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# Chemical composition and *in situ* digestion kinetics of urea-molasses treated fallen leaves of *Quercus Rugosa*

## Abstract

The aim of the study was to determine the effect of the use of urea (0, 2, 4 and 6%) or molasses (0, 15, 30 and 45%) on the nutritive value of leaves of *Quercus rugosa* Née. The *in situ* digestibility of dry matter was also estimated. The metabolizable energy (ME), net energy of lactancy (NEl), the organic matter digestion coefficient (OMD) and short chain volatile fatty acids (SCFA) were determined from data of the *in vitro* gas production technique. Leaves were collected from two sites located in the state of Jalisco and one site in the state of Zacatecas, México. In general, the OM, NDF and ADF contents diminished as the levels of molasses increased in diets. Conversely, CP, nonfiber carbohydrates (NFC), ash, ME, NEl and SCFA contents augmented as molasses increased. In general, when urea and molasses were higher, the fractions a, b, a+b of the *in situ* digestibility were higher. All the molasses mixtures with addition of urea at 4 or 6% had higher chemical composition and *in situ* digestibility.

**Keywords:** *quercus rugosa*, chemical composition, *in situ*, digestibility, urea, molasses

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## Introduction

Fallen leaves of *Quercus rugosa* are used for food source for ruminants at the end of winter when defoliation occurs.[1] However, fallen leaves from *Quercus* have high concentrations of structural carbohydrates and low dry matter digestibility and crude protein content. It has been suggested that to improve the rumen digestion of straw fed animals the supplementation with urea and molasses.[2,3] *In situ* digestion parameters are important characteristics of forage digestion in ruminants.[4] This study was carried out with the aim to determine the effect of the inclusion of urea (0, 2, 4 and 6%) and molasses (0, 15, 30 and 45%) to the fallen leaves of *Q. Rugosa* Née on the chemical composition and *in situ* digestion parameters.

## Materials and methods

The study was carried out in three collection sites; two sites were located in the state of Jalisco, Mexico and one y the state of Zacatecas, Mexico. Collection of fallen leaves of *Quercus* was achieved during the years 2012 and 2013 during the second week of March. Leaves were collected in a plot of about 50m×50m randomly located in each collection site. Grinded fallen leaves (1.5kg) were mixed with the ingredients for each treatment (4x4=16); first diluted urea with 10% of water was added to leaves, then the molasses were included and completely homogenized the three components of the treatment mixtures. Each treatment mixture were ensiled in cylindrical laboratory silos made by polyvinylchloride of 5cm in diameter and 30cm long and sealed in each extreme of the silo. After a period of 28days, the silos were opened and dried at 60°C.

Samples were analyzed to determine OM, ash, EE and CP (AOAC, 1990), NDF and ADF.[5] Hemicellulose (NDF - ADF) and OM (DM - ash) were determined by difference. The NFC were calculated by the equation of Sniffen et al.[6] NFC (%)=DM-(CP+NDF+EE+ash). The concentration of condensed tannins (CT) was estimated using the butanol-HCl method.[7] Gas production was determined by the *in vitro* procedure proposed by Theodorou et al.[8] Since the *in vitro* production of gas is proportional to the DM degraded, the net yield of gas at 24h (ml/700mg) incubation of the substrate was used to calculate the ME and IVOMD using the equations proposed by Menke & Steingas.[9]

The technique of nylon bag[10] was used to assess the degradability of DM. To determine the parameters of *in situ* degradability and passage rate, the data obtained were processed by the equation proposed by Ørskov et al.[11] Data was analyzed as one-way analysis of variance in a 4x4 factorial arrangement considering the urea (0, 2, 4 and 6%) and molasses (0, 15, 30 and 45%) levels as the main effects. The GLM procedure of the SAS statistical software (SAS/STAT® User's Guide (8.1 Edition), SAS Inst. Inc., Cary, NC, USA[12] was used to compute the data.

## Results and discussion

The CP content in fallen leaves significantly increased as the addition of urea and molasses increased being the higher treatment-mixture with 45% molasses and 6% urea (Table 1). Conversely, Vallejo-Solís[13] argued that The CP content in fallen leaves of native trees and shrubs was reduced as molasses augmented in diets. In this study, NDF and ADF were significantly reduced as the addition of urea and molasses increased. Araiza-Rosales et al.[4] reported similar tendency in reduction of structural carbohydrates. In this study, the NFC content significantly diminished as the addition of urea and molasses increased. In general, as the percentage of urea and molasses increased the ME, NEl and SCFA contents in treated fallen leaves, significantly augmented (Table 1).

In general, as the *in situ* digestibility parameters **a**, **b** and **a+b** significantly augmented as the addition of urea and molasses increased in fallen leaves of *Quercus* (Table 2). Similar findings were observed by Araiza-Rosales et al.[4] when corn silage was added

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with 5 and 10% molasses. Conversely, Vallejo-Solís[13] reported that the potential degradability of silages based on tree and shrub fodders was reduced as the levels of molasses were increased.[14] In this study, higher digestion rates (**c**) were achieved in leaf litter samples with molasses and 4 and 6% of urea (Table 2). In concordance with this study, Souza et al.[2] reported that the rate of digestion of barley straw increased as the level of urea increased from 0 to 6%.

## Conclusión

The OM, NDF, ADF and NFC contents in leaf litter samples diminished as the levels of urea and molasses augmented. However, CP, hemicellulose, ME, NEl and SCFA augmented as the levels of urea and molasses increased. In general, the *in situ* digestion parameters **a, b**, **a**+**b** and **c** were improved as the levels of urea and molasses increased.

## Acnowledgements

None.

## Conflict of interest

The author declares that there is no conflict of interest.

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