of 20 hybrids of corn

Hybrids	Cellulose (%)	Significance
Turda 200	1.86	Mt.
HST 129	3.00	***
Turda 165	1.27	000
Turda 213	2.31	***
Turda Star	1.54	000
Turda Favorit	1.75	000
Turda Mold 188	1.62	000
HST 132	3.19	***
HD 115	2.63	***
Elan	3.26	***
Turda 215	2.86	***
Turda 100	2.91	***
Turda SU 181	2.07	***
HS 105	1.75	000
HST 128	1.75	000
HST 131	3.34	***
Saturn	3.62	***
Turda 201	2.31	***
HST 133	1.28	000
Turda 145	2.67	***

The significance of effect: *** very significant positive, 000 very significant negative
 DL_{5%}= 0.05 % DL_{1%} = 0.06% DL_{0.1%} = 0.09 %

Crude fiber was found fourth largest chemical present in the maize grains after carbohydrates, protein, fats and moisture content. Percent crude fiber was found in the range of 1.27 (Turda 165) – 3.62 (Saturn) %. Ijabadeniyi and Adebolu [14] reported slightly higher values (2.07 – 2.77 %) of the fiber content for the corn varieties.

Carbohydrates are the major chemical component of the corn grains. The result of the neazotate extractables content of different maize varieties is shown in Table 6. The variability of the neazotate extractables content in corn ranged between 69.02% and 75.84%. Starch is the major carbohydrate of corn, making up 72–73% of the kernel [15].

Table 6. The neazotate extractables content of 20 hybrids of corn

Hybrids	Neazotate extractables content (%)	Significance
Turda 200	72.65	Mt.
HST 129	73.24	ns
Turda 165	73.79	***
Turda 213	69.42	000
Turda Star	73.41	*
Turda Favorit	71.63	00
Turda Mold 188	73.04	ns
HST 132	71.16	000
HD 115	71.49	000
Elan	69.02	000
Turda 215	71.13	000
Turda 100	69.52	000
Turda SU 181	71.82	0
HS 105	71.69	00
HST 128	73.74	**
HST 131	72.13	ns
Saturn	70.48	000
Turda 201	73.34	*
HST 133	75.84	***
Turda 145	72.17	ns

The significance of effect: ns not significant, * significant positive, ** significant distinct positive, *** very significant positive, 0 significant negative, 00 significant distinct negative, 000 very significant negative
 DL_{5%}= 0.65 % DL_{1%} = 0.87% DL_{0.1%} = 1.14 %

4. Conclusion

The data indicate that seeds of these varieties vary greatly in term of carbohydrates protein, fats, ash, crude fiber and moisture contents. HST 133 hybrid contains larger amount of the neazotate extractables than other hybrids (>73% neazotate extractables content). The varieties HST 129, HST 132, Elan, HST 131 and Saturn contain high (>3%) crude fiber of 3,00; 3,19; 3,26; 3,34 and 3,62, respectively. HST 132 and Turda 100 have the same values of the ash content as Turda 200 (control sample). Turda 145 (4,66%) have a high oil content and Elan (10,21) have a high protein content. These results will be useful to know about the nutritional properties of the local maize varieties.

Compliance with Ethics Requirements

Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

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