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Current Anatolian Water Buffalo (*Bubalus bubalis*) Husbandry Practices at Iğdir Province, Turkey

Abstract

This study was conducted as a survey study in the 2017 (from September to December) to analyze the current status and husbandry practices of Anatolian water buffalo enterprises in Iğdir, Turkey. Using the Simple Random Sampling procedure, a sample of 98 enterprises was selected among 319 Anatolian water buffalo producers to apply a questionnaire as a primary source of data collection. The data revealed that the average age of the owners was 56.87±1.27 years and they are literate and have mixed enterprises. The first age of the breeding of buffalo, postpartum service interval, insemination after estrus detection, lactation length and the number of inseminations per gestation were 28.20±0.67 months, 72.47±2.82 days, 2.91±0.23 hours, 236.74 days and 1.29±0.06 times, respectively. The average intake time of first colostrum, the amount of milk intake within the first two hours after birth and the weaning age in the Anatolian water buffalo calves were 1.59±0.72 hours, 2.71±0.97 kg and 208.42±48.25, respectively. Implementation of effective policies to develop the breeding of Anatolian water buffalo in Iğdir is mandatory. Such policies include extension services (on nutrition, veterinary care, product processing...etc.), increasing the herd numbers, and establishing a union for Anatolian Water Buffalo Breeders in Iğdir province.

INTRODUCTION

Buffaloes (*Bubalus bubalis*) are large-ruminant animals that play an important role in the lives of millions of human beings as a source of milk, meat, draught power, transportation, and on-farm manure. Therefore the demand for buffalo breeding is increasing all over the world (Demiryurek et al., 2008; Naveena and Kiran, 2014; Wanapat and Chanthakhoun, 2015; Ahmad et al., 2021). Also buffalo milk contains high levels of protein, fat and minerals (especially calcium and phosphorus) when compared to cow's milk. High milk quality and processing of milk (especially mozzarella, cream, yoghurt, etc.) as well as meat (such as especially sausage, bacon and roasting) products increased the demand for water buffalo production (Damé et al., 2010; Yilmaz et al., 2011; Canbolat, 2012). In this respect, buffalo and buffalo products offer a very important option for producers and consumers. As the essential requirements of agricultural production, milk-producing animals must have sanitary care and nutrition, clean shelters, and a qualified workforce for processing and marketing of the products. The “Anatolian Water Buffalo Husbandry Project” was initiated in Turkey in 2011 with the objectives of extending water buffalo breeding, improving milk yield and maintaining the number of water buffaloes (Anonymous, 2015). Water buffaloes have been bred for centuries in Turkey as an essential part of farm stocks (Yilmaz et al., 2012). Water buffalo enterprises in Turkey are concentrated in all regions except the Mediterranean region (Isık and Gul, 2016). The population of water buffaloes was declined in Iğdir province from 1992 onwards (2560 in 1992 head, 1220 in 2000 head, 1273 in 2012 head, 1879 in 2015 head and 2235 in 2017 head) and started to increase later on. As this was the case for the total water buffalo population in Turkey for the same period (352.410 in 1992, 104.965 in 2005 and 161.934 in 2017) (TUIK, 2017). The main reason for this increase is the provision of state subsidies

for water buffalo husbandry (Anonymous, 2015). Just as many researchers from the world have studied structural characteristics of water buffaloes (Panda et al., 2006; Kiper et al., 2009; DeLong et al., 2017; Ayub et al., 2017), many researchers from Turkey have also studied milk, reproductive traits and structural characteristics to determine productivity traits of Anatolian Water Buffalo raised in public agricultural enterprises in Turkey (Kok, 1996; Kaygisiz, 1999; Sekerden and Avsar, 2008; Gurcan et al., 2011; Sahin and Yildirim, 2012; Kocaman, 2018). The primary source of livelihood of the majority of people living in Iğdir province is agriculture. The employment rate in the agricultural sector in Iğdir is 54%, which is greatly higher than the Turkish average, which accounts for 23.6% (TUIK, 2017). Iğdir has great potential for new investments with the cultivation of proper fodder crops and suitable pasture areas. The province is the region having the least rainfall in Turkey. Land areas in Iğdir Plain are irrigated by the water withdrawn from the Aras river. Because of this, there are many irrigation channels in Iğdir province. But, It has been reported that proper irrigation is required in order to obtain high efficiency in silage and grain corn production (Keten and Değirmenci, 2020; Taş, 2020). Water buffaloes bathe in these channels, grazing of pastures and consume reed maces around these channels. Iğdir province in Eastern Turkey has good potential in terms of water buffalo breeding. However, there is no study about the current status and husbandry practices of water buffalo enterprises. Determination of the current situation and husbandry practices of Anatolian water buffalo in Iğdir province may contribute to the identification and solution of problems in this region and similar conditions. Therefore, this study was conducted to determine the current situation in animal care and nutrition, husbandry practices, disease control and opportunities of marketing as well as to take the opinions of producers for determining

the required actions for developing Anatolian water buffalo husbandry in the region.

MATERIAL and METHODS

Igdir Plain and its vicinity, where Anatolian water buffaloes are bred, are situated within a “microclimatic” area; continental climatic conditions close to the Mediterranean climate prevail in the region while sub-humid cold climatic conditions dominate higher areas. Thus, the research on the husbandry characteristics was carried out in a geography where the average altitude above sea level varies between 800-900 m, the average annual temperature is 12.1 °C and the average annual precipitation is 258.6 mm. The temperature of the region varies between 39 °C and 42 °C during the June-August period. The total land area of Igdir is 3.588 km², 26% of which (922 km²) are plains, while the remaining 74% (2.617 km²) consists of mountainous and rugged terrain. In this study, the breeding characteristics of the Anatolian water buffaloes were investigated in Igdir province which has the climatic characteristics mentioned above.

According to the records of the Igdir Provincial Directorate of Food, Agriculture and Stockbreeding, there are a total of 2438 Anatolian water buffalo bred in 319 enterprises in Igdir province. 33.84% (824 heads) of these water buffaloes are owned by 104 enterprises in the Igdir Central district, while 33.55% (817 heads) are owned by 117 enterprises in Aralık district, 32.95% (791 heads) are

owned by 94 enterprises in Karakoyunlu district and 0.16% (4 heads) are owned by 4 enterprises in Tuzluca district. A sample of 98 water-buffalo-breeding enterprises was established according to the sampling method described by Arikan (2007) and Yamane (2010) and data were collected primarily through a questionnaire to the owners of the selected enterprises. The first source of the data used in this study was the people who breed Anatolian Water buffaloes. The questionnaire was designed to obtain answers. It was obtained data about themselves, their animals and businesses from these breeders. Second group of the sources of information about buffaloes breeding's in the Turkey and World were FAO, Turkish Statistical Institute (TUIK) and local governmental bodies as well as locally and internationally published scientific studies.

When collecting data through sampling, if there are easy transportation means and low costs associated with collecting the data, then it is better to use total population sampling (Arikan, 2007). Otherwise, in the case when standard deviation and variance are not known due to lack of prior extensive studies on the subject conducted in the region while the total population value (N- in this case, the total number of enterprises in Igdir province) is known, it is better to determine the sample size (number of enterprises to-be-surveyed by the questionnaire) by performing the Simple Random Sampling formula (equation 1) used by Arikan (2007) and Yamane (2010).

$$n = \frac{N \cdot t^2 \cdot pq}{(N - 1) D^2 + t^2 pq} \quad (1)$$

n=Sample size

D=Accepted or desired sampling error

p=Proportion to be estimated

$$n = \frac{319 \cdot 1,96^2 \cdot 0,1 \cdot 0,9}{(319 - 1) 0,05^2 + 1,96^2 \cdot 0,1 \cdot 0,9} = 98$$

N=Population size

t=Table value

q=1-p

Thus, the determined sample size of the questionnaire was 98 Anatolian water buffalo husbandry enterprises. Data collected through questionnaires was organized in Excel spreadsheet software and prepared for the analyses. Data Obtained were evaluated by using descriptive statistics and parametric and non-parametric tests (Yildiz et al., 2011). In this context, descriptive values for the investigated characteristics are presented in Tables and the findings of the study were compared to the findings of other studies on water buffaloes conducted in other regions in Turkey and other countries and discussed.

RESULTS and DISCUSSION

In the present study, the data was collected from Anatolian water buffalo breeding enterprises through a questionnaire, descriptive values for the investigated characteristics are presented in Tables and the findings of the study are comparatively discussed against the findings of other studies on water buffaloes conducted in other regions in Turkey and other countries.

According to FAO's 2015 records, water buffaloes are commonly bred in 38 countries around the world. The population of water buffaloes in these countries is increased by 99.5%, from 97.3 million (between 1961 and 1970) to 194.1 million (between 1961 and 2010). India

undoubtedly has the greatest share in terms of the number of enterprises breeding water buffaloes, with 57.53% of all water buffalo breeding enterprises around the world are in India as of 2010, followed by Pakistan (15.86%) and China (12.16%). While China was the second-highest water buffalo breeding country in the world after India, Pakistan had passed China due to its social structure. When we analyze the period (1961-2010), it can be seen that the population of water buffaloes increased 13 times in Brazil, 8 times in Italy and 4 times in Nepal (Isık and Gul, 2016).

In addition to professional experience and the educational status of people dealing with animal husbandry, knowledge of animal husbandry and nutrition techniques are also among the main factors affecting the development of stockbreeding. Production of sufficient and quality coarse fodders is important for the development of stockbreeding as well as the knowledge of husbandry and nutrition techniques. Production of fodder crops is important for the sustainability of the enterprises. It is recommended that stockbreeders produce their needs from coarse fodder and quality fodder crop production from within their enterprises for a productive and profitable stockbreeding. Thus, land assets, cultivated plants and water buffalo assets of the enterprises are compared in Table 1.

Table 1. Some statistics on water buffalo, land and plant production assets of enterprises in Iğdir, Turkey

Enterprise Data	N	\bar{X}	$S_{\bar{x}}$	Min.	Max.	Median	Z*	p-value
Total land area (ha.)	98	4.25	0.42	0.2	25.8	2.85	1.633	0.010
Irrigated land (ha.)	98	4.10	0.41	0.2	25.8	2.50	1.686	0.007
Non-irrigated land (ha.)	98	0.09	0.05	0.0	0.40	0.0	5.314	0.000
Total fodder crops (ha.)	98	2.48	0.30	0.0	2.50	0.20	1.961	0.001
Corn silage (ha.)	98	0.20	0.05	0.0	0.30	0.0	4.827	0.000
Total grains (ha.)	98	1.34	0.20	0.0	1.58	0.9	2.472	0.000
Total water buffaloes (heads)	98	3.74	0.27	1	14	3	1.889	0.002
Buffalo cow (heads)	98	2.49	0.14	1	7	2	1.973	0.001

* Data were analyzed by Kolmogorov-Smirnov test.**: The differences between enterprises are very significant since $P < 0.01$; ha.:hectare

According to Table 1, the average cultivated land size (total area) in the enterprises is 2.85 hectares (ha), the average total land area cultivated with fodder crops is 2.0 ha (100% alfalfa) and the average area cultivated for silage (100% corn) is 0.20 ha. The average land area cultivated with grains is 0.9 ha. The average value of land area cultivated with fodder crops per milking buffalo cow per enterprise is 1.0 ha. All enterprises have irrigated lands (Table 1).

The 2.0 ha (average value) of the arable land are reserved for cultivation of forage crops in all investigated enterprises, which corresponds to 74.8% of all arable lands in total and it is determined that there are 2.20 hectares (2.0+0.20 hectare) of fodder crops cultivation and 0.45 ha of grains (wheat + barley) cultivation in average terms per animal. In another study conducted by Yilmaz (2005) in Erzurum, it was determined that 34.0% (4.59 ha) of all cultivated lands are reserved for fodder crops in enterprises who breed imported heifers while this was 16.4% (1.36 ha) in enterprises who became cooperatives, and 2.69 (ha) in average. The percentage of enterprises cultivating fodder crops (70.2%) for all enterprises in our study is found to be higher than the percentage (60.7%) obtained in a study conducted in Bolu province. Moreover, 0.2 ha (4.6%) obtained for enterprises that cultivate silage corn as fodder crops is found to be lower than the values (10%) (Sahin, 2000) obtained for Bolu province.

All Anatolian water buffalo husbandry enterprises (100%) have the structure of mixed enterprise (plant and animal production) and it is observed that they take put emphasis on fodder crop production. The average population of water buffaloes in Anatolian water buffalo husbandry enterprises is 3.74 heads while the average population of milking water buffaloes is 2.49 heads. In their study of enterprises breeding Anatolian water buffalo in Mus province, Isik and Gul (2016) found that the average population was 10.11 heads while the average population of milking water buffaloes was 4.56 heads. Gunlu et al., (2010) reported that the average population of water buffaloes was 15.56 heads and the average population of milking water buffaloes was 6.74 heads in their study conducted in Afyonkarahisar province on enterprises at different ages. All these findings are quite higher than the total (3.74±0.27 heads) and milking (2.49±0.14 heads) water buffalo populations obtained in our study.

Optimal reproductive performance is essential to the milk yield sustainability. However, no enough reproductive records were kept in water buffalo husbandry enterprises, and thus information about some reproductive traits was deducted from the declarations of enterprise owners and the results of the statistical analyses are presented in Table 2.

Table 2. Some reproductive traits of Anatolian water buffaloes in Iğdir, Turkey

Reproductive traits	N	\bar{X}	$S_{\bar{x}}$	F*	p
Age at first breeding (month)	98	28.20	0.67	0.493	0.612
Postpartum insemination time (day)	98	72.47	2.82	0.235	0.791
Insemination after estrus detect (hour)	98	2.91	0.23	0.125	0.883
Number of inseminations per pregnancy (times)	98	1.29	0.06	1.486	0.231

*Data are subjected to ANOVA test.

According to Table 2, the average age at first breeding of Anatolian water buffaloes bred under Iğdir's conditions was 28.20±0.67 months, while average calving

to first service interval was 72.47±2.82 (days), the average time of bull introduction after the detection of the first estrus was 2.91±0.23 hours and the average number of

inseminations per gestation was 1.29 ± 0.06 times. There were no significant differences among the enterprises in terms of the mentioned traits ($P > 0.05$) (Table 2).

According to Turkey's Domesticated Animals Genetic Sources Promotion Catalogue (URL, 2004), the average age at first breeding of Anatolian water buffalo is 25 months (in the range of 24-26 months), however, the average age at first breeding determined in the present study (28.20 ± 0.67 months) was higher.

On the other hand, Yilmaz (2013) reported that the age at first breeding is in the range of 18-25+ (months) for Anatolian water buffaloes bred under village conditions in Afyonkarahisar province, while Uslu (1970) reported 20-24 months for water buffaloes bred in State Research

Institute in the same province. These findings are lower than the average of 28.20 ± 0.67 months found in our study conducted under stockbreeder conditions.

The average interval from calving to the first service of Anatolian water buffaloes in Iğdir province was 72.47 ± 2.82 days. Some researchers recommend that water buffaloes should be introduced to bulls at the first estrus, otherwise the second estrus might be seen after 8-10 months (Uslu, 1970).

As in dairy cattle farming, high milk yields and their continuity are also desirable in water buffalo husbandry. The data on milk production and yield are obtained from the responses of the owners of Anatolian water buffalo husbandry enterprises and presented in Table 3 after statistical analyses.

Table 3. Milk yield measurements of Anatolian water buffaloes in Iğdir, Turkey

Enterprise	N	\bar{x}	$S_{\bar{x}}$	Min.	Max.
Average daily milk yield (kg)	98	5.48	0.07	3	11
Lactation period (days)	98	226.00	1.52	150	305
Annual milk yield (kg)	98	1228.56	15.60	540	2430

The average lactation period, average milk yield per animal and lactation milk yield in the enterprises were calculated as 226.0 days, 5.48 kg and 1228.56 kg, respectively (Table 3). Moreover, it was observed that all (100%) water buffalo husbandry enterprises in Iğdir province make two milking daily and all milking was carried out by finger milking.

Yilmaz (2013) reported that all Anatolian water buffaloes are usually milked twice a day and this is decreased to one during dry periods under village conditions in Afyonkarahisar province. In another study conducted in the same province, Uslu (1970) also reported that water buffaloes are usually milked twice a day. The number of milking in our study is in agreement with the findings of these studies.

The calculated average lactation period of the enterprises was 226.0 days, the average daily milk yield was 5.48 kg and the

lactation milk yield was 1228.56 kg. According to Communiqué Regarding the Registry of Turkey's Domestic Animals Breeds and Lines numbered 2004/39 (Anonymous, 2009), the lactation period of Anatolian water buffaloes is registered as 232.83 days with the lower and upper limits are 112.0 and 449.0 days, respectively, lactation period milk yield was 925.33 kg (in the range of 186.0-2403.0 kg) and daily average milk yield for 305-days was 1230.75 kg. Yilmaz (2013) reported that the average milk yield of Anatolian water buffaloes under village conditions in Afyonkarahisar province is 1205 (lt lactation⁻¹) and the yield varies between 600 kg and 2200 kg. Uslu (1970) calculated the average lactation period milk yield of the herd belonging to the State Research Institute in Afyonkarahisar as 893.4 ± 58.45 kg (442 - 1715 kg) and 709.59 ± 23.25 kg (186 -1603 kg) under village conditions in the same province.

Sahin and Ulutas (2013) reported lactation milk yield, the average daily milk yield and the average lactation period of Anatolian water buffaloes bred in Tokat province and its districts as 708.5±15 kg, 4.84±0.099 kg and 147.9±1.63 days, respectively. In another study on Anatolian water buffaloes bred by the villagers in Amasya province, the average daily milk yield was 2.76 ± 0.051 kg, lactation milk yield is determined as 470.91 ± 9.784 kg and the average lactation period is determined as 171.8 ± 1.66 days (Kul et al., 2016).

Borghese (2013) reported lactation milk yield and average lactation period of Italian water buffaloes as 2.200 kg and 270 days, respectively. All these findings are below the findings of the present study conducted on Anatolian water buffaloes bred in Iğdir province. On the other hand, Pawar et al., (2012) obtained the average lactation milk yield as 2229.87 ± 93.7 kg in their study conducted on 515 Murrah water buffaloes in Ludhiana province of Punjab, India.

In a questionnaire survey on Anatolian water buffaloes bred under village

conditions in Afyonkarahisar province, breeders expressed that the lactation period is in the range of 121-270 days (Yılmaz, 2013). On the other hand, Uslu (1970) reported the average lactation time for stocks in the Afyonkarahisar State Research Institute as 244.4±2.54 days in a range of 134-349 days while the average lactation period is 256.1±4.28 days in a range of 112-449 days under village conditions. In the present study, the average lactation period was found to be shorter (226.0±1.52 days) than those reported in these studies (Uslu, 1979; Yılmaz, 2013).

To get the maximum benefit from the available live material in dairy cattle farming and to operate the enterprises most productively, breeders should primarily seek to have one offspring annually from each animal in the stock and to apply proper care and nutritional programs for achieving quality and high milk yield and for keeping animals in the stock for longer periods. Thus, information obtained on the feeding of Anatolian water buffaloes bred in Iğdir province is summarized in Table 4.

Table 4. Statistics on nutrition and feeding of buffalo cows and buffalo calves at Iğdir, Turkey

Anatolian water buffalo feeding traits	N	\bar{X}	$S_{\bar{x}}$	Median	Min.	Max.	Z*	P
Buffalo cow feeding								
Number of daily meals (times)	98	2.17	0.38	2	2	3	4.972	0.000
Daily concentrate feed (kg)	98	1.71	0.18	1	0	5	2.447	0.000
Daily coarse fodder (kg)	98	11.29	3.51	10	3	20	2.436	0.000
Daily silage (kg)	98	1.37	0.41	0	0	15	4.874	0.000
Buffalo calf feeding								
First colostrum feeding (hours)	98	1.59	0.72	1.5	1	5	2.929	0.000
Amount of daily milk fed (kg)	98	2.71	0.97	2	1	5	3.146	0.000
Weaning age (days)	98	208.42	48.25	210	90	305	1.289	0.072

* Kolmogorov-Smirnov Z test was performed to test the data.

As seen in Table 4, water buffaloes are fed 2.17± 0.38 times per day. The amounts of concentrate feed, coarse fodder and silage per water buffalo were 1.71±0.18 kg, 11.29±3.51 kg and 1.37±0.41 kg, respectively. It was also observed that buffalo calves have their first intake of

colostrum within 1.59±0.72 hours after birth. On the other hand, the average daily milk allowance for buffalo calves was 2.71±0.97 kg and the average weaning age was 208.42±48.25 days. It can be said that buffalo calves' first colostrum intakes are timely and sufficient. Having said that, it is

also observed that weaning time is rather long.

As in all living beings, the presence of parasites negatively affects animal productivity in water buffalo husbandry and

parasites are known to be effective in the transfer of some diseases. Therefore, the presence of parasites in Anatolian water buffalo enterprises is investigated and the obtained data are summarized in Table 5.

Table 5. Statistic on the presence of parasites in enterprises of Anatolian water buffaloes in Iğdir, Turkey

Districts	N/%	No parasites	Parasites Exist	Kinds of parasites				Total
				Pediculus	Ticks	Scabs	Pediculus+ticks	
Central	n	4	26	9	6	2	9	(26)30
	%	13.3	86.7	34.6	23.1	7.7	34.6	100.0
Karakoyunlu	n	7	39	16	5	4	14	(39)46
	%	15.2	84.8	41.0	12.8	10.3	35.9	100.0
Aralık	n	4	18	3	3	0	12	(18)22
	%	18.2	81.8	16.7	16.7	0.0	66.7	100.0
Genel	N	15	83	28	14	6	35	(83)98
	%	15.3	84.7	33.7	16.9	7.2	42.2	100.0

$\chi^2=8.300$, $P=0.405$; () Numbers in parentheses show the number of enterprises with the occurrence of parasites and their percentages.

84.7% of all Anatolian water buffalo husbandry enterprise owners expressed that parasites are present in their enterprises while 15.3% expressed that there are no parasites present in their enterprises. It is determined that pediculus seen in 33.7%, ticks in 16.9%, scabs in 7.2% and pediculus + ticks are seen in 42.2% of enterprises that expressed the presence of parasites in herds (Table 5).

It was reported in a study on Anatolian water buffaloes bred under village circumstances in Afyonkarahisar province that 90% of breeders expressed the presence of parasites in their stocks (Yilmaz, 2013).

This proportion is higher than the proportion of farms with parasites (84.7%) obtained in this study.

Controlling animal health and deaths is a necessity to keep up sustainability in animal husbandry enterprises. If animal death rates in an enterprise are high, then animal care-nutrition and stock management practices must be reviewed and revised. In this respect, the problem of water buffalo cow and buffalo calf deaths and fertility problems were investigated in Anatolian water buffalo husbandry enterprises. Obtained data is presented in Table 6.

Table 6. Information on water buffalo and buffalo calf deaths and fertility problems within the last five years in enterprises of Anatolian water buffaloes in Iğdir, Turkey

General problems	N/%	No Problems	Problems Exist	Repetition of the problems			Total
				1(times)	2(times)	3(times)	
Calf death problem	N	55	43	38	4	1	(43) 98
	%	56.1	43.9	(88.4) 38.8	(9.3) 4.1	(2.3) 1.0	100.0
Cow death problem	N	73	25	22	3	0	(25) 98
	%	74.5	25.5	(88.0) 22.4	(12.0) 3.1	(0.0) 0.0	100.0
Fertility Problems	n	67	31	27	3	1	(31) 98
	%	68.4	31.6	(87.1) 27.6	(9.7) 3.1	(3.2) 1.0	100.0

(): If the problem exists, is how many repeated (number and %)

Proportions of Anatolian water buffalo husbandry enterprises that experienced buffalo and buffalo calf deaths within the last five years are 25.5% and 43.9%, respectively. Proportions of the enterprises who expressed that they lost one, two and three calves within the last five years are 38.8%, 4.1% and 1%, respectively. On the other hand, proportions of the enterprises that expressed that they lost one, two and three adult water buffaloes within the last five years are 22.4%, 3.1% and 0%, respectively. As for the fertility problems, proportions of the enterprises who expressed that they experienced one, two and three fertility problems situations within the last five years are 27.6%, 3.1% and 1%, respectively.

According to Communiqué Regarding the Registry of Turkey's Domestic Animals Breeds and Lines numbered 2004/39, the average calf survival rate of Anatolian water buffalo is 88.11% for the first 6 months (URL, 2004). Yilmaz (2013) reported a 90-100% calf survival rate for Anatolian water buffaloes bred under producer conditions in Afyonkarahisar province. The very low calf death ratio within the five years obtained in our study indicates high calf survival rates for enterprises in Iğdir province and it can be said that this ratio is similar to those reported in other studies.

CONCLUSION

The research showed that the Iğdir region is very suitable for water buffalo husbandry. Particularly, large forage growing areas, production of alfalfa, which is a high-protein coarse fodder indicate high profits for stockbreeders. However, some actions and measures should be taken to achieve profitable water buffalo husbandry in the region. These are; the number of buffalo cows in the Anatolian water buffalo husbandry enterprises should be increased to maximize production and to maximize the effective utilization of the workforce. Males of the high-yielding animals in the enterprises of the region should be selected

for breeding purposes to increase milk yields. An "Anatolian Water Buffalo Breeders Union" should be established in the region. In this way, organized breeders would have a chance to act collaboratively and find solutions to the problems of water buffalo husbandry more easily. The union would improve the profitability of water buffalo husbandry, as it will facilitate the extension of modern husbandry techniques as well as a collective action on matters of product processing, storing and marketing. The coordinated action of breeders with other animal husbandry organizations throughout Turkey should be encouraged to facilitate their actions for developing effective policies by keeping water buffalo husbandry on the general agenda.

REFERENCES

- Ahmed, S., Aamir, M., Ul-Haque, M., Ahmad, N., Marghazani, I., Khan, M. 2021. Influence of rumen bypass fat fed with total mixed ration on growth performance in Nili-Ravi buffalo calves. *Journal of the Hellenic Veterinary Medical Society*, 71(4): 2437-2444.
- Anonymous, 2009. Anatolian water buffalo. The regulation of registration rules of native farm animal breeds and lines. At available, <https://www.tarim.gov.tr> (2004/39), (Access on: 11 May 2018).
- Anonymous, 2015. Ministry of agriculture and forestry, general directorate of agricultural research animal breeding in the hands of the people national project. Available at: https://www.tarim.gov.tr/TA_GEM/Belgeler/Halk_2015.pdf (Access on: 2 September 2020).
- Arikan, R. 2007. Research techniques and report preparation. Asil Publishing Distribution Ltd. Sti., ISBN:975-8784-35-8. Ankara.
- Ayub, M., Zuber, M., Khan, Z.I., Yousaf, M., Ahmad, K., Sher, M., Arshad, S.H., Mehmood, N., Bashir, H. Shad, H.A. 2017. Cobalt methionine complex as feed additive in buffaloes in selected districts of punjab, Pakistan. *Fresenius Environmental Bulletin*, 26(12): 7243-7254.

Borghese, A. 2013. Buffalo livestock and products in Europe, Buffalo Bulletin, 32: 50-74.

Canbolat, O. 2012. Buffalo breeding and current situation in Turkey. Agriculture Turkish Journal, 30: 176-180.

Damé, M.C.F., Lima, C.T.S. del, Marcondes, C.R, Ribeiro, M.E.R. Garnero, A.D.V. 2010. Preliminary study on buffalo (*Bubalus bubalis*) milk production in Southern Brazil. Proceedings 9th World Buffalo Congress. Buenos Aires, April, pp: 582-584.

DeLong, K.L., Lambert, D.M., Schexnayder, S., Krawczel, P., Fly, M., Garkovich, L., Oliver, S. 2017. Farm business and operator variables associated with bulk tank somatic cell count from dairy herds in the southeastern United States. Journal of dairy science, 100(11): 9298-9310.

Demiryurek, K., Stopes, C., Guzel, A. 2008. Organic Agriculture: the case of Turkey. Outlook on Agriculture. 37(4): 261-267.

Gunlu, A., Cicek, H., Tandogan, M. 2010. Socio-economic analysis of dairy buffalo enterprises in Afyonkarahisar province in Turkey. Journal of Food, Agriculture Environment, 8(1): 689-691.

Gurcan, E.K., Tuna, Y.T., Soysal, M.I. 2011. The morphometric characterization of anatolian water buffalo according to body measurements. Journal of Tekirdag Agricultural Faculty, 8(2): 143-152.

Isik, M., Gul, M. 2016. Economic and social structures of water buffalo farming in Mus province of Turkey. Revista Brasileira de Zootecnia, 45(7): 400-408.

Kaygisiz, A. 1999. Lactation curve traits of native buffaloes. Journal of Agriculture Science, 5(1): 1-8.

Keten, M., Değirmenci, H. 2020. Comparison of leaf water potentials of second crop silage corn and sorghum plants under different irrigation levels. ISPEC Journal of Agricultural Sciences, 4(4): 865-874.

Kiper, T., Ozdemir, G. Basaran, B. 2009. Applicability of agricultural tourism

in the case of murefte sarkoy and women's role. International conference on, pollution management and environmental protection" in Tirana, Albania, BENA, September, 16-20, p:119

Kocaman, I., Sisman, C.B., Comert Kurc, H. Gezer, E. 2018. A Study on gas emissions and environmental impacts from traditional water buffalo barns in Turkey. Fresenius Environmental Bulletin, 27(4): 2173-2179.

Kok, S. 1996. A research on some morphological and genetic traits of water buffalo populations in various provinces of Marmara and the Black Sea Regions. Ph.D. Thesis. Trakya University Institute of Science.

Kul, E., Sahin, A., Cayiroglu, H., Filik, G., Ugurlutepe, E. Oz, S. 2016. Effects of calving age and season on some milk yield traits in Anatolian buffaloes. Series D. Animal Science. Vol. LIX.

Kul, E., Sahin, A., Cayiroglu, H., Filik, G., Ugurlutepe, E., Oz, S. 2016. Effects of calving age and season on some milk yield traits in Anatolian buffaloes. Scientific Papers: Series D, Animal Science-The International Session of Scientific Communications of the Faculty of Animal Science, 59: 33-37.

Naveena, B. M., Kiran, M. 2014. Buffalo meat quality, composition, and processing characteristics: Contribution to the global economy and nutritional security. Animal frontiers. 4(4):18-24.

Panda, N., Kaur, H. Mohanty, T.K. 2006. Reproductive performance of dairy buffaloes supplemented with varying levels of vitamin E. Asian-Australian Journal Animal Science, 19(1):19-25.

Pawar, H.N., Ravi Kumar G.V.P.P.S. Narang, R. 2012. Effect of year, season and parity on milk production traits in murrh buffaloes. Journal of Buffalo Science, 1: 122-125.

Sahin, A Ulutas, Z. 2013. Milk yield and birth weight of anatolian water buffaloes bred in Tokat Region. 8th National Zootechny Science Congress, pp. 388. 5-7 September, Canakkale.

Sahin, A. Yıldırım, A. 2012. Somatic cell count and raw milk composition in water buffaloes. Gazi Osman Pasa University Journal of Agriculture Faculty, 29(2): 43-48.

Sahin, O. 2000. Structure of cattle husbandry in Bolu province. Ph. D. Thesis. Ankara University Institute of Science and Technology, Ankara.

Sekerden, O. Avsar, Y.K. 2008. Milk composition, rennet coagulation time, urea content and environmental factors affecting them in Anatolian buffaloes. Journal of Animal Production, 49(2):7-14.

Taş, T. 2020. Determination of the relationship between the grain traits and grain yield of some Hybrid Dent Corn (*zea mays indentata sturt*) varieties. ISPEC Journal of Agricultural Sciences, 4(2), 222-233.

TUIK, 2017. Turkish Statistical Institute (TUIK). Statistical database. Available at: <http://www.tuik.org.tr> (Access on: 04 May 2020).

URL, 2004. Notice regarding the registration of local animal breeds and lines. Notification no: 2004/39. Annex-6: Anatolian Buffalo. Available at: <https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6109MevzuatTur=9MevzuatTertip=5> (Accessed on 02 September 2020).

Uslu, N.T. 1970. Some characteristics of water buffaloes of Afyonkarahisar Region and comparative researches on milk yields under rational and village conditions. Ph.D. Thesis. Afyonkarahisar Forage Crops Production and Animal Enrichment

Station., Birlik Printing press, 81 s., Bornova.

Wanapat, M., Chanthakhoun, V. 2015. Buffalo production for emerging market as a potential animal protein source for global population. Buffalo Bulletin, 34:169-180.

Yamane, T. 2010. Elementary Sampling Theory. Literatur Publishing. ISBN:978-975-8431-34-2. İstanbul.

Yildiz, N., Akbulut, O. Bircan, H. 2011. Introduction to statistics, practical basics and solved examples. Active publishing house 7th printing. 328 pp. Erzurum.

Yılmaz, A., Ekiz,, B., Soysal, M.İ., Yılmaz, İ. Yalcıntan, H. 2011. Certain carcass and meat quality characteristics of Anatolian Water Buffalos. 8th Global Conference on The Conservation of Animal Genetic Resources, 149-156, 4-8 October, 2011, Tekirdag.

Yılmaz, I., 2005. Analysis of breeding of exotic cattle brought from different sources in Erzurum province. Ph.D. Thesis. Ataturk Univ. Institute of Science and Technology, Erzurum.

Yılmaz, O., Ertugrul, M. Wilson, R.T. 2012. Domestic livestock resources of Turkey Water buffalo. Tropical Animal Health and Production, 44: 707-714.

Yılmaz, S. 2013. Afyonkarahisar Region Buffalo Breeding. Msc. Thesis. Kucukcobanlı village Example. Adnan Menderes University, Institute of Science and Technology, Animal Science, Afyonkarahisar.