The Possibility of Simulation Program For Selection of Beef Cattle Weaning Weight at Ranch Operation

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ABSTRACT: The study was conducted to investigate the possibility of using simulation program of selection for weaning weight and to improve productivity of beef cattle. The production and reproduction data of Brahman Cross (BX) cattle during three yearwere collected for three year from Bila River Ranch (BRR), South Sulawesi, and PT Kariyana Gita Utama (KGU) Sukabumi. The data were analyzed by using a simulation selection program for the weaning weight. The results indicated that selection response was 0.58 kg/year, the average of weaning gain was 1.63 kg/year (2.01%) for the parents and 2.28 kg/year (0.32%) for the offsprings, and the difference of weaning weight between the selected population and control was 14.41% in the 17th generation of selection.It was concluded that simulation program could be used in analyzing weaning weight selection, and illustrated the genetic and phenotypicimprovemnent, fastly and cheaply.

Key Words: Beef Cattle, Simulation Selection, Weaning Weight, Selection Response.

Introduction

The breeding program for improving productivity or production development of parent-offspring beef cattle at a ranch must be emphasized on production and reproduction traits, which have economical values, namely calf crop, weaning weight, yearling weight and slaughter weight. Besides, the selection and or breeding management of beef cattle takes long time and high cost, so the problems can be solved by theorical approach in animal breeding, using the data of field record and observation. The data were then analysed by computer simulation program.

The study was done to investigate the possibility of utilizing simulation program for improving the genetic quality of beef cattle weaning weight, using a simulation selection of weaning weight.

Material and Method

Brahman cross (BX) beef cattle at Bila River Ranch, PT Berdikari United Livestock Pare-pare, South Sulawesi and at the feedlot of PT Kariyana Gita Utama, Cicurug, Sukabumi, were used in this study.

The data used in this study were the production and reproduction records, and three-year pedigree records.

The genetic parameters used for the initial simulated population were the heritability values for the weaning weight, yearling weight, and slaughter weight, and were 0.34, 0.48 and 0.58, respectively. The genetic correlation between the weaning weight and slaughter weight was 0.52, and the repeatability of the weaning weight was 0.42. Furthermore, at year seven, the genetic parameters were calculated, and used in year 8 to year 12 of simulation selection in control and selection population. At year 12 the genetic parameters of control and selection population were calculated, and then the parameters were used in simulation selection from year 13 to year 17 (figure 1 and 2). To asses the validity of the model used in this study the average weaning weight of the field data were compared with the data obtained from simulation by t-test, and the selected weaning weight were calculated its accurate range (Steel and Torrie, 1984).

Results and Discussion

Validation model. An inspecting approach methods was used in validity the model by comparing the field data as an input data with simulation data (Law and Kelton, 1991).

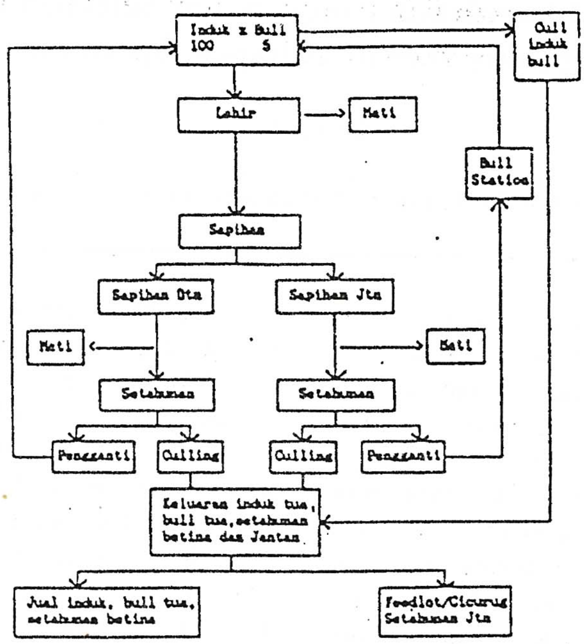

Figure 1. Diagram of production simulation of Brahman cross (BX) cattle.

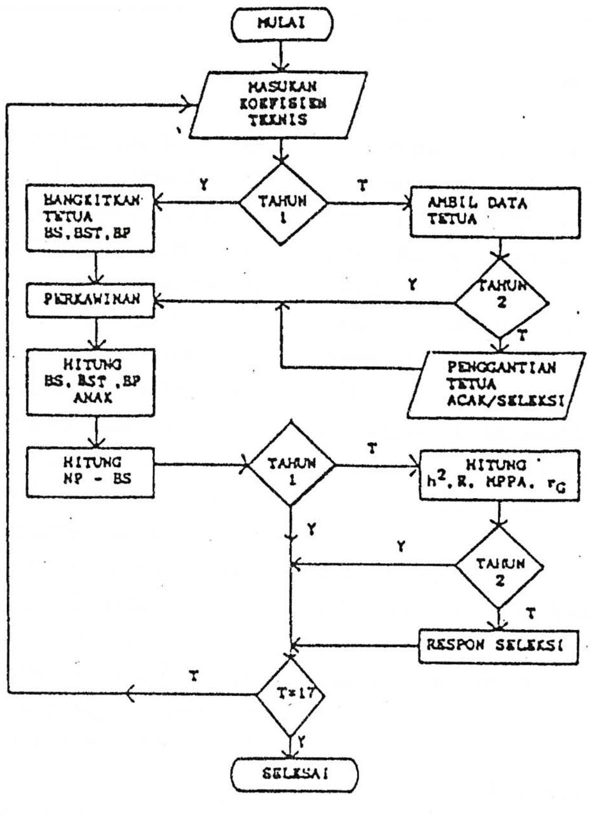

Figure 2. Flowchart diagram of parent-offspring production of BX.

In the first year, the field data and simulation data were significantly different (P<0.01), while in the year 2 and 3 there was no significant difference (Table 1 and Figure 3). The differences in the first year between the field data and simulation data ware due to the the old management, especially irregular weaning; where the weaning age was relatively older compared to the weaning age at year 2 and year 3. Besides that irregular replacement of dam and bull, and improper selection of cattle replacement and pasture management. At the year 2 there was reorganization of the BRR, management and adopting the up to date managerial aspect.

Table 1. Weaning weight of the field and simulation data

Year	Field data (kg)	Simulation data (kg)
1	107.24+28.07a	101.58+10.40b
2	101.75+17.45a	101.41+10.31a
3	102.85+14.71a	101.29+ 7.89a

a,bMean on the same row with different superscripts differ (P<0.01).

According to the statistical analysis the simulation model used in this study was considered valid, and could be used in the analysi. Figure 4 sohwed that the weaning weight in simulated from year 1 to 3 was in the range of one standard above and below the mean of deviation the weaning weight obtained from the field data.

Genetic changes of weaning weight. Selection on weaning weight was practiced to improved the weaning weight directly. The genetic change of weaning weight was measured as the direct respons to selection and Table 2 showed that genetic change of weaning weight based on the year and paddock were variedand showed irregular changes. The average of genetic changes of weaning weight of all years at paddock I, II, III, and IV were 0.59, 0.57, 0,57 and 0.60 with overall means of 0.58 kg (Table 2).

The genetic variability and irregularity of changes of weaning weight. Were due to various causes, namely the differences of generation intervals or means of parent ages when they were valving. This was due to the difference of dam culling percentage, so that the age composition in each year and paddock would also differ. Besides that, the selection was practiced on each paddock with different selection intensity for each year, and the changes of genetic parameter in 5 years interval (Table 2), these would cause the irregularity means of weaning weight inter and intra paddock (Barker et al., 1975 and Pane, 1988).

The different selection intensity for each paddock and for each year was due to the number of male and female calves per paddock and per year was different; while the number of animal substitution was constant, namely 20 heads for the female and 5 heads for the male. If the calf crop was getting higher and the number of the male and female calves used as a substitution was constant the

Table 2.Selection response (Ry) of weaning weight per year

Year	Paddock				Means	Standard Deviation
	I	II	III	IV		
6	0.73	0.74	0.53	0.67	0.67	0.10
7	0.58	0.56	0.48	0.55	0.54	0.04
8	0.55	0.47	0.46	0.46	0.49	0.04
9	0.48	0.53	0.52	0.44	0.48	0.04
10	0.54	0.49	0.50	0.63	0.54	0.06
11	0.70	0.53	0.43	0.51	0.54	0.11
12	0.44	0.50	0.69	0.49	0.53	0.11
13	0.57	0.49	0.55	0.98	0.65	0.22
14	0.52	0.71	0.60	0.65	0.62	0.08
15	0.59	0.54	0.92	0.60	0.66	0.17
16	0.77	0.74	0.57	0.68	0.69	0.09
17	0.61	0.56	0.53	0.55	0.56	0.03
Means	0.59	0.57	0.57	0.60	0.58	0.09

selection intensity was getting higher. Thus, the increasing number of calf crop indicated that fertility had increased. This would increased productivity, and also increased the genetic improvement, so management of reproduction to increase the fertility was an important part of cattle breeding program (James and Pattie, 1978). Besides that, the high reproduction rates made shorter generation interval.

The genetic change weaning weight was illustrated in Figure 5. The selection response of the weaning weight decreased from year 6 to 12, and increased in year 13 and was nearly flat up to year 17. Probably this was due to different heritability values used in this study, namely 0.34 for year 6 and 7, 0.26 for year 8 to 12 and 0.34 for year 13 to 17. The differences of standard deviation used in calculating the selection response, especially for year 6 and year 7 also affected the selection response.

The lower heritability value of the weaning weight used in calculating the selection response from year 8 to 12 was due to morestable population was achieved. In this population the animals were uniform with low variation so the obtained heritability was relatively low.

The heritability values used from year 13 to 17 were from the data of year 8 to 12 , in which the animal population was stable and varied, so the heritability was relatively high, and it caused the selection response for year 13 to 17 was relatively high.

All of the changes and genetic improvement, resulted the positive values, thus, the individu with the high weaning weight could be selected as a replacement and resulted the genetic improvement, and could be used as one of the selection criteria (Murrai and Enwistle, 1978). Beside that, selection based on high weaning weight also reflexted dam production, the dam maternal ability and a good pre-weaning, and the weaning weight was very responsive to selection due to high heritability og this trait (Taylor, 1984).

The changes of the weaning weight. The weaning weight after 10 years of selection resulted the increase of the weaning weight of the parent and the offspring population (Table 4, 5, 6, 7 and figure 6). The average of weaning gain per year for all paddock was 0.01% for the parent, and 1.74% for the offspring (Table 8). The weaning gain of the parent and offspring were the results of the direct effected of the positive selection of the weaning weight. Besides, the selection of the weaning weight also indirectly increased the yearling weight and slaughter weight.

The difference of the weaning weight between the selection and control cattle in year 17 was 14.41%, In Australia, selection growth up to yearling in Angus beef cattle for 14 years could increased the weaning weight and yearling weight with the average of 0.72% and 0.84%, respectively (Parneel, 1989). It also showed that the high weaning weight resulted the high yearling weight, the earlier puberty ages, and 4% higher calf crop in selected popultion than the control population. Therefore, the selection of the weaning weight also indirectly increased the reproduction rates of beef cattle.

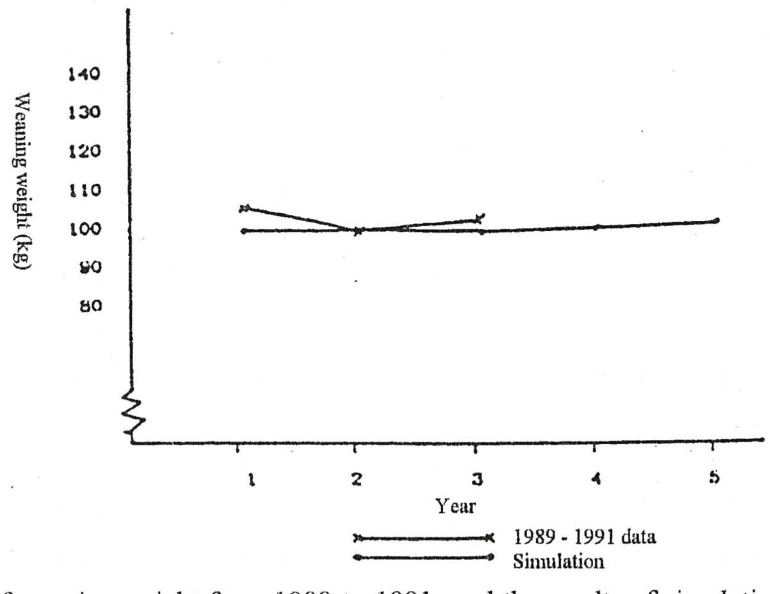

Figure 3. Curve of weaning weight from 1989 to 1991 and the results of simulation from 1 st year to 5th year.

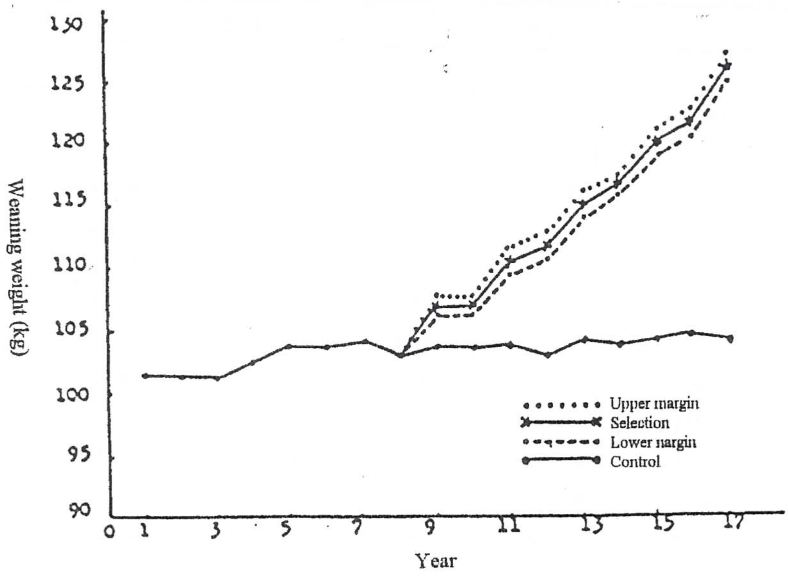

Figure 4. Curve of average of weaning weight of control population, selection and reliable intervals.

Table 3. Genetic parameters used in the simulation

Year	Heritability			Genetic Correlation		Repeatability of weaning wg.
	W	Y	Sl	WY	WS	
1- 7	0.34	0.48	0.58	0.55	0.52	0.42
8-12C	0.26	0.19	0.25	0.64	0.79	0.22
13-17C	0.38	0.17	0.40	0.42	0.15	0.22
8-12S	0.26	0.19	0.25	0.64	0.79	0.22
13-17S	0.34	0.52	0.48	0.67	0.62	0.23

W = weaning weight
Y = yearling weight
Sl = slaughter-weight
WY = weaning weight and yearling weight
WS = weaning weight and slaugter weight
C = controle
S = selection

In the control population during 17 years, the weaning weight of parent and offspring also increased (Table 4, 5 and figure 5). The weaning gain of the parent population and offspring were 2.03 and 2.04 kg, respectively, probably it was due to the yearly culling of dam in the population. The number of dam culled per year was 20% of dam population with the criterias as followed : (1) death dam, (2) dams over 7.5 and 6.5 years old, (3) no calving in two successive years, and (4) low productivity. According to these cases, the dams used in breeding were relatively high productivity, so that the offsprings had the higher weaning weight relative to the parent population. Besides, the weaning weight also had high genetic correlation with the yearling weight and slaughter weight. As a result of the increasing of the weaning weight will also indirectly increased the yearling weight and slaughter-weight (Warwick et. al., 1983).

Table 4. The average of weaning-weight of control cattle (kg)

	Paddock I		Paddock II		Paddock III		Paddock IV	
Year	P	O	P	O	P	O	P	O
1	100.59	99.72	101.67	104.31	98.68	99.44	101.36	105.64
2	100.58	97.69	101.67	104.13	98.60	98.02	101.36	105.66
3	100.52	104.37	101.18	97.93	98.90	100.21	102.43	102.61
4	100.88	104.21	102.13	104.02	99.18	99.42	103.18	102.37
5	101.07	105.98	101.35	103.09	99.14	100.75	102.66	105.28
6	101.65	105.93	101.72	102.34	99.43	102.10	102.52	103.12
7	102.39	103.41	101.62	103.44	98.98	102.84	103.06	106.60
8	102.67	104.83	100.82	99.38	98.08	101.55	102.14	104.87
9	103.90	106.99	100.23	101.27	100.15	102.17	102.57	103.78
10	104.14	105.61	100.37	103.22	100.78	101.43	103.04	103.17
11	104.30	105.91	100.49	101.10	100.53	102.31	103.47	105.66
12	104.00	104.28	100.28	100.28	101.09	102.27	103.51	103.17
13	104.28	106.60	100.38	101.63	101.29	102.43	103.87	105.94
14	103.98	106.06	100.10	101.33	101.29	102.43	103.87	105.45
15	100.49	101.02	101.71	103.51	101.71	103.51	103.22	104.67
16	104.35	105.12	100.72	102.40	101.68	104.97	103.16	105.29
17	104.82	106.34	100.27	104.41	101.78	103.55	103.53	104.42

P = parent
O = offspring

Table 5. The average of weaning-weight of control cattle for all paddock (kg)

Year	Weaning weight	
	Parent	Offspring
1	100.57	101.53
2	100.57	101.57
3	100.76	101.28
4	101.34	102.50
5	101.76	101.28
6	101.33	103.62
7	101.51	104.07
8	101.13	102.66
9	101.71	103.56
10	102.08	103.36
11	102.20	103.75
12	102.22	102.75
13	102.46	104.00
14	102.11	103.59
15	101.78	103.95
16	102.48	104.45
17	102.60	103.93

Table 6. The average of weaning weight of selection trial (kg)

Year	Paddock I		Paddock II		Paddock III		Paddock IV	
	P	O	P	O	P	O	P	O
8	102.67	105.66	100.82	100.77	98.88	100.49	102.14	104.46
9	104.57	109.08	101.44	104.98	101.43	107.00	103.04	106.58
10	106.14	110.85	102.22	103.37	102.69	105.24	109.29	107.50
11	107.08	112.48	103.72	106.56	104.57	110.28	106.38	111.69
12	108.05	112.52	104.20	106.72	106.41	113.50	108.40	113.16
13	110.79	116.66	106.57	111.21	108.37	114.57	110.63	116.62
14	112.23	117.79	107.91	113.39	111.05	116.52	112.16	117.65
15	113.72	118.98	109.25	115.99	113.85	120.65	114.89	123.51
16	115.85	121.53	111.43	117.64	115.80	123.69	116.28	122.07
17	117.81	124.33	113.93	123.44	118.51	128.47	119.26	126.54

P = parent
O = offspring

Table 7. The average weaning weight of parent and offspring of all paddock (kg).

Year	Weaning		Yearling		Slaughtering	
	Parent	Offspring	Parent	Offspring	Parent	Offspring
8	101.13	102.90	290.30	293.92	423.15	426.00
9	102.62	106.91	291.34	296.05	421.15	428.52
10	103.83	106.74	291.73	295.69	421.98	428.07
11	105.44	110.25	292.73	295.69	422.95	429.89
12	106.77	111.47	292.71	297.25	423.85	430.30
13	109.09	114.85	293.37	299.59	424.60	432.61
14	110.84	116.34	293.89	300.21	425.42	432.61
15	112.93	119.76	295.00	302.22	427.10	435.48
16	114.84	121.28	296.08	305.03	427.75	435.25
17	117.38	125.70	297.61	305.68	429.40	437.41

Table 8. The average weaning-gains (%) of selection trial

Year	% of weaning- gains	
	Parent	Offspring
1	1.26	1.69
2	1.01	1.61
3	1.64	2.08
4	1.31	1.56

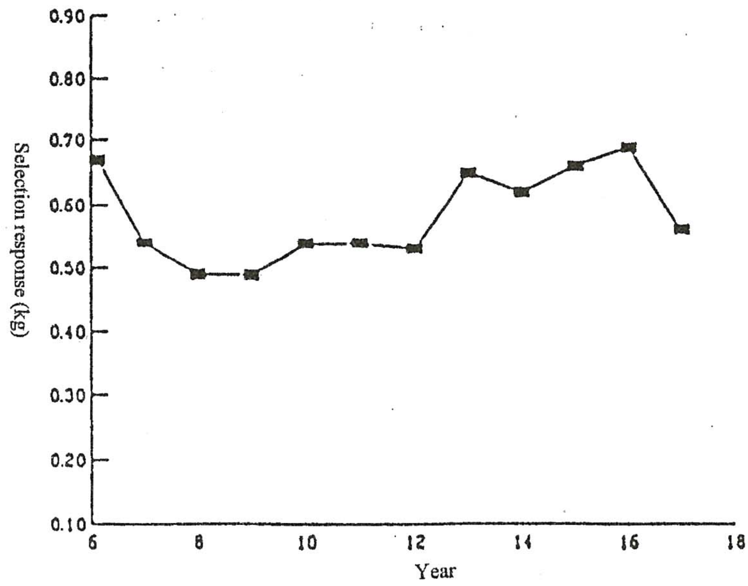

Figure 5. Curve of selection response of weaning weight.

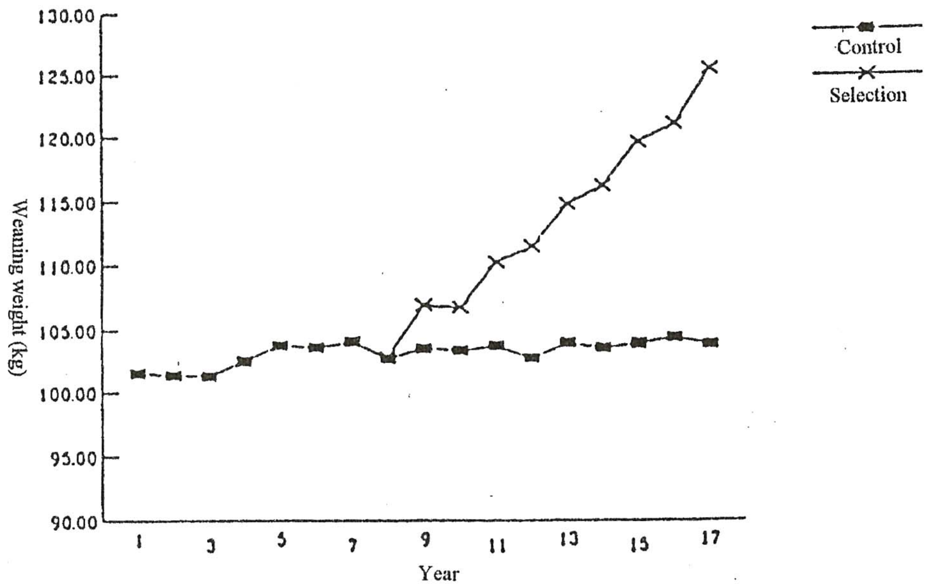

Figure 6. Curve of the average of weaing weight.

Conclusions

The weaning weight selection of Brahman cross (BX) beef cattle at ranch in 10 years increased directly the genetic quality of weaning weight directly with the average of genetic improvement of 0.58 kg.

The weaning weight in an economical trait in beef cattle or Brahman cross (BX) and can be used as selection criteria, to increase the parent-offspring production at ranch, and could increase the weaning weight of 2.28 kg during 10 years.

The simulation and computer program could be used as a tools in experiment and analysis of selection on weaning weight of Brahman cross (BX) cattle at ranch. Besides, the program could be used in estimating the genetic improvement correctly and cheaply, and can be used as an input in decision making of ranching management.

Suggestions

The animal scientists commonly and especially the breeding scientists could cooperate with programers in making the simulation program to be used in research analysis, estimating and illustrating the genetic improvement and animal phenotypes correctly and cheaply on training and planning the breeding programs.

In beef cattle ranching operation, besides to increase the productivity through the quantity and quality of cattle, it should be integrated with the animal feedlot, abattoir operation, and animal products processing and marketing of the animal and animal products in order to obtain optimal profits.

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