Comparison of Holstein and Simmental cows in terms of performance, cost and profitability

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Abstract

Purpose of this study is to compare Holstein and Simmental cows in terms of performance, cost and profitability. The main material of this study consisted of face to face interview with 24 producers in Burdur, Isparta, Konya, Izmir, Afyon, Aksaray and Kırşehir provinces that prevail in dairy cattle production in Turkey. Data were collected in 2018, but the gathered information covered the production period that started in 2017 and lasted until 2018. Of the 24 farms, 10, 7 and 7 consisted of farms raising Holstein, Simmental and mix (60% Holstein and 40% Simmental) breeds. Holstein cows had higher daily milk yield than Simmental and Mixed breed ($P<0.05$). Simmental cows had higher milk fat and protein percentages than other cows ($P<0.05$). Daily dry matter intake did not differ among breeds ($P>0.05$). Total production cost per cow was similar regardless of breed ($P>0.05$). Total production cost per Holstein, Simmental and Mixed breed cow was 1940.76, 1904.82 and 2046.79 USD, respectively. Feed cost had the highest share in total cost (71.29-73.29 %) followed by permanent labor (7.56-9.67 %) and cow depreciation (7.64-10.28 %). Proportion of feed cost

in total variable cost was 94.39, 94.10 and 93.82% for Holstein, Mixed and Simmental breed cows, respectively. Holstein breed had significantly higher gross product value than Simmental breed (P<0.05). For each breed, income from milk sale was the main contributor to income in the gross product value. Profitability indicators showed that Holstein breed was more profitable than Simmental (P<0.05). The reason for Holstein to be more profitable than Simmental was that even though they had similar production costs, Holstein had higher gross product value. In recent years there has been an interest toward Simmental breed in Turkey and Europe by producers due to their lower culling rate, resistance to diseases and higher milk fat percentages even though they have lower milk yield than Holstein cows. Results of this study showed that when deciding a breed to raise, cost and profitability of the production should be also be considered.

Keywords: Holstein. Simmental. Cost. Profitability. Performance. Breed.

1. Introduction

Dairy cattle and milk production are an important industry of the animal production sector and has an important position in Turkish economy with its employment rate and values of products. Annual milk production in Turkey in 2019 was 22 960 379 tonnes and 90.51 % of it was obtained from cows (Anonymous, 2020).

In Turkey, European dairy cattle breeds which have higher meat and milk yield than local breeds are preferred by producers and their share in total number of cattle is increasing. Total number of cattle in Turkey in 2002 was 9 803 498 head and 18.94, 44.45, 36.58% of this total number was composed of European, cross and local breeds, respectively. In 2019 total number of cattle increased to 17 688 139 and proportion of European, cross and local breeds in total number became as 48.39, 42.71, 8.90%, respectively (Anonymous, 2020).

Holstein breed constitutes the highest proportion in European breeds in Turkey. However, in recent years there has been an interest toward Simmental breed in Turkey by producers due to their lower culling rate, resistance to diseases and higher milk fat percentages even though they have lower milk yield than Holstein cows (Karslıoğlu Kara and Koyuncu 2018, Koç 2017). (Miciński et al., 2014) also reported that European farmers also started to prefer Simmental breed over Holstein for the same reasons Turkish farmers consider. Being a dual purpose, Simmental cattle have higher average daily gain and heavier carcass weight than Holstein cattle and this also makes cattle fatteners to prefer Simmental breed (Karslioglu Kara and Koyuncu, 2018). Milk price in Turkey is determined according to fat and protein percentage of it and there have been penalty for low milk fat percentage. For this purpose, some farmers raise Holstein and Simmental cows together to benefit from Simmental having higher milk fat percentage to make average milk fat percentage above the

penalty level. Simmental calves receive higher price than Holstein calves and this is another reason for farmers to prefer the breed. Because of all the reasons given above, proportion of Simmental breed in total cattle population increased and ranked second after Holstein (Koç, 2016).

Even though Holstein and Simmental breeds in Turkey are increasing in numbers, there has been no study comparing them in terms of cost and profitability. Thus purpose of this study is to compare Holstein and Simmental cows in terms of performance, cost and profitability. In the study, performance, cost, income and profitability are given on a cow basis and based on the results more profitable breed is determined. It is thought that the results obtained from this study would benefit researchers, policy makers, farmers and other interested stakeholders.

2. Literature Review

In recent years there has been an interest toward Simmental cattle due to their hardiness, resistance to diseases, higher milk fat and comparable milk yield. Karslıoğlu Kara and Koyuncu (2018) reported that dairy cattle farmers preferred Simmental cattle because of their lower culling rate, resistance to diseases and higher milk fat percentages even though they have lower milk yield than Holstein cows. Miciński et al., (2014) also reported that European farmers in recent years started to prefer Simmental cows. Since farmers started to prefer Simmental cattle their share in Turkish cattle population increased making them second in numbers (Koç, 2016).

One of the reasons farmers preferred Simmental is that they have higher milk fat percentage. This fact is well established in our results and literature as Ozhan et al (2015), Bigler (2001) and Mlynek et al (2018) reported that Simmental cows had higher milk fat percentage than Holstein cows.

Total production cost consists of variable and fixed costs. Of the variable cost, feed cost is the most important cost item. In a study comparing the effect of farm sizes on profitability of dairy cattle production, Demircan et al (2006) reported that feed cost was the main contributor in variable cost and it accounted more than 50 % of total production cost. Similar results to this was also reported by El-Awady (2012) who found that in Egypt, feed cost constituted between 91.53 and 92.62% of total variable cost.

Milk sale was the main contributor in gross product value and it was highest for Holstein and lowest for Simmental cattle. Perez-Cabal and Alenda, 2002, (Demircan et al.,

2006) and (El-Awady, 2012) also found that income from milk sale was the main contributor in the gross product value.

Profitability is the main driving force behind animal production enterprises. Thus a system that is not profitable cannot sustain itself. Our results showed that Holstein breed had higher net profit than other breeds. In other studies Krupová et al., (2009) found that Holstein cows were more profitable than Slovak Simmental and Slovak Pinzgau cows. Whereas in another study comparing profitability of Holstein and Jersey cows, Cunha et al., (2010) found that Holstein cows were more profitable than Jersey cows due to their lower total production cost and higher milk gross income coming from higher lactation milk yield.

3. Materials and Methods

The main material of this study consisted of face to face interview with 24 producers in Burdur, Isparta, Konya, Izmir, Afyon, Aksaray and Kırşehir provinces that prevail in dairy cattle production in Turkey. Besides the data acquired via questionnaire, similar studies conducted by other institutions and researchers were also utilized. Data were collected in 2018, but the gathered information covered the production period that started in 2017 and lasted until 2018. Of the 24 farms, 10, 7 and 7 consisted of farms raising Holstein, Simmental and mix (60% Holstein and 40% Simmental) breeds.

For cost and profitability analysis, depreciation for buildings, machinery and cows were calculated. Depreciation rate for building and machinery were 2 and 5%, respectively (Erkus et al., 1995). Depreciation costs of a cow was calculated by using the equation 1 (Kıral et al., 1999).

$$Cow\ depreciation = \frac{value\ as\ breeding\ stock - value\ if\ \ slaughtered}{productive\ life} \quad (1)$$

Equation 2 was used to calculate interest expenses for building and machinery.

$$Interest\ \ Building = \frac{machinery\ or\ \ building\ worth}{2} * interest\ \ \ rate \quad (2)$$

Equation 3 was used for calculating cow capital interest and formula is given below.

$$\text{Cow capital interest} = \left[\left(\frac{\text{Value as breeding stock} - \text{value if slaughtered}}{2}\right) + \text{value if slaughtered}\right] * \text{interest rate} \quad (3)$$

Net nominal interest rate was calculated as nominal interest rate – (nominal interest rate*income tax witholding rate) where nominal interest rate was 20.64% and income tax witholding rate was 12%.

Since end of the year value (worth) were considered for machinery, building and cow capital, real interest rates were used (Kadlec, 1985):

$$i = \frac{(1+r)}{(1+f)} - 1 \qquad (4)$$

Where:

i : real interest rate

r : net nominal interest rate

f : inflation rate (wholesale price index)

In period during which questionnaire was conducted, annual net nominal interest was 18.16 % and inflation rate was 16.33 % and thus real interest rate was found to be as 1.58 %.

Since some farms in the sample have both crop production and dairy, fixed and some variable costs for machinery were common costs for those production branches. The distribution of common cost between crop production and dairy branch was evaluated based on machinery use ratio between dairy and crop production. Management expense was assumed to be 3 % of variable costs. Since milk is marketed daily, for this product revolving fund interest was neglected.

Milk cost has been computed by using comparative sale price value. With this method, total common expenses separated to main product and by product according their share on total gross revenue. Main and by product cost per unit are computed by dividing total value of these product by corresponding expenses (Kıral et al., 1999).

Market values of products produced as a result of dairy production plus appreciation in yearly assets constitute gross product value. By subtracting variable costs and production cost from gross product value gross profit and net profit were obtained respectively (Rehber, 2016). Relative return was calculated by dividing gross product value to total production costs.

Information obtained from farmers by questionnaire were analyzed and evaluated by using Excel spread sheet. GLM option in SAS program (SAS 1999) also, was used to determine significance levels of the dependent variables. Since farm size affects profitability (Demircan et al., 2006), farm size was used as covariate in the statistical program to eliminate the effect of farm size.

4. Results and Discussion

Daily and lactation milk yield, fat and protein percentages of milk according to breeds is provided in Table 1. Holstein cows had higher daily milk yield than Simmental and Mixed breed (P<0.05). Mixed breed (60%Holstein, 40% Simmental) was intermediate in terms of daily milk yield and differed from Simmental cows (P<0.05). Previous reported studies conducted in other countries and Turkey well established that Holstein cows had higher daily and lactation milk yield than Simmental (Karslioglu Kara and Koyuncu 2018, Çilek, Tekin 2005, Micinski et al. 2014, Janzekovic et al. 2009, Budimir et al. 2011, Toledo-Alvarado et al. 2017, Mlynek et al. 2018).

Table 1: Milk yield and milk composition of breeds

Performance characteristics	Breeds		
	Holstein	Mixed	Simmental
Lactating cow (head)	136[a]	34[b]	68[c]
Daily milk yield (kg)	28.30[a]	25.65[b]	20.36[c]
Lactation milk yield (kg)	8631.44[a]	7823.63[b]	6208.21[c]
Fat (%)	3.60[c]	3.74[b]	4.04[a]
Protein (%)	3.10[b]	3.16[b]	3.47[a]

[abc]Means with different superscript in the same row differ (P<0.05)

Simmental cows had higher milk fat and protein percentages than other cows (P<0.05). Even though Mixed breed had numerically higher fat and protein percentages than Holstein cows this difference was not significant (P>0.05). (Ozhan et al., 2015) reported that Holstein dairy cows had 3.62% milk fat whereas Simmental cows had milk fat percentage between 3.75 and 4. (Perišić et al., 2009) reported that milk fat percentage of Simmental cow raised in different Europen countries varied between 3.88 and 4.18 and it agreed with our results. (Bigler, 2001) reported that Simmental and Holstein cows had milk protein percentages of 3.35 and 3.21, respectively. In a study comparing milk components of Simmental breed raised in different European countries, (Perišić et al., 2009) found that milk protein percentage varied between 3.24 and 3.48. In addition, (Mlynek et al., 2018) found that Simmental cows had higher milk fat percentage than Holstein and in terms of milk protein percentage they did not differ from each other.

Milk price in Turkey is determined according to fat and protein percentage of it and there have been penalty for low milk fat percentage. For receiving milk premium support, National Milk Council of Turkey set minimum requirement for milk fat and protein as 3.6 and

3.2%, respectively. Farms producing less quality milk are punished however even though National Milk Council gives extra premium for high quality milk (higher milk fat and protein percent), farms producing higher quality milk do not receive extra premium in practice. (Cunha et al., 2010) reported that in Brazil payment for milk quality started receiving greater attention especially because of the creation of the Conselho Nacional de Qualidade do Leite and suggested that because fat and protein are the components of greatest economic value in milk, the payment system should reward them adequately. (Madalena, 2000) stated that payment system rewarding milk fat and protein content has been done for more than two decades in more developed countries such as Australia and New Zealand, which are consolidated as large exporter countries.

Daily dry matter intake (DDMI) of cow by breed is provided in Table 2. DDMI did not differ among breeds (P>0.05). Holstein, Simmental and Mixed breed had DDMI of 20.81, 20.4 and 21.41 kg per cow, respectively. As Simmental cow are heavier than Holstein cows, it would be expected to have higher DDMI than Holstein cows when they produce equal amount of milk, however as noted in Table 1, Holstein cows produced nearly 8 kg more milk than Simmental cows and considering that milk has 13% solid matter these facts make Holstein cows' DDMI similar to Simmental cows. Of the total DDMI, roughage had higher share than concentrate in all three breeds.

Table 2: Daily dry matter intake per cow by breeds

	Breeds					
	Holstein		Mixed		Simmental	
	kg/cow	%	kg/cow	%	kg/cow	%
Concentrate	8.71	41.85	9.79	45.73	8.17	40.05
Roughage	12.10	58.15	11.62	54.27	12.23	59.95
Total	20.81	100.00	21.41	100.00	20.4	100.00

Production costs per cow by breeds is given Table 3. Total production cost consisted of variable and fixed costs. Variable costs are costs that occur when production is made and they increase or decrease depending upon the production volume. Fixed costs are costs that do not change with respect to the production volume or costs that occur whether production is made or not (Inan, 2016). Total production cost per cow was similar regardless of breed (P>0.05). Total production cost per Holstein, Simmental and Mixed breed cow was 1940.76, 1904.82 and 2046.79 USD, respectively. Variable cost was the biggest contributor in total

production cost and ranged between 75.76-77.65 % whereas fixed cost was a smaller contributor that ranged between 22.35-24.24 %. When production cost items were examined, it was noticed that feed cost had the most prominent share in total cost (71.29-73.29 %) followed by permanent labor (7.56-9.67 %) and cow depreciation (7.64-10.28 %). Proportion of feed cost in total variable cost was 94.39, 94.10 and 93.82% for Holstein, Mixed and Simmental breed cows, respectively.

Table 3: Production costs per cow by breeds

Cost items	Breeds					
	Holstein		Mixed		Simmental	
	$	%	$	%	$	%
Feed	1422.43	73.29	1459.21	71.29	1376.65	72.27
Veterinary medication and artificial insemination	39.41	2.03	38.27	1.87	40.61	2.13
Other costs(electricity, water, oil etc)	45.17	2.33	53.21	2.60	50.05	2.63
Variable costs (A)	1507.02	77.65	1550.68	75.76	1467.31	77.03
Management cost	45.21	2.33	46.52	2.27	44.02	2.31
Permanent labor	174.21	8.98	197.89	9.67	144.00	7.56
Building depreciation	11.38	0.59	9.92	0.48	8.49	0.45
Building capital interest	10.45	0.54	9.11	0.45	7.80	0.41
Building repair cost	26.46	1.36	23.07	1.13	19.76	1.04
Cow depreciation	148.32[a]	7.64	192.05[b]	9.38	195.72[b]	10.28
Cow capital interest	7.03[a]	0.36	9.10[b]	0.44	9.28[b]	0.49
Machinery depreciation	9.22	0.47	7.28	0.36	7.28	0.38
Machinery capital interest	1.46	0.08	1.15	0.06	1.15	0.06
Fixed costs (B)	433.74	22.35	496.11	24.24	437.51	22.97
Total production cost (A+B)	1940.76	100.00	2046.79	100.00	1904.82	100.00

[ab]Means with different superscript in the same row differ (P<0.05)

In a study examining effect of different farms sizes on profitability of dairy cattle production (Demircan et al., 2006) found that on average, feed costs accounted for 85.20% of variable costs and 58.20% of total production cost. In a study reporting economic profitability of Holstein Friesian cows under different intensive production systems in Egypt, (El-Awady, 2012) found that feed cost constituted between 91.53 and 92.62% of total variable cost. These results are similar to our results indicating that feed cost is main contributor of cost items. Since feed costs account for the highest portion of variable costs, farmers should seek a way of decreasing feed costs. In Turkey, dairy cattle producers rely on pelleted concentrate mix provided by milk purchaser firm. Since this concentrate mix is more expensive than if it was produced in farm, farmers should learn ways to prepare their ration to decrease the feed cost. As it may be observed in Table 2, farmers fed cattle on a relatively concentrate diet which

increases feed cost. Thus good quality and cheap roughage and adequate ration should be incorporated into dairy cattle feeding. A study conducted in Switzerland showed that the feeding of roughage to cows was more advantageous in terms of feed costs (Hilfiker, 1996). Supporting the results reported by (Hilfiker, 1996), (Koknaroglu et al., 2006) found that beef cattle receiving higher roughage level were more profitable than those receiving medium and low roughage levels.

Income items per cow by breeds is given Table 4. Simmental breed had significantly lower gross product value (2612.13 USD) than other breeds (P<0.05). Holstein breed had highest gross product value (3190.98 USD) and did not differ from Mixed breed (2992.26 USD; P>0.05).

Table 4: Income items per cow by breeds

Income items	Breeds					
	Holstein		Mixed		Simmental	
	$	%	$	%	$	%
Milk sale	2368.26[a]	74.22	2146.62[b]	71.74	1703.39[c]	65.21
Cattle value appreciation	520.93[b]	16.33	561.27[b]	18.76	660.85[a]	25.30
Government support	259.81[a]	8.14	237.83[b]	7.95	193.87[c]	7.42
Manure sale	41.97[c]	1.32	46.54[b]	1.56	54.01[a]	2.07
Gross product value	3190.98[a]	100.00	2992.26[a]	100.00	2612.13[b]	100.00

[abc]Means with different superscript in the same row differ (P<0.05)

The reason for Simmental to have lower gross product value than other breeds is that they had lower milk yield (Table 1). Income from milk sale was the main contributor to income in the gross product value with the proportion varying between 65.21 to 74.22 %. Income from milk sale for Holstein, Mixed and Simmental breeds was 2368.36, 2146.62 and 1703.39, respectively and breeds differed from each other (P<0.05). (Perez-Cabal and Alenda, 2002), (Demircan et al., 2006) and (El-Awady, 2012) also found that income from milk sale was the main contributor in the gross product value. The reason for breeds to have different contribution of milk sale in total gross product value is that breeds had significantly different daily milk yield (Table 2). Results from (El-Awady, 2012) showed that cattle having 22.41 and 26.32 kg/day milk yield had income from milk sale proportion in total gross product value of 83.65 and 88.11%, respectively, meaning that as daily milk yield increases proportion of income from milk sale in total gross product value increases. Simmental had higher cattle value appreciation than other breeds (P<0.05) and the reason for this was to have higher sale price for calves. According to report from the General Directorate of Agricultural Enterprises of Turkey, Simmental calf sale price was higher than Holstein, Jersey, Brown Swiss (Anonymous, 2019). Government support, consisting of calf support and milk

premium, for Holstein, Mixed and Simmental breeds was 259.81, 237.83 and 193.87 USD, respectively and breeds differed from each other (P<0.05). The reason for Holstein breed to have higher government support is that Holstein cows had higher milk yield than other breeds and they also had satisfying level of milk fat and protein percentages to receive milk premium (Table 2). As mentioned earlier in introduction section, farmers raise Holstein and Simmental breeds together to avoid penalty for low fat and protein percentage however our results showed that farmers do not need to raise Holstein and Simmental cows together.

Profitability indicators per cow by breeds is given Table 5. Gross profit is an important criterion that determines the competitive margin of the production activity of the farm in terms of insufficient resources use. In other words, gross profit is a criterion that shows the success of the enterprise (Erkus et al., 1995).

Table 5: Profitability indicators per cow by breeds

	Breeds		
	Holstein	Mixed	Simmental
Gross product value ($/cow)	3190.98[a]	2992.26[a]	2612.13[b]
Variable costs ($/cow)	1507.02	1550.68	1467.31
Production costs ($/cow)	1940.76	2046.79	1904.82
Gross profit ($/cow)	1683.96[a]	1441.58[a]	1144.82[b]
Net profit ($/cow)	1250.22[a]	945.47[b]	707.31[b]
Relative return	1.64[a]	1.46[ab]	1.37[b]

[ab]Means with different superscript in the same row differ (P<0.05)

Simmental breed had significantly lower gross profit (1119.87 USD) than other breeds (P<0.05). Holstein breed had highest gross profit (1659.02 USD) and did not differ from Mixed breed (1416.63 USD; P>0.05). When net profit was examined it was observed that Holstein breed had higher net profit (1225.28 USD) than other breeds (P<0.05; Table 5). Even though it was not significant, Mixed breed had higher net profit than Simmental breed (920.53 vs 682.36 USD; P>0.05). Relative return is another criterion that measures the success of a farm and it was 1.63, 1.45 and 1.36 for Holstein, Mixed and Simmental breeds, respectively. Relative return is the unit return for each unit invested. For example for Holstein breed relative return was 1.63. It means that Holstein farms received 1.63 USD return for each 1 USD investment (Table 5). Holstein breed had higher relative return than Simmental breed (P<0.05) and Mixed breed being intermediate in terms of relative return did not differ from other breeds (P>0.05). Profitability indicators showed that Holstein breed was more profitable than Simmental (P<0.05). The reason for Holstein to be more profitable than Simmental was that even though they had similar production costs, Holstein had higher gross product value.

As mentioned earlier in Table 4, milk sale was the biggest contributor in gross product value and this favored Holstein breed. Similar conclusion was also made by (Wolfová et al., 2007) who found that the higher milk price for dual-purpose cattle (Czech Fleckvieh) was nullified by lower milk production of this breed and consequently the breed reached lower profitability in comparison with Holstein cattle. Different studies also found that milk sale was the main contributor in revenue (83.4-94.8%) and this brings the importance of lactation milk yield of breed into consideration (Visscher et al., 1994, Vargas et al., 2002, Pärna et al., 2005).

In a study examining economic weights of production and functional traits in dairy cattle under a direct subsidy regime, (Krupová et al., 2009) found that under three subsidy scenarios (scenario A: no agricultural subsidies included; scenario B: adding the agricultural subsidies to total revenues; scenario C: including agricultural subsidies in the costs of feed production) Holstein cows were more profitable than Slovak Simmental and Slovak Pinzgau cows.

In another study aiming to compare Holstein and Jersey breeds profitability by varying milk price payment system, (Cunha et al., 2010) found that Holstein cows were more profitable than Jersey cows due to their lower total production cost and higher milk gross income coming from higher lactation milk yield.

Milk production costs and profit margin per kg of milk are given in Table 6. It was found that Holstein breed had lower milk cost per kg than other breeds ($P<0.05$). Milk production cost per kg was 0.18, 0.21 and 0.22 USD for Holstein, Mixed and Simmental breeds, respectively. There was no difference in milk sale prices among the breeds since the milk price is determined by National Milk Council. Holstein breed had higher profit margin for per kg of milk than other breeds ($P<0.05$).

Table 6: Milk production cost per cow by breeds

Breeds	Ratio of income from milk sale and milk premium in gross product value (%) A	Total production costs ($) B	Milk production costs C=A*B	Amount of milk produced (kg) D	Milk cost ($/kg) E=C/D	Milk sale price ($) F	Profit margin ($/kg) G=F-E
Holstein	82.36	1940.76	1598.402	8831.44	0.18[a]	0.27	0.09[a]
Mixed	79.69	2046.79	1631.031	7823.63	0.21[b]	0.27	0.06[b]
Simmental	72.63	1904.82	1383.525	6208.21	0.22[b]	0.27	0.05[b]

[ab]Means with different superscript in the same column differ ($P<0.05$)

Profit margin per kg of milk was 0.09, 0.06 and 0.05 USD for Holstein, Mixed and Simmental breeds, respectively. When profit margin is divided by milk sale price, percent of profit per marketed milk is found. In this study it was 33.33, 22.22 and 18.52% for Holstein, Mixed and Simmental breeds, respectively, meaning that for example for Holstein cows 33.33 percent of each kg of marketed milk is profit. (Cunha et al., 2010) reported that Holstein cows had lower production cost per kg of milk than Jersey cows. Feed is the most important input that raises milk production costs. Thus farmers should focus their efforts on the lowering of feed expenses. In the study, it was found that in dairy production along with milk production, especially the cattle value appreciation increased farm income.

5. Conclusion

Results showed that total production cost per cow was similar regardless of breed. Variable cost was the biggest contributor in total production cost in which feed cost had the highest share. Simmental breed had significantly lower gross product value than other breeds. Holstein breed had highest gross product value and did not differ from Mixed breed. Income from milk sale was the main contributor to income in the gross product value and breeds differed from each other. Simmental had higher cattle value appreciation than other breeds and the reason for this was to have higher sale price for calves. Profitability indicators showed that Holstein breed was more profitable than Simmental. The reason for Holstein to be more profitable than Simmental was that even though they had similar production costs, Holstein had higher gross product value. Holstein cows produced high enough percentages of fat and protein in milk to meet the minimum criteria set by National Milk Council of Turkey and thus farmers do not need to raise Holstein and Simmental cows together.

6. References

ANONYMOUS. Republic of Turkey ministry of Agriculture and Forestry. Retrieved on July 14, 2020 from: https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/HAYGEM.pdf. 2020.

ANONYMOUS. The General Directorate of Agricultural Enterprises (TIGEM). Retrieved on July20, 2020 from: https://www.tigem.gov.tr/WebUserFile/DosyaGaleri/2019/4/0cc0bf84-4307-4ae0-

a4493c4102ca2dc2/dosya/2019%20Dam%C4%B1zl%C4%B1k%20Fiyatlar%C4%B1.pdf. 2019.

BIGLER, A. Performance increased further.Weitere Auswertungen im Geschaftsjahr 2000/2001, Leistungen weiter gestiegen. *Schweizer Fleckvieh*, v. 7, p. 37-43, 2001.

BUDIMIR, D.; PLAVŠIĆ, M.; POPOVIĆ-VRANJEŠ, A. Production and reproduction characteristics of Sımmental and Holstein Friesian cows in Semberija area. *Biotechnology in Animal Husbandry*, v. 27, n. 3, p. 893-899, 2011.

CUNHA, D. N. F. V. D.; PEREIRA, J. C.; CAMPOS, O. F. D.; GOMES, S. T. *et al*. Simulation of Holstein and Jersey profitability by varying milk price payment system. *Revista Brasileira de Zootecnia*, v. 39, n. 4, p. 913-923, 2010.

CILEK, S.; TEKIN, M.E. Environmental factors affecting milk yield and fertility traits of Simmental cows raised at the Kazova State Farm and phenotypic correlations between these traits. *Turkish Journal of Veterinary and Animal Sciences*, v. 29, p. 987-993, 2005.

DEMIRCAN, V.; BINICI, T.; KOKNAROGLU, H.; AKTAS, A.R. Economic analysis of different dairy farm sizes in Burdur province in Turkey. *Czech Journal of Animal Science*, v. 51, n. 1, p. 8-17, 2006.

EL-AWADY, H.G. Effect of milk yield on economic profitability of Holstein Friesian cows under intensive production system in Egypt. *Pakistan Veterinary Journal*, v. 33, n. 1, p. 23-26, 2013.

ERKUŞ, A.; BÜLBÜL, M.; KIRAL, T.; AÇIL, A.F. *et al*. 1995. Agricultural economics (in Turkish). Ankara Üniv. Zir. Fak. Eğitim, Araştırma ve Geliştirme Vakfı Yayınları, Ankara.
Hilfiker, J. 1996. Dairy farming: milk performance and structure influence the farm result. *Agrarforschung*, v. 3, p. 291–294, 1995.

INAN, I.H. Agricultural economics and management (in Turkish*). İdeal Kültür Yayıncılık*, ISBN:978-605-5729-67-7. p.415, 2016.

JANŽEKOVIČ, M., OCEPEK, M., VIRK, T., ŠKORJANC, D. Comparison of longevity and production traits of Holstein and Simmental cows of different origin in Slovenia. *Mljekarstvo*, v. 59, n. 4, p. 336-342, 2009.

KADLEC C.E. Farm management, decisions, operation, control, *Prentice-Hall*, Inc, 1985.

KARSLIOĞLU KARA, N.; KOYUNCU, M.A. Research on longevity, culling reasons and milk yield traits in between Holstein and Simmental cows. *Mediterranean Agricultural Sciences*, v. 31, n. 3, DOI: 10.29136/Mediterranean, p. 443409, 2018.

KIRAL, T.; KASNAKOGLU, H.; TATLIDIL, F.; FIDAN, H. *et al*. Data base guide and production cost methodology for agricultural products (in Turkish). *Agricultural Economics Research Institute*, *Publication* No: 37, Ankara 1999.

KOC, A. Simmental Yetiştiriciliğinin Değerlendirmesi, 2. Türkiye'deki Çalışmalar. *Adnan Menderes Üniversitesi Ziraat Fakültesi Dergisi*. v. 13, n. 2, p. 103-112, 2016.

KOC, A Siyah–Alaca, Kırmızı–Alaca ve Simmental Irkı Sığırların Sürü Ömrü Üzerine Bir Araştırma. *ADÜ Ziraat Derg*, v. 14, n. 2, p. 63-68 — doi: 10.25308/aduziraat.321914, 2017.

KOKNAROGLU, H.; YILMAZ H.; DEMIRCAN V. Afyon ili besi sığırcılığı işletmelerinde kesif yem oranının besi performansı ve karlılığa etkisi (Effect of concentrate level on beef cattle performance and profitability in Afyon province). *Süleyman Demirel Üniversitesi Ziraat Fakültesi Dergisi* , v. 1, n. 1, p. 41-51. In Turkish, 2006.

KRUPOVÁ, Z.; HUBA, J.; DAŇO, J.; KRUPA, E.*et al.* Economic weights of production and functional traits in dairy cattle under a direct subsidy regime. *Czech J. Anim. Sci*., v. 54, n. 6, p. 249–259, 2009.

MADALENA, F.E. Valores econômicas para seleção de proteína e gordura do leite. *Revista Brasileira de Zootecnia*, v. 29, n. 3, p. 678-684, 2000.

MICIŃSKI, J.; MARŠÁLEK, M.; POGORZELSKA, J.; VRBOVÁ, A. *et al*. The comparative analysis of milk performance in Czech Pied Cattle raised in the Czech Republic versus Polish Holstein-Friesian, Simmental and Czech Pied cattle raised in Poland. *Veterinarija ir Zootechnika*, v. 67, n. 8, p. 75-80, 2014.

MŁYNEK, K.; GŁOWIŃSKA, B.; SALOMOŃCZYK , E.; TKACZUK, J. *et al*. The effect of daily milk production on the milk composition and energy management indicators in Holstein–Friesian and Simmental cows. *Turk J Vet Anim Sci*, v. 42, p. 223-229, 2018.

OZHAN, M.; TUZEMEN, N.; YARAR, M. Büyükbaş Hayvan Yetişitirme (Cattle Husbandry). *Atatürk University Agricultural Faculty Publication* No 134. Erzurum, Turkey (In Turkish) 2015

PÄRNA, E.; KIIMAN, H.; VIINALASS, H.; VALLAS, M. Bioeconomical model application in cattle breeding. *Acta Agriculturae Slovenica*, v. 86, p. 117–124, 2005.

PÉREZ-CABAL, M.A.; ALENDA, R. Genetic relationships between lifetime profit and type traits in Spanish Holstein cows. *Journal of Dairy Science*, v. 85, n. 12, p. 3480-3491, 2002.

PERIŠIĆ, P.; SKALICKI, Z.; PETROVIĆ, M.M.; BOGDANOVIĆ, V.*et al*. Simmental cattle breed in different production systems. *Biotechnology in Animal Husbandry*, v. 25, n. 5-6, p. 315-326, 2009.

REHBER, E.; TIPI, T. Agricultural management and planning (in Turkish). *Ekin Publishing*, Bursa, 2016.

TOLEDO-ALVARADO H.; CECCHINATO, A.; BITTANTE G. Fertility traits of Holstein, Brown Swiss, Simmental, and Alpine Grey cows are differently affected by herd productivity and milk yield of individual cows. *Journal of Dairy Science*, 100, p. 8220–8231, 2017.

VARGAS, B.; GROEN, F.; HERRERO, M.; ARENDONK VAN J.A.M. Economic values for production and functional traits in Holstein cattle of Costa Rica. *Livestock Production Science*, v. 7, p. 101–116, 2002.

VISSCHER P.M.; BOWMAN, P.J.; GODDARD, M.E. Breeding objectives for pasture based production systems. *Livestock Production Science*, v. 40, p. 123–137, 1994.

WOLFOVÁ M.; WOLF, J.; PŘIBYL, J. 2007. Impact of milk pricing system on the economic response to mil selection on milk components. *Journal of Animal Breeding and Genetics*, v. 124, p. 192–200, 2007.