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***Djellal F., Kadi SA., Madani T., Abbas K., Bannelier C., Gidenne T.***

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FOR GROWING RABBITS.**

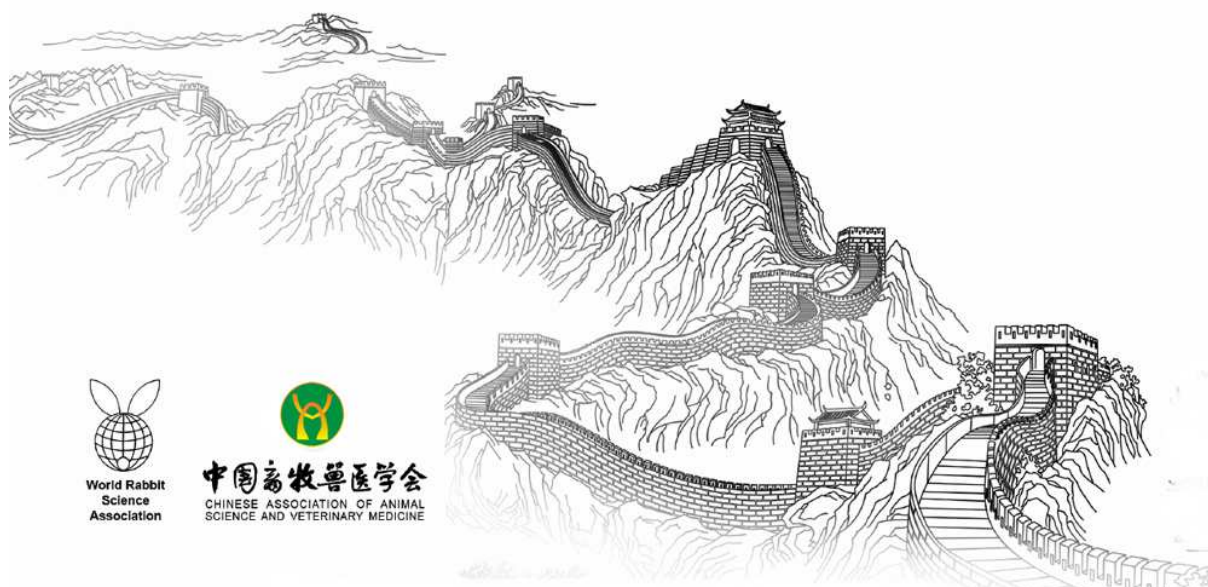
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## NUTRITIVE VALUE OF FRESH ASH (*FRAXINUS ANGUSTIFOLIA*) LEAVES FOR GROWING RABBITS

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### ABSTRACT

The nutritive value of Ash (*Fraxinus angustifolia*) leaves, harvested in autumn was determined (direct method), using ten rabbits (individually caged) weaned at 35d old (mean body weight: 911g) fed *ad libitum* only fresh Ash leaves during 16 days. Ash leaves composition was: organic matter (OM) 89.3%, crude protein (CP) 14.6%, neutral detergent fibre (NDF) 39.4, acid detergent fibre (ADF) 26.3, acid detergent lignin (ADL) 15.1% on dry matter (DM) basis. The faecal digestibility of the Ash leaves was measured between 48 and 51 days old. The digestibility of OM, CP, NDF and ADF were 74, 67, 59 and 59% respectively. The concentration in digestible energy and digestible protein of the Ash leaves was estimated to  $13.59 \pm 0.90$  MJ and  $98 \pm 10.4$  g/kg DM respectively. The Ash leaves harvested in autumn could be considered as a good source of energy and fibre for growing rabbit.

**Key words:** Ash leaves, *Fraxinus angustifolia*, nutritive value, autumn, digestibility

### INTRODUCTION

Since immemorial time, fodder trees exploited in animal feeding especially for ruminants. Leaves and twigs can be grazed directly or cut and distributed to the animals (El Shaer, 2000). Ash (*Fraxinus sp.*) is one of those fodder trees exploited in the whole Mediterranean area. Ash leaves has been reported to be a valuable component in ruminants feed due to its adequate content in energy and protein (Bourbouze, 1980). According to Bourbouze (2005), Albanian farmers stock the dry foliage of Ash to feed goats. In Algeria, especially in Kabylia, *Fraxinus angustifolia* is the most available species of ash. As an herbivore, rabbit is known to valorise roughage and fibrous resources. Several studies (Raharjo *et al.*, 1986; Deshmukh *et al.*, 1993a; Kadi, 2012) have reported the possibility of incorporating tree leaves in rabbit diets. The chemical composition of Ash leaves (17 % crude protein according to Jayanegara *et al.*, 2011) may fit the minimal nutrient requirement of growing rabbits. Accordingly, the aim of the present research is to determine, via the direct method, the nutritive value for growing rabbits of the fresh Ash (*Fraxinus angustifolia*) leaves harvested in autumn.

### MATERIALS AND METHODS

#### Animals and diet

Ten local white rabbits, weaned at 35 d of age (mean weight:  $911 \pm 128$  g) and placed in wire mesh individual cages (56 x 38 x 28 cm) in flat deck disposition, were used to assess the nutritive value of Ash leaves.

The green leaves of Ash tree (*Fraxinus angustifolia*) were harvested manually, daily in the morning and distributed ad libitum as sole feed for the rabbits. Permanent access to clean fresh water is available using an automatic watering. Samples of Ash leaves were collected throughout the digestibility trial period, mixed and stored in polyethylene bag at  $-20^{\circ}\text{C}$  until the chemical analysis.

### Digestibility trial

After a 12 days adaptation period (56 d old), rabbits were used for the digestibility trial, following the European reference method described by Perez *et al.* (1995). The cages were equipped with a wirenet under the floor to collect individually and totally the hard faeces during a 4-day period. Faeces were stored daily in polyethylene bags at  $-20^{\circ}\text{C}$  until chemical analysis. Two samples of Ash leaves were collected every day during the 4 days. The first sample is collected at the moment of the distribution for rabbits. The second concern the daily Ash leaves refused in order to determine their dry matter.

### Analytical methods

The chemical analyses were performed at INRA of Toulouse (UMR 1388 GenPhySe, France). Dry matter, crude ash, crude protein (N x 6.25), energy (adiabatic calorimeter Parr), Van Soest fibre (NDF, ADF and ADL) were measured on Ash leaves and faeces according to EGRAN harmonised procedures (EGRAN, 2001).

### Statistical analysis

Because only one diet was used, the results are presented with mean and standard error.

## RESULTS AND DISCUSSION

### Chemical composition

According to their chemical composition (Table 1), Ash tree leaves seem to be relatively balanced feedstuff for rabbits. Indeed, their crude protein content was interesting (147 g/kg DM) for fresh tree leaves and close to that of some raw material (as wheat bran, wheat feed and rice bran) reported in EGRAN tables by Maertens *et al.* (2002). For instance, those Ash leaves that can be considered as fibre source (NDF: 394 g/kg DM, ADF: 283 f/kg DM, ADL: 161 g/kg DM) contain more protein (131.4 g/Kg if reconsidered for 90% DM as in EGRAN Tables) than Alfalfa meal 12 (126 g/Kg), Beet pulp (90 g/kg), Citrus pulp (59 g/Kg), Olive leaves (90 g/Kg) or carob meal (47 g/Kg).

**Table 1.** Composition and digestibility coefficients of fresh Ashleaves (*Fraxinus angustifolia*) given as a sole ration for growing rabbits

	Ash composition*	
	g/kg raw basis	g/kg DM
Dry Matter (DM)	410	-
Organic matter (OM)	366	893
Crude ash	44	107
Crude protein (CP)	60	146.7
Neutral detergent fibre (NDF)	162	394
Acid detergent fibre (ADF)	108	283
Acid detergent lignin (ADL)	62	161
Energy (MJ/kg)	7.95	19.39

\*sample of Ash offered during the digestibility period,

Moreover, it is known that the fibrous feedstuffs that contain amounts of protein are scarce. In addition, protein content of the fresh Ash studied here are higher than that obtained by Deshmukh *et al.* (1993b) for coastal Bermuda grass (116 g/kg DM) and El Shaer (2000) for *Acacia saligna* (125 g/ kg DM).

Those amounts of energy, proteins and fibre would be enough to justify the use of direct method for estimate nutritive value of those leaves.

### Nutritive value

The apparent digestibility coefficient (Table 2) of Ash leaves energy was 70 %. It was slightly superior to the norms generally recorded with forages, which vary from 45 to 65 % (Villamide *et al.*, 2010). This energy digestibility corresponds to 13.6 MJ/kg DM with a standard error of 0.36 calculated by the equation proposed by Villamide (1996). With a similar digestible energy, we can classify the Ash leaves as a good source of energy for the rabbit diet.

**Table 2.** Body weights, feed intake, digestibility coefficients and nutritive value of fresh Ash leaves (*Fraxinus angustifolia*) given as a sole ration for growing rabbits.

	Weight and feed intake		Digestibility (%)	
	Mean	SE	Mean (%)	SE
Initial body weight (g)	911	52		
Final body weight (g)	903	77		
Feed intake (g DM/day)	97	04		
Feed intake (g as fed/day)	236	10		
Dry Matter (DM)			75	1.6
Organic matter (OM)			74	1.6
Crude protein (CP)			67	2.9
Neutral detergent fibre (NDF)			59	2.4
Acid detergent fibre (ADF)			59	2.4
Gross Energy			70	2.0
<i>Dietary nutritive value</i>				
DE (MJ/Kg DM) <sup>1</sup>			13.59	0.36
DP (g/Kg DM) <sup>2</sup>			98.08	4.26

<sup>1</sup>DE: digestible energy, <sup>2</sup>DP: digestible crude protein

The faecal digestibility of Ash leaves protein was 67 %, a normal value for forages. Its similar to the values obtained with direct method and reported in the bibliography for ryegrass (67 %, Fernandez-Carmona *et al.*, 2001); but slightly higher than that of Lucerne (64 %, Fernandez-Carmona *et al.*, 1998) or Sulla flexuosa (64%, Kadi *et al.*, 2012). NDF and ADF digestibility were high (59%) probably due to an important digestible fraction of fibres such as pectins (Gidenne *et al.*, 2010).

According to De Blas *et al.* (1985), the requirements in terms of DCP/DE ratio for maintenance are close to 6.8 g MJ/d. The daily average intake of DCP and DE were 9.52 g and 1.32MJ, respectively, which implies that Ash leaves assure the maintenance requirements for rabbit (average daily gain of 2 g during 13 days).

### CONCLUSION

The nutritive value of fresh Ash (*Fraxinus angustifolia*) leaves harvested at autumn season and estimated by direct method was 13.6 ±0.90 MJ DE/kg DM and 98.0 ± 10.43 g DP/kg DM. Those results seem interesting and must be confirmed especially by the regression method proposed by Villamide *et al.* (2001).

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## REFERENCES

- Bourbouze A. 1980. L'élevage dans la montagne marocaine. Organisation de l'espace et utilisation des parcours par les éleveurs du Haut Atlas. *Institut National Agronomique & Institut Agronomique et Vétérinaire Hassan II, Paris Grignon & Rabat*, 322 p.
- Bourbouze A. 2005. Stratégies des éleveurs et politiques forestières dans les montagnes méditerranéennes : du conflit à la conciliation. In: Georgoudis A., Rosati A. and Mosconi C. (Eds.). *Animal production and resources utilization in the Mediterranean mountain areas. E.A.A.P., Greece*, 521-531.
- De Blas J.C., Fraga M.J., Rodríguez J.M. 1985. Units for feed evaluation and requirements for commercially grown rabbits. *J. Anim. Sci.*, 60, 1021-1028.
- Deshmukh S.V., Pathak N.N., Takalikar D.A., Digraskar S.U. 1993a. Nutritional effect of mulberry (*Morus alba*) leaves as sole ration of adult rabbits. *World Rabbit Sci.*, 1, 67-69.
- Deahmukh S.V., Pathak N.N., Randhe S.R. and Deahmukh S.S. 1993b. Voluntary intake, digestibility and nutritive value of coastal Bermuda grass (*Cynodon dactylon*) employed as sole feed for rabbits. *World rabbit Sci.*, 1, 109-111.
- EGRAN 2001. Technical note: Attempts to harmonise chemical analyses of feeds and faeces, for rabbit feed evaluation. *World Rabbit Sci.*, 9, 57-64.
- El Shaer H. 2000. Utilization of *Acacia saligna* as livestock fodder in arid and semi-arid areas in Egypt. In: Sulas L. (Eds.). *Legumes for Mediterranean forage crops, pastures and alternative uses. Cah. Opt. Med.*, 45, 213-217.
- Fernandez-Carmona J., Bernat F., Cervera C., Pascual J.J. 1998. High lucerne diets for growing rabbits. *World Rabbit Sci.*, 6, 237-240.
- Fernandez-Carmona J., Cervera C., Moya J., Pascual J.J. 2001. Feeding ryegrass hay to growing rabbits, a note. *World Rabbit Sci.*, 9, 95-99.
- Gidenne T., García J., Lebas F., Licois D. 2010. Nutrition and Feeding Strategy: Interactions with Pathology. In: De Blas C. Wiseman J. (Eds.). *The Nutrition of the Rabbit. CABI Publishing. CAB International, Wallingford Oxon, UK*, 179-199.
- Jayanegara A., Marquardt S., Kreuzer M., Leiber F. 2011. Nutrient and energy content, *in vitro* ruminal fermentation characteristics and methanogenic potential of alpine forage plant species during early summer. *J. Sci Food Agric.*, 91, 1863-1870.
- Kadi S.A., Belaidi-Gater N., Oudai H., Bannelier C., Berchiche M., Gidenne T. 2012. Nutritive value of fresh Sulla (*Hedysarum flexuosum*) as a sole feed for growing rabbits. In *Proc. 10<sup>th</sup> World Rabbit Congress, 2012 September, Sharm El-Sheikh, Egypt*, 507-511.
- Kadi S.A. 2012. Alimentation de lapin de chair : Valorisation de sources de fibres disponible en Algérie. *Thèse de doctorat, Université Mouloud Mammeri de Tizi-Ouzou (Algérie)*, 143 p.
- Maertens L., Perez J.M., Villamide M., Cervera C., Gidenne T., Xiccato G. 2002. Nutritive value of raw materials for rabbits: EGRAN tables 2002. *World Rabbit Sci.*, 10, 157-166.
- Masson C., Decaen C. 1980. Composition chimique et valeur alimentaire des jeunes pousses de peuplier (*Populus*) et de frêne (*Fraxinus*). *Ann. Zootech.*, 29, 195-200.
- Perez J.M., Lebas F., Gidenne T., Maertens L., Xiccato G., Parigi-Bini R., Dalle Zotte A., Cossu M.E., Carazzolo A., Villamide M.J., Carabaño R., Fraga M.J., Ramos M.A., Cervera C., Blas E., Fernández-Carmona J., Falcao E., Cunha L., Bengala Freire J. 1995. European reference method for *in vivo* determination of diet digestibility in rabbits. *World Rabbit Sci.*, 3, 41-43.
- Raharjo Y. C., Cheeke P. R., Patron N.M., Supriyati K. 1986. Evaluation of tropical forages and by-product feeds for rabbit production. I. Nutrient digestibility and effect of heat treatment. *J. Appl. Rabbit Res.*, 9, 56-66.
- Villamide M.J. 1996. Methods of energy evaluation of feed ingredients for rabbits and their accuracy. *Anim. Feed Sci. Technol.*, 57, 211-223.
- Villamide M.J., Maertens L., Cervera C., Perez J.M., Xiccato G. 2001. A critical approach of the calculation procedures to be used in digestibility determination of feed ingredients for rabbits. *World Rabbit Sci.*, 9, 19-26.
- Villamide M.J., Maertens L., De Blas C. 2010. Feed evaluation. In: De Blas C. Wiseman J. (Eds.). *The Nutrition of the Rabbit. CABI Publishing. CAB International, Wallingford Oxon, UK*, 151-162.

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## Aim of the work

The aim of the present research is to determine the nutritive value for growing rabbits of the fresh Ash (*Fraxinus angustifolia*) leaves harvested in autumn.

## Material and Methods

✓ Ten rabbits of Algerian white local population, mean weight: 911±128, placed in wire mesh individual cages, were used to assess the nutritive value of Ash leaves (*Fraxinus angustifolia*) harvested in autumn.

✓ The green leaves of Ash tree (*Fraxinus angustifolia*) were harvested manually, daily in the morning and distributed *ad libitum* as sole feed for the rabbits. Permanent access to clean fresh water was available using an automatic watering.

✓ After a 12 days adaptation period (56 d old), rabbits were used for the digestibility trial, following the European reference method described by Perez et al. (1995). The cages were equipped with a wirenet under the floor to collect individually and totally the hard faeces during a 4-day period. Faeces were stored daily in polyethylene bags at – 20 °C until chemical analysis. Two samples of Ash leaves were collected every day during the 4 days. The first sample is collected at the moment of the distribution for rabbits. The second concern the daily Ash leaves refused in order to determine their dry matter.



Ash tree (*Fraxinus angustifolia*)

## Results

### Composition of fresh Ash leaves given as a sole feed for growing rabbits

	Ash leaves composition	
	g/kg raw basis	g/kg DM
Dry Matter (DM)	410	-
Organic matter (OM)	366	893
Crude ash	44	107
Crude protein (CP)	60	146.7
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1DE: digestible energy, 2 DP: digestible crude protein

## Conclusion

✓ The nutritive value of fresh Ash (*Fraxinus angustifolia*) leaves harvested at autumn season and estimated by direct method was **13.6 ±0.90 MJ DE/kg DM and 98.0 ± 10.43 g DP/kg DM.**

✓ Those results seem interesting and must be confirmed

