MANAGEMENT STUDIES TO REDUCE CALVING INTERVA OF MURRAH BUFFALO DAIRY HERD: HEAT DETECTION THROUGH RECTAL/OVARIAN PALPATION [1]

Cesar C. Arevalo[2] and Grace Marjorie R. Recta [2]

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[2] Supervising Science Research Specialist and Agricultural Center Chief, Philippine Carabao Center at Mariano Marcos State University, Batac City, Ilocos Norte
email: boboy1204@yahoo.com; Tel/Fax No. 077-79-3187

Title	**:**	**Management Studies to Reduce Calving Interval of Murrah Buffalo Dairy Herd: Heat Detection through Rectal/Ovarian Palpation**
Researchers	:	Cesar C. Arevalo and Grace Marjorie R. Recta
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INTRODUCTION

The framework of existence of the Philippine Carabao Center (PCC) is embodied in various components of the Carabao Development Program which aims to improve the carabao industry through genetic improvement program (GIP), enterprise development, and research and development. Gene pools for dairy buffalo, notably the Murrah breed, are maintained in the regional centers and the elite animals are the subject of sustained GIP involving selection, evaluation and testing. The best genetics are utilized for extensive upgrading of domestic swamp buffalo stocks through artificial insemination and breeder female dairy stocks of good quality are also available.

The Bulgarian Murrah buffalo is a prolific milk producing breed that is tropically adapted. To take advantage of the animal's optimum potential to produce milk, it is important to shorten the calving interval, which is the period between two successive calving or parturition of a cow. The normal average gestation period of this kind of animal is 312 days. (Sarabia, 2009). Ideally cows should calve at least twice in three years. In this way, more calves and milk could be produced; animal selection achieved in the shortest time possible; and carabao population of good genetics would continue to increase.

Starting with five heifers in 1997, the institutional herd of Bulgarian Murrah buffaloes of PCC at Mariano Marcos State University gradually grew and is presently maintained at 50-head, to showcase best practices in managing dairy buffaloes under a cut-and-carry and farm-residue based system of operation in the Ilocos Region. Reproductive and productive performances of the female animals are religiously recorded and form part of the Buffalo Integrated Database System of the agency.

Under the PCC-GIP, artificial insemination (AI) is used as a priority mating system. This was to ensure that the semen of the best bulls is used. AI is regarded as the best tool in massive reproduction of genetically improved breeds and shortening calving interval can contribute to the goals and objectives of carabao upgrading program considering that majority of small-hold farmers own only one head of carabao for breeding. Natural mating with a less superior clean-up bull is resorted to only after three successive unsuccessful AI services.

As of December 2010, the calving interval of the PCC at MMSU herd was 22.30 months. This may due to several management factors such as poor observation or detection of post-partum heat or little time was devoted to heat detection. The success of AI depends on critical observation of animals to detect heat at appropriate time as late insemination leads to failure of conception. The performance of herd in general and female in particular depends on how female animals are being noticed in heat and when they are artificially inseminated. Acceptance of the male is considered as the most reliable estrus indicator, but this is not possible in the herd where there is no vasectomized bull and AI is the priority mating system. Frequent urination, bellowing, vulva swelling and mucus discharge are referred to be salient signs of heat but their expression, in buffalo is extremely weak. Ovulation cannot be predicted from the

behavior signs because even when they are shown, they are not reliable. For these reasons, the application of AI is limited in buffalo, considering that a high conception rate depends mainly on insemination at a correct time relative to ovulation.

In support to the PCC-GIP and to improve reproductive performance, this operational research was embarked. With the general objective of shortening the calving interval from 22.30 months in 2010 to 16 or 14 months by 2015, it specifically aims to a) determine the number of days of first heat post-partum, b) observe external signs of heat after calving, c) identify uterine, vaginal and/or ovarian conditions during estrus, d) determine conception rate and/or AI efficiency, and e) determine calving intervals.

REVIEW OF LITERATURE

The purpose of breeding is to improve the genetic make-up of livestock intended for the next generations, to produce animals that can adapt and perform well under the local condition. Foremost considerations are good in milk production, ideal body conformation and mammary system to support high milk production, produce live calf every breeding season, good tolerance to heat and humidity and good resistance to diseases and external parasites. In this way the best breed becomes better and better. All of these can be achieved in a shorter period of time if the animal calves twice in every three years or can achieve the normal calving interval of 11.5 to 19 months (Philippine Carabao Center, 2009).

The average length of estrous cycle has been reported to be 21 days in the riverine type. Several factors such as climate, temperature, photoperiod and nutrition have shown to affect the length of estrous cycle and degree of heat expression. Estrus behavior in buffalo has lower intensity than in cows and is therefore much more difficult to detect (Barile, 2012).

PCC at Ubay Stock Farm in Ubay, Bohol used uterine flushing to ensure protection of an un-involuted postpartum estrus from infection and lessen the delay of successive occurrence of heat postpartum. With the help of a teaser bull in heat detection, the center was able to establish that buffaloes come in heat between 4 a.m. and 6 a. m. (before morning milking) and between 5 p.m. and 7 p.m. (after afternoon milking). Based on the study, the highest success rate of AI was attained when 73.2% or 63 out of 86 animals showed signs of estrus during the first estrus heat occurrence. The study also noted that with the use of uterine flushing combined with teaser bull in 86 animals, the average days from calving to first AI service was reduced from 181.8 days (without flushing) to 62.32 days in 2009. In 2010, an average of 49.20 days to frist service, was observed. Further, the study showed that AI is best done within 60 days after calving contrary to the traditional practice of conducting it 60 days after calving (Marcelo, 2011).

Different signs are studied carefully for detection of heat. Heat detection aids are very important tools for efficient reproductive management if used in combination with

expert eye (Rao et al, 2013). These techniques include: heat mount detectors, use of teaser bull, automated systems or hormonal treatments. Cows with detector (KaMar) plus CHALK marking on tail were more efficient than detector alone. Visual observation with tail paint is 98% efficient as compared to heat watch alone (91%).

The presence of teaser bull is helpful to identify buffaloes in heat, in this case the standing estrus is the most reliable sign. Utilizing a teaser bull and inseminating the animals after the end of heat gave higher pregnancy rates (Barile, 2012).

Manual checking of the female reproductive tract is another method of detecting estrus. The female reproductive tract of the buffalo is similar to that of the cow in structure and location, although the cervix is less conspicuous and the uterine horns are more coiled. As in cattle, the uterine horns are turgid and coiled and have marked tone during estrus; they are flaccid with lack of tone during diestrum (Suthar and Dhami, 2010).

METHODOLOGY

Being an operations research, this study did away with the conventional experiment type with different sets of treatments and replications. Improvements and interventions in management were made from previous year's accomplishments or performance of the herd.

Management in 2011:

In 2011, expectant cows were separated from other animals in the herd when signs of parturition were observed so that cow was not disturbed during calving as disturbance that may prolong the occurrence of estrus and may cause difficulty of calving. Immediately after calving, the calf was separated from the dam and placed in an elevated calf pen located at a grow-out barn. Fifteen days postpartum, laborers were directed to detect external signs of heat and report immediately to the Farm Supervisor for insemination. Common external heat signs were bellowing, restlessness, frequent urination, mounting other animal, stand still when mounted, presence of mucus in the vulva or tail portion. In-heat animals were inseminated following the mating plan and morning and afternoon insemination and other standard operating procedure in the conduct of artificial insemination. During insemination, the condition or tone of the uterus and presence or absence of mucus discharge was also noted.

Management in 2012 onwards:

In January 2012, weekly rectal/ovarian palpation was included in the day-to-day activity related to heat detection, wherein all open cows including newly-calved cows (15 days postpartum) were subjected to rectal and ovarian palpation. This was to increase the number of observed animals in heat since external heat signs were seldom seen in the

previous year. Uterine horns are turgid and coiled and have marked tone during estrus; they are flaccid with lack of tone during diestrum (Suthar and Dhami, 2010).

All open cows were subjected to rectal palpation to know the condition of the uterus. Tone 1 (T1) if the uterus was flaccid or no tone, Tone 2 (T2) if the uterus was somewhat hard and Tone 3 (T3) if the uterus was very hard and the uterine horns were coiled. If flaccid, palpation continued to the ovaries attached to the left and right fallopian tube or oviduct. If corpus luteum (CL) was present, either corpus luteum small (CLS) or corpus luteum large (CLL) in one of the ovaries, the animal was subjected to close monitoring until the CL regressed. This was considered to be the best time to conduct artificial insemination (AI).

Pregnancy diagnosis was also done starting 15 days after AI. When the uterus of the animals was hard, no fertilization/conception took place. Follow-up AI was done when the animal had T2 and T3 especially when there was mucus being aspirated from the vagina. On the other hand, when the uterus was soft and has growing CL, chances are the animal conceived.

Another intervention was the aspiration of mucus present in the vagina. M1 if no mucus discharge, M2 if mucus present was cloudy and M3 if mucus aspirated was copious and very clear (like egg white). Animal in estrus has mucus discharge or vulva was wet with mucus. When uterine tone was T2 and T3, the researcher aspirated (as) mucus placing the tip of the straw sheathe before the opening of the cervix. This was to ascertain that the animal was indeed in heat. The combination of two heat signs (T3 and M3) is a good indication that animal should be inseminated.

In 2013, vaginal color was included in the observation of heat classified as pale (V1), slightly red (V2) and Reddish (V3).

Data Gathered:

- **Days to first heat post-partum** – This is the number of days from calving to the day of first observed estrus. Estrus was based on external manifestations such as bellowing, frequent urination, mounting other animals or being mounted by other animals in the pen, presence of mucus on vulva

- **Tones of the uterus** classified as flaccid (T1), hard (T2) or very hard (T3)

- Presence of **mucus discharge** or mucus in the vagina classified as cloudy (M2) or clear (M3) or its absence (M1)

- AI efficiency:

$$\% \text{ AI Efficiency} = \frac{\text{No. Pregnant Animal}}{\text{No. of Insemination Services}}$$

- Pregnancy Rate

  $$\% \text{ Pregnancy Rate} = \frac{\text{No. Pregnant Animals}}{\text{No. Open Cows}}$$

- Calving Interval (CI):

  $$CI = \frac{(\text{Date of Most Recent Calving}) - (\text{Date Previous Calving})}{30.5 \text{ days}}$$

- Monthly report of artificial insemination indicating all signs of heat manifested by the animal, date and time of AI including the follow-up

- Body condition score of animals prior to calving and during lactation.

Recording, Analysis and Reporting:

Record all insemination data were in the individual animal record and annual Mating Record from 2011 to 2015. Update Gene Improvement Program (GIP) data base was updated immediately after each activity. Monthly report was submitted to the PCC National Headquarters while analysis and reporting was done every quarter.

RESULTS/FINDINGS

2011 Performance:

During the first year of the study (2011), in-heat animals were determined by close monitoring of external heat signs like, bellowing, reddening of the vulva, frequent urination, restlessness, mounting and being mounted by other animals.

Table 1 shows the number of days to first heat postpartum of cows. One animal manifested heat within 30 days after calving, while 5 or 33% came into heat between 31 to 60 days. Most of the 15 cows were observed for first heat post partum after 60 days.

From inseminations made on the 15 cows, only 6 or 40% got pregnant. The animal which came into heat before 30 days got impregnated immediately while only 40% got pregnant from those which came into estrus and inseminated within 31to 60 days. Lesser occurrence pregnancy was observed in those which showed heat later than 60 days.

Table 1: Days to first heat postpartum, PCC at MMSU, 2011

Days to 1st postpartum heat	No. of Animals	No. Pregnant
0-30	1	1
31-60	5	2
61-90	1	none
91-150	4	1
151 above	4	2
Total	15	6

Table 2 shows the external heat signs manifested by the animals. There were 30 insemination services conducted to 15 cows in the herd. Only 6 animals got pregnant. AI efficiency obtained during the first year of the study was 20% with pregnancy rate of 40%. It could also be noted that a very hard uterine horn (T3) and presence of mucus discharge during AI resulted to more pregnancies (33.33%). This observation happened to fall on a monthly ovarian/rectal palpation routine activity in the center. Out of the 30 insemination services with very hard uterus (T3), 6 animals got pregnant.

No pregnancies resulted from animals which were inseminated when they showed behaviors such as mounting, frequent urination and presence of dry mucus in the vulva. Those with dry mucus had flaccid to hard uterus. This observation somewhat agrees with Barile (2012) that estrus behavior in buffalo has lower intensity than in cows and is therefore much more difficult to detect.

Based from the Gene Improvement Program (GIP) data base, the average calving interval for 2011 obtained was 21.30 months.

Table 2. External heat signs, uterine tone and vaginal discharge observed in postpartum cows, PCC at MMSU, 2011.

Different Heat Signs		No. of Insemination Services	No. Pregnant	AI Efficiency (%)
Before AI	During AI			
	T3, M3	5	2	40
	T3, M2	4	1	25
	T3, M1	2	1	50
	T3	12	2	17
Mounting, FU	T3	1	None	0

Dry Mucus	T2	3	None	0
	T1, M2	2	None	0
Dry Mucus	T1	1	None	0
Total		30	6	20

T1 – Flaccid M1 – No mucus discharge FU – frequent urination
T2 – Hard M2 – Cloudy mucus discharge
T3 – Very Hard M3 – Clear mucus discharge

2012 Performance:

Accomplishment during the first year of the study was very low. Based from the pregnancies resulting in animals which had very hard uterus and with mucus discharge, an intervention was done and been part of daily routine activity in the institutional herd - the weekly rectal/ovarian palpation.

In 2012, there were 22 cows and first postpartum heat within 30 days was detected in 8 animals with a pregnancy rate of 50% (Table 3). Three animals which showed post-partum heat from 31 to 60 days and two got pregnant. Seven animals came into heat after 60 days and resulted to 86% pregnancy rate. The pregnancy rate for the whole year, regardless of number of days to first heat postpartum was 77%.

Table 3. Days to first heat postpartum, PCC at MMSU, Batac City, 2012.

Days to 1st postpartum heat	No. of Animals	No. Pregnant
0-30 days	8	4
31-60 days	3	2
61-90 days	7	6
91-150 days	none	none
151 above	4	3
Total	22	17

Table 4 shows the external heat signs manifested by the animals. A total of 61 insemination services were conducted to the 22 cows, resulting in 17 pregnancies with AI efficiency of 28% and 77% pregnancy rate. As in the previous year, the presence of mucus and a hard to very hard uterus was a good indication of heat. A very hard uterine horn (T3) and presence of mucus discharge during AI resulted to more pregnancies.

Although mounting, frequent urination and bellowing were noted in some animals, pregnancies were obtained from those which had very hard uterine horns and

clear mucus discharge during insemination. This observation corroborates the report of Suthar and Dhami (2010) that manual checking of the female reproductive tract is another method of detecting estrus.

Based from the Gene Improvement Program (GIP) data base, the average calving interval for 2012 was slightly reduced from 21.30 to 20.20 months.

Table 4 : Different heat signs, in 2012

Different Heat Signs		No. of Insemination Services	No. Pregnant	AI Efficiency (%)
Before AI	During AI			
	T3, M3	4	1	25
	T3, M2	22	8	36
	T3, M2 (as)	8	2	25
	T2, M2 (as)	5	None	0
	T3	8	3	38
Mounting, FU	T3, M3	2	1	50
Bellowing	T3, M2	4	None	0
	T3, M3 (as)	2	1	50
Mounting, FU, Bellowing	T3, M3	1	1	100
FU	T3, M2	4	None	0
	T3 (ES)	1	None	0
Total		61	17	28

T1 – Flaccid
T2 – Hard
T3 – Very Hard

M1 – No mucus discharge
M2 – Cloudy mucus discharge
M3 – Clear mucus discharge
ES - Injected with heat hormone.

FU – Frequent Urination
(as) - Aspirated

2013 Performance

On the third year of the study (2013), there were 24 cows and 2 animals came into first postpartum heat within 30 days with a pregnancy rate of 50% as shown in Table 5. Three animals which showed post-partum heat from 31 to 60 days and two got pregnant. The pregnancy rate for the whole year, regardless of number of days to first heat postpartum was 62.5%.

Table 5: Days to first heat postpartum, PCC at MMSU, 2013.

Days to 1st postpartum heat	No. of Animals	No. Pregnant
0-30 days	2	1
31-60 days	3	2
61-90 days	2	1
91-150 days	7	5
151 above	10	6
Total	24	15

Table 6 shows the external heat signs manifested by the animals. A total of 57 insemination services were conducted to the 24 cows, resulting in 15 pregnancies with AI efficiency of 26% and 62.5% pregnancy rate. This trend is close to that obtained in 2012. The results also affirm the earlier observation that very hard uterine horn (T3) and presence of mucus discharge are good indicators of heat.

Frequent urination was the only external behavior observed during the year. However, the color of the vagina was included and was good indicator of heat as manifested in Table 6.

Based from the Gene Improvement Program (GIP) data base, the average calving interval for 2012 was slightly reduced from 21.30 to 20.20 months.

Table 6: Different Heat Signs in 2013

Different Heat Signs		No. of AI Services	No. Pregnant	AI Efficiency (%)
Before AI	During palpation/ AI			
	V2, T3, M3 (as)	16	5	31
	V2, T2, M3	7	3	43
	V3, T3, M3 (as)	5	2	40
	V2, T3, M2 (as)	4	1	25
	V2, T3	4	0	0
FU	V3, T3, M3	3	0	0
	V1, T3, M2 (as)	4	0	0
FU	V2, T3, M3 (as)	4	1	25
	V2, T3, M2 (as)	3	1	33
	V1, T3, M3 (as)	1	0	0
	V2, T2, M3 (as)	3	1	33
	V2, T3, M3 (ES/as)	3	1	33
Total		57	15	26

T1 – Flaccid	M1 – No mucus discharge	V1 - Pale
T2 – Hard	M2 – Cloudy mucus discharge	V2 - Slightly red
T3 – Very Hard	M3 – Clear mucus discharge	V3 - Reddish
FU – Frequent Urination	ES - Injected with heat hormone	As - Aspirated

The number of inseminated animals and number of pregnant animal with the corresponding conception rate in 2012 and 2013 as a result of monitoring the ovarian activity by ovarian palpation is shown in Table 7. During the weekly rectal palpation, corpus luteum from small corpus luteum (CLS) to large corpus luteum (CLL) were observed in the either both of the ovaries. The CLS and the CLL were monitored until they matured and regress – thus the animal was ready for insemination. In some instances, during weekly palpation CL especially CLS could hardly felt or palpated. This is the reason why there were animals ready for insemination at the time of palpation. . Inseminated animals with observed corpus luteum had a higher conception rate than no observed CL.

Table 7: Result of Ovarian Palpation

Observations	# of Insemination Services		# of Pregnant Animal		AI Efficiency (%)	
	2012	2013	2012	2013	2012	2013
With Corpus Luteum	19	26	12	11	63%	42%
No Corpus Luteum (CL) at the time of palpation	12	31	5	4	42%	13%

The summary of the herd performance from 2011 to 2013 is shown in Table 8. Calving rate for three years is from 21.3 for 2011, 20.2 for 2012 and 19.5 for 2013. Pregnancy rate is from 40 %, 55% and 65 % for 2011, 2012 and 2013 respectively. Likewise AI efficiency is 20 % for 2011, 28% for 2012 and 26% for 2013.

Table 8: Herd Performance, PCC at MMSU, 2011-2013

Herd Performance	2011	2012	2013
Calving Interval (Months)	21.3	20.2	19.5
Pregnancy Rate (%)	40	55	63
AI Efficiency (%)	20	28	26

CONCLUSION/RECOMMENDATTION:

Postpartum heats were observed as early as 30 days after calving. In 2011, there were 5 postpartum heat (90) days observed with 60% AI efficiency. A total of 25 animals were inseminated within 90 days postpartum in 2012 and 2013 with 64%. Likewise, combinations of very hard uterine tone and with clear mucus discharge had a high AI efficiency followed by hard uterine tone with clear mucus discharge. However, there results of high efficiency from the combinations of T3 and M3 and T2 and M2

Herd performance on pregnancy rate increased from 40% to 63%. AI efficiency also increased from 20% in 2011 to 28% in 2013. Calving interval was also reduced from 22.30 months in 2010 to 19.5 months in 2013.

It is recommended therefore to continue the weekly rectal/ovarian palpation to all open cows including the newly calved (15 days post-partum) animal to increase number of animals detected with heat signs, increase artificial insemination activity and increase the number of pregnant animals within 90 days postpartum.

It is also recommended to add in the insemination activity the follow-up insemination even the animals have been inseminated in the morning and in the afternoon. If the animal has still hard to very hard uterus, insemination should still be done because ovulation still takes place towards the end of the estrous.

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