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EVALUATION OF LINEAR TYPE TRAITS FOR BROWN SWISS CATTLE REARED IN THE RESEARCH FARM OF ATATÜRK UNIVERSITY

Mete YANAR[1] Recep AYDIN[1] Naci TÜZEMEN[1] Feyzi UĞUR[1]

SUMMARY: *Brown Swiss cows reared in the Research Farm of Agricultural College at Atatürk University were scored linearly for 16 type traits. Differences between scorers were significant for some type traits such as chest width, angularity, foot angle, rear leg (side view), rump width, teat placement (side view) and udder depth. Parity had significant effect on stature, rump angle, foot angle, rear legs (rear view), rump width, teat length and udder depth. Regression on age at first calving was insignificant for all the type traits.*

ATATÜRK ÜNİVERSİTESİ ARAŞTIRMA ÇİFTLİĞİNDE YETİŞTİRİLEN ESMER SIĞIRLARIN LİNEAR FORM ÖZELLİKLERİ BAKIMINDAN DEĞERLENDİRİLMESİ

ÖZET: *Bu araştırmada, Atatürk Üniversitesi Ziraat Fakültesi Araştırma Çiftliğinde yetiştirilen Esmer sığırlar 16 adet linear form özelliği bakımından değerlendirilmiştir. Puantörler arasındaki farklar göğüs genişliği, üsten görünüş (açısallık), ayak açısı, arka bacak (yandan görünüm), sağrı genişliği, meme başı yerleşimi (yan görünüş) ve meme derinliği gibi form özelikleri için önemli bulunmuştur. Laktasyon sırasının da cidago yüksekliği, sağrı dikliği, ayak açısı, arka bacaklar (arkadan görünüm), sağrı genişliği, meme başı uzunluğu, meme derinliği üzerine önemli etkileri olmuştur. İlkine buzağılama yaşının incelenen bütün form özellikleri üzerine regresyon etkisi ise önemsiz bulunmuştur.*

INTRODUCTION

Dairymen, extension personnel and researchers have argued importance of type traits involved in selection programmes for a long time. Although, milk yield is still the primary significant trait for selection, most breeders also consider type traits as important for selection purposes. Allaire and Henderson (1967) reported that some of type traits such as fore and rear udder attachments were important in culling decision in second and later lactations. Berger et al. (1973) indicated that phenotypic type score was 0.35 to 2.94 times as important as production phenotype in determining length of herd life.

Type classification programme was first developed and used by Holstein Friesian Association of America in 1929 (White, 1974). Then, it has undergone various changes from a single total score to unified score system composed of such divisions as general appearance,

[1] Department of Animal Science, College of Agriculture, Atatürk University, Erzurum.

dairy character, body capacity and mammary system. Recently, Uniform Functional Type Traits (UFTT) programme was recommended by Ad hoc Committee appointed by the National Association of Animal Breeders. The UFTT (linear system) programme was implemented in 1980 by Ayrshire, Guernsey and Jersey Breed Associations. The Holstein Friesian Association of America implemented it in 1983. The National Association of Animal Breeders proposed scoring 14 traits on a 50-99 point basis, but the 50-99 point basis was later changed to 1-9 point basis. Each trait is scored uniformly from one biological extreme to the other (Thompson et al. 1983).

There are several advantages of the linear system over the unified score system. These are: (1) Linear system is simpler than the previous unified score system, (2) scores cover the biological range, (3) degree rather than desirability is recorded and (4) scoring allows analysis with continuos scale and mix model evaluation, (5) a wide range of numerical scores is used, (6) Traits are scored individually rather than in combination (Norman et al. 1988; Vij et al. 1990).

Researchers in the developed countries have studied the genetic importance of linear type traits and the environmental factors that influence them (Norman et al. 1983; Lucas et al. 1984; Thomas et al. 1985; Schaeffer et al. 1985; Hayes and Mao, 1987; Foster et al, 1988). But little work on this subject has been done in Turkey.

The present study undertaken to determined the linear type scores for various type traits and to investigate the effect of nongenetic factors on the linear type traits in Brown Swiss cattle reared in the Research Farm of Agricultural College at Atatürk University.

MATERIAL AND METHODS

A total of 246 Brown Swiss cows from cattle herd of Research Farm of Agricultural College at Atatürk University were scored linearly for type traits. One of the type traits, stature (height at withers), was determined by using a tape measure. The other type traits were evaluated by two judges The linear type traits evaluated in this study are described in Table 1.

Only the cows in lactation were scored in the afternoon before evening milking. Data regarding with parity, age at first calving, days in milk were obtained from the records maintained at the Department of Animal Science in College of Agriculture at Atatürk University. Days in milk were divided into five stages of lactation that were 1 (<2 months), 2 (2- <4 months), 3 (4- <6 months), 4 (6- <10 months) and 5 (>10 months) as suggested by Vij et al. (1990).

Table 1. Definition of Traits in the Linear Type Appraisal System for Brown Swiss Cattle.

Physical Traits	Scores		
	1	5	9
Stature	Very Small (125 cm & Less)	Intermediate (137 cm)	Very Tall (149 cm & over)
Chest Width	Very Narrow	Intermediate	Very Wide & Strong
Angularity	Very Thick and Coarse	Intermediate	Very Sharp & Angular
Foot Angle (Angle of Front Wall of Hoof to the Horizontal)	Very Low	Intermediate	Very Steep
Rear Legs (Side View)	Very Straight & Posty	Intermediate	Very Sickled
Rear Legs (Rear View)	Very Close Hooks with Severe Toe-out	Moderate Toe-out	Straight
Rump Angle	Pins Much Higher Than Hips	Slight Downward Slope Hips to Pins	Very Low Pins Relative to Hips
Rump Width	Very Narrow	Intermediate	Very Wide
Fore Udder Attachment	Veyr Weak/Loose	Intermediate	Very Strong/Tight
Rear Udder Width	Very Narrow	Intermediate	Very Wide
Rear Udder Height	Very Low	Intermediate	Very High
Teat Placement (Rear View)	Teats on Outside of Udder	Intermediate (Centrally Placed)	Base of Teat Almost Touching
Teat Placement (Side View)	Very Close	Intermediate	Far Apart
Teat Length	Very Short	Intermediate	Very Long
Suspensory Ligament	Negative Cleft & Broken Support	Defined Cleft	Extremely Cleft & Strong Support
Udder Depth	Level With or Below Hock	Above Hock (8 cm)	Very Well above Hock (16 cm Above)

The following statistical model was used to analyse each of 16 type traits.

$Y_{ijkl} = \mu + a_i + b_j + c_k + b\ (X_{ijk} - X) + e_{ijkl}$

Where;

Y_{ijkl} = Individual cow type score,

μ = Overall mean,

a_i = Effect of i th scorer (i = 1, 2),

b_j = Effect of j th parity (j = 1,.....,6),

c_k = Effect of k th stage of lactation (k = 1,.....,5),

b = linear partial regression coefficient on age at first calving,

X_{ijkl} = Effect of age at first calving of the ijkl th cow,

X = Mean age at first calving,

e_{ijkl} = Random error.

The least-squares analysis and Duncan multiple comparison test were carried out by using two statistical package programs (Harvey, 1987 and SAS, 1986).

RESULTS AND DISCUSSION

The results regarding with least-squares analysis and means for type traits are presented in Table 2. The classification of Brown Swiss cows in the Research Farm of Agricultural College on the basis of average score for each traits is given in Table 3.

Effect of Scorer

The differences between two scorers were statistically significant ($P<0.05$) for some traits such as foot angle, rump width and udder depth and highly significant ($P<0.01$) for chest width, angularity, rear legs (side view) and teat placement (side view) (Table 2). Lucas et al.(1984), Schaeffer et al. (1985), Lawstuen et al. (1987) and Vij et al. (1990) also reported significant differences between scorers for most of the form traits. However, in the present study, most of the udder traits for example, fore udder attachment, teat placement (rear view), teat length, suspensory ligament, rear udder width at attachment and rear udder height at attachment were not significantly affected by the scorers.

Effect of Parity

Type traits such as stature, foot angle, rear leg (rear view), rump angle, rump width, teat length and udder depth were significantly influenced by parities. As parities of the animals advanced, scores of the teat length gradually increased but, scores belonging to the udder depth

Table 2. Least Squares Means and Standard Deviations and Results of Multiple Comparison Test for the Type Traits of Brown Swiss Cattle.

		St.	C.W	Ang.	F.A	R.L.S	R.L.R	R.A	R.W	F.U.A	T.P.R	T.P.S	T.L	S.L	U.D	R.U.W.A	R.U.H.A
Scorer																	
Significance		NS	**	**	*	**	NS	NS	*	NS	NS	**	NS	NS	*	NS	NS
1	n=123	1.7±0.10 bc	4.6±0.14bc	4.2±0.19	4.6±0.18 ab	4.3±0.16	4.7±0.15 bc	5.0±0.16 bc	5.5±0.16 bc	5.7±0.17 ab	5.1±0.13 ab	4.3±0.13	5.2±0.12	5.3±0.14	6.2±0.14 a	5.7±0.18	4.9±0.16
2	n=123	1.7±0.10	5.1±0.14	4.9±0.19	5.0±0.18	4.6±0.16	4.5±0.15	5.0±0.16	5.2±0.16	5.6±0.17	5.0±0.13	4.7±0.13	5.2±0.12	5.3±0.14	5.9±0.14	5.6±0.18	4.8±0.16
Parity																	
Significance		**	NS	NS	**	NS	*	*	*	NS	NS	NS	**	NS	**	NS	NS
1	n=94	1.4±0.10c	4.8±0.14	4.7±0.18	5.5±0.17a	4.5±0.16	4.2±0.16b	5.5±0.15ab	4.8±0.15c	5.9±0.17	4.9±0.12	4.3±0.12	4.8±0.12	5.2±0.14	6.6±0.13a	5.9±0.17	4.4±0.15
2	n=84	1.7±0.11bc	4.6±0.14	4.5±0.19	4.5±0.18b	4.8±0.16	5.1±0.15a	5.4±0.16ab	5.3±0.15bc	5.5±0.17	4.7±0.12	4.2±0.12	4.8±0.12a	5.1±0.14	6.5±0.14a	5.5±0.17	4.5±0.16
3	n=20	2.26±0.20a	4.9±0.28	4.9±0.36	4.8±0.34ab	4.4±0.32	5.1±0.29a	5.6±0.31a	5.1±0.31c	5.6±0.34	5.3±0.25	4.5±0.24	4.8±0.23a	5.6±0.27	6.2±0.26a	5.6±0.34	4.7±0.30
4	n=22	1.80±0.19bc	4.8±0.27	4.6±0.35	4.3±0.33b	4.7±0.31	4.2±0.28b	4.9±0.30bc	4.9±0.29c	5.3±0.33	5.1±0.24	4.7±0.24	5.4±0.22b	5.4±0.26	6.3±0.26a	5.5±0.33	4.8±0.30
5	n=18	1.80±0.21ab	4.7±0.29	3.6±0.38	4.1±0.35b	4.8±0.33	4.8±0.30ab	4.3±0.32c	5.8±0.32ab	5.5±0.35	5.1±0.26	4.6±0.25	5.5±0.24b	5.4±0.28	5.4±0.27b	5.5±0.35	5.2±0.32
6	n=8	1.54±0.32bc	5.0±0.44	5.0±0.57	5.4±0.53a	3.4±0.50	4.5±0.45ab	4.4±0.48c	6.0±0.47a	5.8±0.53	5.1±0.38	4.3±0.13	5.7±0.36b	5.0±0.42	5.2±0.41b	5.8±0.53	5.6±0.47
Stage of Lactation																	
Significance		NS	**	NS	NS	NS	NS	NS	*	*	**	NS	NS	NS	NS	NS	NS
1	n=24	1.88±0.19	4.5±0.26c	4.9±0.33	4.5±0.31	4.2±0.29	4.6±0.27	4.7±0.29	4.8±0.28c	5.6±0.31abc	4.5±0.23c	4.3±0.22	5.1±0.21	4.7±0.25	6.2±0.24	5.6±0.31	4.6±0.28
2	n=101	1.64±0.13	4.3±0.15c	4.8±0.19	4.5±0.18	4.2±0.17	4.7±0.15	5.0±0.17	5.4±0.16b	5.4±0.18bc	4.8±0.13bc	4.4±0.13	5.2±0.12	5.3±0.14	5.9±0.14	5.4±0.18	5.1±0.16
3	n=39	1.98±0.80	5.1±0.22ab	4.6±0.29	5.0±0.27	4.4±0.25	4.6±0.23	4.9±0.25	4.9±0.24bc	5.1±0.27c	5.3±0.19a	4.8±0.19	4.9±0.18	5.5±0.21	6.1±0.21	5.1±0.27	5.1±0.24
4	n=65	1.82±0.58	4.7±0.16bc	4.4±0.21	4.5±0.20	4.6±0.19	4.7±0.17	5.1±0.18	5.4±0.18b	5.8±0.20ab	5.2±0.14ab	4.3±0.14	5.2±0.13	5.4±0.16	6.2±0.15	5.9±0.20	4.8±0.18
5	n=17	1.54±0.22	5.5±0.31a	4.2±0.40	4.9±0.37	4.8±0.35	4.5±0.32	5.3±0.34	6.1±0.33a	6.2±0.37a	5.5±0.27a	4.8±0.26	5.5±0.25	5.5±0.29	5.7±0.29	6.2±0.37	4.9±0.33

St.: Stature; C.W. :Chest Width; Ang.: Angularity; F.A: Foot Angle, R. L. S : Rear Legs (Side View), R. L R: Rear Legs (Rear View) , R. A : Rump Angle, R.W. : Rump Width, F.U.A : Fore Udder Attachment, T. P.R. : Teat Placement (Rear View), T. P.S : Teat Placement (Side view), T.L. : Teat Length. S.L. : Suspensory Ligament, U.D. : Udder Depth (Relative to Point of Hock), R. U. W. A : Rear Udder Width at Attachment, R. U. H. A : Rear Udder Height at Attachment. NS: Nonsignificant, * :P<0.05, **:P<0.01

gradually decreased (Table 2). There was also an increasing trend in the rump width. The results could be attributed to the growth of the animal, since animal advances in age and along with it in parity. Insignificant effects of the parity on the chest width, angularity, rear leg (side view), fore udder attachment, teat placement (rear and side view), suspensory ligament, rear udder width and rear udder height at attachment were observed in this study. The results were in agreement with findings of Vij et al. (1990) and Thompson et al. (1983). However, Schaeffer et al. (1985), Boldman and Famula (1985), Hayes and Mao (1987) reported significant effect of parity on all type traits.

Table 3. Classification of Brown Swiss Herd of Research Farm of Agricultural Collage at Atatürk University.

Trait	Average Score	Classification
Stature	1.7±0.10	Small
Chest Width	4.8±0.13	Intermadiate width
Angularity	4.6±0.16	Intermediate angularity
Foot Angle	4.7-0.15	Intermediate angle (40°-50°)
Rear Legs (Side View)	4.5±0.14	Intermediate Sickled
Rear Legs (Rear Wiew)	4.6±0.13	Moderate toe-out
Rump Agnle	5.0±0.14	Moderate slope from hocks to pins
Rump Width	5.4±0.14	Intermediate width of the pelvic area
Fore Udder Attachment	5.6±0.15	Intermediate (neither strong not loose)
Rear Udder Width (at Attachment)	5.4±0.14	Intermediate width
Rear Udder Height (at Attachment)	4.9±0.13	Intermediate height
Teat Placement (Rear View)	5.1±0.11	Centrally placed
Teat Placement (Side View)	4.5±0.11	Intermediate
Teat Length	5.2±0.10	Intermediate length
Suspensory Ligament	5.3±0.12	Defined cleft
Udder Depth	6.0±0.11	Slightly above bock

Stage of Lactation

The form traits of chest width, teat placement (rear view), rump width and fore udder attachment were significantly affected by the stage of lactation (Table 2). Lucas et al. (1984) also reported significant effects of stage of lactation on fore udder attachment, udder depth, and

udder height but stage of lactation did not significantly influence other traits. Scores for teat placement increased as the stage of lactation advanced except for fourth stage. Similar result was determined by Vij et al. (1990). Thompson et al. (1983) reported that stage of lactation had a significant effect on the scores for all traits while udder traits were affected more than other traits.

Regression of Type Traits on Age at First Calving

Regression on age at first calving was not significant for all the type traits. The result indicated that anatomical and physiological growth of Brown Swiss cattle raised in the Research Farm of Agricultural College was completed before the cows initiated milk production.

Correlations Among Type Traits and First Lactation 305 Days Milk Yield

Phenotypic correlations among the type traits are tabulated and presented in Table 4. Most of the correlations were low to medium. Similar findings were reported by Norman et al. (1983), Vij et al. (1990). Stature had significant ($P<0.05$) correlation with rump width ($r = 0.221$). Also, some statistically significant ($P<0.05$) correlations between rear udder width and rump width ($r = 0.376$); rear udder width and rear udder height ($r = 0.507$); udder depth and rear udder width ($r = -0.253$); udder depth and rear udder height ($r = -0.342$); udder depth and teat placement (side view) ($r = -0.247$) were calculated.

Results of the study suggest that there is a variation between scorers and a need to train the people in this field. Also parity and stage of lactation have significant influences on the some of the type traits.

Table 4. Phenotypic Correlations Among Type Traits and Between Type Traits and First Lactation Milk Yield of Brown Swiss Cattle.

Type Traits		Sature	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Chest Width	(1)	-0.029															
Angularity	(2)	-0.022	-0.134														
Foot Angle	(3)	-0.027	0.047	0.245													
Rear Legs (Side View)	(4)	-0.161	0.133	-0.004	-0.174												
Rear Legs (Rear View)	(5)	0.158	-0.073	-0.208	-0.216	0.094											
Rump Angle	(6)	-0.135	0.043	0.081	0.165	0.084	-0.006										
Rump Width	(7)	0.221	0.068	-0.176	-0.026	-0.032	0.095	0.124									
Fore Udder Attachment	(8)	0.067	-0.015	0.106	0.077	-0.062	-0.135	-0.064	0.097								
Rear Udder Width at Attachment	(9)	0.057	0.143	-0.145	-0.072	0.079	0.244	0.061	0.376	0.116							
Rear Udder Height at Attachment	(10)	-0.022	0.091	-0.178	-0.043	0.073	0.106	-0.174	0.211	-0.021	0.507						
Teat Placement (Rear View)	(11)	-0.089	0.034	0.053	0.014	-0.093	-0.054	-0.024	0.017	-0.013	0.122	0.064					
Teat Placement (Side View)	(12)	0.035	-0.040	-0.042	0.002	0.030	-0.029	-0.028	-0.014	-0.206	-0.089	0.185	0.127				
Teat Length	(13)	0.007	0.054	-0.006	0.000	0.003	-0.006	-0.120	0.236	0.190	0.167	0.232	0.043	0.001			
Suspensory Ligament	(14)	-0.072	-0.04	-0.008	-0.034	-0.085	0.041	-0.008	-0.048	-0.139	-0.023	-0.003	0.252	0.117	-0.067		
Udder Depth	(15)	-0.039	-0.067	0.031	0.170	-0.092	-0.050	0.151	-0.123	0.012	-0.253	-0.342	-0.072	-0.247	-0.122	-0.009	
First Lactation 305 Days Milk Yield		0.116	0.026	-0.115	-0.052	0.020	0.055	-0.060	0.133	0.003	0.100	0.119	0.128	0.069	0.089	0.094	-0.128

r ≥ 0.0.18 for P<0.05, r≥ 0.25 for P<0.01

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