IMPACT OF ECOCOOL SILAGE INOCULANT ON CORN SILAGE DIGESTIBILITY AND MYCOTOXIN CONTAMINATION AFTER AIR EXPOSURE

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INTRODUCTION

Corn silage is a globally significant fermented forage for ruminants, prized for its palatability, high energy and **digestible fibre (NDF)**, which supports animal performance. However, after preservation, exposure to oxygen can lead to rapid spoilage by yeasts and moulds, causing substantial losses in dry matter and energy, reduced palatability, and decreased feed intake. A critical concern is the potential for mould growth to produce **mycotoxins**, which severely impair livestock health and reproductive performance. Beyond mycotoxin contamination, silage spoilage also leads to a substantial **decline in nutritive value**. The combined effects of reduced nutritive value and potential mycotoxin contamination can result in considerable **economic losses** for livestock producers. Silage inoculants are a key prevention strategy, inhibiting spoilage organisms and enhancing aerobic stability during feed-out.

OBJECTIVE

This study evaluated the impact of **Ecocool**, a dual-strain silage inoculant containing ***L. plantarum*** **MTD/1 NCIMB 40027** and ***L. buchneri*** **PJB/1 NCIMB 30139**, on corn silage quality, focusing on **aerobic stability**, **nutritive profile** (especially NDF digestibility), and **hygienic quality** after aerobic exposure.

MATERIALS & METHODS

Field-harvested corn (22% DM) was ensiled in 1.8 L glass jars using a 2x2 factorial design, comprising two treatments: **CON** – water only, or **EC** – treated with the Ecocool silage inoculant to a target total LAB count of 3.0 x 10^5 cfu/g fresh forage; and two time points: 46 or 95 days. Three replicate jars were prepared for each treatment / time combination, packed to a density of 110 kg DM/m^3 and stored at 20 ± 1°C. Upon silo opening, each replicate was homogenized, and subsamples were analyzed to determine silage quality parameters.


pH


Microbial Populations


Dry Matter by oven drying at 60°C


Fermentation Acids & Alcohols by HPLC


Aerobic Stability (time needed until silage temp. >2°C above ambient)


Mycotoxins using HPLC-MS


Nutritional Value using wet chemistry


Statistical Analysis in R using ANOVA and HSD (α = 0.05)

RESULTS & DISCUSSION

After 46 days of ensiling EC-treated silage exhibited significantly **lower DM losses** (p = 0.042; Figure 1a) and **higher LAB counts** (p <0.005; Figure 1b) compared to CON. EC treatment also significantly **increased acetic acid** (p = 0.003; Figure 1d), leading to a significant **reduction in yeasts** (p = 0.009; Figure 1c) and **ethanol levels** (p = 0.003; Figure 1e). This translated to significantly **improved aerobic stability** in EC silage (p = 0.002; Figure 1g).

By day 95 post-ensiling, EC-treated silages maintained significantly **higher acetic acid** (p <0.001; Figure 1d) and 1,2-propanediol (p <0.05; Figure 1f). Yeasts remained **undetectable** in EC silages (vs. persistent in CON). Crucially, EC-treated silages continued to show significantly **improved aerobic stability** (p <0.001; Figure 1g) and had **lower aerobic losses** after exposure, compared to CON (5.93 and 12.70 g/kg FM respectively; p = 0.002).

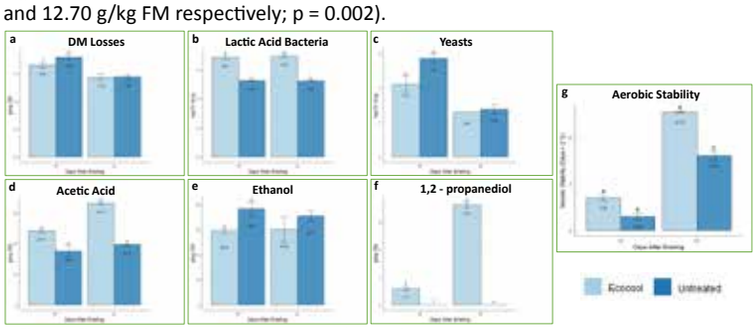

Figure 1. Silage quality parameters by treatment and time point.

Following 95 days of fermentation and 12.7 days of aerobic exposure, **visible fungal growth was observed on the surface of control (CON) silages, whereas no such growth was evident on EC-treated silages** (Figure 2). Subsequent mycotoxin analysis identified four present in the silages.

Figure 2. Appearance of silages after 95 days fermentation and 12.7 days of aerobic stability.

Mycophenolic acid (MPA) and **zearalenone (ZON)** were present at low levels in CON (MPA only) and EC (MPA and ZON) silages after 95 days ensiling, whilst **deoxynivalenol (DON)** was present in far greater concentrations (Figure 3a), having also been detected in pre-ensiled corn (10,229 ppb). Mycotoxin levels were assessed again following a period of 12.7 days aerobic stress, where **EC silages contained significantly lower levels of both MPA (p <0.001) and roquefortine C (RoqC; p <0.001), relative to CON** (Figure 3b), representing an approximate 98% difference, and indicating better control of fungal growth during exposure to air.

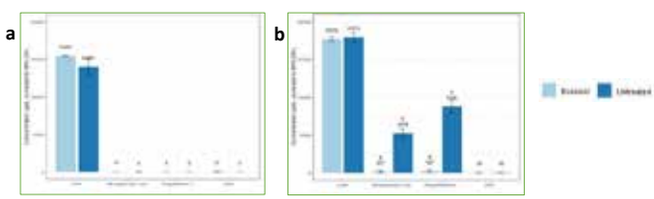

Figure 3. Mycotoxins detected in corn silage: a) after 95 days ensiling, b) after 95 days of ensiling and 12.7 days of aerobic stress.

Following 95 days of fermentation and 12.7 days of aerobic exposure, EC-treated silages demonstrated significantly elevated levels of **essential amino acids, lysine** (p = 0.002) **and methionine** (p = 0.005) (Figure 4), and **enhanced NDF digestibility** relative to untreated controls (Figure 5). Given the previously described correlation between NDF digestibility and animal performance (Oba & Allen, 1999) EC silages have the potential to support greater **milk production** than CON.

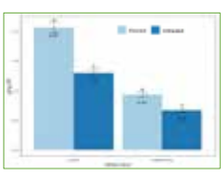

Figure 4. Levels of essential AAs lysine and methionine in silages after 95 days of ensiling and 12.7 days of aerobic exposure.

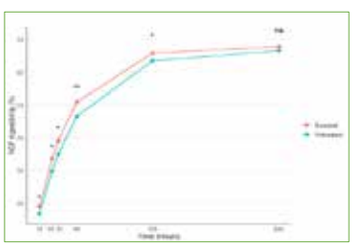

Figure 5. NDF digestibility of corn silage after 95 days of ensiling and 12.7 days of aerobic stress.

CONCLUSION

- **Ecocool silage inoculant significantly enhanced corn silage's aerobic stability** by increasing acetic acid production and suppressing yeast and mould growth during air exposure.
- This led to a **better hygienic quality of the silage**, evidenced by reduced mycotoxin production.
- Ecocool application also resulted in **significantly improved silage NDF digestibility**.
- **Corn silage treated with Ecocool had greater nutritive value than those without treatment** and therefore hold the potential to better drive livestock productivity.

References: Oba, M., & Allen, M. S. (1999). Evaluation of the Importance of the Digestibility of Neutral Detergent Fiber from Forage: Effects on Dry Matter Intake and Milk Yield of Dairy Cows. *Journal of Dairy Science*, *82*(3), 589–596

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