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Supplementation of area specific mineral mixture improves the reproductive performance in buffaloes—a field study

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Supplementation of minerals decreases service period and intercalving interval and also enhances conception rate in bovines (Selvaraju *et al.* 2009). The deficiency of certain macro-and micro-minerals in dairy animals was reported in field conditions (Prasad and Gowda 2005).The supplementation of ASMM increased reproductive efficiency in buffaloes and 70% buffaloes showed normal cyclicity (Annual Reports, DARE, 2008–2009). In the present study an attempt was made to observe the effect of ASMM supplementation on reproductive performance in buffaloes under rural conditions.

The study was carried out in adopted villages of institute in Bareilly district of Uttar Pradesh. The reproductive problems of the animals were identified at the farmer's door in the villages. The details of the dairy buffaloes were recorded and all the animals were examined per rectally to assess the reproductive status/problem. The delayed pubertal heifers with good body score at the time scale of 3 to 5 were also included following 2 gynaecological examinations conducted at 10 days interval. The postpartum anestrus (not showing symptoms for more than 100 days after calving) and repeat breeding (not conceiving following 3 inseminations) animals were selected based on history as well as gynaecological examination.

Blood samples were collected in 15 ml tubes containing 25µl of heparin and transported to the laboratory in an ice box. The plasma was separated within few hours of blood collection by centrifugation at 3000 rpm for 15 min and stored at –20°C until analyzed for minerals and progesterone levels. Analysis of plasma progesterone estimation was carried out using RIA kit to confirm ovarian functional status. The animals with endometritis, cervicitis were excluded from the experiment. ASMM was procured from Agriculture Technology Information Centre of the institute. It contains all macro- and micro-elements, which are essential to animals. The selected animals were supplemented with ASMM @ 40–50 g/buffalo/day until the animal responds or maximum up to 90 days.

The reproductive parameters (onset of estrus, estrus duration, duration of estrous cycle and pregnancy) were recorded. Response of ASMM supplementation was considered only when the animal had shown estrus in case of anestrus and conceived in repeat breeders within 3 months of feeding. The copper, zinc and iron levels in plasma were estimated by atomic absorption spectrophotometer after digesting the plasma samples in nitric acid and triple acid mixture. The progesterone profile during estrus and diestrus stages of estrous cycle were estimated between normal cycling and repeat breeding animals and the differences in the levels were statistically analyzed by using student's 't' test.

Reproductive problems were found in 220 (78.57%) out of 280 examined animals. Within the reproductive problem animals examined, postpartum anestrus (40%) ranked first followed by repeat breeding and delayed sexual maturity (20% each), silent heat (10.9%) and infections (9.09%). The percentage of animals with reproductive problem showing mineral deficiencies in the adopted villages is presented in Table 1. Animals having plasma levels of Cu<0.68 µg/ml,

Table 1. Animals (%) with reproductive ailments showing microelements deficiency

Reproductive condition	Microelements deficiency (%)		
	Copper	Zinc	Iron
Postpartum anestrus (n =88)	47.72 (n =42)	38.63 (n =34)	34.0 (n =30)
Repeat breeders (n =44)	56.81 (n =25)	22.72 (n =10)	18.18 (n =8)
Delayed puberty heifers (n =44)	68.18 (n =30)	68.18 (n =30)	45.45 (n =20)

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Table 2. Progesterone profile (mean±SEM ng/ml) of repeat breeding animals during estrus and diestrus before supplementation of ASMM

Reproductive status	Progesterone level (ng/ml)	
	Estrus	Diestrus
Normal cycling	0.38±0.11(n =8)	1.78±0.26(n =8)
Repeat breeder	0.57±0.17(n =8)	1.90±0.22(n =8)
Significance	NS	NS

Zn<0.8 µg/ml and Fe<1.5 µg/ml were considered as mineral deficient (McDowel 1992). In the present study the mean duration of postpartum anestrus in the selected animals was 243.28±87.18 days (range 100 to 480) and the average number of inseminations in case of repeat breeder was 4.0±0.33 (range 3 to 6). The progesterone level in postpartum anestrus animals was 0.27±0.25ng/ml and the mean values did not differ between the cycling and repeat breeding animals during estrus and diestrus stage of estrous cycle (Table 2). However, the progesterone levels at estrus were nonsignificantly higher in repeat breeders, which reflects delayed luteolysis associated with asynchrony between onset of estrus and ovulation which results in either failure of fertilization or early embryonic mortality as reported earlier by Selvaraj and Kumar (2001).In our study nonsignificanlty higher progesterone levels may be due to the less number of animals and also large variations in concentration of progesterone between the animals.

Among the ASMM supplemented group, 38.63% of the postpartum anestrus animals started cycling within 2 months and another 13.64% exhibited estrus later and thus a total of 45.65% animals conceived within 3 inseminations (Table 3). Among the repeat breeders 11.76%, 23.52%, 64.70% buffaloes conceived in first, second and third inseminations, respectively. Overall 38.63 % of repeat breeding animals conceived after 3 months supplementation of ASMM. Further, among the delayed pubertal animals (44) supplemented, 50 % heifers started cycling and 68.18 % conceived within 3 months of supplementation. Among the total of 24 silent heat cases, 9 (37.5%) conceived within the same period following supplementation of ASMM.

Table 3. Effect of supplementation of area specific mineral mixture on postpartum anestrus and repeat breeder buffaloes

Category	Number of animals responded (%)*			
	< 1 month	1–2 month	2–3 month	No. of animals conceived (%)
Postpartum anestrus (n =88)	11 (12.5)	23 (26.13)	12 (13.64)	21 (45.65)
Repeat breeder (n =44)	2 (11.76)	4 (23.52)	11 (64.70)	17 (38.63)

* Estrus onset in anestrus and conception in repeat breeder animals

Several studies (Gowda *et al.* 2008, Selvaraju *et al.* 2009) showed that adding trace minerals to animal diets benefits animal productivity even when no deficiency symptoms are obvious. The effectiveness of feeding supplemental zinc, copper and manganese to improve reproductive efficiency of cows is also well documented. Subclinical trace mineral deficiencies occur more frequently than recognized by most livestock producers. Currently this is a bigger problem than clinical mineral deficiencies, because the farmer does not see specific symptoms that are characteristic of a subclinical trace mineral deficiency.

Improvement in reproductive efficiency in these animals supplemented with ASMM containing all essential macro- and micro-elements has been attributed to various factors. Minerals have very important role in endocrine system as well as in resumption of follicular growth and fertility in dairy cows (Smith and Akinbamijo 2000). The lower copper level is related to repeat breeding (Ingraham *et al.* 1987). Prasad *et al.* (1989) also observed a positive correlation between copper and reproductive hormones. Similarly, optimum level of zinc is essential to maintain the activity of FSH and LH (Apgar 1985) and thereby facilitating normal reproductive performance. Therefore, improvement in reproductive efficiency in the present study may be attributed to the beneficial action of these supplemented minerals on the neuro-endocrine axis and reproductive functions. This study further confirms that the supplementation of ASMM improves fertility in buffaloes under rural conditions.

SUMMARY

In a field trial the efficacy of area specific mineral mixture (ASMM) supplementation on reproductive efficiency in buffaloes was assessed. Out of the 280 buffaloes examined, 220 had postpartum anestrus (40%) and repeat breeding (20%) followed by delayed sexual maturity (20%), silent heat (10.9%) and endometritis of mild to moderate degree (9.09%). Among the postpartum anestrus buffaloes 52.27% and 45.65% exhibited estrus and conceived, respectively, within 3 months of ASMM supplementation. Among the repeat breeders, which received the ASMM, 38.63% conceived within 3 inseminations. Onset of estrus occurred in 50% of the delayed pubertal animals, which received the ASMM. However, from silent estrus cases, 37.5% conceived within 3 months of the ASMM supplementation. The present study indicated that supplementation of ASMM improves reproductive performance in buffaloes under rural conditions.

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