Field progeny testing of Frieswal bulls - Retrospective and perspective

A K DAS[1✉], RAVINDER KUMAR[1], UMESH SINGH[1], SUSHIL KUMAR[1], T V RAJA[1] and A S SIROHI[1]

ICAR-Central Institute for Research on Cattle, Grass Farm Road, Meerut Cantt., Uttar Pardesh 250 001 India

ABSTRACT

Young Frieswal bulls (334; cross of HF and Sahiwal) were put under test mating in 16 different sets at four states located in varied agro-climatic conditions of India. Daughters born up to 12th set of bull who had completed their first lactation 305 days milk yield were evaluated. Total 469,501 artificial inseminations were performed in the project, of which 410,163 AI followed and 184,598 pregnancies confirmed amounting to an overall conception rate of 45%. Total 58,168 female calves were born, of which 17,107 reached age at first calving till 2020. Total 233 bulls have so far been evaluated on the basis of 9,680 daughters first lactation 305 day milk yield records showing an increasing trend in breeding values from first set (1958.0±26.90) to last evaluated set (3429.84±48.13). Through the intervention of Field Progeny Testing programme of this Institute, the average first lactation 305 days milk yield of the Frieswal progenies in the adopted villages had increased by 60.35% in KVASU-Thrissur, 42.86% in GADVASU-Ludhiana, 10.9% in BAIF-Pune and 41.64% in GBPUA&T, Pantnagar unit. Further, the average age at first calving (AFC) of the Frieswal progenies had also reduced by 12.87% in KVASU, 21.71% in GADVASU, 1.9 % in BAIF and 9.29 % in GBPUA&T unit.

Keywords: Age at first calving, Breeding value, First lactation 305 days milk yield, Frieswal

Crossbred animals undoubtedly produce more milk as compared to Indian cattle breeds and non-descript animals (Acharya 1989, Bhat *et al*. 1978). There is a great demand for meritorious crossbred bulls with high genetic potential in cattle genetic improvement programs. The progeny-testing program was first taken up with Hariana cows at the cattle-breeding farm, Hisar during III Five-Year Plan to ensure the production and identification of high quality bulls of known genetic merit based on the actual performance of their progenies instead of their dams yield basis. The National Commission on Agriculture identified the small herd size of the cattle breeding farms as the major constraint in taking up progeny testing program to evaluate the sires, and recommended that large herds should be established and farmer's herd should also be involved for proper implementation of progeny testing program to test the young crossbred bulls (Chagunda *et al*. 2004, Kumar *et al*. 2015). The bulls of Karan Swiss and Karan Fries crossbreds developed at the National Dairy Research Institute, Karnal were tested at different climatic conditions of the country on a huge population. The production performance of Karan Swiss and Karan Fries crossbred cows showed high potential to form bull mother herds for generating young male crossbred calves (Nehra 2011).

Kerala Livestock Development Board and Milk Marketing Board started a Progeny Testing Program in 1977 to identify the crossbred bulls with higher breeding value. It was initiated in selected pockets having dense crossbred cattle population based on field milk recording system. Holstein-Friesian crosses have gained most popularity among all crossbreds due to their highest milk production as reported by Singh *et al.* (2000), Upadhyay *et al.* (2000) and Akhter *et al.* (2003). Evaluation of bulls through progeny testing and their extensive use has been a major source of genetic improvement in dairy animals. Selection of sires based on daughter's first lactation milk production would be a better choice in crossbred cattle (Singh *et al.* 2017). Adequate numbers of progeny tested bulls are not available in India and whatever small numbers of bulls are progeny tested, they have low repeatability as the progeny tests are based on small number of daughters mostly reared at the institutional farms. To overcome these constraints, a mega Field Progeny Testing (FPT) program was initiated in mid-eighties, at the Project Directorate on Cattle (PDC), Meerut, Uttar Pradesh presently known as ICAR-CIRC (Central Institute for Research on Cattle), in collaboration with Agricultural/ Veterinary Universities (Kerala Veterinary and Animal Sciences University (KVASU), Mannuthy, Thrissur; Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana; G. B. Pant University of Agriculture and Technology (GBPUA&T), Pantnagar and Non-Government Organization BAIF Development Research Foundation, Central Research Station, Uruli-Kanchan, Pune) (Das *et al*. 2020). This article attempts to

Present address: [1]ICAR-Central Institute for Research on Cattle, Meerut, Uttar Pradesh. ✉Corresponding author email: achintya137@yahoo.com

report the detailed progress of the FPT Program executed at four agro-climatic conditions in India since the inception of the project and the future perspectives.

MATERIALS AND METHODS

The Field Progeny Testing program was initiated with the objective to undertake progeny testing of crossbred bulls on a large scale in the field and to improve the genetic make-up of cattle available in nearby pockets. This program envisages testing of 30 Holstein-Friesian (HF) crossbred bulls in each batch having 50-75% exotic inheritance and dam's mature equivalent milk yield of minimum 4500 kg. The bull - dams should be of good conformation. Initially, technical program was formulated with the aim to introduce 10 bulls from BAIF, Pune; 5 bulls from GADVASU, Ludhiana and 15 bulls from ICAR-CIRC, Meerut. From 1992 to 2012, total 238 bulls were inducted in 12 different sets consisting of 118 bulls from BAIF, Pune; 41 bulls from GADVASU, Ludhiana and 79 bulls from ICAR-CIRC, Meerut. In 2013, the technical program was revised to induct only Frieswal bulls having 62.5% exotic inheritance of Holstein Frisian and 37.5% of Sahiwal breed developed by ICAR-CIRC, Meerut. From 2014 to 2019, a total 96 Frieswal bulls were inducted in four different sets by ICAR-CIRC, Meerut. So far, 334 Frieswal bulls were inducted in this project of which 233 bulls were evaluated based on their daughter's first lactation 300-day milk yield. Bulls' breeding values was estimated through best linear unbiased prediction (BLUP) procedure using Model 8 in least squares and maximum likelihood computer package (Harvey 1990).

Technical program: This project covers about 2,50,000 test females in the field conditions located at four different regions, viz. Thrissur-Kerala, Ludhiana-Punjab, Uruli-Kanchan-Pune, Maharashtra and Pantnagar-Uttarakhand. The bull sets of 30 young Frieswal crossbred bulls were introduced at an interval of 15-18 months. The target was to record at least 40 daughters per bull spread over 4 different units. This can be achieved by inseminating at least 300 cows per bull at each unit, thus a population of about 9,000 cows at each unit was required for test mating with 30 bulls (Akhter *et al*. 2003) amounting to a total of 36,000 breedable females. Animals were registered under the project to collect information on animal number, age, sire, dam, date of insemination, pregnancy result, date of calving and monthly test day milk yield etc. The registered animals were regularly monitored for collecting reliable data and frequent visits were made to ensure the pedigree of calves born to the registered crossbred females.

From the information, traits required for evaluation like first lactation 305-days milk yield, age at first calving etc. were generated. Further, information on the socio-economic status of the farmers covering herd size, landholding, education level of farmers, feeding, housing and herd management practices, season and year of calving (Garcha and Dev 1994, Gaur 2007, Singh *et al.* 2014) and data loss were also collected under the project. The milk

recordings of registered animals were done at monthly intervals both in morning and in evening by milk recorders. Milk supervisors and senior officers of the project make surprise visit to ensure accurate milk production and performance recording. The bulls were evaluated based on first lactation 305-days milk yield of their daughters reared in field conditions at farmers herd.

RESULTS AND DISCUSSION

Since inception of the project in 1992, total 334 bulls were inducted in 16 different sets. Total 46,9501 artificial inseminations were done in the project of which 410,163 AI followed and 184,598 pregnancies confirmed amounting to an overall conception rate of 45%. Total 58,168 female calves born, of which 17,107 reached age at first calving till 2020. Total 233 bulls had so far been evaluated on the basis of 9,680 daughter's first lactation 305 days milk yield records showing an increasing trend in breeding values from first set (1958.0±26.90) to last evaluated 12th set (3429.84±48.13) showing an increase of 75.14% (Table 1).

Table 1. Set wise bull evaluation

Bull set no.	No. of bulls	Total no. of daughters	Average no. of daughters per bull	Overall breeding values
1	12	296	34.6	1958.0±26.90
2	10	223	22.3	1976.8±32.70
3	14	800	57.1	2603.28±125.00
4	19	941	49.5	2691.22±95.91
5	20	852	42.6	2761.72±105.16
6	22	769	35.0	2874.69±101.38
7	24	684	28.5	2930.20±108.17
8	22	736	33.5	2865.59±143.25
9	16	583	36.4	3144.37±46.72
10	24	1171	48.8	3012.58±116.54
11	22	1165	52.9	3100.41±42.18
12	28	1460	52.1	3429.84±48.13

There is a trend of increase in 1st lactation 305 days milk yield of daughters in subsequent sets of bulls in all the four units and it was also reported in Annual reports of ICAR-CIRC, Meerut (2017-18 and 2018-19). In KVASU, Thrissur unit, the average 305-days milk yield of the 1st set of bull (1992) was estimated as 1958.4 kg and in 14th set of bull (2020) it was recorded as 3140.43 kg which indicates a sharp increase of 1182 kg (60.35%) over the sets. In GADVASU, Ludhiana, in the 1st set of bulls (1995), it was recorded as 2697.8 kg and it was 3854.3 kg in 14th set of bull which indicates a sharp increase of 1156.5 kg (42.86%). In BAIF, Pune, the average for 1st set of bull (1995) was 2930.4 kg which had increased to 3250 kg in the 14th set showing a sharp increase of 319.6 kg (10.9%). In GBPUA&T, Pantnagar, the average 305-days milk yield of the 1st set of bull (2010) was estimated as 2494.8 kg and in 14th set of bull (2020), it was recorded as 3533.7
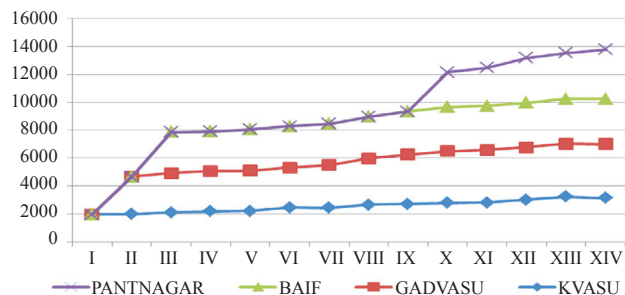
Fig. 1. Progressive improvements in 305 days milk yield in daughters of test bulls in four units of FPT project.

Fig. 2. Progressive decrease in age at first calving in daughters of test bulls in four units of FPT project.

kg which indicates a sharp increase of 1038.9 kg (41.64%) over the sets (Fig.1).

Accordingly, a trend of decrease in age at first calving (AFC) was also observed over the sets in all the units (Annual Report ICAR-CIRC (2017-18, 2018-19), Das *et al.* 2017). In KVASU, Thrissur, it was recorded as 1136.4 days in progenies of first set of bulls (1992) which had reduced to 990.12 days in 14th set indicating a sharp decrease of 146.28 days (12.87%). In GADVASU, Ludhiana, the average AFC was 1192 days in progenies of first set of bulls (1995) which reduced to 933.1 days in 14th set with a sharp decrease of 258.9 days (21.71%). In BAIF, Pune, AFC was recorded as 976.5 days in progenies of first set of bulls (1995) which reduced to 957.6 days in 14th set indicating a decrease of 18.9 days (1.9%). In GBPUA&T, Pantnagar, AFC was recorded as 1149 days in progenies of first set of bulls (2010) which reduced to 1042.2 days in 14th set indicating a decrease of 106.8 days (9.29 %) (Fig. 2).

KVASU, Thrissur

Field progeny testing is a tool for accurate selection of superior bulls based on the performance of their progenies. Field proge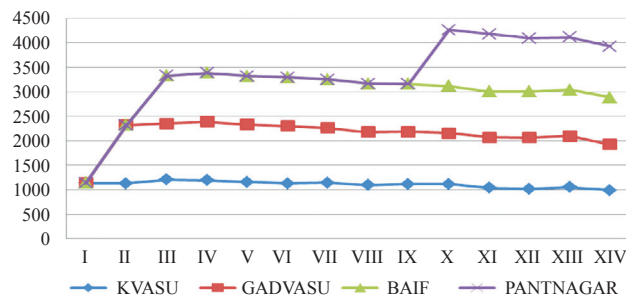ny testing program is implemented at this unit through the establishment of 7 field units and 6 artificial insemination centers along with 3 livestock farms of KVASU. The continued improvement in productivity of cattle in the project areas of ICAR Field Progeny Testing Programme is evident throughout the period. This is hence providing the best crossbred germplasm of the country to the farmers of Kerala state. About 16985 farmers have so far been registered and benefitted through this project in Thrissur district of this unit. More than 93% of cattle of the state are crossbreds as crossbreeding of cattle is the accepted breeding policy in Kerala for genetic improvement of dairy animals since 1950s. Continued genetic improvement and increase in first lactation production efficiency of the Frieswal cattle is attempted through the project (Rajeev *et al*. 2017). It opens up the availability of Frieswal bull semen to the farmers of the state. The progenies born under the project are normally producing 450 to 500 kg milk over and above their contemporaries and hence are in high demand. Rathee *et al*. (2018) reported the progeny born from test bulls of the scheme is producing almost 500 litres more milk per lactation than the other contemporary crossbred cows in the area and farmers are getting extra

Table 2. Information regarding different sets at KVASU unit since inception

Set No.	Date of start	Total bulls used	Total inseminations	Total A.I.'s followed	Pregnancies confirmed	Conception rate %	Followed for calving	Females calves	
								Born	Reached AFC
I	01/01/1992	12	23351	6722	2420	36	1902	956	319
II	01/04/1994	11	12817	4800	1680	35	1300	603	240
III	01/07/1995	11	9331	3942	1324	33.6	1065	757	89
IV	01/11/1998	15	11750	3753	1501	39.9	1489	676	178
V	01/07/2001	17	3437	3261	1136	34.8	847	401	139
VI	01/07/2003	20	8173	7683	2582	33.6	1689	746	216
VII	01/02/2005	24	5759	5211	2281	43.7	1298	597	180
VIII	01/09/2006	22	5703	5514	2472	44.8	1538	768	160
IX	01/02/2008	16	3393	3131	1181	37.7	801	394	81
X	01/07/2009	24	5781	5612	2124	37.8	1324	664	162
XI	01/04/2011	21	4820	4401	2006	45.6	1280	659	235
XII	01/08/2012	28	6045	5531	2357	42.61	1302	642	262
XIII	01/03/2014	14	5211	4850	2063	41.97	1114	545	257
XIV	01/07/2015	29	9682	9211	4134	44.88	2515	1229	392
XV	02/08/2017	26	10735	10191	4639	45.52	2733	1361	13
XVI	09/08/2019	25	8801	6704	2801	41.78	859	420	0
Total		315	134789	90517	36701	40.00	23056	11418	2923

income of ₹ 16,000/year/cow. The increasing number of inseminations under the project is an indicator of the increasing popularity of the scheme among the farmers of the Kerala State. The first set of bull at KVASU was executed in January 1992. So far, 315 bulls in 16 different sets have been inducted in the program. Total 134,789 artificial inseminations have so far been done of which 11,418 female progenies born, 2,923 female progenies have reached age at first calving (Table 2). Total 2,313 daughters (296 from 1st, 223 from 2nd, 85 from 3rd, 159 from 4th, 125 from 5th, 187 from 6th set, 158 from 7th, 98 from 8th, 59 from 9th, 140 from 10th, 171 from 11th, 200 from 12th, 218 from 13th and 194 from 14th set of bulls) from first 14 sets of bulls have completed their first lactation. The overall average 1st lactation 305-days milk yield of 2,313 daughters was found to be 2546.49±41.69 kg. The averages of first lactation 305-days milk yields of first 14 sets of daughters of bulls were 1958.4, 1976.8, 2098.2, 2190.7, 2209.7, 2466.0, 2433.7, 2659.4, 2696.4, 2776.3, 2817.7, 3001.1 and 3225.9 and 3140.4 kg, respectively (Table 4). The milk yield showed an increasing trend among the progenies of different sets. A trend of increasing first lactation 305-days milk yields was also observed in subsequent sets of bulls as reported by earlier researchers (Gaur *at el*. 2006, Gaur *et al*. 2008, Rathee *et al*. 2018). In first set, it was 1958.4 kg, which increased up to 3140.43 kg in 14th set. The overall average age at first calving among the progenies of 2,313 daughters was 1108.23±16.21 and the averages for first 14 sets of daughters were 1136.4, 1125.9, 1204.7, 1195.4, 1160.3, 1129.0, 1144.3, 1095.9, 1112.1 1112.8, 1036.4, 1019.8, 1052.0 and 990.12 days, respectively. The age at first calving showed positive trend of decrease from 1136.4 days for the progeny born from the first bull set to 990.12 days for the progenies born from 14 bull set. A trend of decreasing age at first calving was also observed in

subsequent sets of bulls as reported earlier (Gaur *et al*. 2006, Gaur *et al*. 2008, Rathee *et al*. 2018).

GADVASU, Ludhiana

The insemination work of the Field Progeny Testing project is undertaken through 32 AI centres in Ludhiana district. Four of these centres were operated by the Punjab State Department of Animal Husbandry and others by trained inseminators. Total 18,031 farmers in Ludhiana district have so far been registered and benefited through this project. The first batch was inducted in April 1995. Total 334 bulls have so far been used in 15 different sets. At this unit, 134,789 inseminations were carried out, 90,517 AIs were followed for pregnancy diagnosis of which 36,701 pregnancies were confirmed, and the overall conception rate was 40%. Out of these pregnancies, 11,418 female calves born of which 2,923 reached age at first calving (Table 3). A total of 5,357 daughters (184 from 2nd, 154 from 3rd, 397 from 4th, 361 from 5th, 361 from 6th, 278 from 7th, 351 from 8th, 326 from 9th, 647 from 10th, 576 from 11th, 690 from 12th, 720 from 13th and 312 from 14th set of bulls) from first 13 sets of bulls have completed their first lactation. The overall average 1st lactation 305-days milk yield of 5,357 daughters was 3304.3±29.32 kg. The average 1st lactation 305 days milk yield of the daughters of 13 sets of bulls were 2697.8, 2827.1, 2878.7, 2896.1, 2855.9, 3051.8, 3305.4, 3556.6, 3714.7, 3751.8, 3766.8, 3798.9 and 3854.3 kg, respectively (Table 4). The milk yield showed increasing trend among the progenies of different sets. This finding is in close agreement with the findings of Kumar *et al*. (2016) and Kumar *et al*. (2017). The average first lactation 305-days milk yield of the crossbred progenies in the adopted villages in 1995 was 2697.8±40.1 kg which has increased to 3854.3±55.9 kg in 2020, showing an improvement of 42.86% in milk production during the

Table 3. Information regarding different sets of bulls (GADVASU)

Set No.	Date of start	Total bulls used	Total inseminations	Total A.I.'s followed	Pregnancies confirmed	Conception rate %	Followed for calving	Females calves	
								Born	Reached AFC
I.	01/04/1995	18	7595	7355	3065	41.7	3000	855	227
II.	01/01/1997	10	5150	4865	2132	43.8	2000	789	210
III.	01/01/1999	23	18006	17159	8258	48.1	8000	1844	562
IV.	16/12/2001	30	12548	11504	5720	49.7	5720	1368	490
V.	01/04/2003	22	10409	10154	4362	43.0	4362	1497	478
VI.	01/02/2005	25	8265	8105	3476	42.9	3476	1181	359
VII.	01/08/2006	22	9710	9710	3999	41.1	3999	1120	448
VIII.	01/01/2008	16	9611	9611	3898	40.6	3898	1186	461
IX.	10/07/2009	24	14581	14581	5679	38.9	5679	1671	885
X.	01/03/2011	20	12971	12971	5604	43.2	5604	2072	688
XI.	01/08/2012	28	15662	15662	7008	44.7	7008	2500	770
XII.	01/02/2014	15	6662	6662	3039	45.6	3039	1321	741
XIII.	01/08/2015	30	8299	8299	3851	46.4	3851	1571	285
XIV.	01/06/2017	26	10715	10715	5043	47.1	5043	1784	3
XV.	01/06/2019	25	4324	1131	584	51.6	-	-	-
Total		334	154508	148484	65718	44.25	64679	20759	6607

Table 4. Set wise progeny performance at different unit since inception

Name of Unit	Set No.	Progeny completed 1st lactation	1st lactation 305 days milk yield (kg)	Age at first calving (days)	Average milk fat (%)
KVASU, Thrissur	I	296	1958.40±27.0	1136.40±13.0	3.46±0.20
	II	223	1976.80±32.7	1125.90±17.7	4.26±0.21
	III	85	2098.20±42.8	1204.70±26.8	3.97±0.31
	IV	159	2190.70±38.2	1195.40±17.6	4.15±0.26
	V	125	2209.70±42.0	1160.30±17.0	3.91±0.34
	VI	187	2466.00±44.0	1129.00 ±13.0	3.89±0.25
	VII	158	2433.70±51.9	1144.30±16.6	3.86±0.43
	VIII	98	2659.47±41.2	1095.90±21.25	3.8±0.39
	IX	59	2696.40±71.8	1112.15 ±47.82	3.7±0.34
	X	140	2776.34±39.6	1112.85±17.63	3.5±0.38
	XI	171	2817.76±34.1	1036.40±11.79	3.7±0.39
	XII	200	3001.12±35.5	1019.86±11.24	3.6±0.34
	XIII	218	3225.92±33.58	1052.00±11.51	3.5±0.37
	XIV	194	3140.43±36.78	990.12±7.54	3.5±0.29
Total 2313 overall average			2546.49±41.69	1108.23±16.21	3.77±0.34
GADVASU, Ludhiana	II	184	2697.8±40.1	1192.1±23.6	3.7±0.02
	III	154	2827.1±48.7	1145.6±20.3	3.8±0.02
	IV	397	2878.7±25.5	1191.9±13.2	3.8±0.02
	V	361	2896.1±26.0	1168.4±14.9	3.8±0.01
	VI	361	2855.9±25.9	1174.9±14.6	3.7±0.01
	VII	278	3051.8±24.5	1115.9±14.2	3.6±0.10
	VIII	351	3305.4±28.9	1082.2±12.2	3.6±0.03
	IX	326	3556.6±31.2	1068.8±15.9	3.7±0.00
	X	647	3714.7±22.9	1044.2±8.5	3.7±0.00
	XI	576	3751.8±22.9	1032.7±8.0	3.6±0.00
	XII	690	3766.8±21.1	1045.2±8.4	3.7±0.00
	XIII	720	3798.9±18.7	1042.5±6.8	3.7±0.02
	XIV	312	3854.3±26.3	933.1±9.1	3.7±0.4
Total 5357 overall average			3304.3±29.32	1095.19±11.48	3.7±0.02
BAIF, Pune	III	1237	2930.34±23.21	976.5±0.06	3.5±0.36
	IV	362	2848.46±39.02	995.1±0.19	3.6±0.32
	V	247	2965.52±37.98	988.2±0.28	3.6±0.34
	VI	193	2972.06±41.13	985.8±0.24	3.6±0.31
	VII	285	2986.98±33.12	989.7±0.21	3.6±0.29
	VIII	248	3008.78±26.78	984.9±0.28	3.6±0.38
	IX	192	3094.02±37.81	976.5±0.30	3.6±0.32
	X	280	3164.72±32.60	955.8±0.31	3.61±0.37
	XI	282	3173.52±25.17	937.8±0.28	3.59±0.38
	XII	359	3198.76±28.36	937.8±0.18	3.57±0.35
	XIII	217	3208.89±46.28	945.6±0.32	3.57±0.45
	XIV	175	3250.01±54.82	957.6±0.26	3.59±0.45
Total 4077 overall average			3066.83±51.32	969.27±0.35	3.58±0.37
GBPUA&T, Pantnagar	X	181	2494.8±63.90	1149.0±0.05	3.76±0.02
	XI	250	2733.1±47.31	1170.0±0.72	3.52±0.02
	XII	211	3227.9±59.80	1091.1±0.81	3.43±0.05
	XIII	294	3309.19±42.50	1071.3±0.33	3.52±0.01
	XIV	223	3533.71±17.85	1042.2±0.60	3.54±0.07
Total 1159 overall average			3059.74±55.31	1104.72±0.49	3.55±0.03

last 25 years. The same trend was also reported earlier (Kumar *at el*. 2015, Singh *at el*. 1990). In general, the average first lactation 305 days milk yields of the crossbred progenies in the adopted villages showed an increase of 51% from the year 1993 to 2014 (Kumar *et al*. 2016). The overall average age at first calving among the progenies of 5,357 daughters was 1095.19±11.48 and the averages for first 13th different sets were 1192.1, 1145.6, 1191.9, 1168.4,

1174.9, 1115.9, 1082.2, 1068.8, 1044.2, 1032.7, 1045.2, 1442.5 and 933.1days, respectively. The age at first calving showed a positive trend of decrease from 1192.1±23.6 days for the progenies of second bull set to 933.1±13.1 days for the progenies of 14th bull set. The field progeny testing programme implemented in Punjab has resulted in the genetic improvement of crossbred cattle through increasing the first lactation 305-day milk yield with reduction in the age at first calving (Kumar *at el.* 2016).

BAIF, Uruli-Kanchan, Pune

BAIF Development Research Foundation (popularly known as BAIF) is an NGO engaged in livestock development as a tool for income generation and improvement of quality of life of rural people. The artificial insemination work of the Field Progeny Testing project is undertaken through 25 AI centres covering 86 villages in BAIF, Urlikanchan, Pune unit. The project area is spread in Ahmednagar, Pune and Satara districts of Maharashtra State. The crossbred population in the region is dominated by various grades of Holstein Friesian breed. A total of 36,405 farmers have so far been registered and benefited through this project in Ahmednagar, Pune and Satara districts of Maharashtra State. The first batch of bulls was inducted in July 1995 and so far 311 bulls in 14 sets were inducted by the unit. So far 133,855 inseminations were carried out and 125,630 AIs were followed for pregnancy diagnosis of which 56,531 pregnancies were confirmed and overall conception rate was 45%. Out of these pregnancies, a total of 16811 female calves born of which 5,663 reached age at first calving (Table 5). A total of 4,077 daughters (1,237 from 3rd, 362 from 4th, 247 from 5th, 193 from 6th, 285 from 7th, 248 from 8th, 192 from 9th, 280 from 10th, 282 from 11th, 359 from 12th, 217 from 13th, and 175 from 14th set of bulls) have completed their first lactation. The overall average 1st lactation 305-days milk yield of 4,077 daughters was 3066.83±51.32 kg. The averages for first

lactation 305-days milk yield of the daughters of 12 sets of bulls were 2930.3, 2848.4, 2965.5, 2972.0, 2986.9, 3008.7, 3094.0, 3164.7, 3173.5, 3198.7, 3208.9 and 3250.0 kg, respectively (Table 4). The milk yield showed increasing trend among the progenies of different sets (Das *et al.* 2017). The average first lactation 305-days milk yield of the crossbred progenies in the adopted villages in 1995 was 2930.3±23.2 kg which had increased to 3250.0±54.82 kg in 2020, showing 10.9% improvement during the last 25 years. The overall average age at first calving among the progenies of 4,077 daughters was 969.27±0.35 days and the set wise averages were 976.5, 995.1, 988.2, 985.8, 989.7, 984.9, 976.5, 955.8, 937.8, 937.8, 945.6 and 957.6 days, respectively. The age at first calving showed a positive trend as it decreased from 976.5±0.06 days for the daughters of third set of bulls to 957.6±0.26 days for the progenies born from 14th set of bulls.

GBPUA&T, Pantnagar

The project at GBPUA&T, Pantnagar, Uttarakhand started during 2009 and presently running through 7 AI centers covering 292 villages of U.S. Nagar and Nainital districts of Uttarakhand. Total 7,898 farmers were registered and benefited through this project. The first batch was inducted in January 2010 and 121 bulls have so far been used in 7 different sets. At this unit, 38,770 inseminations were carried out and 37,194 AIs were followed for pregnancy diagnosis out of which 21,430 pregnancies were confirmed since inception of the project and the overall conception rate was 57.61%. Out of these pregnancies, 7,461 female calves born of which, 1,479 reached age at first calving (Table 6). Total 1159 daughters (181 from 10th, 250 from 11th, 211 from 12th, 294 from 13th and 223 from 14th set of bulls) from first 5 sets of bulls have completed their first lactation.

The overall average 1st lactation 305 days milk yield of 1159 daughters was 3059.74±55.31 kg and the set

Table 5. Information regarding set of bulls (BAIF)

Set No	Batch Start date	Bulls used	A.I. done	A.I. followed	Pregnancies confirmed	Conception rate	Followed for calving	Female calves	
								Born	Reached AFC
III	01/07/1995	20	16118	15063	7001	46.48%	4868	2344	1563
IV	01/07/1998	19	21321	17239	7673	44.51%	3815	1756	514
V	01/07/2001	20	7461	7380	3398	46.04%	2626	1201	364
VI	01/07/2003	20	5249	5162	2162	41.88%	1493	731	289
VII	01/02/2005	25	6806	6638	2989	45.03%	1969	856	394
VIII	01/09/2006	22	6533	6327	2899	45.82%	1993	885	371
IX	01/02/2008	16	4902	4902	2169	44.25%	1561	733	313
X	01/08/2009	24	6893	6867	2987	43.50%	1997	878	391
XI	01/04/2011	21	6364	6364	3109	48.85%	2270	1010	409
XII	01/08/2012	28	9270	9030	4190	46.40%	2509	1182	504
XIII	01/03/2014	15	7139	7139	3221	45.12%	2536	1163	305
XIV	01/08/2015	30	14223	14189	6196	43.67%	4007	1783	246
XV	02/07/2017	26	12535	12301	5515	44.83%	3888	1840	0
XVI	08/07/2019	25	9041	7029	3022	42.99%	973	449	0
Total		311	133855	125630	56531	45.00%	36505	16811	5663

Table 6. Information regarding set of bulls (GBPUA&T)

Set No.	Date (FSD received)	Bulls used	Total AI	A.I. followed	Pregnancy confirmed	Conception rate %	Total calving	Female calves	
								Born	Reached AFC
X	20/01/2010	10	1,784	1,750	1,030	58.85	782	340	201
XI	16/03/2011	6	2,303	2,303	1,546	67.12	1,207	542	296
XII	25/07/2012	9	2,473	2,473	1,405	56.81	1,215	573	224
XIII	05/02/2014	15	5,205	5,205	2,944	56.56	2,433	1,058	306
XIV	22/07/2015	30	9787	9787	5414	55.31	4582	2126	165
XV	15/06/2017	26	9886	9886	5664	57.09	4587	2160	02
XVI	25/06/2019	25	7332	5790	3427	59.18	1467	662	-
Total		121	38770	37194	21430	57.61	16273	7461	1479

wise averages for 1st lactation 305 days milk yield of the daughters of five sets of bulls were 2494.8, 2733.1, 3227.9, 3309.19 and 3533.71 kg, respectively (Table 4). The milk yield showed increasing trend among the progenies and is in accordance with the earlier report (Komatwar *at el*. 2010). The average first lactation 305-days milk yield of the crossbred progenies in the adopted villages in 2010 was 2494.8±63.9 kg, which has increased to 3533.71±17.85 kg in 2020, showing 41.64% improvement during the last 10 years. The overall average age at first calving of 1159 daughters were estimated as 1104.72±0.49 days and the averages for five different sets were 1149.0, 1170.0, 1091.1, 1071.3 and 1042.2, respectively. The age at first calving also showed a positive trend of decrease from 1149.0±0.05 days for the first set progenies to 1042.2±0.60 days for the progenies of fifth set of bulls.

Conclusion

The Field Progeny Testing program is the only reliable available option under Indian situation for the genetic improvement of the crossbred animals in rural conditions. A number of programs were executed on this aspect in sixties/seventies but their results were not satisfactory due to various reasons like small herd size, non-availability of superior bulls, lack of proper recording, insufficient infrastructure facilities etc. A mega project on Field Progeny Testing was initiated during mid-eighties by the ICAR-CIRC, (formerly Project Directorate on Cattle), Meerut, Uttar Pradesh in collaboration with State Agricultural Universities and Non-Governmental Organization at different agro-climatic conditions of the country. The objective of the project is successfully achieved through the genetic improvement of crossbred cattle maintained by the farmers in terms of increase in milk production and decrease in age at first calving. Thus, the project improves the economic status of the farmers through sustainable dairy farming. Necessary technical inputs and scientific interventions in terms of nutrition, breeding and health management were regularly provided under the project. The loss of data due to sale of animals is very high under field conditions which is an impediment factor for getting the required number of daughter records. The frequent movement of contractual data recorders working in the project is also a recurrent problem in data recording in the field.

This project helped in recording of performance data on large number of daughters and their use in sire evaluation to increase the efficiency and accuracy of Progeny Testing Program. Field Progeny Testing Project has a major contribution for making genetic improvement of the field cattle by using high genetic potential crossbred bulls and providing technical expertise in the adopted villages. The supply of semen of high genetic potential test bulls to the farmers in the villages adopted under the Field Progeny Testing Project has changed the scenario of dairy farming in the area. The project has helped in improving the economic status of small, marginal and landless farmers in the villages. More and more farmers are adopting large-scale dairy farming. The milk yield has increased among the progenies of test bulls under field progeny testing. Age at first calving has declined over the period in the operational area. The top ranked bulls are being used in nominating mating for production of male calves for induction in the new sets. The program is not only enough to produce and test the superior crossbred male calves in the field but also capable for improving genetic level of the cows available in the operational area of the program leading to increase in milk production. A large number of data on Phenomics' are available in this project which can be further used for Genomic selection in crossbred cattle in India.

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