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## RESEARCH ARTICLE

### IMPACT OF ESTROUS INDUCTION ON INTER-CALVING PERIOD AND ECONOMIC RETURNS TO FARMERS AIMING POVERTY ALLEVIATION IN TWO DISTRICTS OF UTTAR PRADESH, INDIA

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#### ABSTRACT

India is the largest milk producer in the world. The dairy enterprise is inherent activity in rural India, encompassing all the agro-system. The prolonged inter-calving period due to anestrus / endometritis or repeat breeding in general term, results in lesser lactation number, less milk yield and lower number of calf / breedable heifer production. Any improvement in inter-calving period resulting in higher economic return will help in reducing the poverty level as well as improving the nutritional security. The present study was conducted to assess the impact of estrous induction on inter-calving period as well as net return to farmers during 2009-12 in the Barabanki and Raebareli districts of Uttar Pradesh. The interventions covered 62 villages in 4 clusters. A base line survey on various aspects was conducted covering 15% of families in 42 villages at the beginning of 2009. Survey on conception rate by artificial insemination (AI) from different sources and natural service was conducted. All the oviparous bovines in the study were given patented estrous induction formulation orally (between 90-120 days of calving) for 10 days to initiate normal estrous cycle through development of corpus luteum and follicles. Animals exhibiting estrous were inseminated either naturally or artificially. The base line survey data indicated prolonged inter-calving period of 27.7 months (pooled data). The inter-calving period of the buffaloes which showed very poor estrous and conception percentage during peak hot and humid months of June-July was reduced to  $17.8 \pm 0.4$  months and  $15.2 \pm 0.7$  months in cows. The reluctance of many farmers to get their animals pregnant before 4 months of calving increased the inter-calving period though the estrous induction, the rate was above 86% in cows and above 74% in buffaloes. The average cost of milch animals in the localities varied during the period from Rs. 3000-4000 / lit milk production for cows and Rs. 4000-5500 / lit for buffaloes. The present formulation not only induced the estrous through corpus luteum and follicular development but probably helped in checking the rejection of pregnancies during first month. Timely insemination, care and observing estrous improved the inter-calving period compared to baseline data. The total cost of estrous induction in 3 subsequent pregnancies, averaged around Rs. 80/- per animal per pregnancy that enhances the number of lactations (around 55-60%) and make the existing low producing animals also a profitable venture.

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#### INTRODUCTION

India is the largest milk producer in the world. Cattle and buffalo population in India contribute 2% and 66.3% of global milk production, respectively. The dairy enterprise is inherent activity in rural India, encompassing all the agro-system (Deb *et al.*, 2013; Rai *et al.*, 2013a; [www.indiagovernance.gov.in](http://www.indiagovernance.gov.in)). There is no ethnic biasness in its rearing, unlike goat, pig, poultry or sheep. Milch animals are part of agriculture activities of all categories of farmers viz. landless, marginal, small and large farmers. While it is the main source of income to landless and small holders, it is the source of milk to large farmers. The landless and marginal farmers (particularly sub-marginal farmers) depend solely for their livelihood security on bovines, goat, pig or poultry due to lack of cultivable land (Ahuja *et al.*, 2003; Deshpande, 2003; Food and Agricultural Organization, 2005, <http://rurallivelihood-ivri.org>). In the recent decades, the continuous increase in buffalo population in India in comparison to declining trend in cattle population has emphasized two important facts.

Though buffaloes are considered as seasonal breeder and suckling of calf is only existing method practiced, its preference is due to higher fat content and lesser susceptibility to diseases (Perera, 1999; Michelizzi *et al.*, 2010; Perera, 2011). Cow milk, in spite of its higher nutritive value and ethnic respect, is gradually being less attractive due to lower economic return (Suresh *et al.*, 2009; Tiwari *et al.*, 2009). Furthermore, due to ban on slaughter of unproductive cows, disposal is a problem for the farmers. In contrast, buffalo male calves and un-productive buffaloes are easily disposed of by the farmers (Farooq *et al.*, 1999; Tiwari *et al.*, 2006). The profitability of any dairy enterprise, whether small or large, depends on the milk production and breedable heifers produced (Dastagir, 2001; Deb *et al.*, 2013; Browne *et al.*, 2013). The quality of germplasm is value addition in the system as the rearing cost is more or less same with narrow variations (Rege and Gibson, 2003; Mariante *et al.*, 2009). The prolonged inter-calving period due to anestrus / endometritis or repeat breeding in general term, results in lesser lactation number, less milk yield and lower number of calf / breedable heifer production (Misra *et al.*, 2009; Yusuf *et al.*, 2010). This finally concludes in lesser return during its productive life, in spite of constant care, feed

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and fodder and health care costs (Singh *et al.*, 1984; Tiwari *et al.*, 2009; Ranasinghe *et al.*, 2011). The situation is similar in most of the developing countries, resembling the socio-economic penury. Any improvement resulting in higher economic return will help in reducing the poverty level as well as improving the nutritional security (Radhakrishna and Ravi, 1992; Kumar and Birthal, 2004; Colman and Zhuang, 2006). The present study was conducted to assess the impact of estrous induction on inter-calving period as well as net return to farmers during the 3.5 years period.

## MATERIALS AND METHODS

The present study was conducted under the NAIP-3 Project of ICAR (World Bank funded) during 2009-12 in the Barabanki and Raebareli districts of Uttar Pradesh (U.P.) representing the socio-economic penury and agro-climate of northern plains of India. The interventions covered 62 villages in 4 clusters. The existing cattle germplasm is mainly non-descript, followed by lower crosses of Jersey or Holstein Friesian. The average lactation yield was 575.6 lit in cows. Buffalo population is of Murrah type with low productivity having average lactation yield of 468.2 lits. The concentrate feeding is not practiced by farmers. The lactating and expected cows are given some quantity of soaked cakes and home grown (sometimes purchased) grains comprising wheat, rice, bajra, maize, sorghum, grain by-products etc. The green fodder availability is inadequate and depends mainly on seasonal grasses. Wheat / paddy straw is the main staple food for bovines and to lure the animals, some quantity of wheat flour or soaked grains and green grasses are repeatedly spread and mixed.

### Base line survey

In the beginning of the project (2009), a base line survey on various aspects was conducted covering 15% of families in 42 villages. The inter-calving period and total annual income of these families (excluding external employments) were included in the present study.

### Survey on conception rate by artificial insemination (AI) and natural service

The artificial insemination services, in the villages of the project area, are being provided by the State Animal Husbandry Department Dispensaries and part of the area is covered by BAIF (Bharatiya Agro Industries Foundation's). The personnel in the BAIF are well trained and experienced while in the Government Dispensaries, the person available is doing the artificial insemination (A.I.) for whom the degree of skill varied greatly. In the case of repeated failure of A.I. or non-availability during estrous period, natural service by locally available bulls (either on cost or free) are practiced by the farmers. A comparison of these three sources of insemination was made to draw a conclusion. We trained 10 youth from both districts and one from each district was provided insemination kit viz. LN2, semen straw, cryocane etc.

### Induction of estrous

Animals not exhibiting estrous up to 4 months of calving and with the consent of farmers, all the oviparous bovines in the study, were given patented estrous induction formulation (Rai *et al.*, 2013b) orally (between 90-120 days of calving) for 10 days to initiate normal estrous cycle through development of corpus luteum and follicles. Animals exhibiting estrous were inseminated either naturally or artificially. In case of repeat breeders, uterus was examined by rectal palpation method for signs of endometritis. Also such repeat breeding animals showing no signs of endometritis were re-inseminated during the next cycle. The monitoring on inter-calving period for 40 months was done. Few animals aborted the pregnancies due to some reasons and were not included in the study. The comparison of inter-calving period was made between four sources of inseminations, base line data and un-intervened farmers.

### Assessment of return

An assessment was made for total return and the cost of healthcare, feeding, care etc., considered constant. The cost of total milk sold and

the value of heifer (expected market value) was considered for the purpose.

## RESULTS

The base line survey data indicated prolonged inter-calving period of 27.7 months (pooled data). The average annual income of various categories of farmers was Rs. 14625.20, Rs. 26813.00 and Rs. 50714.70 for landless, marginal and small farmers, respectively. This included income obtained from livestock also.

### Comparison of insemination methods for conception

The comparison of insemination success rate (resulting into conception) has been given in the Table 1. The success rate of BAIF was higher and more or less constant over the years. The lowest success rates observed are from the state Government Dispensaries. The trained personnel in the project gradually gave better results.

**Table 1. Comprising of success rate of AI (%)**

Source	2009-10	2010-11	2011-12	2012-13
BAIF	53.2	52.1	54.3	53.6
State AH dispensaries	29.4	32.6	33.4	35.2
Natural service	56.2	54.2	53.4	55.1
Project trained person	-	-	54.3	64.2

From the late 2009-10, the estrous induction was practiced in the villages. Till 2012-13, more than 15,000 cows and buffaloes have been intervened. The data of 50 families have been recorded for 3.5 year for induction rate, inter-calving period and total milk sale along with the heifers available. The results are presented in the Table 2.

**Table 2. Impact on pooled inter-calving period (No. of animal)**

Group	Average inter-calving period (months)
Intervened animals (1175)	16.9 ± 0.4
Un-intervened animals (165)	23.6 ± 1.2
Base line data	27.7

**Table 3. Inter-calving period, species wise**

Species	Inter-calving period (months)
Cows (712)	15.2 ± 0.7
Buffaloes (463)	17.8 ± 0.4

The buffaloes which showed very poor estrous and conception percentage during peak hot and humid months of June-July resulting in prolonged inter-calving period, revealed better conception rate and inter-calving period was reduced to 17.8 ± 0.4 months. The reluctance of many farmers to get their animals pregnant before 4 months of calving increased the inter-calving period though the estrous induction which was above 86% in cows and above 74% in buffaloes. The time of insemination and quality of semen influenced the conception rate. These 1,340 animals covered in the study were either covered by BAIF, natural service, or by trained persons in the project. The inter-calving period in the animals of neighboring un-intervened families also showed reduced inter-calving period compared to the base line data. The estimate of total return during 40 months to these 40 families (landless and marginal in terms of cultivable land holdings) are presented in the Table 4.

**Table 4. Estimated average return to the families (Rs) during 40 months**

Source	Intervened families	Un-intervened families
Sale of milk (306 liter./animal x 2 cycle) @Rs. 18/=lit.	11016.8 ± 62.1	5508.4 ± 38.6
Produced heifers / female calves per animal	1.4 ± 0.1	0.4-0 ± 0.9

The average cost of milch animals in the localities was decided on the basis of milk production status which varied during the period from Rs. 3000-4000/lit for cows and Rs. 4000-5500/lit for buffaloes. The variation included stage of pregnancy, number calving already taken and health status of the animals. There was no exiting prevalent rates for heifers, but being improved germplasm, the cost varied between Rs. 15000-30000/= for cattle and Rs.18000-35000/= for buffaloes.

## DISCUSSION

Inter-calving period is an essential parameter that determines the dairy economics. The profitability of dairy unit in the families is severely influenced by the inter-calving period (Plaizier *et al.*, 1997; French and Nebel, 2003; Wolf, 2003). Anestrous / endometritis or repeat breeding prolongs the inter-calving period (Larson and Ball, 1992). This result in losses in terms of less number of lactation, lesser milk produced and less number of female calves' availability to upgrade the unit (Plaizier *et al.*, 1998). Milch animals are integral part of rural areas in most of the developing countries (Ambrose and Colazo, 2007). So unproductiveness due to prolonged inter-calving period results in lesser return that proves unprofitable to the farmers (Hansel and Convey, 1983). There are several new approaches to improve the reproductive efficiency in large ruminants (Bo *et al.*, 2009). Two main factors emerged from the present study viz., skill of insemination and quality of the semen with time of insemination that severely influenced the conception and inter-calving period. The conception rate must be linked with these two factors also. The present formulation not only induced the estrous through corpus luteum and follicular development but probably helped in checking the rejection of pregnancies during first month which has been reported to be 3-10% (Agarwal and Tomes, 2003; Rai *et al.*, 2013). Whenever any technological infusion is made in the system, it generates some degree of awareness in the area because of the profitability out of its use (Otte *et al.*, 2009). The inter-calving period in the animals of un-intervened families of neighboring areas also showed improvement compared to the base line data (Agarwal and Tomes, 2003; <http://rurallivelihood-ivri.org>). This improvement was mainly due to timely insemination, care and observing estrous (Ambrose *et al.*, 2010). It is well known that the inter-calving period in buffaloes is prolonged as they exhibit very poor estrous and conception percentage is less during peak hot and humid months resulting in prolonged inter-calving period (Mehmood *et al.*, 2012). In spite of individual reluctance, the inter-calving period in cows came down to  $15.2 \pm 0.7$  months and in buffaloes to  $17.8 \pm 0.4$  months. This resulted in more number of lactation, more milk and more improved calves. These improved calves can establish small dairies with higher productivity and profitability. The total cost of estrous induction in the three subsequent pregnancies was Rs. 240/- only and may be averaged around Rs. 80/- per animal per pregnancy. It can enhance the number of lactations by around 55-60% and make the existing low producing animals also as a profitable venture. Few farmers during the period upgraded their unit to 4-5 high producing animals without any extra cost.

## Conclusion

Timely estrous induction by using the present formulation along with timely insemination and care enhances the number of lactations which ultimately proves beneficial to the farmers, and thus could bring good economic returns and help aiming poverty alleviation.

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