
CHEMICAL AND QUALITATIVE ASSESSMENT OF (*Azolla pinnata*) SILAGE AND ITS EFFECTS ON FATTENING OF ZEL LAMBS EXPOSED TO HEAT STRESS

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ABSTRACT

An experiment was conducted to investigate the effect of *Azolla pinnata* (AP) silage in combination with wheat straw as a non-conventional feedstuff on growth performance of Zel lamb during high ambient temperature. Fresh AP was gathered from a pond in Mazandaran province, Iran. Four kinds of silage were prepared as follow: 100% AP, 50% AP + 50% sugar beet pulp, 75% AP + 25% rice straw, and 66% AP + 33% wheat straw. These mixtures ensiled for two months under anaerobic conditions. Fleig point in 100% AP, 50% AP + 50% sugar beet pulp, 75% AP + 25% rice straw, and 66% AP + 33% wheat straw was 68.47, -99.57, -35.00, and 52.85, respectively. Furthermore, silages of 100% AP and 66% AP + 33% wheat straw were fed to sheep that both of them had good palatability in pre-trial phase. Thus, pure AP or in combination with 33% wheat straw had the best quality for practical feeding in livestock. After that, the AP combined with wheat straw was chosen for in vivo study. Two silages of 100% corn and 66% AP + 33% wheat straw were fed to two groups of sheep that contained 5 each. Both of them had good palatability. In conclusion, 66% AP or in combination with 33% wheat straw (22.46% AP and 11.23% wheat straw in the diet) had resulted in reduction of body weight gain and deteriorated feed efficiency as compared with control treatment (100% corn silage).

Keywords: *Azolla pinnata*, feed intake, lamb feedlot, Zel

Introduction

Azolla (*Azolla* sp.) is an aquatic fern consisting of a short, branched, floating stem, bearing roots which hang down in the pond. Its diameter ranges from 1-2.5 cm for small species such as *Azolla pinnata* (AP) (Lumpkin et al., 1980). *Azolla* has a historical role in agriculture. For centuries, it has been recognized as a useful plant in Southern China and Northern Vietnam, where it has been used as a bio fertilizer and green manure for the rice crop due to its N-fixing abilities (Van Hove et al., 1996). *Azolla* was also mentioned as a poultry feed in Peru in the 18th century (Feuillée, 1725).

Azolla was brought from Philippine to Iran some decades ago to produce nitrogenous fertilizer for paddy lands of the northern region. After a while, it became a problem for ponds and rivers which threatens aquaculture due to prevention of sunlight.

Azolla contains essential amino acids, trace minerals, beta-carotene and cyanocobalamin (Cheryl et al., 2014). Due to azolla nutrient contents and its fast growth, the utilization of Azolla in livestock in many regions of the world is going to more common. Azolla can be used as fresh, semidried, dried and ensiled in animal feeding. Thus, an experiment has been conducted to evaluate AP silage as a non-conventional feedstuff in different mixtures as pure and in combined with wheat straw has been evaluated as *in vitro* and *in vivo* in feedlot of Zel lambs.

Materials and Methods:

Fresh AP was gathered from a pond in Mazandaran, IRAN. Four kinds of silage were prepared as follow: 100% AP, 50% AP + 50% sugar beet pulp, 75% AP + 25% rice straw, and 66% AP + 33% wheat straw. The following picture illustrates the above mentioned silages, respectively. These mixtures ensiled for two months under anaerobic conditions.



Figure 1 – Four kinds of silages from 100 to 66% AP (from left to right)



Figure 2 -Internal view of a silage containing 100% *Azolla pinnata*



Figure 3 – A silage containing 66% AP and 33% wheat straw which was evaluated as *on vivo* study

This farm trial was conducted with at least 6 hours above 30 centigrade and more than 60% relative humidity in Goldasht farm, Jouybar county, Mazandaran province in summer. A total number of 10 Zel lamb (with average age 5 months and average weight 25 kg) were randomly assigned into two treatments with 5 replicates (heads of lambs) each. Control treatment contained commercial feedlot lamb diet with 67.4% corn silage as-fed. The second treatment included a silage comprising chopped wheat straw and semi-dried azolla which were 11.23 and 22.66 of the diet, respectively. The experiment was conducted during one month.

Feed intake, body weight gain, and feed conversion ratio (FCR) were measured during the trial. The obtained results were analyzed using the GLM procedure of SAS software (SAS, 2004). Duncan's multiple range test was used to compare the means. All statements of significance were based on probability of $P < 0.05$.

Results and Discussion:

Chemical analysis showed that dry matter, crude protein (as-fed basis), and pH for 100% AP silage were 43.7%, 5.32%, and 5.6, respectively. Moreover, dry matter, crude protein, and pH for 50% AP + 50% sugar beet pulp silage were 14.11%, 2.13%, and 8.32, respectively. Also, dry matter, crude protein, and pH for 75% AP + 25% rice straw silage were 33.59%, 3.19%, and 7.68, respectively. Finally, dry matter, crude protein, and pH for 66% AP + 33% wheat straw silage were 45.72%, 2.68%, and 6.09, respectively. Flieg point $\{220 + (2 \times \text{dry matter}\% - 15) - 40 \times \text{pH}\}$ was calculated for all groups. Fleig point in 100% AP, 50% AP + 50% sugar beet pulp, 75% AP + 25% rice straw, and 66% AP + 33% wheat straw was 68.47, -99.57, -35.00, and 52.85, respectively. Furthermore, silages of 100% AP and 66% AP + 33% wheat straw were fed

to sheep that both of them had good palatability. In conclusion, pure AP or in combination with 33% wheat straw had the best quality for practical feeding in livestock.

The results of performance of lambs fed the experimental diets are shown in Table 1. It has been shown that diets containing azolla silage and wheat straw significantly caused to less body weight gain and unsuitable feed conversion ratio. The current observation is in line with Gouriet al. (2012) dried azolla up to 20% of concentrate of goat kids palatable with no adverse impact on the kids. However, at the level of 50% resulted in diarrhea. In the current trial, also azolla caused to negative effects of performance but there was no scour.

Table 1- effects of dietary treatments on growth performance of Zel lambs under heat stress

Dietary treatments	Total feed intake (kg)	Target weight of lambs (kg)	Body weight gain (kg)	Feed conversion ratio
TMR containing corn silage	54.300	29.050 ^a	3.840 ^a	14.5 ^b
TMR containing 50% corn silage and 50% silage of azolla and wheat straw (2:1 ratio)	44.100	27.450 ^b	2.300 ^b	18.9 ^a
SE	4.225	0.390	0.370	0.900
P-value	0.126	0.027	0.023	0.011
^{a, b} Means with various superscripts in each column are significantly different.				

The AP is easily digestible through gastrointestinal tract of domesticated ruminants which includes high crude protein and low lignin. The AP is cost effective due to its prevalence in swamps and easy access for collection.

Parashuramulu et al. (2013) evaluated the protein content and *In Vitro* digestibility for ruminant livestock. They reported that AP is a suitable protein supplement comprising 21.37% CP, 1759 kcal ME per kg, as well as highly digestible dry matter and organic matter.

In conclusion, it has been suggested that AP silage can be used for lamb feeding just in a restricted percentage to reduce feed cost. However, it may result in suboptimal performance of the livestock.

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