

E X T E N S I O N

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Beef

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**MATERNALLY AND NATURALLY
ACQUIRED ANTIBODIES TO *MANNHEIMIA
HAEMOLYTICA* AND *PASTEURELLA
MULTOCIDA* IN BEEF CALVES**

Pasteurella multocida and *Mannheimia haemolytica* are common inhabitants of the upper respiratory tract of healthy cattle and have been associated with cases of enzootic pneumonia in dairy or housed calves and shipping fever in feedlot animals. Calves are naturally born hypogammaglobulinemic because of the syndesmochorial character of the ruminant placenta which prevents prepartum transfer of immunoglobulins from the cow. During the first 24 h of life, calves must ingest and absorb colostral immunoglobulins from their seropositive dams in order to acquire passive immunity. Passive immunity against bovine viruses may persist for up to 9 months after colostral ingestion. Antibodies to *M. haemolytica* and *P. multocida* have been found in colostrum of dairy cows, and these are passively transferred to calves; however, little is known about passive transfer of antibodies to these bacteria in beef calves. **The objectives of this study were to determine and compare the dynamics and duration of maternal antibodies to *P. multocida* and *M. haemolytica* in beef calves from two herds, and to determine the age at onset of acquired immunity to these agents.** Two groups of unvaccinated cattle were used in this study. Serum antibody responses were measured by enzyme-linked immunoassay for antibodies of the IgG1, IgG2 and IgM isotypes binding *M. haemolytica* whole cells (WC) or leukotoxin (LKT) and *P. multocida* outer membrane proteins (OMPs). Comparisons of mean antibody responses to *M. haemolytica* LKT and WC and *P. multocida* OMPs were made within each group. Maternally derived antibodies against *M. haemolytica* and *P. multocida* reached lowest levels at 30–90 days after birth. Calves began production of

antibodies against *M. haemolytica* and *P. multocida* between 60 and 90 days of age in both groups. **Based on the results of this study, in beef herds vaccinated against *M. haemolytica* and/or *P. multocida*, it may be best to vaccinate calves around 3 months of age. In contrast, beef calves from unvaccinated herds might benefit from vaccination at 4 months of age.**

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**EFFECTS OF A LONG ACTING, TRACE
MINERAL, RETICULO-RUMEN BOLUS ON
RANGE COW PRODUCTIVITY AND TRACE
MINERAL PROFILES**

The objectives were to determine if strategic supplementation of range cows with a long-acting (6 mo), trace mineral, reticulorumen bolus containing Cu, Se, and Co would: (1) increase cow BCS and BW, and calf birth, weaning, and postweaning weights, or weight per day of age (WDA); (2) increase liver concentrations of Cu or Zn in cows, or blood Se, Cu, or Zn concentrations in cows and calves; and (3) vary by cow breed for any of these response variables. There were 192 control and 144 bolused Composite cows (C = 25% Hereford, Angus, Gelbvieh, and Senepol or Barzona); 236 control and 158 bolused Hereford (H) cows; and 208 control and 149 bolused Brahman cross (B) cows used in a 3-yr experiment. Cows were weighed and scored for body condition in January, May, and September, and all bolused cows received boluses in January. Each year, from among the 3 breed groups a subset of 15 control and 15 bolused cows (n = 90) had samples obtained in January and May for liver Cu and Zn, blood Se, and serum Cu and Zn. As for cows, blood and serum from the calves of these cows were sampled each year in May and

September for Cu, Se, and Zn. There was a significant breed x year x treatment interaction ($P = 0.001$) for cow weight loss from January to May. Calf WDA, weaning, and postweaning weights did not differ ($P > 0.40$) between bolused and control cows, but there was a significant ($P = 0.022$) breed x year x treatment interaction for birth weight. **Liver Cu was deficient (<75 ppm; $P < 0.001$) in control cows and adequate (<75 to 90 ppm) for bolused cows.** Liver Cu differed by year ($P < 0.001$). Blood Se was adequate (<0.1 ppm) for all cows except in January 2001 and 2002. There was no difference ($P > 0.50$) in blood Se between treatment groups in January, but bolused cows had greater ($P < 0.01$) blood Se in May. Breed differences for blood Se concentrations existed for bolused cows, with B having greater ($P < 0.05$) blood Se than either C or H cows. Breed differences also existed for control cows, with H having less blood Se ($P < 0.04$) than B or C cows. **Calves from bolused cows had greater blood Se than calves from control cows ($P = 0.01$).** **Supplementation via a long-acting trace mineral bolus was successful in increasing liver Cu in cows and blood Se in cows and calves, but the responses varied by year. Bolus administration had variable effects on BW change in early lactation, depending on breed and year, which may indicate the need for breed- and year-specific supplementation programs.**

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EFFICACY OF AZITHROMYCIN DIHYDRATE IN TREATMENT OF CRYPTOSPORIDIOSIS IN NATURALLY INFECTED DAIRY CALVES

The objective of this study was to evaluate the therapeutic efficacy of azithromycin treatment of cryptosporidiosis in naturally infected calves under field conditions. Azithromycin, a **macrolide antibiotic**, has been used in cryptosporidiosis both in immunocompromised animals and humans, with variable efficacy. A subclass of macrolide antibiotics derived from erythromycin, azithromycin differs chemically from erythromycin with a methyl-substituted nitrogen atom incorporated into the lactone ring. The drug is rapidly absorbed from the gastrointestinal tract, and

although the absorption of the drug is incomplete, it exceeds that of erythromycin. Azithromycin is highly effective in a dose-dependent manner in the prevention and the treatment of experimental cryptosporidial infection in the ileum of immunocompromised rats. Fifty Holstein calves with cryptosporidiosis infection were divided into 5 groups: 1 group (10 calves) was unmedicated and served as the control group and was given distilled water only, whereas the other groups (10 animals per group) were medicated orally with azithromycin at the doses of 500 (group 1), 1,000 (group 2), 1,500 (group 3), and 2,000 mg (group 4) PO once daily for 7 days. The animals were examined clinically and fecal samples were collected on the 1st (inclusion day), 7th, 14th, and 21st days of the study. Drug efficacy was assessed by evaluating diarrhea, oocyst shedding, and weight gains from days 1 to 21 (4 assessments). Significant differences were observed in reductions of oocyst shedding and the fecal diarrhea incidence in groups 3 and 4 when compared with groups 1 and 2 and the control group. Weight gain of medicated calves was significantly higher than that of the unmedicated calves throughout the study. The economic losses due to cryptosporidial infections of neonatal calves are related to diarrhea: dehydration, growth retardation, and, to a lesser extent, mortality. **Although the drug did not suppress cryptosporidiosis completely, it gave significant improvements by reducing the clinical symptoms, the intensity of infection, and the fecal output of oocysts.** Therefore, this suppression may have a significant effect on the reduction of environmental contamination by cryptosporidial oocysts. **From the economic point view, authors suggest that the most effective dose of azithromycin for the treatment of cryptosporidiosis in calves should be 1,500 mg/d for 7 days.**

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MODIFICATION OF ACTIVE IMMUNIZATION WITH LIVE BOVINE HERPESVIRUS 1 VACCINE BY PASSIVE VIRAL ANTIBODY

The study in bovine herpesvirus-1 (BHV-1) naïve calves investigated the effect of intramuscularly (IM) administered BHV-1 neutralizing

bovine immunoglobulin on the efficacy of a live intranasally (IN) administered BHV-1 vaccine. Overall on a daily basis, there was between 40- and 5,000-fold less vaccine virus shed by the passively immune calves, compared with that shed by the naïve counterparts. The latter seroconverted to the vaccine, whereas the virus neutralizing (VN) antibody titers in the passively immune calves decreased after vaccination. Compared with unvaccinated naïve or passively immune calves, both groups of vaccinated calves shed significantly less challenge BHV-1, but the daily amount shed was significantly lower in vaccinated naïve calves. The latter were also significantly better protected against pyrexia following the IN BHV-1 challenge, compared with vaccinated passively immune calves. Unlike vaccinated calves, clinical reaction to challenge in both unvaccinated groups also involved nasal discharge, but the duration of both the nasal discharge and severe pyrexia was significantly shorter in unvaccinated passively immune calves. **Conclusions from the study are: the circulating VN antibody is significantly protective against virus shedding and to a lesser extent also against the febrile respiratory disease; passively immune calves are unlikely to seroconvert after an active infection; and passive antibody does negatively affect vaccine efficacy.**

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Vaccine

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FERTILITY OF YEARLING BEEF BULLS DURING MATING

Crossbred (*Bos taurus*) yearling beef bulls were assessed for breeding soundness and physical traits prior to multi-sire natural mating at pasture. Bulls (n=60) were assigned to six groups of nine or 10 bulls and two bull-groups were rotated on 14-day intervals during a 63-day mating season in each breeding herd (n=3) of 191–196 cows. The remaining bulls (n=14) were maintained under similar environmental conditions without mating exposure. Bulls were observed during mating and assessed for breeding soundness and changes following mating. Bulls used for breeding (UFB) lost 77kg of body weight and declined from body condition scores of 6 to 4.5, whereas bulls not used for breeding (NUB) maintained body condition scores of 6 and gained 27kg. The UFB bulls incurred a 75% total injury rate with 63% incidence

of lameness and 12% incidence of reproductive injuries, resulting in a 22% attrition rate. Only 45% were physically sound at the end of mating. Scrotal circumference declined in UFB bulls (−4.58%) and increased in NUB bulls (2.49%). From the 98% BSE-satisfactory rate (UFB) prior to breeding, only 61% were BSE-satisfactory post-breeding. The NUB bulls declined from 57 to 36% satisfactory. The BSE classification was influenced by significant increases in abnormal spermatozoa (primary and secondary), which was significantly associated with injuries incurred during mating. Group and breed differences in injury rates and BSE-status following mating were evident. Environmental conditions and mating activity influenced bull seminal quality and physical condition. **Pregnancy rates in all three breeding herds (91–96%) were similar, with insignificant differences between bull-groups; the effects of physical and reproductive changes on individual bull fertility were immeasurable.** Fertility-potential of yearling beef bulls is dependent on the interaction and relationships of multiple physical, reproductive and behavioral factors. In addition, the environmental and management conditions imposed upon young bulls may favorably or unfavorably influence reproductive capability. Within the conditions of this study, yearling beef bulls of satisfactory fertility-potential prior to a mating season incurred marked physical and reproductive changes from the physiologic stress of mating activity, adverse environmental conditions and effects of injuries. **The breeding soundness status of nearly 50% of the bulls declined through the mating season to standards considered less than satisfactory for expected mating performance.** However, reproductive performance within the breeding herd was sustained at acceptable levels due to sufficient fertility of individual bulls through the course of the mating season and moderate mating loads. **Undoubtedly, individual bulls contributed differently to the herd reproductive results due to the altered physical and reproductive characteristics and variable responses to the factors identified as affecting fertility.** Further investigation will elucidate individual bull reproductive performance under the conditions imposed by this study and individual bull responses to the environmental impacts.

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INTRODUCTION OF BULLS AT DIFFERENT DAYS POSTPARTUM ON RESUMPTION OF OVARIAN CYCLING ACTIVITY IN PRIMIPAROUS BEEF COWS

The objective of this study was to evaluate postpartum resumption of ovulatory cycles among primiparous, suckled beef cows that were exposed continuously to mature bulls beginning at various intervals after calving. We sought to determine whether cumulative distributions of proportions of cows resuming ovarian cycles and interval from the start of bull exposure to resumption of ovarian cycling activity differed among cows exposed continuously (BE) or not exposed (NE) to bulls beginning on d 15, 35, or 55 after calving. Angus x Hereford cows ($n = 56$) were assigned randomly to one of six treatments in a 2 (exposure type) x 3 (day exposed postpartum) factorial arrangement. Blood samples were collected from each cow starting on d -1, and every third day until the end of experiment. **An increase in baseline progesterone concentrations that exceeded 1.0 ng/mL in three consecutive samples was used as evidence of resumption of ovarian cycling activity. More BE cows resumed cycling activity by the end of the experiment than NE cows.** Proportions of cows resuming cycling activity did not differ among cows exposed to bulls on d 15, 35, or 55 postpartum. Proportions of BE cows that were exposed to bulls on d 15, 35, or 55 were greater for each 10-d interval than those for NE cows during the first 40 d after exposure. More BE cows exposed to bulls on d 55 resumed cycling activity by 30 d after exposure than BE cows exposed to bulls on either d 15 or 35. **Interval from calving to resumption of cycling activity was decreased by the presence of bulls.** Day of exposure did not affect interval from calving to resumption of cycling activity; however, interval from day of bull exposure to resumption of cycling activity decreased linearly as day of exposure to bulls after calving increased. The mechanism whereby bulls accelerate resumption of ovarian cycling activity in postpartum suckled beef cows is unknown. Ultimately, the biostimulatory effect of bulls alters secretory pattern of LH that culminate in ovulation. The biostimulatory effect of bulls may be mediated directly or indirectly by 1) attenuation of the negative feedback effect of estradiol-17 β on the tonic release of the hypothalamic mechanisms regulating GnRH release; 2) attenuation of the negative feedback effects associated with maternal

bonding and suckling; 3) a reduction in hypothalamic opioid tone; 4) by a direct effect that stimulates hypothalamic mechanisms controlling GnRH release; or 5) through combinations of these physiological mechanisms. **We conclude that exposing primiparous beef cows to bulls decreased the postpartum anovulatory interval and increased the proportion of cows that exhibit resumption of ovarian cycling activity, independent of day of bull exposure. Furthermore, cows exposed to bulls at progressively later intervals postpartum seemed to respond more rapidly to the biostimulatory effect of bulls than when they were exposed earlier in the postpartum anestrous period.**

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SEMEN AND REPRODUCTIVE PROFILES OF GENETICALLY IDENTICAL CLONED BULLS

In this comparative study, reproductive parameters and semen characteristics of cloned bulls ($n=3$) derived from somatic cell nuclear transfer (SCNT) were compared to their original cell donor Holstein-Friesian ($n=2$) bulls from the same enterprise to assess the differences in reproductive potential between a donor bull and its clones. The parameters evaluated included motility of fresh, frozen-thawed and Percoll-treated frozen-thawed spermatozoa, as well as in vitro fertilization (IVF) ability, embryo quality, birth and survival of calves following IVF and embryo transfer with frozen-thawed semen. With fresh semen, spermatozoa from one cloned bull had lower motility than its donor. Cloned bulls had higher velocity parameters in fresh semen, but those effects were not obvious in frozen-thawed or frozen-thawed semen selected with a Percoll gradient. Semen collected from cloned bulls had significantly higher IVF rates compared to donors; however, embryo development per cleaved embryo or quality of blastocysts did not differ between donors and cloned bulls. Pregnancy and live offspring rates from one donor and its cloned bull did not differ between fresh (40%, 16/40 versus 46%, 17/37) and vitrified/thawed (13%, 2/16 versus 25%, 4/16) embryo transfer following IVF. A total of 26 calves were obtained from genotypically identical donor and cloned bulls with no signs of phenotypical

abnormalities. **These preliminary results suggested that the physiology of surviving postpubertal cloned bulls and quality of collected semen had equivalent reproductive potential to their original cell donor, with no evidence of any deleterious effects in their progeny.**

R. Tecirlioglu, M. Cooney, N. Korfiatis, R. Hodgson, M. Williamson, S. Downie, D. Galloway, A. French; *Theriogenology*
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INFLUENCE OF LIMITED FALL PROTEIN SUPPLEMENTATION ON PERFORMANCE AND FORAGE UTILIZATION BY BEEF CATTLE GRAZING LOW-QUALITY NATIVE GRASS PASTURES

Two studies were conducted to evaluate the impact of feeding limited quantities of a high-crude protein (CP) supplement during the fall on beef cow performance and forage utilization. The supplement used in both experiments contained 455 g/kg CP (dry matter [DM] basis; rumen degradable protein [RDP] = 652 g/kg of CP) and was fed 3 days/week with the amount fed pro-rated to deliver the designated daily allotments. In Study 1, 136 pregnant, Hereford × Angus cows (body weight [BW] = 490 ± 46.7 kg) and their nursing calves were assigned to supplementation treatments. Control cows received no fall supplementation, while supplemented cows received 0.61 kg/day of supplement pre- and post-weaning (PRPO; 15/8 to 14/12; weaning = 15/10) or only post-weaning (POST; 15/10 to 14/12). During the winter, all cows received 1.62 kg supplement/day (14/12 to calving). Through weaning, PRPO cows gained more (P=0.03) BW. After weaning, PRPO and POST had higher (P=0.02) BW gains and lost less (P=0.02) body condition score (BCS) than did control cows. Cumulative BW gains were higher (P=0.05) for supplemented cows through calving, although BCS change did not differ among treatments. Calf birth weights did not differ among treatments, but the gain of calves from PRPO and POST was faster (P=0.03) than that of controls. Fall supplementation did not affect the proportion of cows cycling before the breeding season or pregnancy rates. In Study 2, 16 ruminally fistulated Hereford × Angus steers (initial BW = 259 ± 22.7 kg) received either fall supplementation (FS) or no fall supplementation (NFS) during early (September) and late (November) fall. Steers were individually fed the

same amount of supplement, relative to BW, as the cows in Study 1. The quality of the diet selected decreased with advancing season (i.e., the CP decreased and fiber increased) and, as a result, digestible organic matter intake and digestion were less (P=0.04 and 0.02, respectively) during November. Fall supplementation did not influence diet selection or forage intake, but did tend (P=0.06) to increase extent of digestion. Feeding beef cows a limited quantity of a high CP supplement during fall can positively affect BW and BCS. **Under the conditions of this experiment, supplementation's effect on forage intake and digestion was less important than was provision of additional nutrients in eliciting treatment effects.**

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An Feed Sci & Tech
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EFFECTS OF AGE ON BODY CONDITION AND PRODUCTION PARAMETERS OF MULTIPAROUS BEEF COWS

Adequate reproduction and calf growth are essential to the profitability of the cow-calf enterprise, and many studies have shown that parity can affect these measures. The objectives of this study were 2-fold. **The first objective was to evaluate effects of age on pregnancy rate, calving interval, birth weight, weaning weight, and BCS within a multiparous cow herd. In addition, because most studies that have evaluated effects of age have dismissed the correlation between BCS and age, our second objective was to determine whether the association of age with pregnancy rate, calving interval, birth weight, and weaning weight was the result of correlated changes in BCS.** Pregnancy rate, calving interval, birth weight, weaning weight, and quarterly BCS were collected for 5 consecutive years on 454 fall-calving multiparous British crossbred cattle (3 to 10 yr of age) to evaluate associations of age with BCS and production parameters. Body weight and BCS were collected pre-calving, prebreeding, at weaning, and midway through the second trimester of pregnancy (August). Body condition score was correlated with age during all seasons (P < 0.01). At calving, breeding, and in August, 3-yr-old cows had the lowest BW and BCS, whereas 8-yr-old cows had the greatest. At weaning, these values were maximal

in 10-yr-old cows. Pregnancy rate was near 80% up to 9 yr of age but decreased to 57% in 10-yr-old cows. The relationship of pregnancy rate with age appears to be correlated with the BCS decrease at breeding in the older cows, supported by the fact that inclusion of BCS at breeding in the statistical model eliminated the effect of age on pregnancy rate ($P = 0.42$). Calving interval was longer in 3-yr-old cows compared with 4- to 9-yr-old cows ($P = 0.02$); however, among older cows, there was little change in the calving interval. Birth weight reached a maximum at 8 yr of age (35 ± 0.9 kg) and a minimum in 3-yr-old cows (32 ± 0.7 kg). Birth weights of calves born to both 3- and 4-yr-old cows were lower than for those born to 5-, 6-, 7-, or 8-yr-old cows ($P < 0.05$). Ten-year-old cows weaned lighter calves (205-d adjusted weaning weight) than younger dams. Furthermore, 3-yr-old cows weaned calves 9 ± 2.1 and 14 ± 2.4 kg lighter than 4- and 5-

yr-old cows, respectively ($P < 0.001$). Interpretation of the age analyses of calving interval, birth weight, and weaning weight was independent of the inclusion of BCS in the model. This study documents the effects of age on calving interval, birth weight, and weaning weight that are independent of BCS. Age was highly related to BW, BCS, and backfat thickness in this study. Furthermore, age was correlated with pregnancy rate, calving interval, birth weight, and weaning weight. **By evaluating effects of age while controlling for BCS, this study implies an inherent effect of age on calving interval, weaning weight, and birth weight, but not on pregnancy rate. The significant effects of age allude to the importance that herd age profiles can have on year-to-year profitability.**

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