PROSTAGLANDIN ADMINISTRATION IN IMPROVING THE BREEDING EFFICIENCY OF SUBOESTROUS COWS

By

R RAJAGOPALAN NAIR

THESIS

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Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Animal Reproduction
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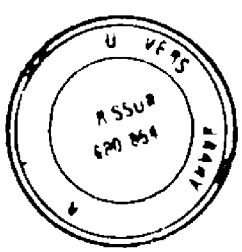

DECLARATION

I hereby declare that this thesis entitled "PROSTAGLANDIN ADMINISTRATION IN IMPROVING THE BREEDING EFFICIENCY OF SUBOESTROUS COWS" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship, or other similar title, of any other University or Society.

Mannuthy,
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R.Rajagopalan Nair

CERTIFICATE

Certified that this thesis, entitled "PROSTAGLANDIN ADMINISTRATION IN IMPROVING THE BREEDING EFFICIENCY OF SUBOESTROUS COWS" is a record of research work done independently by Sri.R.Rajagopalan Nair, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

Dr. E.Madhavan
(Chairman, Advisory Board)
Associate Professor,
Department of Animal Reproduction

Mannuthy,
28 -2-1983.

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DEDICATED TO THE LOVING MEMORY

OF

MY BELOVED TEACHER

Dr. C.K. SURENDRA VARMA RAJA

INTRODUCTION

INTRODUCTION

Modernisation of the dairy industry in India gained momentum as early as 1951, with the aim of catering clean milk to the growing population of the country. With this object in view, several governmental agencies are implementing major crossbreeding programmes in the country with the ultimate object of improving the production potential of our cattle. It has been estimated that by the year 1985, there should be about 10 million crossbred cows and by 2000 AD about 20 million crossbred cows in the country.

In Kerala too, several crossbreeding projects like Indo-swiss Project and Intensive Cattle Development Project were initiated and as a result large number of crossbreds with varying combination of exotic germ plasms have emerged. It is a matter of pride that Kerala has today the largest population of high potential crossbred cattle, probably about one million which is almost 30 per cent of the total number of crossbreds in the whole country.

It is well established that the overall production efficiency of any bovine population has to be built upon

a strong and sound foundation of scientific management of breeding, failure of which will result in low reproductive efficiency. Though, precise information on the magnitude of economic loss on account of infertility in cattle in India is not available, there are reasons to believe that the majority of cows reaching slaughter houses are disposed off for reasons of infertility. Thus, improvement of reproductive efficiency by combating the problem of infertility, demands greater technical care and planned research. It is all the more so in the present context in Kerala, as we have launched an ambitious plan of massive cross-breeding programme, with the ultimate object of 'white revolution'.

There is concensus of opinion that temporary infertility rather than permanent sterility poses greater threat to livestock production warranting greater care and vigil. Aberrations of sexual cycle as a cause of infertility or subfertility in cattle have been well documented. Among these, silent heat or suboestrum assumes paramount importance. The expression 'suboestrum' or silent heat indicates that ovulation has taken place but no external signs of oestrum have been exhibited or at least have not been

observed. These cows are actually fertile but for want of timely insemination they fail to conceive and thus declared as infertile. Suboestrum has been reported to occur more commonly in pubertal heifers and in cows within the first 60 days postpartum (Roberts, 1971). Economically this condition is vital because it lengthens the calving interval.

During the past several years considerable amount of research has been done to combat this paradoxical situation. Experimental evidence indicated that Prostaglandin F_2 alpha released naturally from the uterus towards the end of oestrous cycle might be the agent responsible for luteal regression. Based on this, several trials have been carried out in the past for causing luteal regression and induction of visible oestrum in suboestrous cows by administration of prostaglandins and its analogues (Rowson, 1972; Cooper et al. 1976; Eddy, 1977; Leid et al. 1978). These trials revealed that Prostaglandin and its analogues could be used effectively for treatment of suboestrum in cattle and buffaloes. However, concerted efforts to study the effect of Prostaglandin F_2 alpha therapy for suboestrum in cross-bred cattle under our conditions are lacking. The present study was,

therefore, taken up with the object of studying the effect of administration of Prostaglandin F_2 alpha in cross-bred cows showing suboestrum especially during early postpartum period. If successful, this method will go a long way in reducing the intercalving period and thus increasing the overall productivity of the herd.

REVIEW OF LITERATURE

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Suboestrum or silent heat is described as a phenomenon wherein the cows show the evidence of normal ovarian activities without exhibiting behavioral signs of heat. The silent heat passes unnoticed by the farmer and the cow is bred only when visible signs of heat are expressed on a subsequent period. Luktuke and Roy (1964) observed that the occurrence of silent heat during postpartum period was the major contributing factor for longer intercalving period in cows.

Suboestrum has been reported to occur most frequently between calving and 60 days. According to Casida and Wisnicky (1950) about 68 per cent of cows, after parturition, showed one quiet ovulation or silent oestrum before the first clinically apparent oestrum is manifested. The frequency of occurrence of silent heat before and after 60 days of calving was reported to be 44.3 per cent and 11 per cent respectively (Kidder et al. 1952). Kruif (1977) studied the oestrous cycle pattern of 2720 postpartum cows and found that 438 (16%) cows failed to show oestrum within 50-60 days of calving and among these 76 per cent was due to subcestrum. However, Morrow et al. (1966) found that the

frequency of occurrence of silent heat in cows, at first, second and third heat after parturition was 77%, 95% and 95% respectively and remarked that more than 93% of cows would exhibit visible signs of heat by about 90 days postpartum.

Zemjanis (1961) opined that silent heat contributed over 90% of anoestrus condition in cows. Rao and Murthy (1972) reported that the suboestrum contributed 67.7% of infertility in cross-bred cows. According to Nambooditipad (1978) 10.8% of the reported anoestrus condition in cross-breds was due to suboestrum. Post service suboestrum has been reported to the extent of 28.2% in cross-bred cows (Stewart, 1952). In heifers the incidence has been reported to the extent of 74% at the first ovulation, 43% at the second and 21% at the third ovulation (Morrow, 1969). Madaway (1979) found suboestrum to be the major cause for reported anoestrum in cattle, the percentage of occurrence of this condition in cross-bred cows and heifers being 50 and 30% respectively. Incidence of suboestrum was reported to be more in nursed cows than in milked cows (Hiltbank and Cook, 1958). However Esslemont (1975) considered this condition only as a myth.

Suboestrum has been identified as one of the major causes of reportedly anoestrus condition in buffaloes. Ishaq (1956) reported that about 30% of oestrum in buffaloes was not pronounced and passed unnoticed even in the presence of a bull. Luktuke (1964) recorded high incidence of quiet ovulations in buffaloes in a Military farm. He also reported that 35% of reported cases of anoestrum in the herd revealed the presence of active corpus luteum denoting periodical rhythm of ovulation. In another study, Luktuke and Roy (1964) encountered 18.1% of weak oestrum in Murrah buffaloes. Chauhan and Singh (1979) observed that out of 197 anoestrous conditions in buffaloes 60% was suboestrus. Chauhan et al. (1977) recorded 31.28% of anoestrum in buffaloes of which 34.59% was silent heat.

Lagerlof (1951) opined that certain breeds of cattle such as Guernsey and Swedish red have a hereditary predisposition to weak oestrum. This view was supported by Rottensten and Touchberry (1957). Lathwetwar et al. (1963) also observed a genetic variation in the expression of heat between animals and concluded that certain lines in Holstein breed exhibited significantly higher rate of

silent heat than others.

The physiological basis for the failure of expression of the typical signs or oestrum is not well understood. Short (1962) postulated that standing oestrum required a regressing corpus luteum producing some amount of progesterone, the deficiency of which would result in silent heat. According to Roberts (1971) weak expression of heat might be due to lack of sufficient secretion of oestradiol by the mature and secondary follicles or due to the need of a higher threshold of oestrogen in certain individuals for full expression of behavioral oestrum.

Recently, Prostaglandin F_2 alpha and some of its synthetic analogues have been shown to be luteolytic in bovines and thus offer greater promise in their successful use for treatment of suboestrum. Prostaglandins, a derivative of prostanoic acid, is a closely related group of biologically active unsaturated fatty acids. It was first identified in the seminal fluid by the Swedish Physiologist, Von Euler (1936) who named it on the belief that it was secreted by the prostate gland. This assumption was proved incorrect when Eliasson (1959) found seminal vesicles to be the site of production of prostaglandins. Subsequent studies

revealed that prostaglandins was widely distributed in mammalian tissues and was not stored in the body but formed immediately prior to release. The biosynthesis and release of prostaglandins was found to occur readily in response to a variety of physiological and pathological stimuli.

The Gorgonian plexora homomella, a caribbean coral has been reported to be the richest natural source of prostaglandins. From this coral, biologically active natural prostaglandins is prepared (Weinsheimer and Anderson, 1973; Scheinedar, 1975).

Chemical structure of prostaglandins was elucidated by Bergstrom et al. (1968). All prostaglandins are 20 carbon hydroxy fatty acids with a cyclopentane ring and two side chains (Fig. 1). They are divided into four groups, designated by the letters E, F, A and B corresponding to differences in the five membered cyclopentane ring. The naturally occurring prostaglandins E and F are referred to as primary prostaglandins, since other prostaglandins are derived from these compounds. The subscript number after the letter denotes the degree of unsaturation in the side chains of the prostaglandin molecule. Thus PGE_1,

PGF_1 alpha, A_1 and B_1 have only one pair of double bonds; E_2, F_2 alpha, A_2 and B_2 have two pairs of double bonds. F_1 Beta and F_2 beta are isomeric alcohols obtained by chemical reduction of E prostaglandins. Only alpha isomers occur naturally. During the biosynthesis of PGF_2 alpha, dietary linoleic acid is converted to di-homo-gamma-linoleic acid and then to arachidonic acid from which PGF_2 alpha is synthesised.

Prostaglandins has a wide range of pharmacological actions. Generally, the individual prostaglandins of a group have the same biological action on any one system but may have quantitative differences. But it is not invariable. The same prostaglandins may have qualitatively dissimilar effects upon different tissues. Likewise prostaglandins from separate groups may have dissimilar actions. For examples, PGE_1 relaxes the umbilical blood vessels in vitro where as PGE_2 has a stimulant action. PGE_1 and E_2 are bronchodilators where as PGF_1 alpha and F_2 alpha induce bronchoconstriction.

The systems on which PGF_2 alpha generally acts include central nervous system, respiratory system, gastrointestinal system, endocrine glands, autonomic nervous system and

reproductive system.

The most dramatic effect of PGF_2 alpha on reproductive system is its ability to reduce progesterone secretion by the corpus luteum (luteolysis), which may or may not be accompanied by a morphological degeneration of the corpus luteum. The luteolytic effect of PGF_2 alpha was first described in the rat (Pharris and Wyngarden, 1969) and in the guinea pig (Hlatchley and Donovan, 1969). This observation prompted a flurry of activity among reproductive physiologists, who were intrigued by the elusive nature of the mechanism for the control of the life of corpus luteum. The luteolytic effect of PGF_2 alpha was later on demonstrated on other lab animals like hamster, (Gutknecht et al. 1971; Labhsetwar, 1971) the mouse (Bartke et al. 1972; Labhsetwar, 1972) and the rabbit (Keyes and Bullock, 1974). In the hamster, Gutknecht et al. (1971) observed a significant drop in progesterone within 15 minutes and in rat, Behrman et al. (1971 a) reported a similar drop within six hours after injection of PGF_2 alpha.

Since the first report on the luteolytic action of Prostaglandin F_2 alpha (Pharris and Wyngarden, 1969), the mechanism of action was explained on the basis of vasoconstrictor effect of the drug. According to them the

luteolytic activity was due to the constriction of the ovarian vessels, causing ischaemia and starvation leading to death of the luteal cells. Labhsetwar (1970, 1974) postulated that the luteolytic effect of PGF_2 alpha in rats, could be due to increased secretion of LH from pituitary and perhaps the alteration in the secretion of gonadrotropins, which constitute a part of the luteolytic hormone complex. A stimulating effect of PGF_2 alpha on gonadotropic secretion had since been confirmed by several workers (Tsafriri et al. 1972; Harms et al. 1973; Batta et al. 1974; Sato et al. 1974). It is thus conceivable that increased secretion of LH/or other gonadotropin hormone complex could account for luteolysis induced by PGF_2 alpha. In fact, this hypothesis implied that luteolytic effect of PGF_2 alpha would involve the hypothalamo-pituitary complex. Behrman et al. (1971 b) postulated that rather than vascular or central effect, intracellular changes induced by a direct action of PGF_2 alpha on luteal cells, might also involve in luteolysis. Seguin et al. (1974) also opined that PGF_2 alpha appeared to act directly on the ovarian luteal tissue.

The hypothesis that prostaglandin F_2 alpha released naturally from the uterus towards the end of oestrous cycle

might be the agent responsible for luteal regression in cattle was supported by Seguin et al. (1974) and Lavoie et al. (1975). The mechanism of transfer of PGF_2 alpha from the uterus to the ovary is not clearly known. However, it was speculated that a counter current transfer mechanism existed in the transfer of PGF_2 alpha between the utero-ovarian vein and ovarian artery (Mc Cracken et al. 1972). The luteolytic action of PGF_2 alpha was further elucidated by Pant (1975). However, Hansel et al. (1975) indicated that PGF_2 alpha was not the uterine luteolysin in cow and opined that arachidonic acid was the luteolytic agent which was extracted from the endometrial tissue.

The indication, that PGF_2 alpha was luteolytic in cattle, prompted the studies for possible application of this drug in controlling reproduction in cattle. There are several reports to indicate that PGF_2 alpha or its analogues, when given to cattle between days 5 and 16 of the cycle, would cause luteolysis with induction of oestrum and ovulation within 3-4 days (Lauderdale, 1972; Rowson et al. 1972 a.b.; Louis et al. 1972; Cooper and Rowson, 1975; Lauderdale, 1975; Philipsen and Rasbech, 1974; Hearnshaw, 1976; Jackson et al. 1979). All these reports showed that PGF_2 alpha or its analogues were ineffective in causing luteolysis, when given

during the first five days of oestrous cycle, a fact that constitutes a serious limitation in the use of this compound. Saumande and Chupin (1981) showed that the absence of luteolytic effect following injection of PGF_2 alpha early in the oestrous cycle in the cow was not due to the absence of oestrogens from the blood.

Among the very numerous analogues of PGF_2 alpha synthesised in recent years for biological evaluation, the most important is a series of 16-aryloxy prostaglandin (Binder et al. 1974). Several of them proved to be many times as potent as PGF_2 alpha in luteolytic activity without being correspondingly toxic (Dukes et al. 1974). Two of these, ICI 79399 and ICI 80996 (Cloprostenol), were tried in cattle and found to be effective in inducing luteolysis. The former was found to be effective in causing luteolysis in heifers (Tervit et al. 1973). Cooper (1974) found Cloprostenol was less toxic and had no adverse reactions in the experimental animals used for the trial. According to Cooper and Furr (1974) cloprostenol had a wide margin of safety in that even 200 times of the normal dose caused only a very little transient diarrhoea.

Although general route of administration of the drug

is intramuscular, intrauterine administration has also been tried with satisfactory results. Rowson et al. (1972 a,b) showed that as little as 0.5 mg of racemic PGF_2 alpha injected on two consecutive days through the cervix into the uterine horn ipsilateral to the corpus-luteum was effective in causing luteolysis with visible signs of heat on the third day after the first dose. Shelton (1973) tried intra-uterine treatment and found better return to oestrus in non-lactating than lactating cows. Cummins et al. (1974) induced oestrum in 9 out of 12 cattle with intrauterine administration of 500 microgram of Estrumate to the horn ipsilateral to the ovary containing the corpus luteum. The intrauterine infusion of PGF_2 alpha ipsilateral to the corpus luteum through the cervix was also demonstrated by Nakahara et al. (1974). It was revealed that 45 out of 52 cows showed oestrus within four days after treatment and the remaining seven showed heat 9-16 days after the treatment. Barnabe (1975) demonstrated that the injection of the drug into the uterine horn ipsilateral to the active corpus luteum was most effective whereas administration into the body of the uterus was less effective and into the cervix least effective. Louis et al. (1974), however, found no

significant difference in the effect of PG deposition in ipsilateral or contralateral horn of the uterus in relation to the ovary containing the corpus luteum. Moore (1976) proved that intra uterine infusion was as effective as intramuscular injection of PG and the dosage required for intrauterine infusion was 4 to 9 times lesser than the intramuscular route. Kosiancwski (1976) and Fulka et al. (1976) also tried the intrauterine administration of PG for inducing oestrus, successfully. Henricks et al. (1974) tried the effects of PGF_2 alpha administration into the lumen of uterus during the three periods of oestrous cycle viz. 3-4, 9-10 and 16-17 and found that oestrus could be induced in all the animals within 3 to 4 days, except in those treated on 3-4 days of the cycle.

Several workers tried intramuscular or subcutaneous administration of PGF_2 alpha or its analogues at different doses and at varying periods and the results did not vary significantly. Roche (1974) tried intramuscular injection of PGF_2 alpha at different stages of cycle from 7th day onwards and found that majority of cows showed oestrus within four days of treatment. Philipsen and Rasbech (1974) also tried different periodsfor administration of PG viz. 6th, 8th and 11th day of cycle and found that all animals

were in oestrum on the 3rd day of the treatment with a conception rate of 70%.

Nakahara et al. (1975), Day (1977), Peters et al. (1977), Barnabe et al. (1978), Seguin and Gustafson (1978), Singh et al. (1979) and Svensson (1979) recommended that 500 microgram of Estrumate was the most effective dose. Hafs and Manns (1975) tried doses of 20, 30 and 40 mg of PGF_2 alpha and found that all these doses were equally effective in inducing oestrum in heifers. Edqvist et al. (1976) tried different dose levels of PGF_2 alpha, 25 mg as a single dose, and 12.5 mg on two consecutive days, by using intramuscular or subcutaneous route and found that mode of injection or the size of the dose had no significant effect on induction of heat or conception rate. Donaldson (1977) also confirmed that slight variation in the dose of PGF_2 alpha or the route of administration had no significant effect on the induction of oestrum or fertility in cows. Boese et al. (1976), however, obtained a better conception rate of 63% and 64.7% respectively on two trials with PGF_2 alpha in doses of 15 mg and 30 mg.

The comparative efficiency of single or double spaced injection of PGF_2 alpha has been reviewed widely in the

literature. Cooper (1974) tried intramuscular injection of ICI 80996 (Estrumate) in 175 heifers by giving two injections at 11 days apart at a dose of 500 microgram each and found that 171 heifers were in oestrum between 48 and 96 hours with ovulation occurring normally. Landerdale et al. (1974); Cooper et al. (1977), Jainudeen and Camoens (1977), Donaldson, (1977), Esselemont et al. (1977), Pathiraja et al. (1977), Kumaratilake (1977), Perera and Kumarathilake (1977), Curto and Sucoi (1978), Binding et al. (1978), Leid et al. (1978), Kupfer (1978), Mac Millan et al. (1978), Rao and Rao (1978), Prasad et al. (1978), Anderson et al. (1979) and Hafs et al. (1979) were of opinion that double spaced treatment was better than single dose schedule as large proportion of animals came into heat after the second injection. King and Robertson (1974) obtained 46% conception rate when given 30 mg of PGF_2 alpha at 10-12 days apart. Ganeswaran and Patil (1975), on a two dose schedule, on 8th and 14th day of the cycle in Swedish red and white heifers obtained a conception rate of 75 per cent for first insemination. King and Robertson (1974) opined that a single injection was sufficient if done at proper time and felt that a second one was superfluous. Rao and Rao (1979) also tried single injection of

500 microgram Cloprostenol and found 34 out of 36 sub-oestrous buffaloes came into heat and 15 conceived. Single injection of 500 microgram of Estrumate was also tried by various workers with varying conception rates (Nakahara et al. 1975; Day, 1977; Peters et al. 1977; Barnabe, 1975; Seguin and Gustaffson, 1978; Swensson, 1979). Johnson (1978), on the other hand, did not find any significant difference between single and double dose schedule, in the interval from the injection of the drug to the expression of heat. Leaver et al. (1975) found no difference in conception rate between single and double injections of Estrumate.

The most recent efforts in the induction of oestrum involve the use of intra muscular injections of PGF_2 alpha in combination with a progesterone releasing intravaginal device (PRID) or subcutaneous implant of progestagen (Thimonier et al. 1976; Chupin et al. 1977). They have reported that subcutaneous implant of progestagen (SC 21009) for ten days and single intramuscular injection of PGF_2 alpha on implant removal gave good results in cows.

Welch et al. (1975) obtained better results by a combination of PGF_2 alpha given into the uterus and

oestradiol benzoate injected intramuscularly 48 hours later. Nancarrow and Radford (1979) observed that the interval from the administration of the drug to the onset of oestrum was shortened when a combination of PGF_2 alpha and oestradiol benzoate was used, the value being 52.9 hours against 74.6 hours when PGF_2 alpha alone was used. The earlier and quick precision of detection of heat by the administration of oestradiol benzoate along with PGF_2 alpha was also reported by Inskeep et al. (1980). The conception rate was also higher in oestradiol treated group.

Elsden et al. (1974) were among the first to report on the preliminary trial using a combination of PMSG and Prostaglandin F_2 alpha. Cows in mid cycle were given 1500-2000 IU of PMSG with first dose of PGF_2 alpha, 48 hours later. The results showed that 50 per cent of the cows failed to show either oestrum or ovulation. On the other hand, Newcomb and Rowson (1975) using PGF_2 alpha following PMSG injection between day 8 and 12 of the cycle found that there was oestrum and super ovulation response. This was later confirmed by Jillella et al. (1976).

Roche (1977) observed that injection of synthetic

LHRH, 48 hours after the second injection of Cloprostenol, significantly advanced the time of ovulation. Similar findings were also made by Cumming et al. (1976) Kaneda et al. (1978) and Humblot (1982).

After an effective dose of PGF_2 alpha, the corpus luteum would reduce in size within 24 hours and become impalpable by 72 hours (Louis et al. 1972 a). Blood progesterone was also found to fall by about half within 4-6 hours and within 48 hours it was below the limit of detection (Inskeep, 1973; Louis et al. 1972 a,b). After an ineffective dose of PGF_2 alpha, the fall in progesterone was less pronounced and not sustained long (Liehr et al. 1972). Oxender et al. (1974) found that plasma progesterone fell from 4.0 ± 0.4 ng ml^{-1} to 1.5 ± 0.2 ng ml^{-1} at 12 hours and 0.8 ± 0.2 ng ml^{-1} at 48 hours after an injection of 30 mg PGF_2 alpha THAM SALT to cows on day 11 of the oestrous cycle. It was also found that plasma LH peaked at 64 ± 4 hours and oestrus began at 74 ± 3 hours with ovulation occurring at 104 ± 6 hours after the injection. Oestradiol concentration was more than doubled by 24 hours and increased to 15.5 pg ml^{-1} by 72 hours after the PGF_2 alpha treatment. The authors stressed the close similarity of this pattern of changes in induced oestrus to that

occurred in natural oestrus in the cow. In a similar work Coulson et al. (1979) observed that the preovulatory LH peak averaged 48.6 ± 9.2 ng per ml which occurred about 70 hours after the second injection of PGF_2 alpha THAM. Progesterone concentration remained /0.4 ng/ml through out the experiment. Kamonpatana et al. (1979) found that when buffaloes were treated with 25 mg PGF_2 alpha, the serum progesterone levels declined from 1.76 ± 0.01 ng/ml to 0.25 ng/ml within 24 hours after injection. The levels increased at about day 11 of treatment and reached a peak of 1.78 ± 0.62 ng/ml on day 18.9 ± 2.45. Stallflug et al. (1975) observed that the decline in blood progesterone, the increase in blood oestradiol, the duration and peak of LH surge, the interval to onset of oestrum and the interval to ovulation in PGF_2 alpha treated cows were not different from that of untreated controls. Louis et al. (1974) observed that progesterone level fell within 12 hours, oestradiol level doubled within 24 hours, LH peaked at 17 hours, oestrus began at 72 hours and ovulation occurred 95 hours after the intra uterine or intramuscular injection of PGF_2 alpha. Hafs and Manns (1975) postulated that the increase in serum LH within 12 hours of PGF_2 alpha treatment in diestrous cattle was dependent upon the withdrawal

of progesterone and not due to serum oestradiol.

The interval between the administration of PGF_2 alpha and the ovulation was reported to be 93.0 ± 18 hours by Elving et al. (1975) and 82.00 ± 5.4 hours by Hoffman et al. (1976). Cumming et al. (1977) reported that 90% of the Fluprostenol treated animals ovulated within 92 hours of the treatment. Jaume and Leal (1980) observed that the percentage of animals that have ovulated by 4, 8, 12 and 16 hours after the end of oestrum was 18.2, 45.5, 90.9 and 100 for natural cycles and 0.0, 50.0, 90.6 and 100.0 for the induced cycles.

Inskeep (1973) and Roche (1974) reported that fertility at oestrum induced by PGF_2 alpha or its analogues was within normal limits. However, conflicting views have been expressed by various workers regarding the fertility of cows, inseminated after detection of oestrum or at fixed intervals after administration of Prostaglandin F_2 alpha or its analogues. Turman et al. (1975) injected 15 heifers with 30 mg of PGF_2 alpha and inseminated 12 heifers after oestrus was detected and obtained a conception rate of 50%. In a different trial Beese et al. (1976) gave two doses of PGF_2 alpha at 15 mg and 20 mg per head and inseminated at the induced heat resulting in a

conception rate of 81.75 and 64% respectively in the two treated groups. According to Lauderdale (1975) normal fertility can be obtained in cattle inseminated at oestrus detected following PGF_2 alpha administration. Kruif and Brand (1976) found that the conception rate at oestrus detected on induced heat by PGF_2 alpha administration was comparable to that of controls, the values being 56 and 58 per cent for treated and control animals respectively. Mac Millan et al. (1978) conducted trials involving 1400 lactating dairy cows and 105 Friesian heifers, which provided data for evaluation of a synthetic analogue of PGF_2 alpha (ICI 80996) in dairy herd management. Using single injection regime in conjunction with efficient heat detection, the proportion of cows conceived during the first two weeks of seasonal breeding programme was increased from 36 (in controls) to 60% in treated groups. However Eddy (1977) reported that the success of the treatment with PGF_2 alpha depended upon the efficiency of oestrus detection in the farm. To overcome the above difficulty, several trials were carried out to inseminate cows at fixed times, after administration of PGF_2 alpha without looking for heat. Lauderdale et al. (1974) conducted an elaborate study to compare the

fertility of cows inseminated at fixed periods of 72 and 90 hours after the administration of PGF_2 alpha to that of those inseminated at detected heat after the administration of the drug. It was revealed that fertility of the cattle inseminated at detected oestrum did not differ from those inseminated at fixed intervals. Hafs and Manns (1975) got a conception rate of 59% in heifers inseminated at fixed intervals of 70 and 88 hours after administration of PGF_2 alpha at 12 days apart. Similar trials were carried out by Carter and Parsonson (1976) and Bosch et al. (1976) with Cloprostenol in heifers and cows and obtained a conception rate of 63% and 64.7% respectively. Cooper (1976) however, reported a marginal decrease in fertility of cows inseminated at fixed time after the induction of heat. But Roche (1977) reported a conception rate of 53% when PGF_2 alpha was given 11 days apart and inseminated 72 and 96 hours later. Similarly, Anderson (1979) in a trial on heifers and cows also obtained a conception rate of 65.8 and 79.5 per cent respectively.

The above trials suggested that optimum fertility could be obtained by two inseminations given at 72 and 96 hours after the second injection of Prostaglandin on a

two dose technique. It is not, however, conclusively proved that at what interval precisely, after PGF_2 alpha, a single insemination should be given or how far short of the optimum level the conception rate may fall.

MATERIALS AND METHODS

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Materials for the present study consisted of cross-bred cows (Jersey X Sindhi, Jersey X Local, Brown swiss X Local, and Holstein Friesian X Local) belonging to the University Livestock farm, Mannuthy, attached to the Kerala Agricultural University. These animals were apparently healthy and maintained under identical conditions of feeding and management. After calving, these cows were observed for visible signs of heat. Those, which have not shown signs of heat even beyond 45 days postpartum, were subjected to detailed clinico gynaecological examination and cows having palpable corpus luteum were considered as suboestrous. Among these, 54 cows having functional corpus luteum of 7-14 days of age were selected for this study. Besides rectal palpation of the ovaries, these animals were also subjected to a detailed clinico gynaecological examination to exclude cows having morbid infections of genitalia like endometritis, cervicitis, bursal adhesions etc.

All the selected cows were administered a single dose each of 500 microgram Estrumate*, intramuscularly. The following observations were made

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* Cloprostenol 500 microgram in 2 ml, ICI-Pharma, Luzern, 6002.

1. Interval from treatment to onset of oestrum

Each animal, after the administration of the drug, was closely watched and tested by a vasectomised teaser bull at an interval of six hours, and those found to be in heat were confirmed by rectal examination. The interval from the treatment to the onset of heat was recorded.

2. Intensity of oestrum

The intensity of oestrum was graded as pronounced, medium or weak from the clinical and behavioral signs (Sharma et al. 1968).

3. Duration of oestrum

Each cow in heat was closely observed with the help of a teaser bull at an interval of four hours, till the symptoms of heat subsided. The period from the first acceptance to the last acceptance was adjudged as the duration of oestrum.

4. Ovulation

The animals in oestrum were examined per rectum at four hour intervals until ovulation occurred. The ovaries and follicles were examined carefully for evidence of

ovulation which was later confirmed by the presence of corpus luteum 7 to 10 days after the end of oestrum. The interval from the administration of the drug to the ovulation was recorded.

All cows in heat were inseminated with good quality chilled semen. The cows which failed to settle with first insemination were reinseminated on subsequent heats. Pregnancy diagnosis was done by rectal examination between days 45 and 60 after insemination.

The data were analysed statistically to find out the effects of parity, breed and intensity of heat on conception (Snedecor and Cochran, 1967).

The data regarding service period and number of inseminations per conception with respect to the rest of the herd were compared with that of the experimental animals.

RESULTS

RESULTS

Results on the investigation of the incidence of suboestrum and the effect of intramuscular administration of Prostaglandin F_2 alpha analogue (Estrumate) to improve the breeding efficiency of suboestrous cows are presented in table 1 to 7.

It could be seen from table 1 that during the period from June 1981 to September 1982, out of 162 cows, 103 (63.58%) were reportedly in anoestrus beyond 45 days post-partum. But detailed repeated examinations revealed that 74 (45.68%) were in suboestrus and 29 (17.90%) in anoestrus. Among the reportedly anoestrous animals of 103, 71.84% were suboestrous and only 28.16% were anoestrous. Out of the 74 suboestrous cows 54 had an active corpus luteum of 7-14 days of age on the first examination.

The results of the treatment on the 54 suboestrous cows are presented in table 2 and fig.2. Treatment of cows was initiated on an average interval of 74.1111 ± 1.9376 days after calving. It was found that 53 (98.15%) cows came into heat and the interval from the administration of the drug to the expression of oestrum ranged from 48 to 72 hours at an average of 53.2075 ± 1.038 hours. The average

duration of oestrum in the experimental animals was found to be 17.8115 ± 0.2964 hours within a range of 16 to 20 hours. Among these, 49 (92.45%) ovulated at an average interval of 82.6122 ± 2.0015 hours (76-92 hours) after administration of the drug. The number of treated animals which conceived on first insemination was 23 (43.40%).

Sixteen of the nonpregnant animals returned to oestrum within 20 days of the last insemination and the remaining 14 subsequently. The mean cycle length of those which returned to oestrum within 20 days was 17.46 days. The animals which failed to conceive at first insemination were reinseminated in the subsequent heats and 41.51% conceived to second and subsequent inseminations, the overall conception rate being 84.91%.

Perusal of the data in table 3 and fig. 3 revealed that the average post-partum oestrus intervals of untreated animals in the herd and that of experimental animals were 88.303 ± 3.9818 and 76.0283 ± 1.9296 days respectively.

The data, when grouped according to parity of the experimental animals (table 4) revealed that parity had no significant effect on the conception rate.

The conception rate of animals treated with Estrumate,

grouped according to different genetic groups is presented in table 5. It was revealed that the number of animals conceived was 3 out of 7, 4 out of 7, 10 out of 16 and 6 out of 24 in Holstein Friesian X Local, Jersey X Sindhi, Brown swiss X Local and Jersey X Local respectively. However, the difference in conception rate between the different genetic groups was not statistically significant, thus conferring that breed did not influence the conception rate in experimental animals.

It could be seen from table 6 that among the 53 cows which showed heat, 23 (43.40%) exhibited pronounced heat, 17 (32.08%) medium heat and the remaining 13 (24.53%) weak signs of heat. The relationship between the intensity of induced heat and conception rate is also presented. It could be seen that all the 23 cows which showed pronounced heat conceived at first insemination. At the same time none of the cows showing weak or medium heat settled with first insemination. The variation in the conception rate with respect to the intensity of heat was highly significant ($\chi^2 = 17.59^{**}$)

The data on the number of inseminations required per conception and service period of the untreated animals of

the herd and the experimental animals are shown in table 7. It was observed that the number of inseminations required per conception in the untreated animals and the experimental animals was 2.4156 ± 0.0867 and 1.56 ± 0.1433 respectively. The mean service period was 135.11 ± 6.9742 and 92.4583 ± 3.5394 days in the respective groups (Fig. 3). On analysis, the service period in the experimental animals was significantly shorter ('t' = 2.162) than that of the untreated animals.

TABLES

Table 1.

Incidence of suboestrum in cross-bred cattle

Period of observation	Total No. of cows in the herd	No. of cows reported in anoestrum 45 days postpartum	Percentage	No. of cows in suboestrum	Percentage	No. of cows in anoestrum.	Percentage	No. of cows having active corpus luteum.
June 1981 to Sept: 1982	162	103	63.58	74	45.68	29	17.90	54

Table 2.

Effect of Estrumate on the postpartum suboestrum

Sl.No.	Particulars	
1.	Number of animals in suboestrum	74
2.	Number of animals treated	54
3.	Average interval from calving to treatment	74.1111 ± 1.9376 days
4.	Number of animals which came into heat	53
5.	Interval from administration of the drug to the onset of heat	53.2075 ± 1.038 hrs. (48-72 hrs)
6.	Duration of oestrum	17.8113 ± 0.2964 hrs (16-20 hrs)
7.	Number of cows ovulated	49
8.	Interval from administration of the drug to ovulation	82.6122 ± 2.0015 hrs
9.	Number of cows conceived at induced heat	23
10.	Percentage of conception at 1st heat	43.40
11.	Number of cows conceived at 2nd and 3rd heat	22
12.	Percentage of conception at 2nd and 3rd heat	41.51

Table 3.

Interval from calving to first postpartum heat

	Without treatment	With treatment	't' value
Period	June, 1980 to May, 1981	June, 1981 to Sept: 1982	
Postpartum oestrum interval with SE	88.303 ± 3.9818	76.0283 ± 1.9296	1.96

Table 4.

Relation between parity and conception rate at first insemination in experimental animals

Parity	No. of cows treated with Estrumate	No. of cows conceived at first insemination	No. of cows not conceived at first insemination
1	13	9	4
2	23	11	12
3	16	3	13
4	1	0	1
6	1	0	1
Total	54	23	31

Inference : Parity has no significant effect on the conception rate in experimental animals.

Table 5.

Relation between breed and conception at first insemination in experimental animals

Breed	No. of cows treated with Estrumate	No. of cows conceived at first insemination	No. of cows not conceived at first insemination
Holstein Friesian X Local	7	3	4
Jersey X Sindhi	7	4	3
Brown Swiss X Local	16	10	6
Jersey X Local	24	6	18
Total	54	23	31

Inference : Breed has no significant effect on the conception rate in experimental animals.

Table 6.

Relation between intensity of heat and conception at first insemination in experimental animals

Intensity of heat	No. of cows conceived at first insemination	No. of cows not conceived at first insemination	Total	Remarks
Pronounced	23	0	23	Out of 54 experimental animals only 53 came into heat
Medium	0	17	17	
Weak	0	13	13	
Total	23	30	53	

Inference : Intensity of heat and conception rate are highly correlated.

Table 7.

Comparison of the reproductive efficiency between the untreated animals and experimental animals

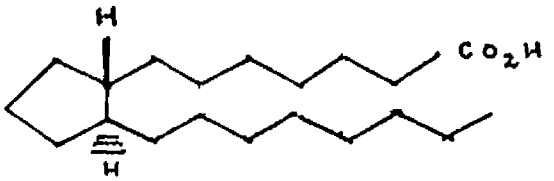
	Untreated animals	Experimental animals	't' value
Period of observation	June 1980 to May 1981	June 1981 to Sept. 1982	
No. of animals	162	54	
No. of inseminations required per conception	2.4156 ± 0.0867	1.56 ± 0.1433	0.4060
Mean service period	135.11 ± 6.9742	92.4583 ± 3.5394	2.162*

Inference : The difference between the service periods of the untreated and experimental animals is statistically significant.

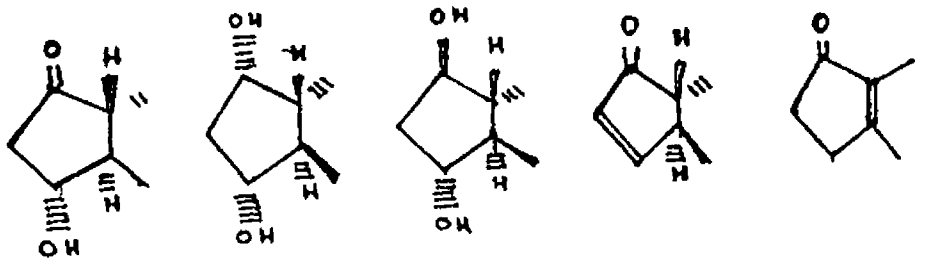
ILLUSTRATIONS

Figure 1

a Prostanoic Acid



b Cyclopentane ring structure of various prostaglandins



E Fα Fβ A B

c Prostaglandin F2 alpha

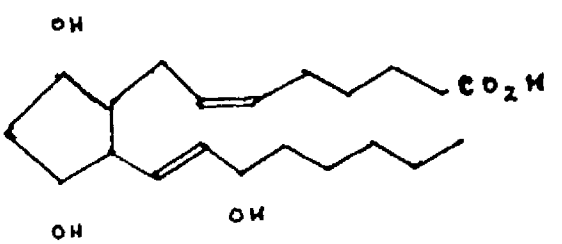


Figure - 2.

Effect of Prostaglandin F 2 Alpha on post partum suboestrum

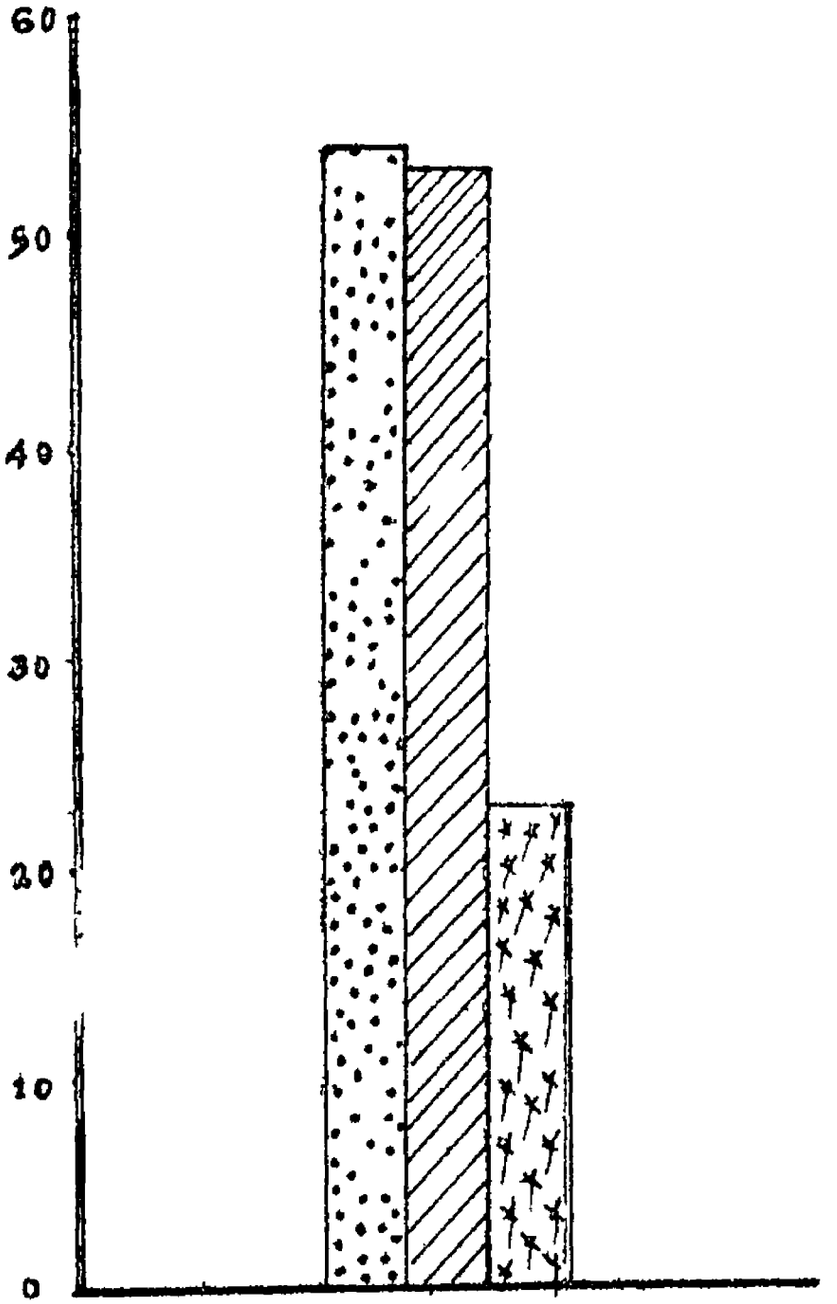
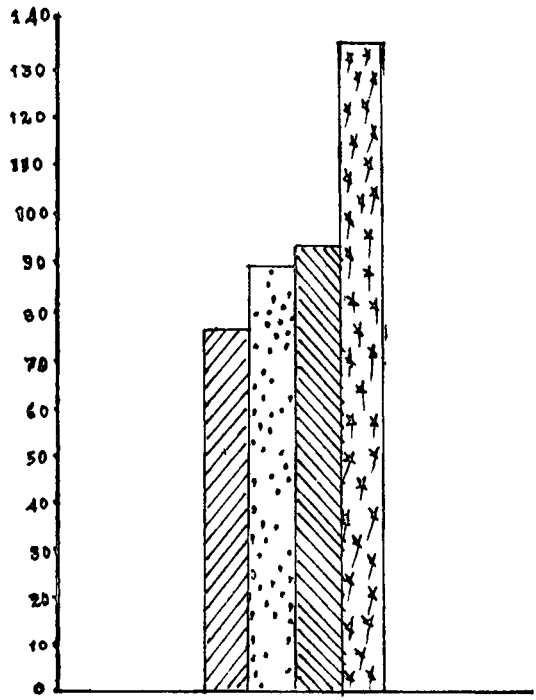


Figure - 3.

Post partum suboestrous interval and service period in experimental animals and rest of the herd



Post partum oestrous interval in exptal animals
Post partum oestrous interval in rest of the herd
Service period of the exptal animals
Service period of the rest of the herd

DISCUSSION

DISCUSSION

Suboestrum is a major cause for reportedly anoestrus condition and is an important contributing factor for reduced fertility or subfertility in crossbred cattle (Luktuke and Roy, 1964; Morrow et al. 1966; Rao and Moorthy, 1972; Kruif, 1977; Ramboodiripad, 1978). The magnitude of this condition is so great that it lengthens intercalving period with the resultant economic loss. Very little attention has been paid for the treatment of this important condition in our country, probably because of the complex causes.

The use of Prostaglandin F_2 alpha, for inducing oestrus in suboestrous cows, is based on the earlier findings of Babcock, (1966) who suggested that prostaglandin F_2 alpha might be the agent from the uterus which possessed luteolytic effect. Since then, several trials were carried out to study the utility of Prostaglandin F_2 alpha and its structural variants in the treatment of suboestrum with appreciable results (Lauderdale, 1975; Cooper and Rowson, 1975; Peters et al. 1977; Johnson, 1978; Rao and Rao, 1979). Therefore, present investigation was taken up to find out the incidence and magnitude of prevalence of suboestrum in

crossbred cattle and to study the efficacy of Prostaglandin F_2 alpha in such cases with the ultimate object of evolving a suitable corrective measure for postpartum suboestrous condition in cows.

The materials used for the present study consisted of 54 crossbred cows of different genetic groups belonging to the University Livestock Farm, Mannuthy which did not show signs of heat even beyond 45 days postpartum.

Perusal of data presented in table 1, revealed that out of 162 cows 74 (45.68%) were suboestrous even beyond 45 days postpartum. Observations similar to this have been made by Casida and Wisnicky (1950), Kidder et al. (1952) and Radawmy (1979). Rao and Moorthy (1972) however, reported a higher incidence of suboestrum in crossbred cows. Mamboodiripad (1978) observed a lesser percentage of silent heat in crossbred cattle of similar genetic groups. It was also found that, though, the reported anoestrus condition in the above bovine population was 10%, only 29 (28.16%) were anoestrous and 74 (71.84%) were suboestrous. The variation in the animals reported to be in anoestrum and the true functional status based on the gynaecological examinations may be attributed to the high

incidence of silent heat during the postpartum period, as reported by Roberts (1971), Kruif (1977) and Luktuke and Sharma (1978). In the present investigation 500 microgram of Estrumate was used as intramuscular injection for induction of oestrus. Though different dose levels of Estrumate have been tried by different workers with varying results, 500 microgram was reported to be effective in causing luteolysis (Nakahara et al. 1975; Day, 1977; Peters et al. 1977; Barnabe et al. 1978; Seguin and Gustaffson, 1978; Singh et al. 1979; Svensson, 1979). The present investigation is based on the above reports.

On an average, treatment of cows was initiated after 74.1111 ± 1.9376 days of calving. It could be seen from table 2 that out of 54 suboestrous cows treated, oestrus was detected in 53 (98.15%). This is essentially in keeping with the findings of Roche (1974), Philipsson and Rasbech (1974), Barnabe (1975), Ganeswaran and Patil (1975), Cooper and Furr (1974), Decze et al. (1976) and Gupta et al. (1978) who reported that majority of the cows treated with PGF_2 alpha evinced oestrus within 2 to 4 days of administration of the drug. The interval from the administration of the drug to the expression of oestrus varied from 48 to 72 hours. It was also observed that on an average

53.2075 ± 1.038 hours were required to induce heat in the subcestrous cows. Similar observations were made by Cooper and Burr, (1974); Leaver et al. (1975) and Gupta et al. (1978) who reported that oestrus could be induced in subcestrous cows within 2 to 4 days of administration of the drug. On the contrary, poor response on the oestrus induction by PGF_2 alpha was reported by Eddy (1977), Leid (1978), Singh et al. (1979), Khurana (1979) and Chauhan et al. (1980). The failure of oestrus induction might be due to selection of cows in nonresponsive stage of oestrous cycle as reported by Chauhan et al. (1980). It was further observed that among 53 cows which responded to the treatment 23 (43.40%) exhibited pronounced heat, 17 (32.08%) medium and 13 (24.53%) weak signs of heat. Though comparable data on the causes of poor expression of heat in cattle are not available, it could be said that subclinical infection of the uterus might be responsible for partial luteolysis, resulting in the expression of weak signs of heat. Subclinical infection is known to inhibit luteolysis in cattle (Ginther, 1968) with poor oestrus detection in such animals.

The average duration of oestrus in the experimental animals was 17.6133 ± 0.2964 hours with a range of 16 to 20

hours. Elving et al. (1975) reported that duration of oestrum was 16.9 ± 1.1 hours in PGF_2 alpha treated animals. The duration of oestrus presently observed agrees with the reports of Roberts (1971) and Arthur (1979) in pure bred cows and Mathai and Raja (1978) and Iyer and Madhavan (1981) in crossbred cows. Thus it could be assumed that the duration of induced oestrus did not show marked variation from the normal oestrus in crossbred cows.

In all, 92.34% cows ovulated with Estrumate treatment. This finding confirms the earlier reports in cattle (Lauderdale et al. 1974; Peters et al. 1977) and in buffaloes (Jainudeen, 1976; Khurana, 1979). The interval from the administration of the drug to ovulation varied from 76-92 hours with a mean of 82.6122 ± 2.0015 hours. Ovulation time in the induced heat concurs with the earlier reports (Hoffman et al. 1976; Kaneda et al. 1978; Nakano et al. 1978). However, ovulation time has been reported to be 93.0 ± 18 hours after administration of PGF_2 alpha (Elving et al. 1975) and 92 hours (Cumming et al. 1977). On the other hand, Jaumy and Leal (1980) reported that percentage of animals that have ovulated by 6, 8, 12 and 16 hours after the end of oestrus was 0.0, 50.0, 90.0 and 100.0 for induced cycles. The present study also revealed that among the 54 cows

23 (43.40%) conceived at induced oestrus on first service. These results are consistant with Kruif (1977); Grunert et al. (1978) Kupferschmied et al. (1979) in cattle and Rao and Rao (1979) in buffaloes. However, conflicting views have been expressed by various workers regarding the fertility of cows in induced heat with Prostaglandin F_2 alpha. The conception rate was reported to be 50% (Turman et al. 1975) 58% (Kruif and Brand, 1976) 67.21% (Christie and Medcalf, 1976) 60% (McMillan et al. 1978) 52.6% (Arriola and Duran, 1980) 49% (Aschermann and Kaiser, 1981) and 49.4% (Hunka, 1981). According to Inskeep (1973) and Roche (1974) fertility at oestrus induced by PGF_2 alpha or its analogues would be within normal limits. On the contrary, a low conception rate has been reported by Barnabe (1975), Elving et al. (1975), Kruif (1977) and Hardin et al. (1980). The satisfactory conception rate obtained in the present study, suggests that Estrumate is effective in induction of ovulatory oestrum with satisfactory fertility and that the drug is suitable for the treatment of suboestrum in cows.

It was further observed that 16 of the non pregnant cows returned to oestrum within 20 days of the last insemination and 14 on later dates. The mean cycle length of those returned to oestrum within 20 days was 17.46 days. This is

in agreement with the observation of Nedumcheralathan (1980) in buffaloes.

The data presented in table 5 reveal that the post-partum oestrus interval was considerably shorter (76.0283 ± 1.9296 days) in the experimental animals than that of the rest of the herd (88.303 ± 3.9818). Beaumont et al. (1977) and Tate and Seguin (1980) also reported the beneficial effect of PGF_2 alpha in reducing the postpartum oestrus interval in cows.

The present study suggested that the conception rate in the induced heat was not influenced by parity or genetic group of the animal. Perusal of literature also did not reveal any significant influence of the above parameters on the conception rate in PGF_2 alpha induced heat.

Data presented in table 6 revealed that out of 23 cows which showed pronounced signs of heat, all the 23 conceived at first insemination while none of the cows showing medium and weak signs of heat conceived. Analysis of the data showed that the conception rate was positively correlated with the intensity of heat. The poor conception rate in animals with medium or weak signs of heat may be attributed to the probability of subclinical infection as reported by

Ginther (1968).

Perusal of the table 7 revealed that the number of inseminations required per conception in the induced heat did not vary significantly from the rest of the herd, the values being 2.4156 ± 0.0867 and 1.56 ± 0.1493 in the respective groups. The number of inseminations required per conception in the induced heat is comparable to that of Anderson (1979) the value being 1.6. This clearly indicates that the fertility in terms of number of inseminations per conception is not adversely affected by chemical induction of oestrum. Similar observations were also made by Inskeep (1973) and Roche (1974). The service period of the experimental animals was significantly shorter (92.4583 ± 3.5394 days) than the herd average (135.11 ± 6.9742 days) (Table 7). Esselmont et al. (1977) also reported that service period of the herd could be considerably reduced by administration of Estrumate on the early postpartum period. The calving interval of the experimental animals was also shorter (367.4583 ± 3.479) compared to the rest of the herd (410.11 ± 12.8505). Thus it could be inferred that administration of Estrumate to the suboestrous cows in the early postpartum period would be beneficial in

reducing the service period and calving interval, thereby improving the overall productivity of the cows in the herd.

SUMMARY

SUMMARY

The aim of the investigation was to assess the incidence of suboestrus in crossbred cattle and to study the efficacy of Prostaglandin F_2 alpha analogue (Estrumate) in the treatment of suboestrum in the early postpartum period.

The materials used for the present investigation consisted of crossbred cows of different genetic groups (Holstein Friesian X Local, Jersey X Sindhi, Brown swiss X Local and Jersey X Local) belonging to the Livestock Farm attached to the Kerala Agricultural University. They were maintained under identical conditions of feeding and management. Cows reported to be anoestrous, even beyond 45 days postpartum, were subjected to detailed clinico gynaecological examination and those having corpus luteum were declared as suboestrous. Among these, 54 cows having an active corpus luteum (7-14 days of age) were treated with intramuscular injection of 500 microgram Estrumate. These experimental animals were closely watched with the help of a teaser bull for signs of heat. The oestrus was confirmed by rectal examination. The cows in heat were inseminated with good quality chilled semen. Pregnancy

diagnosis was done at 45-60 days after insemination. Those which failed to conceive at first insemination were reinseminated at the subsequent heats. The efficacy of Estrumate was assessed on the basis of the number of animals showing visible heat after the administration of the drug, number of cows ovulated and the number of cows conceived at the induced heat.

The incidence of suboestrum was found to be 45.68% beyond 45 days postpartum. The percentage of suboestrum in the reportedly anoestrous cows was 71.84%. It was found that out of 54 cows treated with Estrumate, 53 (98.15%) cows evinced oestrum at an average interval of 53.2075 ± 1.038 hours. Among these 23 (43.40%) cows showed pronounced heat, 17 (32.08%) medium and 13 (24.53%) weak signs of heat. The duration of induced oestrus ranged from 16 to 20 hours with a mean of 17.8113 ± 0.2964 hours. Among these, 49 (92.54%) ovulated at an average interval of 82.6122 ± 2.0015 hours after administration of the drug. The number of cows conceived at first insemination was 23 (43.40%). The cows which did not conceive at first insemination were reinseminated at subsequent heats and 41.51% conceived at second and subsequent inseminations. The mean duration of cycle length

of those returned to oestrus within 20 days of first insemination was 17.46 days.

The mean postpartum oestrus interval of the experimental animals was 76.0283 ± 1.9296 days compared to 88.303 ± 3.9818 days of the untreated animals in the herd. Parity and genetic group of the cows did not influence the conception rate in the suboestrous cows. The intensity of heat significantly influenced conception rate in the experimental animals. Number of inseminations required per conception was not significantly different from that of untreated animals in the herd. Service period was significantly shorter in the experimental animals than that of the other animals in the herd.

The results of the present investigation suggest that Estrumate was effective in induction of oestrus and ovulation in suboestrous cows. Fertility in the induced oestrus was very encouraging and advocates the suitability of the drug for the treatment of suboestrum in cattle.

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PROSTAGLANDIN ADMINISTRATION IN IMPROVING THE BREEDING EFFICIENCY OF SUBOESTROUS COWS

By

R RAJAGOPALAN NAIR

ABSTRACT OF A THESIS

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Master of Veterinary Science

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Animal Reproduction
COLLEGE OF VETERINARY AND ANIMAL SCIENCES
Mannuthy - Trichur

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ABSTRACT

The object of the study was to find the incidence of postpartum suboestrus in crossbred cattle and to evaluate the efficacy of PGF_2 alpha (Estrumate) in the treatment of suboestrus.

For this, the crossbred cows belonging to the University Livestock Farm, Mannuthy which were reported to be anoestrous even after 45 days postpartum were subjected to detailed clinico gynaecological examination and those having palpable corpus luteum were considered as suboestrous. Among these, 54 cows which had an active corpus luteum of 7-14 days of age were given 500 microgram of Estrumate and the result of the treatment was assessed.

The observations made and inferences drawn are summarised below. The incidence of postpartum suboestrus in the herd was 45.68% and in the reportedly anoestrous animals 71.84% were suboestrous. In all, 98.15% cows exhibited oestrus at an average interval of 53.2075 ± 1.038 hours, after the administration of the drug. Among these 92.45% ovulated at an average interval of 82.6122 ± 2.0015 hours after the administration of Estrumate. The percentage of treated animals which conceived at first insemination was 43.4. The conception rate in the induced heat

was significantly influenced by the intensity of heat. The number of inseminations required per conception did not vary significantly from that of the rest of the herd. The service period of the treated animals was significantly shorter (92.4583 ± 3.5394) than that of the herd (135.11 ± 6.9742) days.

In short, it may be stated that PGF_2 alpha analogue, Estrumate, was effective in the induction of ovulatory oestrum with satisfactory fertility in the suboestrous cows.