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CASTELAR, ARGENTINA

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Argentinean High-Lysine and Modified Starch Corn Hybrids. II. Determination of the Grains Chemical Composition by Near-Infrared

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The gross chemical composition of grains yielded by single and double-crosses grown at the Instituto de Genética Dr. E.A. Favret (IGEAF-INTA Castelar) during the growin season 2010/11 was determined using an infrared spectrophotometer model Foss Infratec 1241 Grain Analyzer to quantify thru a non-destructive assay protein content (%), starch content (%) and oil content (%). The analysis was performed on two 60 g grain samples of each genotype obtained by hand pollination to prevent contamination and *xenia* effect particularly on oil content. These results were average to obtain the final values and come to complete others published previously (*see* MNL83: 12-13, 2009).

Maize is the best energy source for animal dietary rations. In average, corn kernel oil content is relatively low (3.0-5.0%) and is mostly found in the germ. According to data published by ILSI and based on samples taken worldwide (Source= *ILSI Crop Composition Database version 2.0*; *www.cropcomposition.org*) corn oil content varies from 1.74 to 5.56%. Nevertheless, MAIZAR (*Argentine Maize Association*) eventually reported that the oil content measured by NIRT technology on 48 commercial hybrids sampled within the limits of the ZMT and the southeastern area of the province of Buenos Aires during the growing season 2004/05 NIR ranged from 3.9 to 6.5%. High-oil content (HOC) corn shows up to twice the content of this component and a higher protein quality than dent maize, so it also has a greater energy value and may replace others high-cost fat and protein sources. According to the U.S. Grain Council any genotype yielding grains with an oil content of ≥ 6.0% should be considered as HOC.

Kernels protein content is highly variable and depends mainly on the variety, sampling, production environment as well as the calculation factors used to convert N into protein. In accordance with ILSI Argentina, kernels average protein content is about 9.5% (*when sampled 109 commercial hybrids grown in the provinces of Cordoba and Buenos Aires between 1999 and 2001*).

The gross chemical composition of the grains produced by the single and double-crosses tested in the experimental field of the IGEAF-INTA Castelar is shown in Table 1. Average oil content was 5.3% (*range=4.1 a 7.3%*). Four crosses may be classified as HOC due to their kernels oil concentration. The *waxy* single-cross HC52 shows the kernels highest oil concentration (7.3%) followed in decreasing order by the double mutant HC69 (6.2%), the high-lysine single-cross HC57 (6.1%) and the double mutant HC59 (6.0%).

The average protein content of the thirty hybrids tested was high (*avg.*= 12.2%; *range*= *10.8 to 13.6%*). The double mutant HC59 yielded the highest protein content (13.6%) followed by the double mutants HC55 and HC95 which produce kernels with 13.3% protein. Also, a high level of protein content (≥ *12.0%*) was detected in the grains of the genotypes HC49, HC50, HC57, HC58, HC67, HC70, HC73, HC74, HC75, HC80, HC85 and HC92. In brief, eighteen out of thirty hybrids yielded grains with more than 12.0% protein.

Finally, the average content estimated for the thirty hybrids was 68.4% ranging from 66.7 to 69.9% (*see* Table 1). These values agree with those detected by MAIZAR thru a NIR analysis of 48 commercial hybrids grown in the main argentine corn area (ZMT) and southeast of the province of Buenos Aires during the season 2004/05.

The single-crosses HC57 and HC59 yielded kernels with both high protein and oil contents. These results strengthen previous results obtained during the growing season 2009/2010 and are infrequent in improved genotypes of this species.

Pearson´s simple correlation coefficients among oil, protein and starch content were calculated (*see* Table 2). The results suggest negative and significant correlations between starch and oil protein content (*r*= *-0.45*; *p: 0.05*), negative and highly significant associations between starch and protein content (*r*= *-0.48*; *p: 0.01*) and once more, as in previous MNL reports, no significant correlations between oil and protein content were found (*r*= *-0.32*; *n.s.*).

The results of mean contrasts ($t_{Student}$) for the different chemical components of the kernels of the groups of hybrids studied revealed that there are only highly significant differences between DR and Flint hybrids for protein and starch content (±*t*= *4.7 and 5.5 respectively*; *p: 0.01*) as well as between MS and Flint genotypes for kernels starch concentration (±*t*= *4.5*; *p: 0.01*).

The kernels oil content (*6.0-7.3%*) of the hybrids HC52, HC57, HC59 and HC69 suggest that they could have competitive advantages for animal feeding. Likewise, the oil and protein content found in these experimental hybrids could be of special interest for animal nutrition and/or the corn transformation industry.

Table 1= *Gross chemical composition* (via NIRT) *of thirty crosses tested in the experimental field of the IGEAF- Castelar during the growing season 2010/11.*

HYBRID	CROSS	TYPE	% OIL	% PROTEIN	% STARCH
HC49	single	MS (wxae1)	4.8	12.0	69.2
HC50	single	MS (wx)	5.0	12.9	68.7
HC52	single	MS (wx)	7.3	10.8	66.7
HC55	single	DR (wxo2o5)	5.5	13.3	67.4
HC57	single	HL (o2o5)	6.1	12.1	67.0
HC58	single	MS (wx)	5.1	12.0	68.8
HC59	single	DR (wxo2)	6.0	13.6	67.4
HC66	doble	DR (wxo2/Oh43)	4.7	13.0	68.2
HC67	double	DR (wxo2)	5.1	12.3	68.2
HC69	double	DR (wxo2)	6.2	11.8	69.1
HC70	double	DR (wxo2o5)	5.1	12.5	68.0
HC72	double	DR (wxo2/Oh43)	5.0	13.0	68.4
HC73	double	DR (wxo2)	5.4	12.1	68.9
HC74	double	DR(wxo2o5)	5.4	12.8	67.3
HC75	double	DR (wxo2)	4.5	12.9	68.6
HC77	double	DR (wxo2/Oh43)	5.4	11.7	68.9
HC78	double	DR (wxo2)	5.4	11.7	68.6
HC80	double	DR (wxo2)	5.6	12.5	68.1
HC82	double	DR (wxo2)	5.5	13.1	67.2
HC83	double	DR (wxo2/Oh43)	5.4	11.9	68.3
HC85	double	DR (wxo2o5)	5.5	12.6	68.3
HC90	double	MS(wxae1)	4.1	11.8	69.1
HC91	double	DR (wxo2)	5.8	11.1	69.3
HC92	double	MS (wx)	5.6	12.9	67.3
HC93	double	DR (wxo2o5)	5.0	11.3	69.9
HC94	double	MS (wx)	5.0	11.6	69.0
HC95	double	DR (wxae1)	4.4	13.3	68.0
HC96	double	DR (wxo2o5)	5,6	11.7	69.0
HC97	double	DR (wxo5)	5.3	11.5	69.2
HC98	single	MS (wx)	5.6	11.4	68.7
ACA2000	single	Flint or vitreous	5.2	11.4	70.3
ACA 929	three-way	Flint or vitreous	4.9	11.6	69.8

Table 2= *Pearson´s correlation coefficients* (r) *among the different chemical components of the kernels determined thru NIRT technology in experimental specialty corn hybrids grown in the IGEAF-CNIA INTA Castelar* (*growing season* 2010/11).

	r
Oil-Protein	*-0,32 n.s.*
Oil-Starch	*-0,45 **
Protein-Starch	*-0,48 ***

ns= *non significant*; ***=** *significant at the level of p≤ 0,05*
**= *significant at the level of p≤ 0,01*