



Development of valuation index for dairy cattle and buffalo in Tamil Nadu

N K SUDEEP KUMAR¹, P R NISHA², S SENTHIL KUMAR³ and G SENTHIL KUMAR⁴

Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu 600 051 India

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ABSTRACT

The present study was carried out to develop valuation index for dairy cattle and buffalo in Tamil Nadu. The data were collected through personal interview using pre-tested interview schedule from 525 dairy cattle and buffalo owners from 7 districts in Tamil Nadu, viz. Tiruvannamalai, Vellore, Namakkal, Salem, Tirunelveli, Madurai and Thiruchirapalli covering 4 agro-climatic zones of Tamil Nadu. A multiple linear regression equation was fitted for arriving at the valuation index for various breeds of dairy cattle and buffaloes. The overall dairy cow valuation index was also fitted and it explained 57.70% of variations through the included variables. The factors like activeness, triple wedge, pregnancy and milk yield were found to be highly significant and each unit of the above variables had influenced the value of animals to the tune of ₹ 2,431.81, ₹ 2,728.59, ₹ 1,114.07 and ₹ 719.54, respectively. The factors like milk yield and pregnancy were found to be significant and had influenced the value of buffaloes to the tune of ₹ 1,746.81 and ₹ 4,188.62, respectively. On the other hand, the factor on calving interval had significant negative influence on the buffalo value to the tune of ₹ 575.22 per year. As a whole, many variables like activeness, whirrs, triple wedge, pregnancy and milk yield were highly significant and each unit of the above variables had influenced the value of dairy animals to the tune of ₹ 2,543.45, ₹ 2,462.60, ₹ 2,414.79, ₹ 1,706.37 and ₹ 1,044.27, respectively. In addition, 2 variables namely breed and species were included to fit the overall cattle and buffalo valuation index and the results implied that these variables were significant at 1% level and they had the influence of ₹ 2,178.00 and ₹ 3,462.99, respectively on the cattle and buffalo value.

Key words: Buffalo, Cattle, Dairy breeds, Holstein-Friesien, Jersey, Murrah, Non-descript

According to FAO (2010), India possessed 210.2 million cattle and 111.3 million buffaloes and it ranked first among various countries in cattle and buffalo population in the world in the year 2010. The milk production in India crossed 100 million tonnes by the year 2006–07 and reached 121.85 million tonnes in the year 2010–11. The milk production in Tamil Nadu also progressed steadily with minor dip during the year 2004–05. Dairying has become an important secondary source of income for millions of rural families and has assumed an important role in providing employment and income-generating opportunities. However, the valuation of dairy cattle and buffaloes were not performed on scientific basis and there were no rules and regulations prevailing in price fixation of dairy animals. Animal owners fix the price of dairy animals based on various traditional factors and use secret code words to define the market price

in which bargaining is hidden, as the bargainers close their digits with towel and negotiate through finger palpation. Buyers and sellers rely mostly on brokers / intermediaries, who reap considerable amount of share of animal price bypassing the buyers and sellers. Several malpractices like tooth rasping, horn sharpening and painting, drenching, etc., were often interfering with the accurate valuation of animals. Thus cattle owners, veterinarians, bankers and insurance officials often find it difficult to judge the price of dairy animals. Hence, the present study was carried out with the following specific objective of development of valuation index for dairy cattle and buffalo in Tamil Nadu.

METHODOLOGY

Tiruvannamalai, Vellore, Namakkal, Salem, Tirunelveli, Madurai and Thiruchirapalli districts in Tamil Nadu, viz. covering four agro-climatic zones of Tamil Nadu based on the cattle and buffalo breed availability in the respective districts, were selected (Fig. 1). Among dairy cattle, 3 breeds namely Jersey cross, Holstein Friesian cross and non-descript breeds were selected. Among buffalo owners, data were collected from 2 breed owners, viz. Murrah graded and non-descript. Out of the selected districts, a cluster of villages were selected based on the concentration of milch cattle and buffalo population. Thus, 5 to 6 villages were selected in each district. Sample respondents of 75 dairy

Present address: ¹Professor and Head (sudeep66@hotmail.com), Department of Livestock Business Management, Madras Veterinary College. ²Associate Professor (nisha_pr@hotmail.com), ³Assistant Professor (usveteng@gmail.com), Department of Veterinary and Animal Husbandry Extension, Veterinary College and Research Institute, Orathanadu. Dept. of Veterinary and Animal Husbandry Extension, Veterinary College and Research Institute, Tirunelveli. ⁴Assistant Professor (smartysen@yahoo.com), Department of Livestock Business Management, Madras Veterinary College, Chennai.

cattle and buffalo owners each from the 7 districts were selected making the total sample size as 525. The data pertaining to the objectives of the study were collected using a pre-tested interview schedule from the 525 samples respondents. The data was collected between October 2010 and January 2011 through personal interview of the respondents by the field enumerators.

For developing valuation index of an animal, multiple linear regression model was fitted as used by Selvakumar (2003), and Pandit and Dhaka (2006). For the present study zero order correlation coefficients among animal values and quantitative factors were worked out to identify multi-collinearity among variables. Those variables that had multi-collinearity problems were dropped from the analysis. Finally, on *a priori* ground the multiple linear regression of the following model was fitted for arriving at the valuation index for dairy cattle and buffaloes with the variables as shown in Table 1.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + \mu$$

Shaeffer's formula (Sastry *et al.* 1983) was used to calculate the body weight of animals as mentioned below.

$$\text{Body weight in pounds} = \frac{L \times (G)^2}{300}$$

where,

L - Body length from point of shoulder to the point of pin bone in inches

G - Girth circumference around the thoracic cavity just behind the elbow joint in inches. Finally the body weight was converted from pound to kg.

RESULTS AND DISCUSSION

In general, the buyers and sellers decide the value of a dairy animal based on breed, order and stage of lactation,

Table 1. Variables for fitting the multiple linear regressions on valuation of dairy cattle and buffalo

Variables	Specifications
<i>Dependent variable</i>	
Y	Valuation of animal in Rupees
<i>Independent variables</i>	
X ₁	Activeness 2 – Good, 1- Average and 0 – Poor
X ₂	Whirls 1 – Whirls located at acceptable region as perceived by the animal owner and 0 – Otherwise
X ₃	Body weight in Kgs
X ₄	Triple wedge 1 – Yes and 0 – Otherwise
X ₅	Age in years
X ₆	Pregnancy 1 – Pregnant and 0 – Otherwise
X ₇	Calving interval in months
X ₈	Milk yield in litres
X ₉	Disease tolerance 1 – Disease tolerant and 0 – Otherwise
X ₁₀	Breed 1 – Crossbred / Upgraded and 0 – Otherwise
X ₁₁	Species 1 – Cattle and 2 – Buffaloes

lactation yield, udder size and morphology, teat structure and position, sex of the calf, colour, temperament, whirls, etc. (Selvakumar 2003).

Development of a valuation index for dairy cattle and buffaloes: For developing valuation index of animal multiple linear regression model was fitted for dairy cattle breeds using the variables namely activeness, whirls, body weight, triple wedge, age, pregnancy, calving interval, milk yield and disease tolerance, breed and species. The results are presented in Table 2 and equations detailed below:

Jersey cross cattle

$$Y = 3205.58 + 964.93 X_1 + 1457.84 X_2 + 4.886 X_3 + 1993.41 X_4 + 158.80 X_5 + 811.31 X_6 + 123.30 X_7 + 628.37 X_8 - 784.34 X_9 + \mu$$

HF cross cattle

$$Y = 1627.39 + 3015.82 X_1 + 2143.79 X_2 + 2.62 X_3 - 3008.43 X_4 - 25.43 X_5 + 1214.56 X_6 + 32.65 X_7 + 717.83 X_8 - 650.14 X_9 + \mu$$

Non-descript cattle

$$Y = 13721.90 + 3640.38 X_1 + 1292.30 X_2 - 3.90 X_3 + 2220.81 X_4 - 397.01 X_5 + 838.71 X_6 + 88.14 X_7 + 254.38 X_8 - 4939.32 X_9 + \mu$$

Overall dairy cattle

$$Y = 2008.80 + 2431.81 X_1 + 1157.36 X_2 + 3.52 X_3 + 2728.59 X_4 - 2.66 X_5 + 1114.07 X_6 + 76.41 X_7 + 719.54 X_8 - 84.58 X_9 + 365.72 X_{10} + \mu$$

Murrah graded buffalo

$$Y = 181.55 + 4752.53 X_1 + 3867.65 X_2 + 1.68 X_3 + 4275.49 X_4 - 637.09 X_5 + 8700.13 X_6 - 555.75 X_7 + 1852.62 X_8 - 3560.69 X_9 + \mu$$

Non-descript buffalo

$$Y = 310.10 + 1865.21 X_1 + 5919.12 X_2 - 0.667 X_3 + 2769.96 X_4 - 9.65 X_5 - 155.20 X_6 + 110.42 X_7 + 894.63 X_8 + 1224.14 X_9 + \mu$$

Overall dairy buffalo

$$Y = 4984.15 + 2445.53 X_1 + 4588.27 X_2 - 5.14 X_3 + 2573.72 X_4 - 95.53 X_5 + 4188.62 X_6 - 575.22 X_7 + 1746.81 X_8 + 4516.93 X_9 + 4705.08 X_{10} + \mu$$

Overall dairy cattle and buffalo

$$Y = -2868.87 + 2543.45 X_1 + 2462.60 X_2 + 0.538 X_3 + 2414.79 X_4 - 56.93 X_5 + 1706.37 X_6 - 75.18 X_7 + 1044.27 X_8 + 1048.93 X_9 + 2178.00 X_{10} + 3462.99 X_{11} + \mu$$

where,

Y, animal value in rupees; X₁, activeness; X₂, whirls; X₃, body weight; X₄, triple wedge; X₅, age; X₆, pregnancy; X₇, calving interval; X₈, milk yield; X₉, disease tolerance; X₁₀, breed; X₁₁, species; μ , random error term.

The co-efficient of multiple determination (Adjusted R square) for the regression equation fitted for the valuation of Jersey cross cow was 0.382 indicating 38.20% variations in the price of Jersey cross cow as explained by the chosen variables. Among various variables, triple wedge and milk yield were positively significant at 1% level. It implied that under *ceteris paribus*, presence of triple wedge increased

the value of animal to a tune of ₹ 1,993.41 and each litre of milk yield increased value of Jersey cross cows by ₹ 628.37. The variable on activeness was significant at 5% level and it influenced the value of animal by ₹ 964.93. Although the

variable on disease tolerance was found to negatively influence on the price of Jersey cross cow, it was nonsignificant.

The valuation pattern of HF cross cow was depicted

Table 2. Valuation index for dairy animal

S.No.	Particulars	Dairy cattle				Dairy buffalo			
		Jersey cross	HF cross	Non-descript	Overall cattle	Murrah graded	Non-descript	Overall buffalo	Overall dairy animal
	Constant	3205.58	1627.39	13721.9	2008.8	181.55	310.1	4984.15	-2868.87
		-1.064	-0.517	-3.165	-1.108	-0.012	-0.052	-0.635	(-1.012)
X ₁	Activeness (2 – Good, 1- Average and 0 – Poor)	964.93 *	3015.82 **	3640.38 **	2431.81 **	4752.53	1865.21	2445.53	2543.45 **
		-2.074	-3.941	-3.33	-5.539	-1.094	-1.802	-1.294	-3.728
X ₂	Whirls (1 – Whirls located at acceptable region as perceived by the animal owner and 0 – Otherwise)	1457.84	2143.79 *	1292.3	1157.36 *	3867.65	5919.12 **	4588.27	2462.60 **
		-2.461	-2.307	-1.068	-2.251	-0.774	-3.817	-1.709	-2.902
X ₃	Body weight in Kgs	4.886	2.62	-3.9	3.52 *	1.68	-0.667	-5.14	0.538
		-1.11	-1.087	(-1.170)	-2.302	((0.117)	(-0.218)	(-0.857)	-0.24
X ₄	Triple wedge (1 – Yes and 0 – Otherwise)	1993.41 **	3008.43 **	2220.81	2728.59 **	4275.49	2769.96 *	2573.72	2414.79 **
		-3.546	-3.91	-1.567	-6.174	-1.099	-2.272	-1.243	-3.453
X ₅	Age in years	158.8	-25.43	-397.01 *	-2.66	-637.09	-9.65	-95.53	-56.93
		-1.475	(-0.196)	(-2.466)	(-0.035)	(-0.764)	(-0.035)	(-0.214)	(-0.443)
X ₆	Pregnancy (1 – Pregnant and 0 – Otherwise)	811.31	1214.56	838.71	1114.07 **	8700.13 **	-155.2	4188.62 *	1706.37 **
		-1.476	-1.882	-0.541	-2.812	-2.646	(-0.150)	-2.437	-2.755
X ₇	Calving interval in months	123.3	32.65	88.14	76.41	-555.75	110.42	-575.22 *	-75.18
		-1.508	-0.313	-0.707	-1.263	(-1.386)	-0.391	(-2.140)	(-0.436)
X ₈	Milk yield in litres	628.37 **	717.83 **	254.38	719.54 **	1852.62 **	894.63 **	1746.81 **	1044.27 **
		-7.122	-9.501	-1.711	-13.774	-4.387	-4.784	-7.011	-12.405
X ₉	Disease tolerance (1 – Disease tolerant and 0 – Otherwise)	-784.34	650.14	-4939.32	-84.58	3560.69	1224.14	4516.93	1048.93
		(-1.263)	-0.777	(-0.503)	(-0.179)	-0.937	-0.476	-1.8	-1.329
X ₁₀	Breed (1 – Crossbred/ Upgraded and 0 – Otherwise)	–	–	–	365.72	–	–	4705.08 **	2178.00 **
					-0.52			-2.655	-2.596
X ₁₁	Species (1 – Cattle and 2 – Buffaloes)	–	–	–	–	–	–	–	3462.99 **
									-4.446
Adjusted R square		0.382	0.561	0.842	0.577	0.4	0.57	0.407	0.404
F value		12.603 **	23.578 **	21.141 **	51.324	6.848	11.898	11.569	33.32
N		170	165	35	370	80	75	155	525

Figures in parentheses indicate 't' value

* significant at five% level and ** significant at one% level

through the multiple linear regression model as mentioned in Table 2. The adjusted R square was 0.561, indicating 56.10% of variation in price of HF cross cow explained by the included variables. Among various variables, triple wedge was significant at 1% level, which implied that its presence would increase the price of animal by ₹ 3,008.43. Similar to Jersey cross breed, the variable milk yield was at 1% level. The value of HF cross cow increased by ₹ 717.83 / litre of milk yield. In addition, the variable on activeness was statistically significant at 1% level and it increased the value of animals by ₹ 3,015.82. The variable on presence of whirls in favourable location was found to be significant at 5% level and its presence increased the value of HF cross cow by ₹ 2,143.79. The variables on body weight, pregnancy, calving interval and disease tolerance were found to be nonsignificant and positively influenced the valuation of HF cross cows.

The multiple linear regression on non-descript cow valuation index revealed 84.20% variations in value which was explained by the variables mentioned in the Table 1. The variable activeness was found to be statistically significant and per unit rise in these variables increased the value of non-descript cow @ ₹ 3,640.38. The variable on age was showed negative influence on animal value and it was statistically significant at 5% level. Each year increase in age of non-descript cow decreased the animal value by ₹ 397.01. All the other variables were found to be statistically nonsignificant.

The overall dairy cow valuation index was also fitted and it explained 57.70% of variations through the included variables. The factors like activeness, triple wedge, pregnancy and milk yield were highly significant and each unit of the above variables had influenced the value of animals to the tune of ₹ 2,431.81, ₹ 2,728.59, ₹ 1,114.07 and ₹ 719.54, respectively. The variables on whirls and body weight had positive influence on animal value and it was statistically significant at 5% level. The variable breed was included for fitting the overall cattle valuation model and was nonsignificant. The variables like age and disease tolerance had negative influence on the overall cattle value and they were nonsignificant.

Although presence of whirls has no scientific basis to influence the price of animal, the psychological perception of owners resulted in the significant influence on the value of dairy cows. The factors like activeness and body weight directly reflects the health of animal, which might have become significant in deciding the value of animal. As pregnant animals will be calving their young ones, which is an added benefit to the farmer, their value was more compared to non-pregnant animals. Apart from these factors, milk yield influenced the animal value as it was directly proportional to the farm income.

The co-efficient of multiple determination (adjusted R square) for the regression equation fitted for the valuation of Murrah graded buffalo was 0.400 indicating 40.00% variation in the price of Murrah graded buffalo which is explained by the chosen variables. Among various variables,

pregnancy and milk yield were found to be positively significant at 1% level. It implied that under *ceterus paribus*, presence of pregnancy increased the value of animal to a tune of ₹ 8,700.13 and each litre of milk yield increased value of Murrah graded buffalo by ₹ 1,852.62. Although the variables on age and calving interval negatively influenced the price of Murrah graded buffalo, they were nonsignificant. The variables on activeness, whirls, body weight, triple wedge, disease tolerance had positive but no significance on the value of Murrah graded buffalo.

The valuation pattern of non-descript buffalo was depicted through the multiple linear regression model as shown in the Table 2. The adjusted R square was 0.570, indicating 57% of variations in price of non-descript buffalo explained by the chosen variables. Among various variables, triple wedge was significant at 5% level, which implied that its presence would increase the price of animal by ₹ 2,769.96. Similar to Murrah graded buffalo, the variable milk yield was significant at 1% level and it is evident that the value of non-descript buffalo increased by ₹ 894.63 / litre of milk yield. In addition, the variable on whirls was statistically significant at 1% level and its presence increased the value of animals by ₹ 5,919.12. The variables on activeness, body weight, age, pregnancy, calving interval and disease tolerance were found to be nonsignificant. The overall dairy buffalo valuation index was also fitted and it explained 40.70% variation through the included variables. The factors like milk yield and pregnancy were significant at 1 and 5% level, respectively, and each unit of the above variables had influenced the value of buffaloes to the tune of ₹ 1,746.81 and ₹ 4,188.62, respectively. On the other hand, the factor on calving interval had significant negative influence on the buffalo value to the tune of ₹ 575.22/year. The variables breed was included for fitting the overall cattle valuation model and was significant at 1% level. The variables like activeness, whirls, body weight, triple wedge, age and disease tolerance were nonsignificant on the regression equation of overall buffalo value. As a whole, valuation index was also estimated for valuation of overall cattle and buffalo. The adjusted R square for the fitted equation was observed to be 0.404 which indicated 40.40% of variations in price of overall cattle and buffalo explained by the chosen variables. Many variables like activeness, whirls, triple wedge, pregnancy and milk yield were highly significant and each unit of the above variables had influenced the value of animals to the tune of ₹ 2,543.45, ₹ 2,462.60, ₹ 2,414.79, ₹ 1,706.37 and ₹ 1,044.27, respectively. In addition, 2 variables namely breed and species were included to fit the overall cattle and buffalo valuation index and the results implied that these variables were significant at 1% level and they had the influence of ₹ 2,178.00 and ₹ 3,462.99, respectively on the cattle and buffalo value. The variables on body weight and disease tolerance were positive and nonsignificant. On the other hand, age and calving interval had negative and nonsignificant influence on the overall value of cattle and buffalo.

The dairy farmers, Veterinary Assistant Surgeons, officials of non-government agencies and institutions like banks and insurance find it difficult to fix the value of dairy cattle and buffaloes. Hence, the formula / index were developed by this study for valuation of dairy cattle may be utilized by the farmers and needy institutions. At the same time, animal owners should be made aware about the factors that are important for fixing the animal value. Banks should provide loans to farmers based on the valuation index developed by this study for purchase of dairy cattle and buffaloes.

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