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Kankrej breed: An incredible germplasm of Zebu cattle

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The importance of cattle in Hindu mythology, is well established, even today it is known by different names viz. *Kamdhenu, Kapila, Nandini, Surabhi* and people worship it as *"Gau-Mata",* but the fact is that legendary history of Indian cow breeds from the time of glorious India to the present day times expedited that today's Indian cow breeds need improvised policy even though Indian bovine breeds were best in the world, then what actually happened to these cow breeds. The one important reason might be the European invaders eyed the invaluable germplasm of these zebu cattle and *"East India Company"* started the export of superior quality of zebu cattle and bulls from India. Indian farmers were misguided to abscond their cows on the roads by spreading the air that they yield less milk. Subsequently, Indian farmers adopted exotic breeds while the foreigners started rearing zebu cattle.

The fact about zebu cattle after independence is that rather to adopt cross breeding, we must lure our pride by conservation and improvement of local breeds in their natural habitats; and earlier number of these were 28, but now-a-days these are 40, inclusive three breeds of Gujarat state viz: Gir (milch purpose), Kankrej (dual purpose) and Dangi (draft purpose). The policy for conservation of these cattle breeds as well as for dairy development in Gujarat region were undertaken by Bombay state benefiting Gujarat region, prior to its formation as a separate state in May, 1960. Thereafter, Government of Gujarat has laid special emphasis on conservation and improvement of these cattle by establishing their farms / breed association etc during different five year plans. At present, India is the prime possessor of about 160 livestock breeds inclusive 40 breeds of cattle having three breeds of Gujarat, while there are about 929 names of cattle breeds without their synonymous in the world (John, 1999). These cattle breeds are utilized for milk, meat, draft and sports purposes, where Kankrej breed is in great demand in the region, which is good for milk production and bullocks are very powerful, suitable for draft and well known for their *"Sawai Chall"*.

The breed gets its name from the Radhanpur state, adjacent to the Kankrej, where it is known as Vadhiar and in Kachchh state it is known as Wagad or Wagadia, taking its name from the community of herdsmen, who reared this breed. Other synonymous of Kankrej are Bannai, Nagar, Talabda, Vaghiyar, Vadhiyar, Wadhir, Wadial and Banas Kankrej. The breed comes from the southeast of the desert of Kachchh in western India, particularly along the banks of the rivers Banas and Saraswati, which flow from east to west and drain into the desert of Kachchh.

It is well known that, Guzerat cattle, a breed developed in Brazil from Kankrej cattle imported from India, is a Portuguese name of Gujarat. They are, of course, very similar, both being tall draft/beef breeds with high horns. The average, Guzerat are darker, bigger and have longer horns than Kankrej. The bulls usually are quite dark on the head and forequarters, lighter elsewhere. Guzerat and Kankrej are the principal breeds used in the formation of the American Brahman, along with the Gir and the Nellore. They show the usual advantages of zebu cattle in the tropics and semi-tropics, having better heat tolerance and disease resistance.

HISTORICAL OVERVIEW

Historical evidence suggested that cattle breeds were existed during the excavation of Mohenjodaro in the Sindh, Pakistan, which was similar to present day Kankrej of India, realizing that breed was existed even before 3000 BC. The establishment of Northcote Cattle Breeding Farm, Chharodi

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during 1889-90 also suggested that breed gained popularity among the animal keepers even before that. The export of Kankrej cattle during 1870-71, 2014-15 and again during 1960-61 to Brazil, 1921-22 to Japan, 1924-25 to USA and during unknown period to Mauritius, realized that breed was in great demand in the different countries of the world, recognized the importance of the breed even before independence. All these evidence shows that GOI have taken right decision by establishing the farms of the breed at Chharodi during 1889-90, following at Anand during 1940-41, Bhuj during 1949-50, Mandvi during 1963-64, Thara during 1967-68 and Livestock Research Station, Sardarkrushinagar during 1978. In addition to these, there are many gaushala, panjrapole, private farms, rearing the pure strain of Kankrej breed.

Year	Milestone in the Development of Kankrej Cow
3000 BC	Mohenjodaro excavations in Sind, Pakistan, shows that Kankrej was existed during this period.
1870-71	Kankrej cows were exported to Brazil
1889-90	Established Northcote Cattle Breeding Farm, Gujarat Cattle Preservation Association" (GCPA), Chharodi (farm was named after the name of Governor of Bombay as "Northcote")
1914-15	Kankrej cows were exported on large scale to central Brazil
1921-22	Kankrej cows were exported to Japan
1924-25	Kankrej breed was popular in the United States and used for cross breeding to develop *"Gujerat"*
	"Santa Gertrudis" breed of beef cattle evolved in the United States of America has Kankrej (G-uzerz. 7) blood in its make up
1940-41	Established Sheth M N Goenka Gaushala, Institute of Agriculture, Anand
1949-50	Established Cattle Breeding Farm, Bhuj (Breeds includes Kankrej, Tharparkar, Gir and Sindhi) Only Kankrej cattle were kept
1960-61	Kankrej Cows were exported to Brazil
1963-64	Established Cattle Breeding Farm, Mandvi
1967-68	Established Cattle Breeding Farm, Thara
1978-79	Established Livestock Research Station, Sardarkrushinagar, Banaskantha
	Elite Kankrej Cattle at LRS, Sardarkrushinagar was renamed as ***"Banas Kankrej"***

(Source[1])

BREEDING TRACT AND POPULATION STATUS

The breed is distributed in India and abroad, where origin place is considered as Kankrej taluka of Banaskantha district of Gujarat, but animals are reared in north Gujarat and Kachchh, western Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, Andhra Pradesh and Tamilnadu state of India and other countries like : USA, Brazil, Japan and Mauritius, where they were exported during 18th century and thereafter. The population of Kankrej cattle is reviewed and found that its population was 5,00,000 during 1951 and it increased to 26,81,800 during 2007. The growth rate of breed was @ of 0.35% per annum over a period of 66 years, indicated that animal keepers preferred the rearing of breed even though mechanization of farm operations takes place very fast[2].

BREEDING POLICY

The efforts of the government and other organizations were continue to improve the productivity of a breed, where every country have its own policy according to their resources / requirements, while for improvements the performance of different breeds reared under different countries, an International Convention held in Rome in October 1936 and decided to establish herd registry associations, where India was also signatory and had initiated herd registration of the cattle breeds, viz. Gir, Haryana, Kankrej, Ongole,

Sahiwal, Red Sindhi and Tharparkar; and breeds of buffaloes. The herd book scheme of the GOI is popularly known as *"Central Herd Registration Scheme"* aims at the compiling, analysing and publishing production and breeding data. The government and private organizations and farmers having animals meeting the standards of performance were registered in the herd book. These information utilized up to some extent in procuring breeding bulls and proper steps were taken to ensure retention of superior germplasm through providing incentives to owners of animals performing according to the standards laid down and ensuring that such animals are not disposed off, more particularly in the first 2 to 3 lactations. Fortunately, scheme has been introduced, but working under limited area, which has meager impact on improvement of productivity of the breed, whereas state animal husbandry departments, SAU, ICAR and some gaushalas are making efforts for the same, but still large population is to be covered and indiscriminate use of bulls must be controlled, having poor production ability. After independence, Kankrej cattle were used for cross breeding with Jersey at Institute of Agriculture, Anand and their Inter-se mating were developed, but again cross breeding has been stopped and pure breed of Kankrej are maintained in the state. The conservation of breed in their native habitats and improvement through grading-up by selective breeding was adopted to improve the performance of breed in the state.

Table 1. Average production of Kankrej cattle at recognised farms in India

Sr No	Year	No of records	Average lactation milk yield (lbs)	Average lactation length (days)	Average dry period (days)
1	1936-37	54	3232	305	184
2	1937-38	54	3159	303	178
3	1938-39	38	3161	315	144
4	1939-40	11	2965	366	180

(Source[3])

PRODUCTION PERFORMANCE: (A) PRE-INDEPENDENCE PERIOD

Kankrej cattle are very highly prized as fast, powerful draft cattle. They are also fair producers of milk. The average milk production of Kankrej cows, based on records at recognized farms i.e. Chharodi in India during 1936-37 to 1939-40, is shown in Table 2. These records have shown that milk-ability of Kankrej breed is very good even though it is classified as dual purpose breed. Similarly, performance of the breed recorded at Sheth M N Goenka Gaushala, Institute of Agriculture, Anand and Northcote Cattle Breeding Farm, Chharodi during 1941-44 and frequency distribution of milk production records of 353 Kankrej cows is given in Table 2.

Table 2. Frequency distribution of Kankrej cow according level of production (1941-44)

Level of production	Frequency of Kankrej cow according to lactation milk yield (lbs)						Total cow
	< 1,500	1,501 - 2,500	2,501 - 3,500	3,501 - 4,500	4,501 - 5,500	> 5,500	
No of cow	67	85	97	62	32	10	353

(Source[4])

These records also prove the milk-ability of Kankrej cow. Production records of Kankrej cattle maintained at Chharodi and Anand farm during the period of 1941-1951 are given in Table 3, shows ability of the breed even though it was maintained on semi-ranching system at Chharodi and loose housing system at Anand.

Table 3. Milk Production of Kankrej herd at Chharodi, Bombay state, during the period 1941-1951

Sr No	Class of cow	No of cow	No of lactations	Lactation milk yield (lbs)	Lactation length (days)	Average dry period (days)	Calving interval (days)
1	Selected cows	40	121	4443	371	153	524
2	Average cows	45	91	2665	307	191	498

However, milk yield of individual Kankrej cow recorded at NCCBF, Chharodi was 7259 lbs. in 362 days, during the third lactation, when the cow was 6-8 years old bringing the daily average of 20·0 lbs[5]. Further, he stated that lactation length, lactation milk yield, average daily milk yield and fat % of 20 Kankrej cows maintained at Institute of Agriculture, Anand during the year 1943-44 were 400 days, 4910 lbs, 12.40 lbs and 4.7 % respectively.

Looking towards the performance of Kankrej cattle, it proves that milk-ability of the breed is very high, which is almost similar, or even better than milch purpose cattle breeds of India. Further, it was reported by[6] that performance of pure Kankrej cattle under proper feeding and management system was excellent, where best lactation yield, daily average milk yield, lactation length and fat% was recorded as 6088 lbs, 15.7 lbs, 387 days and 5.4%, respectively.

PERFORMANCE IN OTHER COUNTRIES

The sizable number of animals was exported to different countries of the world and used for improving local breeds or for developing new breeds or by maintaining pure breed of Kankrej.

Brazil

The breed is mainly located in the region of Cetntral Brazil, especially in the state of *"Minas Gerais ao Paulo", "Gtoias"* and *"Mato Grosso"*. These animals were used for pure breeding as well as for grading up and cross-breeding and have been evolved a new breed of cattle known as "*Ihe i idubrasil"* by crossing with Kankrej cattle and maintained at the Government's Experimental Livestock Breeding Station near Uberaba. In most of the Brazilian regions, Kankrej are used for beef as well as for milk. They are mostly raised on grassland and are ready for slaughter at the age of 3.5 years.

United States of America

The strains of zebu cattle in USA is referred as Brahman cattle, while Kankrej cattle, popularly known as Guzerat cattle and is well known since 1924 in the USA. The report of[6] suggested that Brahman cattle, which have high proportion of blood of Kankrej cattle were used to improve the non descript cow by crossing, showing high adaptability in the region having sub-tropical climate and high rainfall.

Mauritius

It is believed that sugarcane estate owners of Mauritius, imported the Kankrej cattle particularly for production of draft animals, but no further information is available relevant to its import and use in the country.

(b) Post-independence period

The main source of draft power for farm operations was bullocks even after independence, where farmers were using the bullocks for ploughing, puddling, leveling, sowing, harvesting, inter-culturing operations, chaffing of fodder, water lifting, race, transport of agricultural produces and other goods etc throughout country, while cow were used for milk production only. During this period, bullocks were in great demand, which gradually decline due to mechanization of farm operations towards the end of 20th century in the country and steady decline in the average size of land holdings, where presently about 80.00% of the total 140million farming families hold less than 2.00 acres of land[8]. Similarly, looking towards the demands of Kankrej cow and bulls in other countries like Brazil, it was found that during the year 1960, Brazil imported three cattle breeds from India including Kankrej, Gir and Ongole and used for different breeding programmes and today Brazil has emerged as the world's biggest exporter of improved cattle embryos and semen of bulls of

Indian breeds, while now a days it is difficult for us to have such pure bred animals in the country. Contrary to this, indigenous breeds reared on the road side grazing land / waste land / gauchar / forest land have indiscriminate breeding with bulls of local or foreign breeds, deteriorating the quality of our pure breeds in the country[9]. Due to such practices, we have lost very good germplasm and now it is very difficult to find out such animals in the country.

(c) Pre-SDAU period

The period after independence till establishment of Sardarkrushinagar Dantiwada Agricultural University (SDAU), Sardarkrushinagar i.e. 1947 to 2004 covered as pre-SDAU period, where performance of Kankrej cow during *state level milk yield competition*, *under organized farm* and records available with the *Central Herd Registration Scheme,* Ahmedabad suggested that breed have excellent milk producing capacity, which shall be explored fully for further improvement of the herd. The daily milk yield of Kankrej cow recorded during state / national level milk yield competition held during 1971-72 to 1973-74 is depicted in Table 4, which shows milk-ability of the breed, where daily milk yield during 1974-75 was about 19.55% higher than 1971-72, shows that breed has potentiality and scope of further improvement in future.

Table 4. Performance of Kankrej cow during milk yield competition

S. No.	Year	Milk yield in 24 hours		Remarks
		State level	National level	
1	1971-72	21.330 kg, first 20.933 kg, second	21.330 kg, first 20.933 kg, second	Winners of the state and national level milk yield competition
2	1972-73	20.250 kg, first 19.575 kg, second	20.250 kg, first 19.575 kg, second	
3	1973-74	19.200 kg, first 19.050 kg, second	19.200 kg, first 19.050 kg, second	
4	1974-75	25.500 kg, first 24.375 kg, second	25.500 kg, first 24.375 kg, second	

(Source[10])

NORTHCOTE CATTLE BREEDING FARM, CHHARODI

The performance of Kankrej cow at NCCBF, Chharodi before independence was excellent, but thereafter, it was declined. The performance of the herd presented in Table 5 for the year 2001 and 2002, shows that milk yield of the breed was almost less than 50% as compared to before independence. The reason of this decline in milk production of the herd may be that good animals were taken away and only poor producing animals were remains. The other possibilities may be environment, management, breeding practices, feeding, improper planning and its execution for the development of the breed.

Table 5. Performance of Kankrej cow at Chharodi during the year 2001 and 2002

S. No.	Traits	Year	
		2001	2002
1	Age at first calving (days)	1429±60 (14)	1528±39 (14)
2	Lactation period (days)	292.5 (30)	243.0 (30)
3	Lactation yield (kg)	1487.70 (30)	1462.0 (30)
4	Dry period (days)	192 (30)	190.00 (30)
5	Service period (days)	153.3 (30)	202.000 (30)

6	Calving interval (days)	512.9±24.10 (30)	515.00±22.70 (30)
7	No of service per conception	2.2	----
8	Wet average (kg)	5.10±0.20 (35)	5.84±0.40 (35)
9	Herd average (kg)	2.69±0.20 (29)	2.79±0.30 (29)

(Source[11])

LIVESTOCK RESEARCH STATION, SARDARKRUSHINAGAR

The main research station for conservation and improvement of Kankrej cow under its natural breeding tract was established at Sardarkrushinagar during 1978 under the erstwhile Gujarat Agricultural University and became the constituent of SDAU after the bifurcation of GAU into four state agricultural universities. Since inception of the farm i.e. 1978, performance of the breed was recorded and depicted in Table 6-10. It shows that total lactation milk yield has improved from 846 lit per lactation in 1978 to 1915.90 lit per lactation in 2002. It shows that milk yield has increased about 44.16% during a period of 24 years after existence of the farm. Similarly, there is significant improvement in first lactation milk yield, 300 days milk yield, dry period, wet average and herd average of Kankrej cows maintained at Livestock Research Station, animals having highest yield during the year 2002-03, is depicted in Table 8 shows that milk production of cows became almost three folds over a period of 24 years, if compared with average performance of the herd in the beginning of the farm i.e. 1978.

Table 6. Performance of Kankrej cow since 1978 to 2003

Sr No	Traits	Year			
		1978-79	1981-82	1991-92	2002-03
		First Lactation Performance			
		First Lactation Performance			
1	Age at first calving (days)	----	----	1307.86±52.59 (07)	1455.0±48.28 (08)
2	Age at first heat (days)	----	21.62±1.78	926.00±38.00 (07)	1016.0±56.45 (08)
3	First lactation length (days)	204 to 438	272.10±19.72 (71)	319.36±10.76 (28)	314±8.41 (23)
4	First lactation milk yield (lit)	245.1 to 2028.40	1012.25±71.03(71)	1572.13±93.74 (28)	1800.0±60.89 (23)
5	First lactation 300 days milk yield (lit)	----	----	1465.83±72.41 (28)	1733.0±55 (23)
		All Lactation Performance			
6	Lactation length (days)	248.00±18 (51)	236.35±8.94 (150)	307.77±7.81 (86)	278±6.07 (76)
7	Dry period (days)	253.00±22 (49)	208.24±24.22 (150)	168.29±9.48 (76)	197.0±11.03 (63)
8	Service period (days)	----	----	157.00±7.60 (84)	196.0±12.94 (63)
9	Services per conception	----	1.81	1.48±0.11 (33)	2.0 (63)
10	Total milk yield (lit)	846.00±90 (51)	915.95±46.01 (150)	1776.78±67.16 (86)	1915.9±50.46 (76)
11	300 days milk yield (lit)	----	----	1669.30±58.01 (86)	1882.4±49.07 (76)
12	Calving interval (days)	508.00±16 (48)	445.45±15.33 (96)	443.88±12.14 (76)	483.0±12.99 (63)
13	Wet average (lit)	----	3.97	5.81+0.19 (62)	7.77 (12)
14	Herd average (lit)	----	1.25	3.62+0.18 (65)	3.86 (12)

(Source[12,13,14])

It is also interesting that best lactation yield and lactation length of Kankrej cow at LRS, Sardarkrushinagar was recorded 3644.80 kg and 413 days, respectively during the year 1991-92, whereas average daily milk yield per in milk crossbred cow was reported about 8.015 kg, whereas wet average of Kankrej cow was about 7.77 lit during 2002-03, but difference is not much higher and we are hopeful that during coming years productivity of Kankrej cattle will be almost either similar or even better than crossbred cow.

Post- SDAU period

The efforts to improve the performance of kankrej cow are continue even after existence of SDAU since May 1st, 2004 and breed shown its superiority over others. The records of Kankrej cattle under state level milk yield competition, CHRS, Ahmedabad and LRS, Sardarkrushinagar were compared and discussed here to know the performance of the breed.

Performance of Kankrej cow during state level milk yield competition

The reports of daily milk yield of Kankrej cow recorded during state level milk yield competition is depicted in Table 9, which shows milk-ability of the breed. The comparative performance of breed during 2014-15 (27.20 kg per day; Table 5) as compared to 1971-72 (21.33 kg per day; Table 7) shows an increase of 21.55 % over a period of 43 years. It realized that this increased in daily milk yield of individual animal during state level milk yield competition has prove the interest of people for rearing of Kankrej cow, which will reflect the future plan of the state, where conservation of local breed is preferred rather than cross-bred, will help the coming generation to brought the glory of the country during coming generation that best cow germplasm is in India.

Table 7. Performance of Kankrej cow during state level milk yield competition (2013-14 and 2014-15)

Sr No	Year	Average milk yield in 24 hours during state level competition 2013-14	Average milk yield in 24 hours during state level competition 2014-15	Remarks
1	Ist prize	24.773	27.200	Winners of the state and national level milk yield competition
2	IInd prize	24.330	25.80	
3	IIIrd prize	24.000	25.600	
4	Runner-up	20.770	23.270	

(Source[15,16])

KANKREJ COW PERFORMANCE UNDER CHRS

The selection of elite animals of different breeds including Kankrej cow and maintained their records under Central Herd Registration Scheme, Ahmedabad Unit during 2010-11, 2011-12 and 2012-13 are depicted in Table 8.

Table 8. Milk yield of Kankrej cow under Central Herd Registration Scheme

Sr No	Traits	Year				
		2010-11	2011-12	2012-13	2013-14	2014-15
1	Number of animals	875	616	420	420	512
2	Average lactation period (days)	317	313	309	309	308
3	Average total milk yield (kg)	2764.097	2800.251	2700.068	2700.068	2722.201

(Source[15,16])

It is revealed that these records are very excellent showing the average lactation milk yield of Kankrej breed as 2764.097, 2800.251 and 2700.068 kg during the year 2010-11, 2011-12 and 2012-13 respectively. The information relevant to milk production of animals and their documentation will help the policy planners of the state, which ultimately will help the animal keepers to improve the productivity of the breed.

PERFORMANCE OF KANKREJ COW AT SDAU, SARDARKRUSHINAGAR

The records of Kankrej cow maintained at Livestock Research Station, S. D. Agricultural University, Sardarkrushinagar were evaluated and found that breed have made significant improvement in the production and reproductive performance since inception of SDAU i.e. 2004-05 and details of some of these records is discussed as below :

FIRST LACTATION PERFORMANCE: REPRODUCTION TRAITS

The reproductive performance of Kankrej cow is known by evaluating the reproductive traits viz: age at first heat, AFC, S/C, service period, dry period and calving interval. The age at first heat, AFC, S/C of first calvers were 955.96 days, 1267.05 days and 2.34, respectively (Table 9). The shortening of AFC and age at first heat shows an improvement of 118.5 days in AFC, leading to 8.55% improvement and 10.34 days in age at first service, shows the progress about 1.04% among first calvers. The average total milk yield, 300 days milk yield, lactation length of first calvers were 551.23 lit., 552.06 lit. and 22.82 days, respectively higher during 2015 as compared to 2005. The corresponding values in percentage are 27.21%, 29.73% and 7.57% higher than 2005.

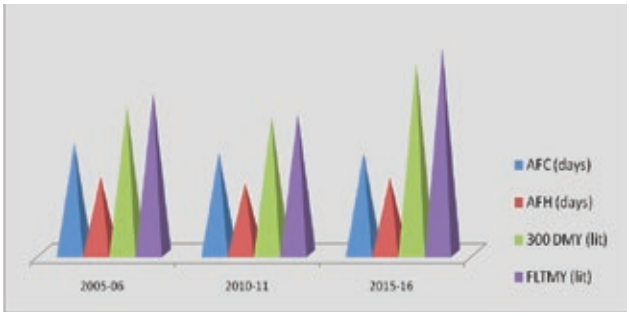

Fig. 1. Performance of Primeparous Kankrej Cow

Table 9. Performance of Primeparous Kankrej cow during the period from 2005-2015

Sr No	Traits	Year			Progress since 2005 to 2015
		2005-06	2010-11	2015-16	
		First Lactation Performance			
1	Age at first calving (days)	1385.55±42.76 (11)	1267.83±21.40 (18)	1267.05±64.53 (19)	+ 118.5 (8.55%)
2	Age at first heat (days)	966.00±41.56 (11)	888.37±37.16 (27)	955.96	+ 10.34 (1.04)
3	First lactation length (days)	301.50±24.97 (26)	281.88±7.09 (18)	324.32±14.18 (19)	+ 22.82 (7.57%)
4	First lactation milk yield (lit)	2026.17±146.85 (26)	1752.28±92.90 (18)	2577.40±143.84 (19)	+ 551.23 (27.21%)
5	300 days milk yield (lit)	1857.21±118.94 (26)	1723.06±80.64 (18)	2409.27±100.18 (19)	+ 552.06 (29.73%)
6	No of services per conception	1.71 (7)	1.00 (05)	2.34±0.29 (25)	- 0.67 (36.84%)

(Source[6,17,18])

OVERALL LACTATION PERFORMANCE: REPRODUCTION TRAITS

The reproductive performance of pluriperous Kankrej cow was evaluated and observed that service period, dry period and calving interval of overall lactation were 115.75, 143.83 and 443.47 days respectively during the year 2015-16, where service period was reduced 28.89 days as compare to 2005-06, which shows an improvement of 19.97% over the year 2005-06.

PRODUCTION TRAITS

The production performance of pluriperous Kankrej cow was evaluated and found that average total milk yield and 300 days milk yield were 258.27 and 219.56 lit higher during 2015 as compare to 2005, respectively. The corresponding values in percentage were 11.17% and 9.86% higher than 2005 (Table 10). The wet average of Kankrej cow is also proving its milk-ability, which is about 7.79, 7.77 and 9.20 lit per day and it is almost double than in milk indigenous cow and almost at par with crossbred cow during the year 2005, 2010 and 2015 respectively.

Table 10. Performance of Pluriparous Kankrej cow during the period from 2005-2015

Sr No	Traits	Year			Progress since 2005 to 2015
		2005-06	2010-11	2015-16	
		Overall Lactation Performance			
1	Lactation length (days)	303.72±7.06 (77)	294.94±6.47 (38)	300.90±10.31 (54)	- 2.82 (0.09%)
2	Dry period (days)	113.00±10.59 (28)	117.77±7.15 (27)	143.83±8.28 (61)	- 30.83 (27.83%)
3	Service period (days)	144.64±7.93 (67)	104.26±5.08 (46)	115.75±9.80 (32)	+ 28.89 (19.97%)
4	No of services per conception	2.10 (39)	1.62 (60)	2.18 (32)	- 0.08 (3.81%)
5	Total milk yield (lit)	2312.37±78.15 (77)	2368.67±70.40 (38)	2570.64±114.03 (54)	+ 258.27 (11.17%)
6	300 days milk yield (lit)	2227.44±71.54 (77)	2309.95±57.85 (38)	2447.00±93.31 (54)	+ 219.56 (9.86%)
7	Calving interval (days)	440.07±14.57 (28)	397.48±8.32 (27)	443.47±15.73 (33)	+ 3.40 (0.77%)
8	Wet Av (lit)	7.79	7.77	9.20	+ 1.41 (18.10%)
9	Herd Av (lit)	4.91	4.91	5.73	+ 0.82 (16.70%)
10	Average daily milk yield (kg) per in milk indigenous cow	3.344	3.750	4.192*	+0.848 (25.36)
11	Average daily milk yield (kg) per in milk crossbred cow	8.324	8.567	9.084*	+0.76 (9.13)

(Source[6,17,18])

The overall increase in milk yield since 1978 (846.00 lit) to 2015 (2570.64 lit) is about 1724.64 lit per animal per lactation, which is almost more than 200% improvement as compare to present productivity of the breed. This achievement is the cumulative effects of 37 years and if we continue this progress at the same speed then productivity of the breed during 2025 will be 3036.58 lit per animal per lactation and during 2050, it will be 4201.83 lit per animal per lactation and during the end of this century it will be 6532.33 L per animal per lactation.

PERFORMANCE OF INDIVIDUAL ANIMALS

Analysis of the average performance of selected individual cow per lactation revealed that the total lactation milk yield is increasing, but there is no specific trend, as it was 3045.72 to 4171.73 lit during 2005-06, while during the year it was decline and reported about 2728.05 to 3320.65 lit per animal per lactation during the year 2010-11. This decline might be due to either environmental problems or location specific nutrition / health problems.

However, again looking towards the performance of Kankrej breed during the year 2015-16 at Livestock Research Station, SDAU, Sardarkrushinagar, it is realized that milk yield of some selected cow was 3225.90 to 5114.78 lit (Table 11). It again shows that performance of the breed is improving continuously except for the period of 2010-11.

Looking towards all these facts and reality, it is realized that breed is potential in milk production, which should be explored further and as per said estimation that in the end of century the average productivity of breed might be about 6532.33 lit. per animal per lactation, if progress of the herd remains same, which was initiated from the 846.00 lit during 1978. The productivity of individual animal is almost comparable with any other breed of cow. Further, it is stated that while looking towards the historical evidence and earlier glory of indigenous cattle, we are confident that breed might be able to perform better and achieve the target with proper planning and its execution in the state.

Table 11. Performance of top milk producing cow on the farm during the Year 2015-16

Sr No	Animal No	Total Lactation Milk Yield (lit)	300 Days Milk Yield (lit)	Lactation Length (days)	Parity
1	04-92	5114.78	4674.93	418	5
2	10.72	3881.82	3133.77	451	1
3	07.63	3825.69	3371.60	417	3
4	08.39	3785.40	3279.64	341	2
5	10.64	3481.51	2674.08	440	1
6	11.26	3367.41	2984.91	369	1
7	06.40	3353.52	2850.12	404	4
8	10.31	3350.55	3126.13	354	1
9	08.10	3278.87	3070.27	365	3
10	07.49	3225.90	3224.00	307	4

FUTURE STRATEGIES

The steady improvement in the performance of Kankrej cow has been achieved due to continuous efforts for proper breeding plan, better housing and feeding practices with proper health care facilities for animals on the farm. To continuous the improvement is possible with selective breeding and grading-up programme on the farm along with other standard managemental practices. The improvement under rural area or in the herd of animals maintained under gaushala, panjarapole or professional breeders should be taken up in a phase wise manner to cover the whole population under grading up programme. Professional breeders having herd of more than 200 cattle shall be considered as an organized farm and facilities of health services, breeding, housing, feeding etc shall be provided to all such herds, initially by government and gradually it should be replaced by shouldering the responsibility on the head of Kankrej Cow Breeders' Association (KCBA) for further improvement of the herd. With the help of these herds, professional breeders having, smaller herds will be supported for necessary services on the basis of terms / conditions of the KCBA. The bull having poor transmitting abilities should be castrated and only proven bull should be used, for which SAU, SVU, NDDB, Cooperative Dairies, State Animal Husbandry Department, KCBA and other

organizations should make a common strategy to supply the proven bull for breeding purposes / AI services within the reach of all farmers. The problems of feedstuffs either qualitative or quantitative must be included in the plan for improvement of the herd maintained by maldharies having poor feed resources and steps should be taken for improving the digestibility of poor quality roughages.

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