Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.6, No.21, 2016

The Response of Estrus Synchronisation of Zebu and Zebu Cross Bred Cattle with Single Treatment of $PGF_{2\alpha}$ in Hadiya Zone, Southern Ethiopia

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Abstract
A study was conducted to test a simple hormonal oestrus synchronization regime and evaluate the response of Zebu and their cross bred to $PGF_{2\alpha}$ in Hadiya zone, Ethiopia.Animals treated with single injection of $PGF_{2\alpha}$ 64% (n=32) of zebu and 70% (n=35) of crossbred ones responded positively and showed standing oestrus with in the interval of 48hrs and 96hrs. The estrus response was 48 hrs (n=3), 72 hrs (n=25) and 96 hrs (n=4) in zebu cattle with mean duration $0.5452^{b,}$ $^{-}0.0393^{a,}$ 0.1636^{c} and 48 hrs (n=10), 72 hrs (n=23) and 96 hrs (n=2) were $0.0000^{b,}$ $^{-}0.03556^{a,}$ -0.981^{c} in cross bred cattle respectively. Parity number was found the significant factor in the study animals. Zero parity (n=17) in Zebu cattle and (n=15) in crossbred highly influenced in the response of estrus in both cattle. The result indicated that as the parity number increased the response rate was decreased in both breeds. Those animals showed standing oestrus were inseminated and 77% (24) of Zebu and 65.5% (n=23) of crossbred conceived. The pregnancy rate 48% (24/32) of Zebu and 46% (23/35) of crossbred were achieved. The conception rate after oestrus synchronistion with cloprestenol was good. Thus on the basis of present findings diagnosis of ovarian structure by means of rectal palpation must be supported by milk or plasma P4 concentration to maximize the efficiency of treatment. Further research is required to evaluate the comparative oestrus synchronization responses and cost of different regimes of Cloprestenol or other prostaglandin and/or combination of GnRH and prostaglandin treatments
Keywords: cross bred cattle, estrumate, and reproducvtive performance.

1. Introduction

Livestock are a vital source of economic and social support for millions of farmers throughout Africa. The majority of Ethiopia's cattle have been known to be indigenous breeds and small non-descriptive zebu type [13] which is known to have poor reproductive performance.

Ethiopia has over 50 million indigenous cattle, and about 10 million are breeder cows, with annual calving rate of 45%. The number of improved dairy type animals is insignificant. Average milk production from local cows is 1.54 liters/cow/day [8] with total annual production of 2.94 billion liters. Per capita milk consumption is low and stands at 19 kg/year FAO [10]. The Ethiopian cattle breed/types are categorized under four broad groups including hump less (Hametic, longhorn and short horn), the Zebu Sanga and the intermediate Sanga/Zabu [1].

The primary goal of dairy cattle breeding is to increase the efficiency of milk production, some farmers have considered crossbreeding an alternative to achieve this goal. Crossbreeding is one alternative for improvement of milk composition, health, fertility and survival, Because differences between breeds are much greater than the differences with in breed and extra benefits can be achieved from heterosis [21]. The reproductive performance of the breeding female is probably the single most important factor influencing herd/flock productivity. Reproductive performance influences the efficiency of milk and meat production and the rate of genetic progress in both selection and cross breeding programs [14]. In most developing countries, the improvement of milk production has been initiated through the introduction of temperate dairy breeds for crossbreeding programmes with the local Zebu cattle [18]. The resulting crossbred cows experience environmental stress and the challenges of high diseases risk [1]. The expression reproductive performance does not usually refer to a single trait, but to a combination of many traits. In general, many authors indicate that the main indicators that would be considered in assessing reproductive performance are age at puberty, age at first calving, calving interval, days open and number of service per conception [11]. Selection for cross breeding or controlled breeding for superior animals has been found to increase productivity. Failure to detect oestrus at right time has, however, resulted in prolonged calving interval, especially in farm using artificial insemination (AI) programmes [15]. Poor oestrus detection has been reported to be the single most important limiting factor for high reproductive efficiency in dairy herd [15]. Despite the use of AI fertility rate in zebu cattle are not improved. There have been attempts to breed zebu cows by AI after oestrus synchronization using prostaglandin ($PGF_{2\alpha}$) or its analogue [13]. Synchronisation of oestrus in cows commonly involves the synchronisation of luteal regression using prostaglandin ($PGF_{2\alpha}$) treatment. The administration of PG in 2 treatments 10 to 12 days apart results in oestrus occurring over a 5-day period. This variability in the occurrence of oestrus,due to the maturity of the ovulatory follicle at luteolysis which in turn reflects the stage of the wave of follicular growth. Improved

synchronization of oestrus could, therefore, be achieved by the synchronization of luteolysis [7].

The oestrus cycle has been defined as the time interval from the onset of oestrous period until the onset of next oestrus or interval between successive ovulations [5]. Oestrus is also defined as the period of time when the female is receptive to the male and will stand for mating with males [17] Observing cows in oestrus and inseminating them at the optimum time are necessary steps for effective reproductive management [15].

The rectal palpation method has been used for several years to determine whether the uterus is pregnant or not [2]. For economic and management reasons pregnancy diagnosis by rectal palpation should be made at about 50 days after insemination. $PGF_{2\alpha}$ for synchronisation of has been widely studied in Europe. How ever very little studies have been conducted in Africa [19]. Oetrous cycle control and regulation is one potential area from which the Ethiopian cattle industry can benefit the technique contributes to improvements in reproductive efficiency, increase efficiency to utilization of available resources, better and organized management operations. Little work has been done in developed countries, however studies need to continue to determine the most effective method of oetrous synchronization and control of oestrus for a particular genotype and post reproductive performance.The main objective is therefore to

- Evaluate the response of Zebu and their cross bred to $PGF_{2\alpha}$
- Evaluate the post treatment reproductive performance of cattle synchronized with $PGF_{2\alpha}$

2. Materials and methods

2.1. Description of the Study Area

The response and post treatment reproductive performance of animals synchronized with single injection $PGF_{2\alpha}$was carried out in Hadiya zone; Ethiopia. The zone belongs to one of the 13 zones and 9 special woredas in Southern Nations, Nationalities and People Regional State (SNNPRS), Ethiopia. The capital city is Hosanna which is located 232 Km away from Addis Ababa, in the south direction. It is located in the northern part of the region bordering with Silte and Gurage zones in the north and north-east direction, Alaba special woreda and Kambata-Tambaro zone in the south and south east direction, Yem special woreda and part of Oromia region in the west direction.

The total area of the zone estimated at 3675.8km2 with the population of 1.243,776 people according to 2007 national population and housing census, among which 89.25% are rural settlers. The population density is over 338 persons per km2 with population growth rate >3% and 83% of population belongs to Hadiya ethnic group. The zone receives seasonal rainfall amount ranging between 469.98 and 156.66mm annual in summer from June to August. The temperature ranges from mean minimum annual temperature 10.35oc to mean maximum annual temperature 22.54oc. There are two rainy and two dry seasons. The small rainy season is from the beginning of March to the end of May followed by main rainy season beginning of June to the end of September. The living style of the people depends on agriculture, using mixed livestock-crop production. Livestock is their dominant, and often sole asset, their principal means to accumulate wealth, and the mainstay of their livelihoods in the area.

2.2. Study population

Zebu and Zebu X crossbred cattle in Hadiya zone,in Hossana town, Lemo district were the study population.

2.3 Study animals

The study animals found in the small holder dairy farms located in Hossana town and Lemo district known with (Zebu X Zebu cross bred) cattle.

The small holder dairy farms located in Hossana town owned Zebu X crossbred and indigenous zebu cattle in Lemo district. The farmers keep different types live stock in addition to cattle and practice mixed farming (crop and livestock production). The average milk production of cross bred cattle is 300-350 kg per/year. The yields are substantially higher than those of non-improved indigenous cattle under similar management. The average body weight Zebu X crossbred is higher than that of non-improved indigenous cattle under similar condition of husbandry. Malnutrition has been singled out as one of the constrains leading to poor reproductive performance. Animal grazed on natural pasture, cows were milked twice a day calves allowed to suckle at each milking. Animals bred by natural mating and/or AI technician. Apart from natural pasture farmers used to cultivate elephant grass, leaf desmodium, Rhodes. When the natural pasture is over grazed during dry period, farmers used to feed their animals crop residues and enset (false banana). Animal health management depends on the capacity of the owners; however de-worming internal parasite and control of tick-borne diseases were practiced in the study area.

2.4 Study design

2.4.1 Synchronization

One hundred apparently health and cycling non pregnant cattle was randomly selected and reproductive tract of

the cattle was palpated per rectum according to Roberts [17], Bekana *et al.* [6] and peters and Ball [16] to determine the cyclical ovarian activities. The ovary was defined as the ovary, on which either follicle or palpable corpus lutem are presented. Animal with medium body condition were selected. All experimental animals were treated with single intramuscular injection of 25 mg of prostaglandin analogue (Estrumate) in the gluteal region. The animals were allowed to graze natural pasture extensively during day time. Visual observation was used to determine the onset, duration and estrous patterns through out of the day and night time. Those cattle were inseminated artificially following standing oestrus and pregnancy was confirmed rectally 60 days apart post insemination.

2.5 Sample size determination and sampling procedures

A total of one hundred (50 cross bred from Hossana city and 50 Zebu from Lemo district) apparently health and cycling non pregnant cattle were randomly selected and reproductive tract of the cattle was palpated per rectum to determine the cyclical ovarian activities.

2.6. Data analysis

The obtained data was stored in Excel-2007. Stored data was tabulated and arranged as percent value. SAS®.2002. User's guide: Statistics, Version 9.1 was applied to determine the level of significance between categorical variables for the data obtained from oestrus response rate, conception rate and pregnancy rate. Data grouped by location, parity.

3. RESULT

Synchronisation

Animals treated with single injection of $PGF_{2\alpha}$ 64% (n=32) of zebu and 70% (n=35) of crossbred ones responded positively and showed standing oestrus with in the interval of 48hrs and 96hrs. The estrus response was 48 hrs (n=3), 72 hrs (n=25) and 96 hrs (n=4) in zebu cattle with mean duration $0.5452^{b,}$ $^{-}0.0393^{a,}$ 0.1636^{c} and 48 hrs (n=10), 72 hrs (n=23) and 96 hrs (n=2) were $0.0000^{b,}$ $^{-}0.03556^{a,}$ -0.981^{c} in cross bred cattle respectively. Parity number was found the significant factor in the study animals. Zero parity (n=17) in Zebu cattle and (n=15) in crossbred highly influenced in the response of estrus in both cattle. The result indicated that as the parity number increased the response rate was decreased in both breeds. Those animals showed standing oestrus were inseminated and 77% (24) of Zebu and 65.5% (n=23) of crossbred conceived. The pregnancy rate 48% (24/32) of Zebu and 46% (23/35) of crossbred were achieved. Standing to be mounted was the most definitive behavioral expression of estrus in both groups whereas, the secondary signs of estrus observed including to mount other cows, clear mucus discharge from vulva, swelling and reddening of the vulva, bellowing and restlessness.

Variation in oestrus response, conception and pregnancy rate

Breed	**location**	**Variable**			**No animals**	**Positive response**		**Rate of estrus response**			**Insemination**		**Conception and Pregnancy rate**	
Zebu	**Lemo**	**Parity**			**treated with single injection of $PGF_{2\alpha}$**	**NR**	**RR%**	Day of response			Inseminated	**None inseminated**	**Conceived No%**	**Pregnant No%**
								Mean estrus duration(hrs)						
		Animals with parity variation			50	32	64%	48(hrs)	72(hrs)	96(hrs)	n=31	n=19	n=24(77)	n=24(48)
								n=3	n=25	n=4	0.0317^{a}	-0.2238^{b}		
								0.5452^{b}	-0.0393^{a}	0.1636^{c}				
		Parity	N	mean										
		0	17	-0.981^{a}										
		1	11	-0.327^{b}										
		2	11	0.327^{c}										
		3	7	0.981^{d}										
		4	4	1.636^{e}										
Probability		P=<.0001												

Variation in oestrus response, conception and pregnancy rate

Breed	location	Variable			No animals	Positive response		Rate of estrus response			Insemination		Conception and Pregnancy rate	
cross	Hossana	Parity			treated with single injection of $PGF_{2\alpha}$	NR	RR%	Day of response			Inseminated	None inseminated	Conceived No%	Pregnant No%
								Mean estrus duration(hrs)						
		Animals with parity variation			50	35	70%	48(hrs)	72(hrs)	96(hrs)	n=35	n=15	n=23(65.7)	n=23(46.0)
								n=10	n=23	n=2	0.2150^{a}	-0.0218^{b}		
								0.0000^{b}	0.3556^{a}	-0.981^{c}				
		Parity	N	mean										
		0	15	-0.981^{a}										
		1	14	-0.327^{b}										
		2	6	0.327^{c}										
		3	4	0.981^{d}										
		4	8	1.638^{e}										
		>5	3	2.944^{f}										
Probability		P=<.0001												

4. Discussion

The synchronization result showed that the intra-muscular administration of single injection of cloprostenol (500µg dose per animals) in both Zebu and crosbred animals is promising success (64-70%). The same result was reported by Vounparet Zeun et al. [20] who found 76.5% and 77.8% in chadu and crossbred cows. However, they are lower than those observed in Awassa –Dalle milk shade that was reported by Azage Tagegen et al. [4] who found 97.7% estrus response. A considerable variation was observed in the interval after $PGF_{2\alpha}$ treatment to oesrus response. This variation could be attributed to the status of the follicular wave at the time of treatment as suggested by [18]. It can be concluded from these studies that $PGF_{2\alpha}$ treatment did not alter the dynamics of follicular growth, and the time of oestrus was responded on the follicular status when luteolysis was induced.
The conception rate for cows treated with dinoprost (25 mg i.m.) and cloprostenol (500 µg

i.m.) according to Martineau [10] was 33,7% and 41,8%, respectively. The conception rate observed in the current study 77% and 65.7% in Zebu and crossbred cattle respectively. It is lower than 83.3% conception rate reported by [7] in Fogera heifers, but higher than the 44% conception rate reported by [13] in Arsi cattle after synchronisation with $PGF_{2\alpha}$. However in the current study pregnancy rate 48% (24/32) and 46% (23/35) were achieved higher than the rate of pregnancy for cows treated once or twice and inseminated during the first 7 d after treatment was 28 %(16/58) and 37 % (27/73), reported by [3].

This variation could be due to possible differences in management factor including nutrition, efficiency and accuracy of estrus detection, timing of insemination relative to observation of estrus, handling of semen and skill of inseminator as has also reported by [9].

5. Conclusion and Recommendation

Despite the existence of artificial insemination services over the last four or so decades in Ethiopia, smallholder farmers have not benefitted adequately from milk production and marketing primarily due to unavailability or high price of improved dairy animals. Weak AI services and poor pregnancy rates have hindered the expansion of dairying in Ethiopia. In order to increase access to improved dairy genetics to smallholder farmers, on-farm hormonal oestrus synchronization and mass insemination of farmer owned indigenous cows could serve as an alternative to kick-start the system. The present study revealed that animals treated with single injection of $PGF_{2\alpha}$ of Zebu and crossbred ones responded positively. Treated animals with less parity responded more successful than animal with many parity. On the other hand causes of luteolytic failure of some animals may be related to several factors including: (1) In ability of palpator or inseminator to detect sensitive or the appropriate phase of the cycle; (2) treatment too early in the luteal phase; (3) incorrect injection site or technique in the case of intramuscular injections;

The conception rate after oestrus synchronistion with cloprestenol was good. Thus on the basis of present findings diagnosis of ovarian structure by means of rectal palpation must be supported by milk or plasma P4 concentration to maximize the efficiency of treatment. Further research is required to evaluate the comparative oestrus synchronization responses and cost of different regimes of Cloprestenol or other prostaglandin and/or combination of GnRH and prostaglandin treatments

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