

A NOTE ON CROSSBREEDING AT JABALPUR TO EVOLVE A DAIRY BREED OF CATTLE UNDER ALL-INDIA COORDINATED RESEARCH PROJECT ON CATTLE

EINE NOTE UEBER ZUCHT-KREUZUNG IN JABALPUR FUEER ENTWICKLUNG EINER MOLKEREI ZUCHT UNTER DEM PROJEKT "ALL-INDIA COORDINATED RESEARCH PROJECT ON CATTLE"

H.K.B. PAREKH *

INDIA

It is well recognised by animal breeders in the country that for increasing milk production of the country, so as to make available minimum requirement of animal protein in the form of milk for every person, the crossbreeding is the only answer. Once the country achieves the minimum requirement, the future increase in milk will depend upon the increase in human population which is about 2 to 2.5% per year. This 2.0 to 2.5% increase per year in milk production can easily be made by bringing selection pressure in crossbred population. With this scientific and socio-economic background, Indian Council of Agricultural Research (ICAR), New Delhi, launched a world's largest crossbreeding experiment in cattle, ever taken by any country so far, under the banner of 'All-India Coordinated Research Project on Cattle' from 1970. The objective of the project is to evolve a commercial dairy breed of cattle by crossing the three different indigenous breeds (Hariana, Gir and Ongole) with exotic frozen semen at 6 different places in the country which represented the country's different agro-climatic conditions. It was aimed to evolve a commercial dairy breed of cattle suitable to the area with an average of 3200 kg of milk per animal in a lactation of 305 days with a minimum of 3.5% fat test. Out of the six units, Jabalpur is one of them, which represents central zone. The cattle breeding farm is located at Livestock Farm of Jawaharlal Nehru Agricultural University (JNKVV).

In addition to above objectives, this project aims to answer the following genetic questions :-

1. Which of the exotic breed is suitable for the area ?
2. Which of the exotic breed to be used to achieve the objectives ?
3. Which of the 3-breed combination will be suitable ?
4. Whether 3-breed cross with 75% exotic inheritance will give additional advantage over halfbreeds ?
5. Whether to develop breed from halfbred interse or 3/4th-breed interse ?

* All-India Coordinated Research Project on Cattle Breeding, Livestock Farm, J.N. Agricultural University, Jabalpur-482 004 (M.P.), India.

TABLE 1
Round of mating to generate halfbreds of 1st generation

Round of mating	H	J	Total
First	233	80	313
Second	140	93	233
Third	91	34	125
Fourth	44	9	55
Total	508	216	726
No. of calves born	462	210	672
% of crop	90	96	92

FIGURE 1 CLIMOGRAPH OF JABALPUR FOR THE PERIOD 1973-77

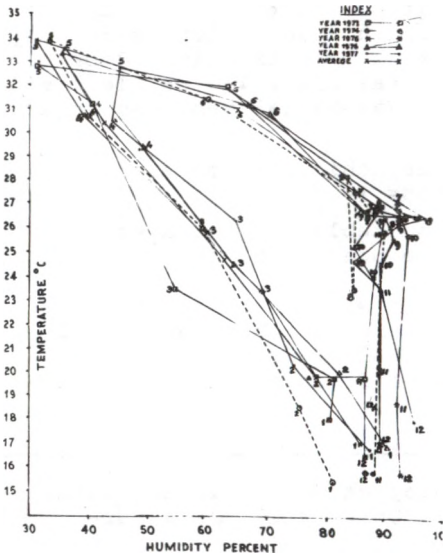
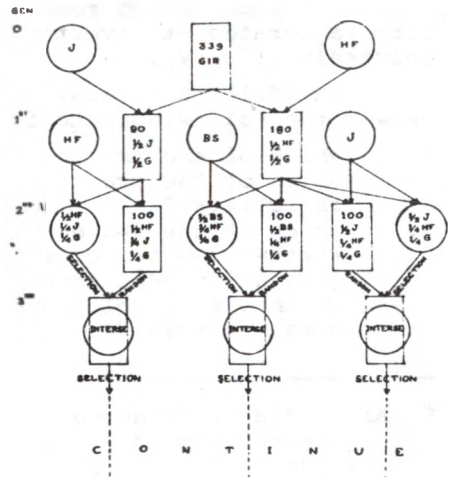


FIGURE 2 BREEDING PLAN AND NUMBER OF INDIVIDUALS FOR EACH BREED GROUP AT A.I.C.R. PROJECT (CATTLE) JABALPUR

O = MALE, □ = FEMALE, HF = HOLSTEIN FRIESIAN, G = GIR, J = JERSEY, B = BROWN SWISS, GEN = GENERATION



MATERIAL AND METHODS

Location and Climate : J.N. Agricultural University Livestock Farm is located on National Highway No.7 at Jabalpur-Katni road about 8 km from the Jabalpur town.

The rains at Jabalpur are spread over 4 months i.e., from June to September. The average rainfall during a decade was 1250 to 1500 mm with minimum of 631 mm and maximum of 2147 mm in a year. The summer is hot and dry and is extended to four months i.e., March to June. The maximum temperature during 10 years ranged from 31°C to ~~22~~^{42.5}°C. While winters are also extremes extending over 4 months i.e., October to February with minimum temperature range of 6 to 19°C during December. The humidity percentage at Jabalpur ranges about 70% for 8-9 months and above 80% for 3-4 months. The climograph for the five years is depicted in Fig.1.

Foundation Stock and Mating Plan : A herd of 325 foundation Gir (G) cows were purchased randomly during 1971-72 as heifers or as calf on foot which were bred to 16 Holstein (H) and 12 Jersey (J) sires to produce 180, 1/2H1/2G and 90, 1/2J1/2G breedable females. The sires selected had a potential over 5000 kg for H and 4000 kg for J. The details of mating are presented in Table 1.

It is to note that to get equal number of females to replace the foundation, 4 mating rounds has to be made as the fertility rate was slightly low in Gir cows. It was aimed in the project to get only halfbreds with minimum of 6 females from each sire. The details of breeding plan under operation is shown in Fig.2.

For second generation, the 1/2H1/2G were mated to another set of H, J and Brown Swiss (BS) sires and the 1/2J1/2G was only mated to another set of H sires so as to generate 100 females in each 3-breed cross with 75% exotic inheritance coming from two exotic breed.

The unit has entered in 3rd generation where interse mating in each second generation breed group is being practiced. The sequential selection of sires in each breed group is ~~practised~~ based on sire index using 100 days dam's production deviated to its contemporaries (+2 months) and the P.D. of sires used. Twelve bulls in each genetic group are being mated to 25 females each so as to have a set of four bulls to be mated in each cycle.

The breeding plan has now been modified by introducing 1/2H1/2G interse mating so as to have a contemporary interse of three-breed cross of second generation. The 1/2J1/2G crosses are being eliminated from the unit as these halfbreds cannot achieve the objectives. The discriminant function analysis is being done to take further decision on combining three-breed crosses.

RESULTS AND DISCUSSION

Births and sex ratio : Total 348 male and 320 female crossbreds were born in the first generation which gave a sex ratio of 1.09. It was high (1.15) for Holstein crosses. In second generation,

TABLE 2

Results of average body weight and other measurements at different age intervals, along with their standard error

Age in months	No.	Body weights	Body length	Height at chest	Heart girth
1/2H1/2G					
0	214	23.6±0.30	61.9±0.47	66.2±0.50	65.9±0.50
3	203	57.4±0.68	81.8±0.52	82.5±0.52	91.3±0.65
6	203	98.4±1.36	97.8±0.54	94.6±0.43	111.0±0.53
12	198	163.7±1.93	113.7±0.41	107.2±0.73	130.9±0.57
18	191	232.3±2.45	125.4±0.40	117.9±0.54	145.6±0.68
24	177	288.3±2.60	134.9±0.64	124.5±0.31	157.4±0.67

1/2J1/2G					
0	100	19.7±0.32	60.7±0.35	64.6±0.30	64.2±0.29
3	94	49.6±1.01	80.1±0.54	80.7±0.39	88.7±0.58
6	90	86.8±1.79	95.7±0.64	92.0±0.50	108.6±0.79
12	93	142.5±3.25	109.6±0.82	103.3±1.08	126.9±0.87
18	91	210.0±3.79	122.4±0.87	113.4±0.46	140.4±1.46
24	88	262.3±3.82	132.7±0.78	121.1±0.46	152.1±0.76

1/2J1/4H1/4G					
0	104	22.2±0.37	62.0±0.49	66.1±0.39	66.5±0.35
3	76	43.1±1.30	77.7±0.76	80.0±0.48	85.7±0.82
6	66	87.0±1.69	90.0±0.89	89.1±0.71	100.8±1.03
12	46	153.7±3.23	108.1±1.49	103.3±0.77	120.1±1.35
18	39	218.3±4.00	121.6±1.08	112.6±0.70	135.7±0.99
24	23	268.0±7.22	131.8±1.48	121.2±1.09	147.3±1.35

1/2H1/4J1/4G					
0	105	22.7±0.35	62.0±0.46	66.6±0.73	67.2±0.4
3	86	43.5±1.31	77.4±1.05	80.2±0.5	86.3±0.87
6	72	85.8±1.70	90.0±0.88	90.2±0.62	102.6±0.94
12	56	155.2±3.33	107.9±1.32	104.5±0.88	121.6±1.42
18	41	229.7±4.08	121.5±1.44	115.5±0.96	137.3±1.37
24	31	286.9±4.83	133.6±1.30	122.9±0.85	148.6±1.31

1/2BS1/4H1/4G					
0	98	27.7±0.45	64.6±0.6	70.0±0.37	70.0±0.41
3	70	45.7±1.32	78.8±0.77	81.9±0.55	86.9±0.93
6	56	85.1±1.83	89.5±0.95	90.3±0.63	100.1±1.06
12	50	156.9±4.02	107.2±1.25	103.4±0.75	118.7±1.08
18	36	209.5±5.45	119.2±1.29	113.1±0.91	132.6±1.45
24	23	275.3±5.35	131.7±1.25	122.0±1.01	147.2±1.61

total 292 males and 279 females were born having exotic inheritance of 75%. The sex ratio was 1.05.

Growth Performance : The average body weights and measurements like heart girth (HG), wither height (WH) and body length (BL), taken at 0, 3, 6, 9, 12 and 18 months of age are presented in Table 2 for different breed groups. The highest birth weight recorded was in 1/2BS1/4H1/4G (27.7±0.45) and the lowest in 1/2J1/2G (19.7±0.32). These weights when compared with Gir breed (20.3±0.3 kg; Bhat *et al.*, 1981) were 16.6% higher for 1/2H1/2G (232.3±2.45) and 3% lower for 1/2J1/2G. The per cent increase in body weight at 18 months over Gir (203.5±2.42; Bhat *et al.*, 1981) was 14% for 1/2H1/2G and 3% for 1/2J1/2G. At 18 months, in 3-breed crosses, the highest weight (229.7±4.08) recorded was in 1/2H1/4J1/4G and minimum (209.5±5.45) in 1/2BS1/4H1/4G and 1/2J1/4H1/4G (218.3±4.00). No superiority of 1/2H1/4J1/4G over 1/2H1/2G was recorded. However, 1/2J1/4H1/4G showed superiority over 1/2J1/2G by 12.7% and 5.6% and 2.9%, respectively at 0, 12 and 18 months of age. The 1/2BS1/4G1/4G body weights were more by 15% over 1/2H1/2G but were lower at 12 months and 18 months of age by 14% and 7.6%, respectively.

The per day growth rate observed at different age intervals for different breed groups are presented in Table 3.

Reproductive Performance : The reproductive performance of different crosses are presented in Table 4. The lowest age at calving was in 1/2H1/4J1/4G (974 days) with maximum in 1/2BS1/4H1/4G (1101.3±33.1). The lowest age at sexual maturity recorded was 565 days in 1/2J1/2G with a maximum of 727 days in 1/2BS1/4H1/4G. The per cent superiority for age at sexual maturity over Gir (1024 days) was by -40% for 1/2H1/2G and -45% for 1/2J1/2G and for age at calving over Gir (1422 days) it was -29% for 1/2H1/2G and -30% for 1/2J1/2G.

No advantage of three-breed crosses over half-bred was recorded for age at first calving. However, for age at first heat 1/2J1/4H1/4G showed superiority over 1/2H1 only.

Reproductive Health : The details of reproductive health of different crossbreds are presented in Table 5, which includes the per cent observation over a period from 1975 to 1980. The low per cent of abortion recorded were in 1/2J1/2G (0.7%) calculated over number of declared pregnancies. The still births percentage was low in 1/2H1/2G. Similar superiority of 1/2H1/2G for per cent retention of placenta (7.2) and per cent mastitis (9.8) cases were recorded.

Production Performance : The production performance of different crosses are presented in Table 6. The highest production during first lactation for 305 days was in 1/2H1/2G. However, the 305 days milking average was highest for 1/2BS1/4H1/4G. The third lactation 300 days yield was maximum for 1/2H1/2G (2912±82.0). The lactation yield for 1/2H1/2G was 2383 and 3126 lits for 1st and 2nd lactation which was higher over Gir (535 lits and 756 lits, respectively for 1st and 3rd lactation) at this unit, by 344% and 301%, respectively. The similar superiority over Gir by 1/2J1/2G was 244% and 224%, respectively, while the complete lactation performance for 1/2J1/2G was 1846 lits and 2452 lits.

TABLE 3
Growth rate in gm/day

Age group	1/2H1/2G	1/2J1/2G	1/2J1/4H1/4G	1/2H1/4J1/4G	1/2BS1/4H1/4G
0-3 months	375.0	310.2	231.5	231.21	200.00
3-6 months	456.0	436.0	488.2	469.6	438.2
6-12 months	362.8	309.6	370.7	388.9	398.6
12-18 months	380.8	374.5	358.4	413.8	292.6
18-12 months	311.2	290.8	276.3	316.7	365.4

TABLE 4
Reproductive performance of halfbreds and three-fourth breds

Breed group	Age at maturity		Age at first calving		Gestation period		Service period		Calving interval	
	n	x±s.e.	n	x±s.e.	n	x±s.e.	n	x±s.e.	n	x±s.e.
1/2H1/2G	165	593.7±9.4	161	1008.9±12.3	446	279.1±0.5	359	147.3±4.9	282	439.4±6.0
1/2J1/2G	91	565.1±12.2	86	993.0±17.7	224	273.4±0.5	147	136.8±5.7	138	414.7±8.4
1/2H1/4H1/4G	30	665.1±15.0	17	974.5±32.1	22	278.4±2.7	10	157.4±20.3	5	446.2±27.4
1/2J1/4H1/4G	28	679.7±26.1	19	999.5±24.2	25	277.0±10.6	9	158.2±31.5	5	381.6±21.0
1/2BS1/4H1/4G	20	727.4±21.5	17	1101.3±33.1	19	287.8±3.1	6	184.8±31.6	2	442.5±16.5

TABLE 5
REPRODUCTIVE HEALTH STATUS

Breed group	No- declared pregnant	Per cent abtptápn	Per cent still birth	No. of calving	Per cent retention of placenta	Per cent of metritis case
1/2H1/2G	527	2.5 (11)	0.19 (1)	437	7.2 (31)	9.8 (43)
1/2J1/2G	284	0.7 (2)	1.1 (3)	223 (29)	13.0 (29)	15.5 (35)
1/2H1/4J1/4G	39	2.5 (1)	-	26 8	7.6 (2)	11.5 (3)
1/2J1/4H1/4G	39	2.5 (1)	-	26	7.7 (2)	23.0 (4)
1/2BS1/4H1/4G	23	-	-	19	(1)	(3)

Figures in parenthesis are the number of cases

TABLE 6
Production performance of halfbreds and three-breed crosses

Breed group	300 days yield	Lactation length	% animals with 300 days or more lact.	Milking average 300 days	Dry period
<u>1st Lactation</u>					
1/2H1/2G	2365.6±35.4	366.9±7.2	81.0	2339.2±36.6	100.0±5.9
1/2J1/2G	1776.0±44.1 (78)	335.0±8.4	68.0	1802.0±64.8	102.0±11.0 (64)
1/2H1/4J1/4G	2294.0±100.5 (13)	322.6±16.0	84.6	2352.6±108.3	-
1/2J1/4H1/4G	2046.0±132.8 (9)	286.9±17.9	55.5	2083.4±93.7	-
1/2BS1/4H1/4G	2220.9±142.1 (11)	319.1±11.2	72.7	2927.0±121.6	-
<u>2nd Lactation</u>					
1/2H1/2G	2599.9±66.9 (94)	334.5±6.5	68.1	2761.0±75.1	90.5±4.4 (92)
1/2J1/2G	1909.3±66.1 (54)	309.8±11.6	48.1	2107.3±99.1	104.0±9.3 (4)
<u>3rd Lactation</u>					
1/2H1/2G	2654.4±83.0 (56)	307.1±5.0	64.3	2912.1±820	83.9±5.6 (51)
1/2J1/2G	1784.7±101.2 (24)	279.8±8.3	28.6	2050.4±137.3	87.8±20.1 (10)

The proportion of animals completing 300 days, milking reduced as the lactation advanced. The drop was quite significant for Jersey halfbreeds.

Servivability : The total mortality during a decade recorded on crosses is presented in Table 7 for different age intervals in females. The three-breed crosses showed more mortality than halfbreeds. High mortality was observed in Brown Swiss (1/2BS 1/4H1/4G) i.e., 27.7% during 0 to 3 month of age group and lowest in Holstein. Total decay rate in halfbreeds upto third lactation i.e., during 1973-1980 and for three-fourth crosses upto first lactation was 1.6% per year in 1/2H1/2G which was minimum and 7.3% per year in 1/2BS1/4H1/4G as maximum.

SUMMARY

Results of decade of research done under the project using a random herd of 325 Gir (G) and 55 Gir heifers bred to 16 Holstein (H) sires and 12 Jersey (J) sires to produce 180, 1/2H1/2G and 90, 1/2J1/2G females in 1st generation which were bred to another set of 12 sires each of H, J and Brown Swiss (BS) to generate 100 progenies each of 1/2H1/2J1/4G, 1/2J1/4H 1/4G, and 1/2BS1/4H1/4G females in 2nd generation are presented.

The per cent superiority for growth measured as weight at birth and 18 months was 16.6 and 14.0 for 1/2H1/2G and -3.0 and +3.0 in 1/2J1/2G, respectively. The reproductive superiority measured in per cent for age at first heat, age at first calving, calving interval was -40.0, -29.0, -3.0 for 1/2H1/2G and 45.0, -30.0 and -13.5 in 1/2J1/2G, respectively.

The productive superiority measured as 1st and 3rd lactation yields, lactation length, and dry period for 1/2H1/2G was 344%, 307%, 92% and -200%, respectively while in 1/2J1/2G it was of the order of 244%, 224%, 83% and -200%, respectively. The survivability superiority measured as decay rate was -30% and -10%, in 1/2H1/2G and 1/2J1/2G, respectively.

The introduction of third exotic breed with increased exotic inheritance gave an overall superiority to 1/2J1/4H1/4G over 1/2J1/2G for growth and production traits, while 1/2H 1/4J1/4G gave overall superiority for productive and fat test value over 1/2H1/2G. The 1/2BS1/4H1/4G was only superior for birth weight (15%) over 1/2H1/2G and for birth weight, weight at 18 months and milk production over 1/2J1/2G.

ZUSAMMENFASSUNG

Als Resultate der Forschung einer Dekade vollzogen unter dem Projekt indem 325, Gir Kuehe und 55 Gir Faersen wurden mit dem 16 Holstein (H) maennliche Stammtiere und 12 Jersey (J) maennliche Stammtiere gekreuzt um 180, 1/2H1/2G und 90, 1/2J 1/2 weibliche Tiere in erster Generation wurden erzeugt. Diese weiblichen Tiere wurden nochmals mit den 12 maennlichen Stammtieren jeweils von H, J und Brown Swiss (BS) gekreuzt um jeweils Nachkommen des weiblichen Geschlechts von je 1/2H1/4J1/4G, 1/2J1/4H1/4G und 1/2BS1/4H1/4G in zweiter Generation erzeugt. Dieses ist als Resultat einer zehnjahriger Forschungsarbeit, vollzogen unter dem Projekt ist hier präsentiert.

Prozentual Ueberlegenheit im punkto Wachstum, gemessen als Gewicht um die Geburt und um das 18 monatiger Alter war 16.6 und 14.0 fuer 1/2H1/2G und -3.0 und 3.0 in 1/2J1/2G der Reihe nach. Die reproduktive Ueber legenheit, prozentual gemessen fuer das Alter um die erste Brunft, um das erste Kalben und Abstand zwischen zwei Kalungen war fuer 1/2H1/2G, -40.0, -29.0, -3.0 und -45.0, -30.0 und 135 fuer 1/2J1/2G der Reihe nach.

Die produktive Ueberlegenheit gemessen als die erste und die dritte Saeugeperioden ertraege, die Laenge der Saeugeperioden und die trocken Zeit fuer 1/2H1/2G war 344%, 307%, 92% und -200% der Reihe nach. Wobei in dem Fall der 1/2J1/2G es war 244%, 224%, 83% und -200% der Reihe nach. Die ueberlebens Ueberlegenheit der Kaelben gemessen als Verfallsrate war -30% und -10% in 1/2H1/2G und 1/2J1/2G, der Reihe nach.

Die Einfuehrung der dritten exotischen Zucht mit vermehrer exotischer Vererbungsanlagen gab eine insgesamte Ueberlegenheit an 1/2J1/4H1/4G ueber 1/2J1/2G fuer Wachstum und Produktions Charakterzuege, wobei 1/2H1/4J1/4G wies inzgesamt die Ueberlegenheit in Produktivitaet und Fetttestwerte ueber 1/2H1/2G, 1/2BS1/4H1/4G war ueberlegen nur im Geburtsgewicht (15%) ueber 1/2H1/2G und in Gaewicht um Geburt, Gewicht um das 18 monatige Alter und Milcherzeugung ueber 1/2J1/2G.

REFERENCES

Bhat, P.N., Bhat, Pran P., Khan, B.U., Goswami, O.B. and Singh, B. (1981). Animal Genetic Resources in India. NDRI Press, Karnal, India.

TABLE 7
Mortality rate in halfbreds and three-breed crosses

Age specific mortality	F ₁						F ₂								
	1/2H1/2G			1/2J1/2G			1/2J1/4H1/4G			1/2H1/4J1/4G			1/2BS1/4H1/4G		
	N	D	%	N	D	%	N	D	%	N	D	%	N	D	%
0-5 months	215	11	5.1	107	7	6.5	105	26	24.8	113	20	17.7	101	28	27.7
3-6 months	204	1	0.5	100	-	0.0	79	1	1.3	83	2	2.4	73	1	1.4
6-12 months	203	1	0.5	100	-	0.0	78	2	0.0	81	1	1.2	72	1	1.4
One year and above	202	11	5.4	100	7	7.0	78	2	2.6	80	-	0.0	71	1	1.4
Total decay rate	215	24	11.2	107	14	13.1	105	31	29.5	113	22	19.5	102	31	30.6

N - Number of animals in the age group
D - Death in the age group