Genetically modified maize for silage production

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Introduction To prepare maize silage, seeks to identify cultivars with higher productivity and nutritive value, by increasing the participation of grains and higher digestibility of the forage portion. Results show that genetically modified foods have the composition (laboratory tests) and nutritional value (animal studies) equivalent to traditional foods and according to regulatory agencies (WHO), there is no risk of consumption of these food sources (Phipps and Beever, 2000; Calsamiglia et al. 2007). Up to the present, transgenic DNA and protein were not found in milk, meat and eggs, emphasizing the benefits to producers, consumers and the environment, both in developed and developing countries, with particular emphasis on the ability of transgenic technology to increases productivity, improves food quality and reduces environmental impacts in agriculture (Phipps and Beever, 2000; Calsamiglia et al., 2007). The objective of this study was to determine productivity and nutritive value of transgenic and conventional maize cultivars, using different technologies available in Brazil.

Materials and Methods Five experiments were installed in the State of São Paulo (cities: Votuporanga, Pindorama, Andradina, Mococa and Tatuí) on 2009/10 and 2010/11 harvest, to evaluate ten maize cultivars, five genetically modified (ImpactoTL, DKB390YG, 30S40Y, 2B688Hx and 30F90Y) and five their conventional pairs. The plots were distributed in a completely randomized block design with four replicates. Each plot consisted of eight lines of 10 meters. Plants were harvested when the dry matter (DM) content was between 32 to 36%. Five plants per line (10 plants/plot) were randomly harvested, fractionated and the fractions weighed: ear (removed with stalk), leaves and stem+tassel. After this phase, cob+grain and bracts were separated, weighed and air dried, and after dried at 60°C for about 24 hours. Later on, the grains were separated from the cob and quantified. The leaves and stems were chopped in a mechanical chopper, sampled (minimum 500 g) and dried at 60°C, for 72 hours. Other 10 plants per plot (whole plant, including ears), were chopped, sampled (500 g) and dried at 60°C, for 72 hours. Samples were grounded in a Wiley mill and analyzed by NIRS (Shenk and Westerhaus, 1991) to obtain the following chemical composition: crude protein (CP), *in vitro* organic matter digestibility (IVOMD), digestible dry matter production (DDMP) was estimated by using productivity and digestibility traits, neutral detergent fiber (NDF), acid detergent fiber (ADF), nitrogen in NDF (NDF-N), cellulose (CEL), hemicellulose (HEMI) and starch. Data were analyzed by using the GLM procedure of SAS, including effects of city, block and type of plant (conventional vs. transgenic).

Results and Discussion Maize plants showed no differences for agronomic and chemical traits (Tables 1 and 2). Pereira (2009) also found no difference (P> 0.10) in chemical composition between Bt and non Bt hybrids and its silages. The authors concluded that Bt event did not interfere in the nutritional quality of produced silage. In another study, Pereira (2009) evaluated the performance and blood parameters of cows fed conventional ("non Bt")' or transgenic maize silage ("Bt maize" TC-1507 Herculex). In that trial, Bt maize did not show any negative change in productivity or even in milk composition when compared to conventional maize. Although

transgenic maize can be resistant to pests and diseases and, in turn have lower field losses, the transgenic maize did not stand out in relation to conventional hybrid for nutritional variables.

Conclusions Cultivars of conventional and transgenic maize do not differ in agronomic or chemical variables at the time of ensiling.

References

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Table 1. Productivity and fractionation on the conventional and transgenic maize plant

Variable	Conventional	Transgenic	SEM	P
DM, %	37.49	38.19	0.47	0.31
DMP, $t.ha^{-1}$	19.95	20.50	0.23	0.09
Leaves, %	20.05	19.98	0.20	0.82
Stem, %	27.78	28.33	0.35	0.29
Ear, %	52.16	51.73	0.38	0.44
Grain, %	33.33	33.34	0.36	0.98
Grain/ear, %	63.16	63.68	0.36	0.32

DM = dry matter; DMP = dry matter production.

Table 2. Chemical composition of conventional and transgenic maize plant

Variable	Conventional	Transgenic	SEM	P
CP, % DM	7.41	7.41	0.05	0.98
NDF-N, % DM	6.97	7.06	0.07	0.39
NDF, % DM	54.17	54.19	0.30	0.97
ADF, % DM	30.08	30.24	0.30	0.71
CEL, % DM	25.58	25.56	0.16	0.93
HEMI, % DM	26.86	26.60	0.24	0.45
STARCH, % DM	22.89	22.94	0.25	0.89
IVOMD, % DM	61.87	61.88	0.19	0.98
DDMP, $t.ha^{-1}$	12.38	12.70	0.14	0.12

DM = dry matter; CP = crude protein; NDF-N = nitrogen in NDF, NDF = neutral detergent fiber, ADF = acid detergent fiber; CEL = cellulose, HEMI = hemicellulose; IVOMD = in vitro organic matter digestibility; DDMP = digestible dry matter production.