**Effect of an inoculant and enzymes on fermentation quality and nutritive value of erect milkvetch (*Astragalus adsurgens* Pall.) silages**

C. C. Xu[1], H. L. Wang[1], W. Hao[1], F. Y. Yang[2], Yuzhu[2], Q. Z. Sun[3]
*[1]China Agricultural University, College of Engineering, Beijing, P. R. China, [2]China Agricultural University, College of Animal Science and Technology, Beijing, P. R. China, [3]Chinese Academy of Agricultural Sciences, Grassland Research Institute, Hohhot, P. R. China*
*Email: xucc@cau.edu.cn*

**Introduction** Erect milkvetch (*Astragalus adsurgens* Pall.) is widely cultivated in diverse environments in arid and semiarid areas of northern China and it is an alternative feed source for animals. Ensiling may be an appropriate method to preserve its nutritive value. However, the small amount of WSC and high buffering capacity make it difficult to be ensiled. The objective of this study was to assess the effect of inclusion of inoculant, enzymes and their mixture during ensiling on the fermentation quality and *in vitro* degradation of erect milkvetch silage.

**Materials and Methods** Erect milkvetch (*Astragalus adsurgens* Pall.) for ensiling was harvested at a bud stage from experimental plots in Beijing in August. The forage was chopped into 1 to 2 cm then divided into four equal portions to subject the following treatments: (1) distilled water (Control); (2) addition of *Lactobacillus plantarum* at a rate of 0.01g/kg of fresh forage (I); (3) addition of fibrolytic enzymes at a rate of 0.033 g/kg of fresh forage (E); and (4) combination of I and E (I+E). Each treatment was mixed well and packed into plastic film bags with 200g per bag, which were sealed with a vacuum sealer and stored at ambient temperature (20 to 25°C). 15 bag silos were prepared for each treatment and three bag silos per treatment were randomly opened on days 1, 3, 5, 15, and 45 of ensiling and the content was processed for quality assessment and laboratory analysis. The 45-d erect milkvetch silage samples were used for *in vitro* digestibility determination.

**Results and Discussion** As shown in Figure 1, for all treated silages, the pH decreased rapidly to below 5.0 during the first 5 days of fermentation except for treatment E. However, it was found that the control silage kept a relative high pH of exceeding 5.3 during the entire periods. Furthermore, all the treated silages had a sustained lower pH than control throughout the ensiling period. In the present study, treatments of both I and I + E exhibited positive effects on silage fermentation as indicated by lower pH and higher lactic acid concentration, than control silage. This may attribute to that the LAB used can improve silage quality by proliferation of LAB and consequently growth inhibition of clostridia and aerobic bacteria. It is also expected that other than the addition of LAB, cellulase increased WSC production which could be then used by LAB for primary lactic acid fermentation. In addition, treatments of enzymes (E, I + E) significantly improved IVDMD and IVNDFD. This is consistent with results reported by other researchers (Eun and Beauchemin, 2008). Silages treated with I significantly increased IVDMD and IVCPD (Table 1). However, Filya et al. (2007) reported that the addition of I did not show significant effects on IVDMD of alfalfa silage. From more than 60% of trials published between 1990 and 1995, Muck and Kung (1997) summarized that fermentation was improved (i.e. reduced pH, increased lactate to acetate ratio, or both) by inoculants, whereas DM digestibility (*in vitro or in vivo*) was increased in only 30% of the trials. Weinberg and Muck (1996), in their review, also reported instances in which fermentation was affected by a LAB inoculant, whereas digestibility was not. Treatments with enzymes (E, I + E) significantly

improved silage IVDMD and IVNDFD. In addition, treatments of I and I + E increased IVCPD (P<0.05) (Table 1).

**Conclusion** All treated silages (I, E and I + E) were well preserved as compared with control silages (P<0.05). Results also indicated that additives tested in our study can improve the erect milkvetch silage fermentation quality and *in vitro* digestibility to some extents.

## References


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Weinberg, Z. G. and R. E. Muck. 1996. New trends in development and use of inoculants for silage. FEMS Microbiol. Rev. 19:53-68.


**Table 1.** Effects of additive treatments on nutrient compositions of 45-d erect milkvetch silages

| Items[1] | Treatments[2] | | | | SEM[3] | P |
|---|---|---|---|---|---|---|
| | Control | E | I | I +E | | |
| Dry matter, g/kg | 259 | 257 | 259 | 260 | 0.1 | 0.119 |
| CP, g/kg DM | 142$^{d}$ | 149$^{c}$ | 155$^{b}$ | 161$^{a}$ | 0.7 | <0.001 |
| aNDF, g/kg DM | 467$^{a}$ | 448$^{b}$ | 451$^{b}$ | 407$^{c}$ | 2.1 | <0.001 |
| ADF, g/kg DM | 315$^{a}$ | 297$^{b}$ | 303$^{b}$ | 272$^{c}$ | 1.5 | <0.001 |
| Lignin (sa) (g/kg DM) | 86$^{a}$ | 76$^{b}$ | 77$^{b}$ | 74$^{b}$ | 0.5 | 0.006 |
| WSC, g/kg DM | 7.1$^{ab}$ | 7.6$^{ab}$ | 6.8$^{b}$ | 8.4$^{a}$ | 0.07 | 0.034 |
| IVDMD, g/kg | 530$^{b}$ | 588$^{a}$ | 594$^{a}$ | 602$^{a}$ | 9.3 | <0.001 |
| IVNDFD, g/kg | 369$^{b}$ | 442$^{a}$ | 393$^{b}$ | 449$^{a}$ | 10.2 | <0.001 |
| IVCPD, g/kg | 719$^{b}$ | 701$^{b}$ | 844$^{a}$ | 837$^{a}$ | 20.0 | <0.001 |

[1] aNDF - neutral detergent fibre assayed with a heat stable amylase and expressed inclusive of residual ash; ADF - acid detergent fibre expressed exclusive of residual ash; Lignin (sa) - sulphuric acid lignin; CP - crude protein; WSC - water soluble carbohydrates; IVDMD - *in vitro* dry matter digestibility; IVNDFD - *in vitro* neutral detergent fibre digestibility; IVCPD - *in vitro* crude protein digestibility. [2] E - enzymes; I - inoculant; I + E - inoculant + enzymes. [3] SEM - standard error of the mean, *n*=3. [a-d] Means in the same row with different superscripts differ (P<0.05).

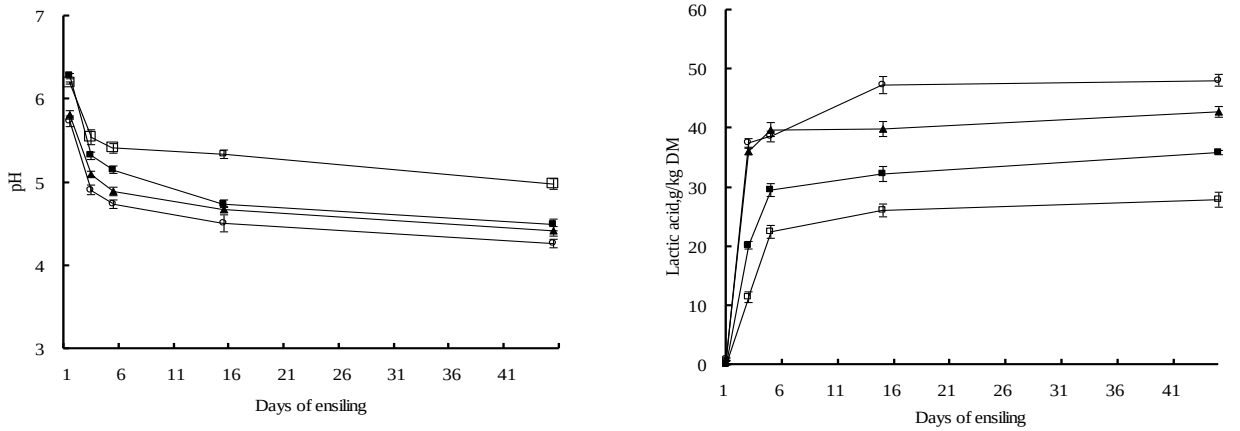


**Figure 1.** Changes in pH and lactic acid during ensiling of erect milkvetch treated with distilled water (□), inoculant (▲), enzymes (■) or inoculant + enzymes (○)