INJECTABLE MICRO-MINERALS (MULTIMIN®) PROVE TO BE AN EFFECTIVE AND ESSENTIAL ROUTE OF MICRO-MINERAL SUPPLEMENTATION FOR LACTATING DAIRY COWS.

Dr Neil Michael, DVM, Angela Storch, MS, Willie Smith, PhD

INTRODUCTION:
Optimizing micro-mineral functions in high producing dairy cows is essential, especially at the three critical events in the annual production/reproduction cycle, namely dry off, calving and breeding. However, recent micro-mineral (TM) research and scientific reviews indicate the micro-mineral status of dairy cows and consequently the efficiency of micro-mineral dependent functions are sub-optimal at these critical stages. Several factors decrease the efficiency of micro-mineral supplementation through TMR’s, grain mixes and free choice mineral supplements.

Hutjens & Tomlinson, (2001) suggest, at the producer level, practical supplementation of dairy cows during the early dry period and three weeks before calving and heifers from pregnancy diagnosis until moving in the close-up group, is often poor. The total, actual days in the close-up group by many animals is too short to correct for poor trace mineral intakes during the early dry period as dry matter intake is significantly decreased during the transition period.

Free-choice mineral supplements have limitations as a route to supply essential micro-minerals to dairy cows during the early dry period due to intake variation and antagonisms between minerals. McDowell (2003) attributes the large variation in intake of free choice supplements between animals to, among others, the following factors; producer management level, soil fertility, forage type, season of year, availability of other supplements and grains or feeds, salt content of drinking water, antagonist content in mineral supplement, palatability of mineral supplement etc.

The negative effects micro-mineral antagonists, located in drinking water, pasture, feeds and free-choice supplements, have on the efficiency of micro-mineral absorption from the digestive tract of ruminants is commonly underestimated. High levels of calcium, phosphorous, iron, sulphur, and molybdenum are known to decrease the efficiency of absorption of the essential micro-minerals, zinc, manganese, selenium and copper from the gut. The degree of absorption suppression depends on the type and amount of antagonists. Arthington (2003) considers the excess antagonists effects, on the absorption of essential micro-minerals from the gut, as the most important factor resulting in ruminants sub-optimal micro-mineral status.

The above factors suggest an alternative route of essential micro-mineral supplementation in dairy cattle should be implemented in micro-mineral supplementation programs on commercial dairy operations. Tissue-friendly injectable supplements, containing key micro-mineral levels in a scientifically correct ratio, have been shown to significantly increase micro-mineral status. Results have demonstrated increased immunocompetence at calving and enhanced reproductive efficiency in dairy cows, especially during the first 100 days in milk (DIM). Mitchell (2003) showed cows receiving two injections (one 4 weeks before calving and one 4 weeks before breeding) had a 22% reduction in mastitis during the first 30 DIM and conception increased significantly resulting in an improved pregnancy rate from 18 to 20%, with a return on investment (ROI) of 19:1.
The objective of the present study was to evaluate the effects of two micro-mineral injections (each supplying 200 mg zinc, 50 mg manganese, 25 mg selenium and 75 mg copper) one 4 weeks before calving and one 4 weeks before breeding on micro-mineral dependent functions in addition to feed micro-mineral supplementation.

MATERIALS AND METHODS:
A well managed dairy herd in Waunakee, Wisconsin (750 cows; 27800lbs RHA; 3X milking), with less than average mastitis and other immune responsive disorders and better than average reproduction efficiency, was selected for this study. At the start of the trial the herd averaged a heat detection rate of 65% and an annualized pregnancy rate (PR) of 16%.

The feeding regime and supplementary micro-mineral/vitamin program was regarded as adequate. The ration was formulated to contain the following micro-mineral levels (ppm): cobalt-1.21, copper-27, iodine-3.4, manganese-89, zinc-95 and selenium-0.5. Micro-minerals were supplemented utilizing an inorganic trace mineral package combined with Zinpro’s 4-Plex™. Iron was not supplemented, but it was estimated the feedstuffs in the total diet contributed 183ppm.

Dairy Comp 305 software was used to track injections, monitor trial progress and collect data. The trial took place from January 2003 to December 2003 with January 2003 to January 2004 data analyzed.

Cows with odd ID’s (n=278) were injected with 5mL Multimin® (MM- treatment group) 3 to 4 weeks prior to expected calving date and 3 to 4 before the end of the voluntary waiting period (VWP = 45DIM). Cows with even ID’s (n=311) were injected with 8mL of MuSe™ (MS- control group) at 3 to 4 weeks before expected calving date. Control cows received MS as part of the dairy’s standard management procedures.

Statistical methods and Data analysis
Cow events occurring up to 150-200 DIM were used in the analysis to focus on the critical period for treatment efficacy. Pregnancy data were classified in a contingency table according to binomial outcome (pregnant or open by DIM cohorts) for each of the two treatments (MM and MS). Chi-squared tests were performed to test the null-hypotheses of independence between the two factors (x – treatment and y – pregnancy result) as follows:

$H_0$: Whether a cow becomes pregnant or not within a given time is independent of the treatment she received.

When the Chi-squared value is significant (P<0.05) the null-hypotheses of independence is rejected.

Health (lameness and retained placentas) and milk quality (mastitis) related incidences were summarized as total number of events by treatment and statistically tested using Chi-Square as mentioned above.

Regression Analysis was used to determine the median days open (MDOPN- DIM when 50% of the herd is open) for each treatment and calculate the respective 95% confidence limits. The regression of percent open on DIM is nonlinear. When percent open is subjected to inverse of Ln transformation the nonlinear relation becomes a straight line. Linear regression analysis was performed for each treatment with DIM as independent variable and 1/(percent Open) or Ln (Open) as dependant variable.
Costs of two injections of MM and economic value of improved reproductive efficiency were used to calculate a return on investment and impact on dairy profitability.

**RESULTS AND DISCUSSION:**
No difference was seen in mastitis incidences between the cows receiving MM and those receiving MS. As referenced in Mitchell (2003), research has shown a correlation between increased selenium content in blood and reduced cases of mastitis. Additional research showed increased keratin production in the teat with organic zinc supplementation. The current dairy provided all cows with organic zinc ration supplementation and control cows received MS, an additional source of selenium, which may have affected the overall results.

Cows receiving MM tended to have lower incidences of retained placentas (RP) \( n=28 \) versus control cows \( n=38 \) \( (P=0.29) \). Although not statistical, decreased RP events may indicate not only selenium, but also zinc, copper and/or manganese are involved in the prevention of retained placentas. Alternatively, selenium in MM was utilized more efficiently within the balanced multi-mineral formulation compared to only selenium in MS.

Cows receiving MM tended to have lower incidences of lameness reported \( n=8 \) versus control cows \( n=16 \) \( (P=0.13) \). Although it was not significant, it represents the potential of MM to improve nutritional balance or micro-mineral status and therefore hoof health.

Percent Cows Pregnant (within a specific time frame) of all MM treated cows trended higher than the percent cows pregnant of control cows at days 80, 90, 100, 110, 120, 130, 140, and 150 in milk (Fig. 1). Values approached significance \( (P<.05) \) at 80, 140 and 150 DIM.

![Figure 1: The Effect of MULTIMIN® vs MuSe on Percent Cows Pregnant (all cows) at Days 80, 90, 100, 110, 120, 130, 140 & 150 in Milk](image)

The percentage increase in pregnancy production resulting from the two MM injections was very similar to that found by Mitchell (2003) indicating injectable micro-mineral supplementation helps increase optimal micro-mineral status and therefore improved reproductive performance.
The effect of MM on percent pregnant (within a specific time frame) was enhanced in second lactation cows, also seen by Mitchell (2003) (Figure 2). This difference was highly significant (P<0.01) early in lactation.

Increased conception and pregnancy production resulted in a decrease in MDOPN from 119 days in the MS group to 99 days in the MM group (P<0.05) (Figure 3).
Second lactation cows receiving MM experienced similar improved reproductive efficiency with MDOPN decreased to 100 DIM from 147 DIM for MS treated cows (P<0.05) (Figure 4).

Figure 4. The effect of Multimin® on days open in Second Lactation Cows between 80 and 200 days in milk of which the regression analysis were used to calculate the 95% confidence limits in decreased Median Days Open

Improved reproduction efficiency by decreasing MDOPN and increasing percent pregnant (within a specific time frame) can be of economic value for producers. The value of reduced MDOPN is worth approximately $2.50 per cow per day. The reduction in MDOPN (all cows) of 20 days found in this study is estimated to be worth approximately $50 per animal per year. With the cost of two MM injections at $4 ($2 per injection), the approximate return on investment is 12.5:1.

CONCLUSION:
Trial results indicate the efficiency of micro-mineral functions in dairy cows on an “adequate” feed micro-mineral program can be enhanced significantly by the addition of two Multimin® injections to the management program given at critical stress periods, 4 weeks before expected calving date and 4 weeks before breeding.

Reductions in retained placentas and lameness events indicate a possible improvement in regulation of immune competence in Multimin® supplemented animals during the transition and early breeding period.

Percent cows pregnant in the Multimin® supplemented group trended higher than their peers receiving MuSe™, especially during early lactation where there was a significant reduction in Median Days Open. Improved reproductive efficiency is a financial benefit to producers, returning cows to the decreasing the calving interval, providing additional replacements, returning animals to the next lactation sooner, ultimately more peak milk production.
REFERENCES: