Turkish Journal of Field Crops, 2010, 15(1): 65-68

UTILIZATION POSSIBILITIES OF CARNATION BY-PRODUCTS AS AN ALTERNATIVE ROUGHAGE SOURCE

Osman YÜKSEL[1]* Sebahattin ALBAYRAK[1] Mevlüt TÜRK[1] Cahit BALABANLI[1]

[1]*Süleyman Demirel University, Faculty of Agriculture, Department of Field Crops, Isparta- TURKEY*
**Corresponding Author: oyuksel@sdu.edu.tr*

ABSTRACT

This study was conducted to determine the possibility of using carnation by-products as an alternative roughage source for animal feeding in Isparta. For this purpose the carnation by-products obtained from a special firm were evaluated as fresh and silage with no additive compound. Dry matter, crude protein, acid detergent fiber and neutral detergent fiber contents of both fresh and silage carnation by-products were determined. Fleig score, pH and physical quality of silages were also determined. According to the results fresh and silage carnation have 22.64 and 19.76% dry matter, 15.50 and 12.19% crude protein, 42.08 and 39.73% neutral detergent fiber and 29.48 and 28.3% acid detergent fiber contents respectively. Silages fleig scores were 69.59, pH values were 4.37 and physical quality was very good in the study. According to the results carnation by-products both fresh and silages have a good nutritive value for animals and can be used as an alternative roughage source. However, since it is very common practice using pesticides in carnation farming. Using this by-product as animal feed should be taken into account for both animal and human health.

Key words: carnation, by-product, crude protein, neutral detergent fiber, silage.

INTRODUCTION

Turkey's roughage production is provided approximately half of the total roughage requirement (Yolcu 2008). The reason for not meeting roughage requirement of ruminants is that, in Turkey ratio of cultivated forage crops in total cultivated area is low (7.4 %) (Anonymous 2008). To eliminate these roughage deficits cereals, straws, horticultural and industrial residues and other alternative roughage sources are used in animal feeding as hay and silage. These wastes may not contain adequate nutritive value and can not be obtained every times but they are cheap and profitable both for industry or producer and farmers.

Roughage quality is an important issue to animal feeding due to the protein and carbohydrates contents. Some forage crops like legume contains much amount of protein and some contains carbohydrates like grass forage crops. For the profitable animal production both proteins and carbohydrates should have well balanced in food ration. Silage is a very important animal feed especially in dairy cattle feeding for economical, balanced and sufficient feeding (Avcıoğlu et al., 1998). Therefore, silage quality can have a major influence on milk production. Ecological conditions of Turkey are suitable for growing forage crops that are used to make silages. Recent statistics show that silage production in Turkey has rapidly increased. Although maize silage constitutes over 80 % of the silage production (Alçiçek and Karaayvaz, 2003), this amount is not enough to meet roughage requirement of ruminants. This is because agro-industrial wastes or by-products become important to decrease these requirements. For this purpose some researchers have investigated different wastes or by-products. Alimon et al. (1994) investigated sugar cane wastes, Nour et al. (1981) and Ashbell et al. (1995) studied on grape wastes, and vegetable processing wastes respectively. Ceron et al. (1996), were also concerned with flowers wastes (carnation) to use as an alternative roughage source.

Approximately 40 ha carnations are grown as ornamental plant in Isparta every year. After harvest, by-products are disposed to eliminate the next growing season's diseases. Approximately 2000 tons of carnation by-products are disposed each year. The destruction of by-products is both expensive and causes the lost organic material. The use of these organic materials in animal production as roughage source will be so profitable and a cycle in different production systems useful for environment. Therefore, this study was conducted to determine the utilization possibilities of carnation by-products as an alternative roughage source in Isparta.

MATERIALS AND METHODS

The research was performed at Isparta (37^o 45' N, 30^o 33' E, elevation 1035 m) located on the Mediterranean region of Turkey during 2007 growing season. Carnation (*Dianthus caryophyllus* L.) by-products were used in the study. Plant samples were obtained from a cut flowers firm (Bircan Tarım Ltd. Şti.) after harvest in September 2007, and were evaluated by both drying and ensiling fresh samples with no additive compound.

Fresh carnation by-products were obtained after cut flower harvest for the determination of silage and roughage quality. A sampling quadrat of 1 m x 1 m used to determine quality parametres. Samples were dried in an oven at 70 ^oC

Table 1. Chemical composition of fresh and silage carnation by-products.

Quality Parameters	Fresh	Silage				
Dry matter (%)	22.64	19.76				
Crude protein (%)	15.50	12.19				
NDF (%)	42.08	39.73				
ADF (%)	29.48	28.3				
pH	-	4.37				
Fleig score*	-	69.59				
Physical quality	-	Smell	Structure	Color	Score	Quality classification
		14	4	1	19	Very good

*81-100 scores; very good, 61-80 scores; good, 41-60 scores; satisfactory, 21-40 scores; middle, 0-20 scores; bad (Alçiçek et al., 1999).

till they reach to constant weight for dry matter content (Martin at al., 1990). Dried samples were ground and the amount of N was determined using Kjeldahl method (Kacar and İnal, 2008) with three replications. Crude protein content was calculated multiplying N amount of each samples by 6.25. Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) concentrations were determined according to standard laboratory procedures of forage quality analysis outlined by Ankom Technology (Anonymous 2010).

The samples were chopped at a length of 3-4 cm using a mechanical forage cutter (BLACK δ DECKER-GS1400 type). The chopped materials were then placed in a five-liter glass jars with no additive compound and prepared with three replications. The jars were opened after 90 days fermentation period (Siesfers and Bolsen, 1997). In order to determine the chemical composition of carnation silage, 3 samples were taken from each jar, mixed and pooled, and used for chemical analyses. The pH values of silages were measured by electronic pH meter and the physical characteristics of silages were evaluated by silage evaluation scale (DLG 1987). For determination of chemical composition of silage samples, the same procedure was used as described for fresh samples. Fleig points were calculated using the following formula. Physical characteristics of silages were evaluated by expert panelists.

Fleig point = 220 + (2 x % dry matter - 15) – 40 x pH (Denek et al., 2004).

RESULTS AND DISCUSSION

The chemical composition of fresh and ensiled carnation by-products has shown in Table 1. Dry matter content of carnation by-products determined in fresh and silage as 22.64% 19.76% respectively. Crude protein contents were founded as 15.50% in fresh and 12.19% in silage carnation by-products. NDF contents were 42.08% and 39.73% in fresh carnation and ADF contents were 29.48% and 28.3% in silage carnation respectively. The pH value was 4.37 and Fleig score was founded as 69.59 in silages and physical quality of silages was very good.

Many researches reported that forage crops both alone and grass-legume mixtures have variable dry matter contents. Çakmakçı et al. (2005) have reported that dry matter content of vetch alone (*Vicia sativa* L.) was 22.67 %, grass alone (*Lolium perenne* L.) 26.92 % and grass-legume mixture was 26.39 %. Geren et al. (2003) have also reported that dry matter content of grass-legume mixtures were changed from 13.42 to16.14 % in their study. In this study dry matter content of fresh carnation was found as 22.64% and is good enough for a roughage source. Ensiling reduced dry matter content from 22.64 to 19.76 %. Dry matter content is an important factor for silage quality. Because increasing dry matter content bring about high soluble carbohydrates so silage fermentation period, pH and many quality factors is associated with silage dry matter content.

Crude protein content is an important factor for determining feeding value of roughages. Fresh and silage carnation have satisfactory crude protein level in fresh and silage15.50% and 12.19% respectively despite of being by-product. Crude protein content was decreased with ensiling as in dry matter content. Crude protein content is high in legume forage crops and relatively low in grass forage crops. Türk et al. (2007) have reported that crude protein (CP) content of narbon vetch hay varied from 13.68 and 16.04%, Albayrak et al. (2009) reported that woolypod vetch CP content is varied between 12.88 and 16.21% as a legume forage crops. Kara et al. (2009) determined CP contents of triticale cultivars silages varying between 7.1 and 8.3%. These results showed that carnation by-products both fresh and silages contains adequate CP levels as in legume forage crops.

The cellular content of forage crops is almost totally digestible, but there is great variation in cell wall digestibility (Van Soest 1967). The digestibility of forage plants depends, therefore, mainly on the cellular content and the digestibility of the cell wall. It is well known that the main components in the cell wall are cellulose, hemicellulose and lignin. Cellulose in young grasses is almost completely digested by ruminants, but lignification decreases digestibility with increasing maturation. Hemicellulose is composed of a mixture of different carbohydrates which vary in digestibility, whereas lignin is resistant to rumen fermentation (Thorvaldsson 2006). Therefore, NDF and ADF contents are the indicator of roughage digestibility. NDF contents of carnation by-products were 42.08% and 39.73% for fresh and silage respectively. Carnation's ADF contents were 29.48 and 28.3% for fresh and silage respectively in the study (Table 1). NDF and ADF contents are decreased with ensiling. In this way ensiling increased the digestibility of carnation by-products. Türk et al. (2009) have reported that NDF and ADF contents of hairy vetch hay varied 23.51-32.40% and 14.60-34.85% respectively same researchers also reported in another study (Türk et al., 2007) that ADF and NDF contents of narbon vetch hay changed from 29.18% to

35.35% and 23.98 to 27.60% respectively. Albayrak et al. (2009) determined NDF and ADF content as 26.25-32.8% and 21.27-26.02% in woolypod vetch hay. Denek et al. (2004) have reported NDF and ADF contents 65.82% and 41.85% in corn silage and 66.45% and 49.02% in sorghum silage respectively. Fitzgerald and Murphy (1999) determined the NDF and ADF content 49.03% and 32.6% in perennial ryegrass silages respectively. These results showed that fresh carnation digestibility is lower than legumes hay but silage carnations were more digestible than corn, sorghum and grasses silages.

Fleig score is used as an indicator for silage quality by many researchers. Fleig scores and pH values of silages were determined as 69.59 and 4.37 respectively in the study (Table 1). The results show that quality of carnation silages is good according to the scales determined by Alçiçek et al. (1999). Denek et al. (2004) determined the fleig score and pH value 86.00 and 4.07 in corn silage and 86.72 and 4.10 in sorghum silage and 67.56 and 4.27 in sunflower silage respectively. Kara et al. (2009) determined the fleig score and pH value in triticale cultivars silages 120.8 and 4.2 respectively. Alçiçek et al. (1999) have also reported corn silages fleig scores varied from 44.00 to 100.00 and pH values varied from 3.90 to 5.20 in their study. According to these researchers studies carnation silage pH values is adequate for palatable silage but fleig score is generally low. This is because the low dry matter content and comparatively high CP contents. Because high CP content has a buffer impact so proteins neutralize the acids and prevent the pH fallings (Açıkgöz 2001). For this reason, fleig score of carnation silages is lower than other conventional silages like corn and sorghum. Carnation silages were evaluated physical quality with regard to smell, color and structure for the physical quality. The evaluation results showed that silages were 'very good' according to quality classification (Alçiçek et al., 1999).

It can be concluded that carnation is an important ornamental plant in Isparta. A by-product is obtained from this crop consisting mostly in leaves and stems that has a good nutritive value for animals. Therefore, carnation by-products both fresh and silages can be used as an alternative roughage source. However it is very common practice using pesticide in carnation farming all growing periods. For this reason using this by-product as animal feed should be taken into account for both animal and human health.

LITERATURE CITED

Albayrak, S., M. Türk, O. Yüksel, 2009. Effects of phosphorus fertilization and harvesting stages on forage yield and quality of woolypod vetch. Türkish J. Of Field Crops, 14:30-40.

Açıkgöz E. 2001. Yem Bitkisi. *Uludağ Üniversitesi Güçlendirme Vakfı. Yayın no*: 182. VIPAŞ AŞ. Yayın no: 58, 584, s.

Alçiçek, A., F. Tarhan, K. Özkan, F. Adışen, 1999. İzmir ili civarında bazı süt sığırcılığı işletmelerinde yapılan silo yemlerinin besin madde içeriği ve silaj kalitelerinin saptanması üzerine bir araştırma. Hayvansal Üretim Dergisi, 39-40: 54-63.

Alçiçek, A., K. Karaavaz, 2003. Used of Maize Silage in Cattle Feed. Animalia, 203:68-76. www.zooteknidernegi.org/dergi/makale/2005_46_2_06-13.pdf

Alimon., A.R., S.Y. Lim, I. Dahlan, I. Halin, A. Djajanegara, and A. Sukmwati, 1994. Effect of urea treatment on intake and digestibility of sugarcane waste by goats. Proceedings of the 7th AAAP Animal Science Congress, Bali, Indonesia, 2, 109-110.

Anonymous, 2008. TUIK, Bitkisel Üretim İstatistikleri, www.tuik.gov.tr

Anonymous, 2010. Ankom, Technology, http://www.ankom.com/09_procedures/procedures.shtml

Ashbell. G.,. Z.G. Weinberg, and Y. Hen, 1995. Studies of quality parameters of variety ensiled broiler litter. Animal Feed Science and Technology 52, 271-278.

Avcioglu, R., H. Soya, H. Geren, A.C. Cevheri, 1998. Situation, problems and solution suggestions in Aegean region. Aegean Region 1th Agriculture Congress, September 7-11, 1998, Ege University Press, 2:235-242. ISBN:975-8254-04-9.

Ceron, J.J., F. Hernandez, J. Madrid, and C. Gutierrez, 1996. Chemical composition and nutritive value of fresh and ensiled carnation (Dianthus caryophyllus) by-product. Small Ruminant Research 20**,** 109-112.

Çakmakçı, S., B. Aydınoğlu, M. Arslan, M. Bilgen, 2005. Farklı ekim yöntemlerinin fiğ (*Vicia sativa* L.)+ingiliz çimi (*Lolium perenne* L.) karışımlarının ot verimine etkisi. Akdeniz Üniversitesi, Ziraat Fakültesi Dergisi, 18(1), 107-112.

Denek, N., A. Can, Ş. Tüfenk, 2004. Mısır, Sorgum ve Ayçiçeği Hasıllarına Değişik Katkı Maddeleri Katılmasının Silaj Kalitesi ve İn Vitro Kurumadde Sindirimine Etkisi. J.Agric Fac. HR. U. 2004, 8 (2): 1-10.

DLG, 1987. Bewertung von Grünfutter, Silage Und Heu. DLG-Merkblatt, pp:224.

Fitzgerald, J.J., J.J. Murphy, 1999. A comparision of low starch maize silage and grass and effect of concentrate supplementation of the forages or inclusion of maize grain with the maize silage on milk production by dairy cows. Livestock Production Science 57:95-111.

Geren, H., H. Soya, R. Avcıoğlu, 2003. Yıllık italyan çimi ve tüylü fiğ karışımlarında farklı hasat zamanlarının bazı kalite özelliklerine etkisi üzerinde araştırmalar. Ege Üniversitesi, Ziraat Fakültesi Dergisi, 40(2): 17-24, ISSN 1018-8851.

Kacar, B., A. İnal, 2008. Bitki Analizleri. Nobel Yayınları, No: 1241, Ankara, 892 p.

Kara, B., V. Ayhan, Z. Akman, E. Adıyaman, 2009. Determination of Silage Quality, Herbage and Hay Yield of Different Triticale Cultivars. AJAVA, 4(3):167-171.

Martin, R.C., H.D. Voldeng, and D.L. Smith, 1990. Intercropping soybean for silage in a cool temperate region: Yield, protein and economic effects. Field Crops research, 23:295-310.

Nour, A.A., A.M. Nour, K.A. El-Shazely, M. Abaza, B.E. Borhami, and M.A. Naga, 1981. Evaluation of some agro-industrial by-products for sheep and lactating cows. *Alexandria Journal of Agricultural Research* 29, 1125-1142.

Siesfers, M.K., K.K. Bolsen, 1997. Agronomic and silage quality traits of forage sorghum cultivars in 1995. Türkiye 1. Silaj Kongresi, 16-19 Eylül, Bursa.

Thorvaldsson, G., 2006. Digestibility of timothy. Timothy productivity and forage quality - possibilities and limitations -NJF Seminar 384, Agricultural University of Iceland, 10 – 12 August 2006 Akureyri, Iceland, p.85-88.

Türk, M., S. Albayrak, O. Yüksel, 2007. Effects of phosphorus fertilisation and harvesting stages on forage yield and quality of narbon vetch. New Zealand Journal of Agricultural Research, vol. 50: 457-462.

Türk, M., S. Albayrak, O. Yüksel, 2009. Effects os fertilisation and harvesting stages on forage yields and qualityof hairy vetch (*Vicia villosa* Roth.). New Zealand Journal of Agricultural Research, vol, 52: 269-275, 0028-8233/09/5203-0269, The Royal Society of New Zealand.

Van Soest, P.J., 1967. Development of a comprehensive system of feed analyses and its application to forages. J. Anim. Sci. 26, 119-128.

Yolcu, H., 2008. Kaba yem olarak kullanılan arpa ve buğday çeşitlerinde ahır gübresi uygulamalarının morfolojik, verim ve kalite özeliliklerine etkisi. OMU, Ziraat Fak. Der., 23(3): 137-144.