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QUESTIONS AND ANSWERS

Dr. Zemjanis: I would just like to indicate that I agree with your findings but at least with our research results, saline did not have any effect on shortening the cycle.

Dr. Morrow: Well, there is one study by Guenther in Germany where he has done it on day four. He did not have any early return to estrus but Nicar's data pretty much agrees with what we found or we agree with what he has found. There is also the study of Guenther's that was published this summer where on day three, using infusions in seven animals, he had an average interval to estrus of 15 days. However, there was quite a lot of variation in his particular study.

From the Floor: Did you have any problem inserting these?

Dr. Morrow: I would say at the time we were using them in this particular study, no, we did not. We are talking about day 20 up to day 25 and as long as day 30 on a couple of animals so we did not have a particular problem. Certainly in a clinical situation where you may be getting outside of this particular area, then you can run into some problems, and we have had particular animals where we were unable to insert them. So, generally speaking, around three weeks as I have indicated—you have to wait until the cervix contracts down so it is small enough to hold the device and yet not too small to get it in.

Question: What antibiotics are the least irritating?

Dr. Morrow: Looking at various antibiotic infusions, my impression would have been that if any would have had little effect, furacin would have been one of those, but as I say, Dr. Guenther is finding that it is also having a shortening effect on the estrus cycle so I guess other than saline, I would not be able to say at this point because we have not tested a number of different ones. I think there is one other comment which I should make and that is that we used about 30 of these in this particular experiment. We did have one animal where when we went to remove this UIU the catheter broke off and the IUI remained in the body of the uterus!

Applying Research in Herd Reproductive Service

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Major advances in our knowledge of bovine reproduction in the past 25 years have occurred in the fields of pathology, physiology, endocrinology, microbiology, nutrition and zootechnics. These have resulted in an increased understanding of puberty; the estrous cycle; ovulation; C.L. formation, maintenance and involution; pregnancy; parturition; uterine involution; sperm cell development; accessory gland function; copulation; ejaculation; sperm transport; fertilization and ova transplant. Radioimmunoassays and protein-binding assays that can readily determine the blood levels of progesterone, estrogen, testosterone, corticosteroids, LH, and other proteinaceous or steroid hormones have rapidly forwarded research in endocrinology.

Other advances in basic and applied research have revealed the nature, complexity, and importance of external stimuli such as light, stress, nutrition and visual, auditory, olfactory, physical and endocrine factors on the central nervous system to cause the manifestation of estrus as well as the production of at least nine distinct polypeptides or releasing factors from centers in the hypothalamus (2). When these factors pass to the anterior pituitary gland by means of the hypophysical portal circulation, they regulate the release of the many endocrine substances in that gland. Preliminary research indicates that the gonadotropic releasing factor (GnRF) that releases FSH and LH from the pituitary gland is of value in the treatment of cystic ovaries (3). It may possibly prove of value in the treatment of certain types of anestrus. Japanese and other studies have shown that parenteral injection of heterologous proteinaceous anterior pituitary hormones such as

FSH and LH into cattle produces antihormones that often cause subsequent injections of the same hormonal substance to be ineffective or of limited value. This has helped explain a portion of the failures in LH treatment of cystic ovaries (1).

Recent studies have indicated that one or more prostaglandins, including PGF_{2a}, are probably the luteolytic factor(s) produced by the bovine endometrium that initiates the involution of CL and a sharp decline in progesterone blood levels late in the estrous cycle. PGF_{2a}, has shown promise of being of value in synchronization of estrus in cattle (4). The intrauterine infusion of infectious agents or irritating substances or the placement of an intrauterine device (IUD) into the bovine uterus about days two to six of the estrous cycle causes a short, eight to ten day, cycle while the intrauterine infusion of an irritating substance about 15 days of the cycle causes a prolonged, 25 day, cycle (1,5). These effects, which have practical significance, are probably mediated by the presence or lack of the luteolytic factor that passes to the ovary and hypothalamus by the circulatory system.

Research has shown that high prolonged levels of estrogen, especially estradiol, also cause the involution of the corpus luteum. This has proven of applied value in correcting pathological uterine conditions such as pyometra, mucometra and mummified fetus, associated with a persistent CL (1). Recent basic research studies with applied significance have shown that the parenteral injection of 400 μg (0.4 mg) of estradiol in the cow without a functional corpus luteum causes a rapid and marked release of LH. This "triggering" effect of estradiol or estrone is similar to the physiologic release of LH that occurs the first few hours of estrus and is produced by the estrogens of the developing graffian follicle.

In recent years bovine endocrine research during pregnancy has revealed that parturition is precipitated by the production of cortisol by the adrenal glands of the fetus, probably under the stress of declining nutritive support. This increased level of cortisol late in the gestation period along with other factors causes the involution of the corpus luteum and a sharp decline in progesterone levels resulting in parturition within one to three days. Applied research has shown that cows in the last two to three weeks of gestation, 265 days or more, when given a parenteral injection of 30 to 50 mg of dexamethasone or seven to ten mg of flumethasone will calve within 72 hours or an average of about 48 hours later. Although an increased incidence of retention of fetal membranes accompanies such therapy, certain advantages include: the grouping of calvings at a selected time, the saving of labor, and possibly the reduction in the percentage of difficult births by a slight reduction in body weight of the fetus may result in this becoming an accepted management practice in selected situations.

During the past 25 years the three major venereal diseases—brucellosis, vibriosis and trichomoniasis—caused infertility and severe economic losses to the cattle industry but have nearly been brought under control. Brucellosis is rapidly being eradicated in the U.S. by programs of vaccination, blood and milk testing, and quarantine. Widespread artificial insemination with vibrio and trichomonad-free semen has enormously reduced the incidence of vibriosis and nearly eliminated trichomoniasis in dairy herds. A highly effective vibrio vaccine has practically eliminated the clinical effects of vibriosis in beef herds (1).

Besides the widespread use of computers in the AI industry for DHIA records and in feed formulations, these modern business machines have been used to a limited extent to record service dates, indicate time to check for pregnancy, time of calving and calving intervals. Further uses of computers in cattle management will undoubtedly continue and increase.

The above discussion has indicated in an abbreviated form some of the many varied and important advances in research in bovine reproduction. Much more basic and especially applied research in large herds under practical farm or ranch conditions that cannot be duplicated under "laboratory" conditions is urgently required. To accomplish this needed research, it is incumbent on practicing veterinarians and their organizations, veterinary and agricultural departments or colleges, the cattle industry and state and federal governments to solicit and/or provide funds for such practical and needed studies so that our basic advances in knowledge can be put to practical uses as promptly and economically as possible.

Estrus detection and improved timing of service is the most serious problem facing cattle owners and is necessary to most effectively utilize the enormous genetic advantages of artificial insemination. Synchronization of estrus, promised by reproductive physiologists nearly every year for the past 15 to 20 years, is still unable to be applied in a practical manner. The use of "teaser" or vasectomized bulls with or without a chin-ball device, nymphomaniac cows, plastic detecting devices fastened to cows' rumps, or "heat prediction" by a veterinarian based on repeated rectal or

vaginal examinations all have disadvantages. Heat detection still requires careful, knowledgeable, frequent (at least twice a day) examination of cows during periods when they are actively moving about, as well as examination of the perineal and buttock areas in stanchioned cattle and maintaining necessary individual cow records even when the above "gimmicks" or aids to heat detection are employed (1).

Cystic ovaries, another serious reproductive problem in dairy cattle, requires further study. The use of large and repeated doses of LH is the principle method employed in handling this condition. Although results are fairly satisfactory, this routine therapy probably has greatly increased the number of affected cattle. Because of the hereditary nature of many cases of cystic ovaries, genetic studies, particularly of bulls used in artificial insemination, should be undertaken. Swedish studies have shown how cystic ovaries may be reduced by using selected sires that do not produce daughters having a high incidence of this undesirable trait (8).

Other genetic studies in bulls used by artificial insemination on thousands of cows should be undertaken. The use of herd, DHIA, purebred and AI records, when collated and placed in a computer, could provide a "genetic profile" of sires that would be of inestimatable value to farmers, ranchers and veterinarians. Besides genetic information on a bull's daughters for production and type, such a profile should provide further genetic information on disposition, incidence of cystic ovaries, twinning, size and viability of calves, undesirable, semilethal, or lethal defects or traits known to be heritable. Other such factors requiring further research might be fertility of daughters based on services per conception and calving interval, constitution, longevity, and ability to withstand heat stress. If many of these genetic characteristics of bulls were made available by the AI industry, this "profile," although somewhat costly, would encourage the knowledgeable use of bulls and further discourage natural service to bulls of inferior quality.

Although ova transplantation has been accomplished in a relatively few cattle for the past 15 years, there is no evidence even with recent improvements in technique, that superovulation, recovery of fertilized ova, storage of ova, estrus synchronization and steps essential to the practical use of this procedure is near achievement. Much further basic studies are indicated (9).

Postpartum uterine infections, including retained placenta, resulting in delayed conception is becoming an increasingly serious problem in large dairy and beef herds kept in confined areas. This is undoubtedly a sanitation or infectious problem that urgently requires large-scale applied research to determine the necessary hygienic procedures essential to control the problem.

If early postpartum breeding at 40 to 60 days after calving is to be highly successful in reduction of the calving interval to 12 months in commercial dairy or beef herds, infectious processes must be prevented. Presently, carefully controlled studies have not been carried out so therapy and prevention is still empirical and wasteful.

Although it is well known that maintaining careful records and good management by doing many small things well is highly important to good reproduction performance in a herd. Additional applied field studies on farms and ranches is urgently needed to develop practical, economic herd health and reproduction programs based on careful research data. The herd reproduction level is the product of female fertility level x the male fertility level x the level of management. The herd reproductive level cannot rise above the lowest level of any of these three components: for example, 90 x 90 x 90 = 73% reproductive level, or 90 x 50 x 90 = 40.5% reproduction level (10). Thus, the successful veterinarian in his consultant and advisory capacity to the dairy farmer or rancher on cattle reproduction must maximize the fertile and minimize the infertility factors.

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