EFFECT OF USING BACTERIAL INOCULATES ON MAIZE SILAGE QUALITY

BY

AHMED MOHAMED MOSTAFA ABIDO

B. Sc. Agric. Sc. (Animal Production), Ain Shams University, 1993

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This thesis for M.Sc. degree has been approved by:

Prof. Dr. Yehia Ibrahiem El-Talty .....

Prof. of Animal Nutrition, Fac. of Agric., Cairo University.

Prof. Dr. Salwa Mahmoud Hamdy .....

Prof. of Animal Nutrition, Fac.of Agric. Ain Shams University.

Prof. Dr. Hamdy Mohamed Ahmed EL-Sayed .....

Prof. of Animal Nutrition , Fac. of Agric., Ain Shams University.

Prof. Dr. Hussein Saad Soliman .....

Prof. of Animal Nutrition , Fac. of Agric., Ain Shams University.

Date of Examination / / 2005

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AHMED MOHAMED MOSTAFA ABIDO

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Under the supervision of:

Prof. Dr. Hussein Saad Soliman

Prof. Emeritus of Animal Nutrition, Animal Production Department, Fac. of Agriculture, Ain Shams University

Prof. Dr.Akila Saleh Hamza

Head of Research, Central Laboratory for Food and Feed, Agriculture Research Center

Prof. Dr.Hamdy Mohamed Ahmed El-Sayed

Prof . of Animal Nutrition , Animal Production Department, Fac. of Agriculture, Ain Shams University

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ABSTRACT

Ahmed Mohamed Mostafa Abido. Effect of using bacterial inoculates on maize silage quality. Unpublished Master of Science Thesis. Department of Animal Production, Faculty of Agriculture, Ain Shams University, 2005.

Two weeks from their parturition, nine lactating buffaloes were used in a feeding trial to study the effect of maize silage inoculated with bacteria on their performance. The inoculants were pioneer 1132 which were composed of 100 billion Colony Forming Unit (CFU) per gm of crop specific Lactobacillus plantarium and Enterococcus facium. Animals were grouped into 3 feeding treatments, according to their weight and milk yield. They were introduced to rations containing 50%:50% roughage of forage: concentrate ratio as an amount of dry matter equal to 3.5% of their live body weight. The control group G1 was fed concentrate feed mixture CFM which composed of 25% un-decorticated cotton seed meal, 35% wheat bran, 30% yellow corn, 3% rice bran, 3% molasses, 2% limestone, 1% urea and 1% mineral salts. and rice straw as the traditional feeding regimen in summer in Egypt, G2 was fed CFM and untreated maize silage and G3 was fed CFM and maize silage inoculated with bacteria. The treatments extended for 3 months after the two weeks of parturition. DM, OM, CP, CF and NFE digestibility coefficients in G3 were higher than those in G1 and G2 , while EE digestibility was unaffected by treatments. Milk yield and 4% FCM yield increased significantly with inoculated silage than the other treatments. Milk composition in G3 was higher in TS, Fat, and lactose values ($P<0.01$) than values recorded for G1 and G2. Consequently, G3 produced more TS, SNF Fat, Lactose and Ash ($P<0.01$) than the other Two groups. Some values of blood serum parameters were discussed. The inoculated silage group performed better than the other two groups in feed and economic efficiency.

Key words: Inoculated silage, Lactating buffaloes, Lactobacillus planetarium, Enterococcus faecium.

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INTRODUCTION

Many factors in maize silage management can influence silage quality and its fermentation characteristics .Studies have demonstrated some of the chemical changes that occur in the corn plant as it matures and leads to less fermentable substrates being available for lactic acid producing bacteria **(McDonald *et al* 1991)** resulting in low silage quality . As the corn plant matures, water-soluble carbohydrate (WSC) level decreases and the starch level increases in whole plant corn producing less fermentable substrate available for lactic acid producing bacteria. This has the potential of delaying fermentation and may result in low quality silage. Several studies have demonstrated the effect of bacterial inoculation into corn silage on silage fermentation characteristics **(Harrison *et al* 1996; Higginbotham *et al* 1998; Cai *et al* 1999; and Ranjit & Kung *et al* 2000).**

Maintenance of an anaerobic environment in the silo during the fermentation and storage phases and maintenance of aerobic stability of silage during the feed out phase (time when silage is removed from silo) are important factors in silage preservation **(Bolsen *et al* 1996).** Failure to achieve such conditions may cause lower recovery of nutrients, and the production of poor quality silage results in reduced DMI and animal performance **(Chen *et al* 1994).** Earlier criteria for the effective preservation of an ensiled crop included a high degree of lactic acid production and a pH below 4.2 after the fermentation phase **(Bolsen *et al* 1996, Cleale *et al* 1990).** The criteria usually produce silage that is stable under anaerobic conditions. However, upon exposure to air, silage quality might be reduced because of the introduction of oxygen, which promotes the growth of yeast, molds, and aerobic bacteria. During exposure to air during the feed out phase, silage also might undergoes increases in temperature and pH and losses in water-soluble carbohydrates (WSC) and in fermentation end products **(Pitt *et al* 1991),** which reduce silage quality. The duration of time before the temperature

of the silage rises (i.e., aerobic stability) affects the nutrient losses in the silo, the likelihood of toxic effects of fungal growth in silage fed to animals, and the degree of management required to minimize exposure to air during the feed out phase **(Pitt *et al* 1991).**

Silage additives primarily that containing lactic acid bacteria (LAB), have been investigated as a mean to improve the aerobic stability of silage. Inoculation of a crop with LAB at ensiling was speculated to improve aerobic stability by providing competition with yeast during the aerobic and fermentation phases **(Honig, 1990).** Some studies have shown improvements in the aerobic stability of silage from forage inoculated with LAB prior to ensiling (**Woolford, 1975),** but other studies have shown negative effects **(Moon *et al* 1980, Rust *et al* 1989)** or no effect **(Schaefer *et al* 1989 and Sanderson 1993).**

2. REVIEW OF LITERATURE

2.1. Plant silage maturity and quality:

In a study conducted by **Bal *et al* (1997);** the whole – plant corn was harvested at early dent, quarter milk line, two – third milk line and black layer stages to evaluate the effects of maturity on intake, digestion, and milk production when corn was fed as silage in the diet for twenty multiparous holstein cows, which diets contained 50 % forage: 50 % concentrate (dry matter basis). They found that intakes of DM were similar across the four treatments and ranged from 3.73 – 3.79 % of body weight.

Also, milk protein production was highest for cows fed silage from corn harvested at two – thirds milk line stage. Also, apparent total digestion of DM, OM, CP, ADF and starch was lowest for cows fed silage from corn harvested at the black layer stage.

Bal *et al* (1997) concluded that, the optimum stage for corn that was ensiled was two – thirds milk line with some flexibility between quarter and two – third milk line.

Bendary *et al* (2001); determined the chemical composition and yield of the whole plants of corn crop of 10 common hybrids and varieties and quality, nutritive value and nutrients production produced / feddan from corn silage of these hybrids and varieties. They found that, the higher yield of whole forage on DM basis were recorded for summer crops, single crosses, Watania – 4, 10 and three way cross 320 (7.27, 6.86 and 6.37 ton/feddan, respectively) and corresponding values of DM produced as silage from these hybrids were 6.94, 6.53 and 6.06 ton/ feddan, respectively, while Giza – 2 variety (Nili crop) achieved the least yields of whole plant and silage (3-71 and 3-51 ton/ feddan). They added that three way cross pioneer – Daheb and single cross 10 recorded the highest grain content from the whole plant (40.30 and 37.17%, respectively). They noticed that, all corn hybrids and varieties produced good quality silage except single cross 158, which had a dark