Anatolian Water Buffalo's Role in The Organic Animal Production in The Republic of Turkey

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***Abstract*—** Organic animal production is a form of production which provides humans with healthy and reliable products, is environmentally friendly and increases animal welfare. Nowadays, consumers' increasing income and education levels have increased the demand for organic products. For this reason, animal holdings are turning towards producing animals which can be an alternative in organic livestock production. In recent years, the use of non-transgenic, disease-resistant animals, which are likely to produce healtful products, has risen to prominence. In fact, a lot of harmful changes which may occur in the milk (bacteria and somatic cell counts) can also naturally be prevented in the milk of the Anatolian water buffaloes (AWB) thanks to their feeding based on meadow, their diets' including non-synthetic feed additives, their being resistant to diseases and their milks's including an excess of lactoferrin and their having narrow breast channels. Since the buffalo's meat is rich in protein and poor in fat, its products are becoming more important. In this review, some information was given about the role and importance of AWB in organic livestock breeding.

***Keywords*---** Organic animals, Anatolian water buffaloes

I. Introduction

Organic (ecological, biological) animal production is a form of production in which not only ecological balance, animal welfare and amount of products but also health criteria in product quality are taken into account [1]. Organic livestock farming has been growing and becoming widespread mainly in the continents of Europe, Australia and America. In recent years, there has been an important increase in the numbers of organic beef cattle, broilers and breeding sheep in the EU countries, in those of dairy cattle and laying hens in the United States and in those of organic dairy cattle, organic goat and organic laying hens in Turkey [2]. The basic principles in organic livestock enterprises are producing organic products having market values in sufficient quantities, preserving pasture and soil structures for a long time, achieving the clean and efficient use of water resources, minimizing waste and pollution occurring during production, protecting genetic diversity, providing safe products to consumers by keeping products free from microorganisms threatening human health [3]-[4]. Turkey has an important potential for organic farming thanks to its general location, geographical conditions, unpolluted structure, having a range of plants and animal products and domestic animals having adapted very well to regional conditions [5]. One of these animals is the Anatolian water buffalo (AWB). Buffaloes in our country have their origins in the Mediterranean buffalo, one of the subspecies of river buffaloes, and are defined as Anatolian buffaloes (*Bubalus bubalis*). It is a domestic race registered by the race registration committee with the communiqué dated 12.12.2004 and numbered 25668 of the Official Gazette 2004/39 [6]. The AWB showing a distribution to all parts of Turkey mainly the Black Sea region and the north of the Central Anatolia has a live weight ranging between 400-450 kg in adult females and 450-500 kg in adult males. It has a height of 129 to 136 cm in the shoulder region (cidago height). The AWB has a rough, angular and muscular body, a low rump and thick and strong joints. The hair colour is black and dark grey in adult buffaloes. Some individuals may have whiteness at their heads, feet and tails (Picture 1). The lactation period ranges between 200-250 days and the total milk yield in the lactation period ranges between 800-1000 kg. The fat ratio in the milk varies between 6-8% [7]. During the Ottoman Empire period, Turks passing to the Balkans took their buffaloes with them. The Turkish buffalo spread to a wide area in the Balkan countries with wet and fertile lands (Mecadonia, Western Thrace and Bulgaria). When Table 1 is examined, it is seen that while the number of buffaloes in our country was 1031 (1000 heads) in 1980s, it has decreased rapidly for such reasons as drying up wetlands, opening pasturelands to public housing, migrating from rural to urban areas and preferring high yielding dairy cows. As a matter of fact, it was determined in our country that the total number of buffaloes was 135.984, the number of milked buffaloes was 54.795 and the total volume of buffalo milk was 54.803 tons in 2015 [8].

TABLE I : THE NUMBER OF BUFFALOES ACCORDING TO YEARS İN TURKEY (1000 HEADS)

	1980	1990	2000	2010	2015	2016
The numbers of buffalo	1.031	371	146	85	135	133.7
% Changing rate		-64	-85	-91	-86	-87

On the other hand, when we look in the general of the world, it is observed that the number of buffaloes has increased in such countries as India, China, Pakistan and Italy [9]. The water buffalo is the second-most important species after dairy cows in the world in terms of milk production [10]. There are differences in milk yields of buffaloes around the world. In fact, the total milk yields in Italian boffaloes are much higer than those in Turkish, Rumanian and Irish ones because Italy has increased the milk yield ability of buffaloes by improving

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the record keeping, breeding buffalo selection, sheltering and feeding conditions.

TABLE II. THE NUMBER OF BUFFALOES ACCORDING TO YEARS IN WORLD (HEAD)

Countries	1980	1990	2000	2010	2016
Indian	66070000	80570000	93831000	107375000	112328821
Chine	18439752	21421975	22595017	23602424	23800633
Pakistan	11547000	17373008	22669000	29413000	36600000
Malesia	285339	205163	142042	129878	118608
Philippine	2870270	2764950	3024403	3270400	2864039
Thai	5650794	5094270	1711573	1622646	886796
Persian	240000	440000	490600	195000	95050
İtaly	88900	112400	182000	365086	385121

Fig. 1: Anatolian Water Buffalo (*Bupalus bupalis*)

It was reported that while the milk yields of Turkish, Rumanian and Irish buffaloes were 1247, 1200 and 1600 kg respectively during the lactation periods of 220-240 days [11], those of the Italian buffaloes may increase to 2220 kg with 8.4% fat and 4.6% protein [12]. However, the low milk yields of the AWBs should not mean that their performances are inadequate. Low milk yields can be increased by selecting quality feeds, feding them adequately and regularly and following their lactation periods [13]. In this review, some information was given about the role and importance of AWB in organic livestock breeding.

II. MATERIAL AND METHOD

A total of 56 resources have been used for this review. The review was divided into three sections, namely the AWB products, organic animal husbandry rules and natural additive use in buffalo rations and the reviewed resources were referred to clarify the subject. In the conclusion and suggestions section, information was given about how AWBs struggle to survive in our country, what problems they face and how to overcome these problems.

1. Buffalo products

There is a wide range of AWB products. For example, Turkish bow, ney bowel, comb and hafta are made from its horn; yoghurt, cream and mozarella cheese are made from its milk and sausages are made from its meat. Although the milk and meat yields of buffaloes are lower than those of cattle, they provide some advantages such as feeding on poor quality roughage and then converting them into yields, producing at a low cost and selling products at a higher price [14]. Buffalo raisers use the buffalo milk firstly to meet their own needs and then give the rest to the dairy union to which they belong and they are used by the small-scale food producers to produce yoghurt and cream [13]. The buffalo milk's containing a higher amount of dry matter and fat compared to those of farm animals is considered to be a superior and distinctive feature of this milk [15]. Although the fat ratio of the buffalo milk is twice as high as the cow's milk, the cholesterol value of this milk is lower than the cow's milk. In fact, the higher the dry matter and fat content of the milk, the higher the efficiency in the yield of products such as butter and milk powder [16] (Table 3).

TABLE III: MEAN COMPOSITION OF MILK İN FARM ANIMALS (%)

Farm animals	Dry matter	Milk fat	Milk protein	Lactose	Milk ash
Dairy	12.6	3.7	3.4	4.7	0.7
Buffalo	17.2	7.4	3.5	5.4	0.8
Sheep	19.3	7.4	5.5	4.8	1
Goat	13.2	4.5	3.2	4.1	0.8
Mare	11.2	1.9	2.5	6.2	0.5

Because buffaloes transform all of the carotene into vitamin A, their milk is whiter than those of the others [17]. For this reason, the buffalo milk is superior to the cow, sheep and goat milks in terms of vitamin A and other oil soluble vitamins. The buffalo milk's containing high amounts of various bioprotective agents (immunoglobulins, lactoferrin, lysozyme, lactoperoxidase) makes this milk superior to the cow milk in special diets and preparing healthy foods [16]. Similarly, it was found in a study made on buffalo and cattle that while the number of bacteria in the cattle milk (1cc) was 2830, it was 576 in the buffalo milk. The reason why the

number of bacteria is so low in buffalo milk is lactoferrin, an antibacterial glycoprotein [18]. When we look at the other buffalo products, we see that the demand for buffalo cheese has been on the increase in many countries because of its being an organic product [19]. The increase observed both in the buffalo products market and the number of buffaloes asing in the same countries is linked to increasing consumer demand. In Italy, in particular, the price of buffalo milk is much higher (€1.20/kg) than that of bovine milk (€0.30). Moreover, mozzarella cheese consumption is increasing both in Italy and in the world: 14 percent of the Italian production is exported to Germany, France, UK, Switzerland, USA and Japan. Buffalo Mozzarella is different from other types of Mozzarella because of its typical texture and juicy consistency, and also its special taste [20] (Table 4).

TABLE IV: PRODUCTS DERIVED FROM BUFFALO MILK IN THE WORLD (TONE) [9]

Products	Egypt	Indian	Italy	Turkey	Chine
Butter	88400	797000	-	1644	9300
Cheese	254000	-	15727	-	12400

Almost all buffalo milk is assigned to cheese making, mainly to mozzarella cheese, therefore it is important to produce milk which will in turn yield a good quality cheese in high quantities. A characteristic of buffalo milk is the very high fat content and the fat to protein ratio is about 2: 1. Another characteristic is the high casein to protein ratio (81-84 percent) [21]-[22] compared to the bovine milk (78 percent). Moreover, the high calcium content of casein micelles results in a faster rennet coagulation, increased curd tension and a faster syneresis [23] and its rennet ability is considered to be very good. Mozzarella from buffalo milk is richer in fat and presents sensorial characteristics which are very different from the more common bovine Mozzarella [23]. The present paper analyses the main factors influencing buffalo milk quality [24].

Buffalo meat contains 40% less cholesterol, 11% more protein and 10% more minerals than bovine meat. Due to this feature, the demand has been on the increase for the buffalo meat in recent years in the USA and Japan [18] (Table 5). The production of buffalo meat has high growth possibilities and poses a minimal level of risk from pesticides and veterinary drugs when compared to bovine meat production in developed countries. Buffalo meat is produced primarily in Asia. The contribution of buffalo meat to world total meat production is only 1.3 percent. India produces 1.43 million tons of buffalo meat annually, which accounts for 36 percent of total meat production contributing significantly to human nutrition [26].

TABLE V. COMPONENTS OF BUFFALO AND BOVINE MEAT (100 GR) [25]

Components	Buffalo	Beef
Calories (Kcall)	131.0	289.0
Protein (gr)	26.8	24.0
Fat (gr)	1.8	21.0
Cholesterol (gr)	61.0	90.0
Minerasl (mg)	641.821	584.0
Vitamins (mg)	21.0	18.5

The quality and amount of buffalo meat depend on many factors, the most important of which are the water buffalo type and breed, age, feeding intensity, management system and environmental conditions. Generally, cattle are superior to buffaloes in their growth rate and also there are differences between the two water buffalo subspecies: River and Swamp. The buffalo performances for meat production, that is, growth, feed efficiency, conversion ratio, dressing percentage, carcass evaluation and composition and meat quality cuts, are very important in economic terms. However, in order to expand the buffalo meat market, the primary attention is paid to the meat quality, which means attaching importance to its chemical, physical, organoleptical and hygienic characteristics and also a good presentation to the consumer. The water buffalo meat, according to judges' visual inspections, was lighter than the bovine meat, which was confirmed with colorimeter. The meat becomes darker with the increasing age of the animal [24].

In the construction of the Turkish Bows, the horns obtained from buffalo oxen were used. The animal, whose horn will be taken, should be old enough to provide horn pieces in sufficient lengths [27]. Considering the information given above, it can be stated that buffalo products are not utilized enough.

2. Rules of organic livestock

In organic animal production enterprises, species and breeds which are resistant to environmental and climatic conditions and diseases should be selected [28]. Buffaloes are resistant to sudden feed changes and can feed on low-quality forages. They are also resistant to diseases caused by blood parasites in their feet and mouth, namely BSE, IBR-IPV [29]. Therefore, because the Anatolian water buffalo does not need a special care, they are sought for organic livestock.

Natural insemination is essential in organic animal breeding. Embryo transfer is not allowed. Artificial insemination can be done with semen stored and obtained from breeding animals through natural methods [28]. Similarly, in organic livestock applications, too, natural mating is applied to buffaloes [30].
It is called the process of transition from the beginning of organic animal production to the acceptance of the product as organic [28] . The transition period for organic beef production (at least ¾ of the life time in any case) is 12 months and, for organic milk production, it is 6 months [28].

It should be fed with milk or milk substitute for at least 3 months to strengthen the immune systems of newborn calves in organic cattle feding [28]. Shortening breastfeeding period in baby buffaloes increases the mortality rate. Therefore, breeders suckle their calves with natural milk for 3 months [30]. Moreover, adaptation food for calves should be added to quality organic roughage and concentrated feeds and put in front of them starting from the 2nd week [31].

According to the regulations of organic agriculture in Turkey, there should be 60% of forage and 40% concentrated dry matter feeds in rations in organic meat and dairy cattle business [28]. If the farmer fails to meet the feedstuffs from the organic production, the maximum 25% of dry matter in the ration can be met from conventional feeds. Organic cattle fattening is a fattening system based on forage feeding with small amounts of concentrated feed. The low rate of live weight gain in organic cattle feed is due to the low concentrate

feed ratio and the lack of synthetic feed additives. Moreover, in the conventional system, where intensive fattening is applied, since the animals move less, they use their energy for development, whereas in the organic system, animals in the pasture use their energy for grazing [32]. Nutrient deficiencies and associated health problems are less likely to occur in organic beef cattle because animal growth rates are lower than in conventional cattle [33]. In many studies, metabolic diseases were reduced in organic livestock compared to conventional animal husbandry [34]-[35]-[36]. The decrease in metabolic diseases is based on the decrease in the yield of livestock in organic livestock [37]-[20].

Lands and pastures prepared for organic animal production are transferred to the two-year transition period. Pastures or open spaces should be accessible for animals in businesses aiming to make organic livestock. Pastures should not contain pesticide residues [28].

Buffaloes have fewer sweat glands compared to ruminant animals and, because of their thick skin, they need to go out to ponds to balance their body heat. In fact, since a typical Turkish house in Anatolia has a courtyard, it allows buffaloes to freely go out. Buffalo breeders in Turkey usually graze their animals in the pasture. However, plants in the pasture are inadequate to meet the basic needs of animals [38]-[30].

Shelters to be used for organic animal breeding should provide animals with sufficient fresh air and daylight. Besides an internal space to give animals enough freedom of movement, there should also be extra open space to meet their outdoor navigation needs. In cattle enterprises producing organic milk, a shelter space of 6 m^2 should be allocated for each animal and also a shelter space of at least 4. 5 m^2 should be provided outside the shelter [28]. Buffalo shelters are generally dark and stuffy. They lack an interior area which will give animals enough freedom of movement. The feed consumption of buffaloes kept in this kind of environment deteriorates and their performances are affected negatively. Buffalo breeders are observed to have a tendency to tether their buffaloes and their calves together [30]. Particularly, the continuous tethering of baby buffaloes during their development period affects the development of their muscles and bones negatively.

Organic animal husbandry is an environment friendly form of production [28]. Buffaloes make space available for farmers by making room in reeds and swamp areas. They establish a strong bond with family members. On hot summer days, buffaloes wash themselves in lakes and rivers and allow birds to eat up external parasites accumulating on their bodies[30].

*The main purpose of the use of fat in dairy cattle is to increase the level of energy in their diet and milk yields. Fractional oils obtained from Palm oil have been used in conventional livestock for many years because of their positive effects on temperature stress, dry matter consumption, milk yield and composition [39]. In organic livestock, the use of vegetable and animal fat is not allowed [28]. When vegetable oil is obtained, solvents are used. Organic animal production is a form of environment friendly production. In order to continue to meet the needs of industrial companies producing palm oil, habitats of wild animals living should not be put in danger by clearing rain forests in such countries as Indonesia and Borneo.

Organic production focuses on quality and health rather than quantity [28]. On the other hand, a considerable development can be achieved in milk yields through adequate and regular feeding, lactation period monitoring and quality feed selection in the rations of buffaloes [13].

In fact, when the Anatolian water buffalo is taken in hand from the point of organic animal husbandry, it is seen that it laready has the required characteristics. If their living conditions are arranged according to the organic farming regulations (shelter, soil, water, air, feeds and feeding conditions), both breeders are supported economically and our buffalo races are protected.

3. Use of Natural additives in Anatolian Water Buffalo

In organic livestock, hormones, antibiotics and the like substances can not be used to speed up the growth rate and maximize the feed utilization. Genetically modified (GMO) feeds, chemically treated feeds or synthetic additives can not be used [28]. Studies have been carried out to improve natural consumption and rumen conditions as well as natural additives in rations of Anatolian water buffaloes. As examples of these additives can be given probiotic, prebiotic and aromatic plants. Probiotics are live microbial feed additives which participate in the rations of animals and affects health positively by regulating the development of beneficial bacteria in the stomach-intestine [40]. Yeast cultures create suitable conditions for cellulolytic degradability and lactate usage by stimulating the development and the activity of ruminal bacteria [41]. [42] suggests that yeasts reduce oxygen in the rumen. Yeast cells in the rumen use available oxygen on the surface of freshly ingested feed to maintain metabolic activity. In addition, *Saccharomyces cerevisiae* competes with other starch-utilizing bacteria for the fermentation of starch [43], which leads to the prevention of lactate accumulation in the rumen. [44] also reported that S. cerevisiae provides growth factors such as organic acids or vitamins. The use of yeast fermentation products in ruminants has been a common practice for at least 20 years. As a matter of fact, [45] found in a study carried out in Karaoglan village that 30 g yeast (*Saccharomyces cerevisiae*) added to AWB rations increased milk yield ($P < 0.01$; 0.91 milk liters / day).

As it is known, the milk yield of an animal after giving birth reaches its peak level in 8-10 weeks. On the contrary, the ability to consume food can not rise rapidly to meet the increase in milk yield [46]. The energy imbalance seen in this period is called as negative energy balance [47]. During this period, animals try to compensate their energy insufficiency by breaking up fat tissues in their bodies. The risk of metabolic disease increases significantly when fat breakdown exceeds physiological limits [48]. In this period, however, the use of aromatic plants in livestock increases feed consumption, thereby reducing the energy imbalance. Herbs containing saponin have a positive effect on their appetite levels by affecting their hypothalami [49]. The seeds of fenugreek contain alkaloids, flavonoids, saponins, amino acids, tannins and certain steroidal glycosides as well as proteins [50].

Saponins naturally occur on the surface of active glycosides. Chemically, saponins are high-molecular-weight glycosides in which sugars (glycone) (1–8 residues) are linked to a triterpene or steroidal aglycone moiety [51]. [52] reported that some saponins (such as Gypsophylla) enhance the permeability of the intestinal mucosa. [53] observed that the galactagoue herbs increased in milk production by stimulating the endogenous hormonal secretion in mammals. Similarly, [54] reported that cumin has galactapoiesis properties, which are mediated by stimulating endogenous hormonal secretion. In a related study, it was determined that the fenugreek at a level of 5% had a significant effect on dry matter consumption (0.83 kg / day) and milk yield (0.67 kg / day) in buffalo rations [55]. In another study, it was determined that adding an amount of cumin of 3% to buffalo rations increased milk yield in AWBs and no negative effects were observed on milk composition [57].

4. Conclusions and Recommendations

Anatolian buffalo has a great potential for organic livestock because it is resistant to diseases, feeds on pasture, does not need any synthetic additive ingredients in its diet and its products are sought and beneficial for human health. On the other hand, the abovementioned adverse effects pose a serious risk to this potential if farmers' technological and economic substructures fall behind, wetlands are dried up, pesticide residues exist in their feeding areas and genetically modified feeds are used.

Buffalo raisers should be able to compete against cow milk producers. That is why, the limits of the buffalo union should be expanded. For example, it should create a dynamic cooperative model including the marketing of organic animal products through e-commerce. Buffalo products have remained limited to the production of milk, yoghurt and cream and the advancing technology has not been followed. The product range of organic buffalo milk processed and transformed to taste such as gummy puddings, tarhana, ice cream and cheese, should be expanded as much as possible. The Ministry of Agriculture can also make production attractive by increasing the contribution to businesses producing organic buffalo products.

The horn of Anatolian buffalo is suitable for the production of the Turkish bow and haft. In recent years, there is an increasing interest in bows in our country. In this respect, workshops can be established in provinces, districts and vocational colleges in the context of crafting. The survival of the Anatolian Buffalo depends on the government's decisions, the projects put into practice by the Ministry of Agriculture and self-sacrificing work of buffalo units.

REFERENCES

[1] Y. Sayan, and M. Polat, ''Ekolojik Tarımda Hayvancılık''. Türkiye 2. *Ek. Tar. Semp.*14-16 Antalya. 2001, pp 95-104.

[2] M. Polat, and Y. Sayan, ''Dünya'da ve Türkiye'de Ekolojik/Org., Hay.,'' Ek.-Org. Tar. Hay. 2013, pp 29-60. Dora Bursa

[3] A. Sundrum, ''Organic Livestock Farming. A critical review''. Livestock Production Sci., 67(3):207-215. 2001.

[4] W. J. Nauta, A.F. Groen, R.F. Veerkamp, D. Roep, and T. Baars, ''Animal breeding in organic dairy farming: an inventory of farmers'views and difficulties to overcome''.NJAS-Wageningen *J. Life Sciences*, 53(1):19-34. 2005.

[5] B. Bayram, H. Yolcu ve Aksakal, ''Türkiye'de organik tarım ve sorunları''. *Ata. Üniv., Zir. Fak., Derg*., 38(2): 203-206. 2007.

[6] Anonymous, http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=9.5.6109&MevzuatIliski=0&sourceXmlSearch. 2016.

[7] S. Atasever, and H. Erdem, ''Manda Yetiştiriciliği ve Türkiye'deki Geleceği''. O.M.Ü. Zir. Fak. Derg., 23(1):59-64. 2008.

[8] TUIK. Turkish Statistical Institute. ''The Summary of Agricultural Statistics'', available at: 298. http://www.turkstat.gov.tr (retrieved: August 2015).

[9] FAO, ''The food and Agriculture organization of the united nations'' http://www.fao.org/faostat/en/#data/QA, 2018.

[10] A. Coroian, S. Erler, CT. Matea, V. Miresan, C. Raducu, C. Bele, and CO. Coroian, ''Seasonal changes of buffalo colostrum: physicochemical parameters, fatty acids and cholesterol variation''. *Chemistry Central Journal* 7, 2–9. 2013.

[11] A. Borghese, and M. Mazzi, Chapter I, ''Buffalo Population and Strategies in the World, Buffalo Production and Research'', Fao Regional Office For Europe, 2005, pp. 17.

[12] A. Borghese, ''Buffalo livestock and products in Europe''. *Buffalo Bulletin* 32, 50–74. 2013.

[13] Degirmencioglu, T., Unal, H., Kuraloglu. H. ''Comparison of extensive or semi-intensive feeding for Anatolian water buffalo,'' *Emirat. J. Food Agric*., 27, 712-715. 2015.

[14] M. Kucuk kebabcı, and S. Aslan, ''Evcil dişi mandalarda üreme özellik''. *Lala.,Hayv Araşt Enst Derg*, 42 (2): 55-63. 2002.

[15] M. İ. Soysal, ''Manda ve Ürünleri Üretimi''. Tekirdağ Üniv.,Zir. Fak., Zootekni Bölümü, Ders Notları. 2006.

[16] Gursoy, A.''Süt ve biyokimyası ders not.''http://cv.ankara.edu.tr/duzenleme/kisisel/dosyalar/06012015013030. 2018.

[17] S. Fevzi, ''Ruminantların beslenmesi'', E.U.Z. F Zootekni Bölümü, Ders notları No: 524; 2001, 225s.

[18] Anonymous, http://www.organicgroup.eu/?dizayn=detay&id=285 (Erişim tarihi: 15.01.2018). 2018.

[19] M. Q. Bilal, M. Suleman, and A. Raziq, ''Buffalo: Black Gold of Pakistan''. *Livestock Res*. 18(9):128. 2006.

[20] E. Boehncke, ''Preventive strategies as a health resource for organic farming, In: Proc. Of the 3 rd ENOF workshop on resource use in organic farming, Ancona, Italy, 5-6 June 1997, pp. 25-35.

[21] C. Tripaldi, G. Catillo, F. Martillotti, and M. Angelucci, ''Influence of some characteristics of diet on the milk quality of water buffalo''. *Buffalo J*., 1: 1-13. 1997.

[22] C. Tripaldi, S. Terramoccia, S. Bartocci, M. Angelucci, and V. Danese, ''Effect of the somatic cell count on yield, composition and coagulating properties of Mediterranean buffalo milk''. *Asian-Aust. J. Animal Sci*., 16: 738-742. 2003.

[23] F. Addeo, L. Chianese, and P. Masi, ''The influence of processing conditions on the quality of water buffalo mozzarella cheese. Prospects of buffalo production in the Mediterranean and the Middle East'', *EAAP Public.*,62: 214-222. 1993.

[24] Anonymous, ''Buffalo production and research'', *food and agrıc.org.,unıted natıons* Rome, 2005. 311 s.

[25] Rocha Loures, R. ''Buffalo production systems in the Americas''. *Proc. of the Sixth World Buffalo Congress*, Maracaibo, Venezuela, May 20-23, 2001. vol. I: 74-86.

[26] T.R.K. Murthy, and I. Prince Devadason, ''Buffalo meat and meat products - An overview''. *Proc. of Fourth Asian Buffalo Congress*, New Delhi, India Feb 25 - 28: 194-199. 2003.

[27] Ü. Yucel ''Türk Okçuluğu'', 446s. 1999

[28] Anonim,''Organik Tarımın Esasları ve Uygulamasına İlişkin Yönetmelik'' http://www.resmigazete.basbakanlik.gov.tr/eskiler/2010/08/20100818.htm. 2010.

[29] Anonymous, ''T.C. Tarım ve köy işleri bakanlığı tarımsal araştırma genel müdürlüğü,'' Türkiye evcil hayvan genetik kaynakları tanıtım kataloğu, 22s. http://www.tarim.gov.tr/TAGEM/Belgeler/yayin/Katalog%20Türkçe.pdf . 2009.

[30] T. Degirmencioglu, ''Possibilities of evaluation of Anatoİıan water buffaloes ın karaoglan vilage of Mustafakemalpasa district'', Bursa. *3 Rd III. International MustafaKemalPasa Symposium* 13-14 -15 May 2016. Bursa 49-60 s.

[31] N. Lampkin, ''Organic Farming, Farming Press Books'', 1990. 701 pp, Ipswich, U.K.

[32] J. Esterhuizen, I. Groenewald, P.E. Strydom, and A. Hugo, ''Acomparison between feedlot, inorganic pasture grazing and organic beef production systems. Animal performance, meat quality and financial implications''*S. Afr. J. Anim. Sci*.38(4):303-314. 2008.

[33] W. Zollitsch, T. Kristensen, C. Krutzinna, F. MacNaeidhe, and D. Younie, ''Feeding for Health and Welfare:the Challenge of formulating well-balanced rations in organic livestock production'', pp.329-349, In: Vaarst,M., Roderick,S.,Lund.W. and Lockeretz W. (eds.), Animal health and welfare in organic aguculture. *CABI Pub.,* UK. 2004.

[34] M. Ebbesvik, and A. K. Loes, ''Organic dairy production in Norway-feeding, health, fodder production nutrient balance and economy-results from the 30-farm Project'':1989-1992. In: Granstedt,A., and R. Koistinen (eds.), ''Converting to organic agriculture'', *scandinavian association of agricultural scientist rapport*, 1994. vol.93, pp.35-42.

[35] M. Vaarst, and C. Enevoldsen, ''Disease control and health in Danish organic dairy herds, In: Hiusman, E.A. (ed), Proc. 4 th Zodiac Symposium, Biological Basis of Sustainable Animal Production''. *EAAP, Publ*. 1994. No. 67, pp. 211-217.

[36] C. Krutzinna, E. Boehncke, and H. J. Hermann, ''Die Milch viehhaltung im Okologischen Landbau''. Ber. Ldw. 74, 461-480. 1996.

[37] M. Vaarst, C. Enevoldsen, and P. Jakobsen, ''Reports on diseases in 14 organic farms in Denmark''. *Acta Vet. Scand.* 89:143-145. 1993,

[38] S. Yılmaz, and O. Karaca, ''Afyonkarahisar yöresi manda yetiştiriciliği; küçükçobanlı köyü örneği'' *yük.lis.tezi*, 2013.144 s.

[39] T. Ayasan, and E. Karakozak ''Korunmuş yağların hayvan beslemede kullanımı'', *Ata. Üniv., Vet. Bil. Derg*. 681: 85-94.

[40] Fuller R., ''Probiotics in man and animals''. *J. Appl. Bacteriol*., 66: 365-378. 1989.

[41] L. K. Yoon, and M.D. Stern, ''Influence of direct-fed microbials on ruminal microbial fermentation and performance of ruminants: A review''. *Asian Australasian J.Animal Scie.*,8 (6), 533-555. 1995.

[42] Rose, A.H. '' Responses to the chemical environment. In: The Yeasts'' (Ed. A.H. Rose and J.S. Harrisson) Vol. 2, *Academic Press*, London, 1987, pp. 5-40.

[43] H.A. Lynch, and S.A. Martin, ''Effects of *Saccharomyces cerevisiae* culture and *Saccharomyces cerevisiae* live cells on in vitro mixed ruminal microorganism fermentation''. *J.Dairy Sci.,* 85 (10), 2603-2608. 2002.

[44] F. Chaucheyras, G. Fonty, G.J. Bertin, M. Salmon, and P. Gouet, ''Effects of a strain of *Saccharomyces cerevisiae* (Levucell SC), a microbial additive for ruminants, on lactate metabolism in vitro''. *J. Canadian Micro.,* 42 (9), 927-933. 1995.

[45] T. Değirmencioğlu, T. Ozcan, S. Ozbilgin, and S. Senturklu, ''Effects of yeast culture addition (*Saccharomyces cerevisiae*) to Anatolian water buffalo diets on milk composition and somatic cell count''. *Mljekarstvo*. 63: 42-48. 2013.

[46] A.W. Bell, ''Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation''. *J. Anim.Sci*., 73:2804-2819. 1995.

[47] M. Gorgulu, ''Büyük ve Küçükbaş Hayvan Besleme'', *Çukurova Üniv. Ziraat Fak., Ders Notu*, 282 s. 2009.

[48] W.F. Knaus, A. Steinwidder, and W. Zolltsc, ''Energy and Protein Balance in Organic Dairy Cow Nutrition-Model Calculations Based on EU Regulations In: Breeding and Feeding For Animal Helath and Welfare in Organic Livestock Systems'', Proceedings of the Fourth NAHWOA Workshop, 24-27 March, 2001. Wageningen, Holland.

[49] P. Petit, Y. Sauvaire, G. Ponsin, M. Manteghetti, A. Fave, and G. Ribes, ''Effects of a fenugreek seed extract on feeding behaviour in the rat: Metabolic endocrine correlates'', *Pharmacol. Biochem. Behav*., 45, 369–374. 1993.

[50] R. Yadav, R. Tiwari, P. Chowdhary, and C.K. Pradhan, ''A pharmacognostical monograph of trigonella foenum- graecum seeds'', *Int. J. Pharm. Pharm. Sci*., 3, 442–445. 2011.

[51] K. Hostettmann, and A. Marston, ''Saponins'', Cambridge: Cambridge University Press, 1995.

[52] I.T. Johnson, J.M. Gee, K. Price, C. Curl, and G.R. Fenwick, ''Influence of saponins on gut permeability and active nutrient transport in vitro'', *J. Nutri.,* 116, 2270–2277. 1986.

[53] S. Kumar, R.K. Mehla, and A.K Dang, ''Use of shatavari (*Asparagus racemosus*) as a galactopoietic and therapeutic herb – a review''. *Agric. Rev*. 29, 132–138. 2008.

[54] N. Bhatt, M. Singh, and A. Ali, ''Effect of feeding herbal preparations on milk yield and rumen parameters in lactating crossbred cows''. *Int. J. Agric. Biol*.11, 721–726. 2009.

[55] T. Değirmencioğlu, H. Unal, S. Ozbilgin, and H. Kuraloglu, '' Effect of Ground Fenugreek Seeds (*Trigonella foenum graecum*) on Feed Consumption and Milk Performance in Anatolian Water Buffaloes'' *Arch. Anim. Breed*, 59 (3): 345–349. Germany 2016.

[56] T. Değirmencioğlu, E. Simsek, H. Unal, H. Kuraloglu, and S. Ozbilgin, ''Effect of Cuminun seeds (*Cuminum cyminum*) in feed diets of Anatolian water buffaloes on shelter into gass concentration, milk yield and composition'' 2018. Proje no'su KUAP(KMYO)-2015/37. Unpublished.