The effect of applying "Silo King" at ensiling on wheat silage studied in laboratory conditions

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Introduction:

Biological additives are very popular in the silage industry, and have many advantages. In the international market it is possible to find vast numbers of inoculants. Many factors affect the activity of these inoculants, therefore it is important to test their effects on the forage that we intend to ensile.

Purpose of this work:

To test the effect of "SILO-KING", a commercial silage additive produced by the AGRI-KING Company, USA, on the fermentation process of wheat silage, in laboratory condition in Israel.

Experiment procedure:

Whole wheat plants, chopped to about 1.5 cm, were brought to our laboratory immediately after commercial harvesting (24th March 2002). The chopped material was mixed three times to ensure its homogeneity. The inoculants were added to a part of the material, according to the producer's recommendation.

The experiment was performed in 1.5-liter glass jars, equipped with a lid which enables only gas release, and not entry. To study the fermentation dynamics we used 15 jars per treatment, in three replicates; they were used for sampling on days 1, 2, 5, 14 and 30, and 5 replicates to be opened after 67 days of fermentation, and were then subjected to an aerobic stability test lasting 5 days.

Chemical and microbiological analysis:

1. The chemical analysis of the fresh forage determined the contents of dry matter, water-soluble carbohydrates (WSC), ADF, NDF, and pH. The microbiological analysis included the enumeration of lactic acid bacteria, yeasts and molds.
2. Fermentation dynamics - pH and enumeration of lactic acid bacteria (LAB).

3. End product (day 67) – analyzed for dry matter (DM), pH, WSC, lactic acid, VFA, LAB, yeasts, molds, ADF, NDF and degradability of organic material, *In-Situ.* Tests were performed after 0, 6, 12 and 48 h

4. Aerobic stability test (5 days) – analyzed for carbon dioxide production, pH, yeasts and molds.

Results:

Raw material analysis (fresh wheat crop day 0) – dry matter 31.5±17%, pH 6.28, WSC 10.0%, ADF 27.4%, NDF 48.7%, LAB* 5.0, yeasts* 4.3, molds* 4.5.

*Microbiological results are given as $\log_{10}$ (number of colony forming units' g^{-1} DM).

Table No. 1. The changes of silage composition during 30 days of fermentation.

Silage	Day	pH	% DM	*Lactobacilli
Control	1	4.42±0.04	---	9.2
Treated	1	4.43±0.00	---	8.9
Control	2	4.17±0.03	32.0±0.31	9.6
Treated	2	4.20±0.02	32.2±0.15	9.6
Control	5	3.86±0.01	---	9.6
Treated	5	3.86±0.01	---	9.4
Control	14	3.67±0.01	31.6±0.42	9.5
Treated	14	3.67±0.00	31.5±0.15	9.4
Control	30	3.63±0.01	---	9.0
Treated	30	3.63±0.01	---	9.1

* Microbiological results are given as $\log_{10}$ (number of colony forming units' g^{-1} DM).

Table No. 2. Chemical and microbiological analysis of the silages after 67 days of fermentation, end experiment (% in DM).

	Control	Treated
% DM	31.2±0.46	31.7±0.41
pH	3.65±0.01	3.65±0.00
**Lactobacilli	5.8	5.6
**Yeasts	5.2	0
**Molds	4.9	1.1
*WSC	3.44±0.80	4.20±1.37
*Lactic Acid	6.32±0.27	6.24±0.25
*Ethanol	0.74±0.27	0.65±0.29
*Acetic Acid	0.87±0.06	0.98±0.14
NDF	48.8±3.06	49.4±0.88
ADF	28.5±1.96	28.8±0.57
CO_2 (g kg^{-1} DM)	0.85±0.27	0.58±0.06

*% in DM

**Microbiological results are given as $\log_{10}$ (number of colony forming units' g^{-1} DM).

Table No. 3. Degradability *In-situ* technique of organic material in Dacron bags (% in DM).

Hours	Control	Treated
*0	35.8	40.0
6	38.6	42.3
12	40.7	44.1
48	52.3	55.8

*Rinsed in water only.

Table No. 4. Results of the aerobic stability test after 5 days.

	Control	Treated
pH	3.84±0.06	3.76±0.06
*Yeasts	8.8	8.2
*Molds	4.9	5.4
CO_2 (g kg^{-1} DM)	21.6±5.20	18.0±5.50

* Microbiological results are given as $\log_{10}$ (number of colony forming units' g^{-1} DM).

Discussion:

Table 1. No significant differences in fermentation dynamics, among the various silages. Changes were typical for wheat silages.

Table 2. Less yeasts and molds and higher residual sugar contents in the treated silages was found. Such results can indicate a better fermentation process. The lower load of yeasts and molds can have a positive effect on the stability of the silage.

Table 3. A consistent tendency towards higher degradability of the treated silages is found.

Table 4. The lower production of carbon dioxide in the treated silages indicates better aerobic stability.

Summary:

The effect of the additive SILO-KING on wheat silage was tested in laboratory conditions. The results indicate a positive effect of the additive in the test condition. I suggest the experiment be expanded, to evaluate the additive in farm conditions.