EVALUATION OF THE IMPACT OF IVERMECTIN TREATMENT ON THE GROWTH AND REPRODUCTIVE PERFORMANCE OF REPLACEMENT BEEF HEIFERS

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INTRODUCTION

In order to calve at about two years, heifers should reach puberty by 13 to 16 months. Early puberty is primarily dependent on genetic capability. Successful management to allow achievement of genetic potential is based on management of environmental factors. A widely accepted objective is to achieve a critical minimum weight (CMW) at which 84% of heifers will conceive in a 42-45 day mating span (1).

The detrimental effects of parasites, particularly *Ostertagia ostertagi*, on bodyweight gain have been established in major cattle markets. Although the value of anthelmintic treatment in preventing these effects has also been well demonstrated, it has not been shown that anthelmintic treatment will allow a greater proportion of heifers to calve at two years.

A series of studies was undertaken to determine if parasite control obtained with strategic use of ivermectin would result in animals attaining CMW at an earlier age, leading to a higher rate of conception at first mating and allowing a short breeding season.

MATERIALS AND METHODS

Trial Design

Trials 1, 2 and 3 were conducted on the same improved bermuda grass pastures in Louisiana, at a stocking rate of 2 heifers per acre, over three consecutive years. Heifers, containing varying percentages of *Bos indicus* and *Bos taurus*, were recently weaned and aged 8 to 10 months. In Trial 1, heifers received ground corn at the rate of 1% of bodyweight from initiation of the trial until the end of the breeding season. In Trials 2 and 3, heifers received 3.6 kg per head per day during that period, with access to hay when growing forage was limited. There were two replicates (a total of 32 cattle) in the first year and six in each of the later years (96 cattle per year). Each trial commenced in November. Treatment groups were grazed separately until commencement of mating, in early May, when replicates within each treatment were pooled onto a single pasture. Breeding seasons were 63 days for Trials 1 and 2 and 56 days for Trial 3.

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Trial 4 was conducted in Kansas using five replicates selected from 80 recently weaned, fall-born crossbred Angus heifers. Heifers grazed at a stocking rate of approximately one animal per 5 acres, commencing on the day of treatment, June 28, until November 7, when the groups were combined for a breeding season of 60 days. From September until November, supplementary protein was provided at a rate of 1.6 kg per heifer per week, progressively increasing to 2.7 kg per heifer per day from commencement of the breeding season.

Trial 5 was conducted in Montana using 102 spring-born, Hereford-cross heifers recently weaned into a drylot where they were maintained from the start of the trial in November until May turnout to pasture for the 62 day breeding season. In the drylot, heifers received a ration based on corn silage, barley and alfalfa. Animals within the same replicate were drylotted together throughout the study.

Allocation and Treatment

In each study, heifers were paired by bodyweight. Each animal within a pair was allocated at random to one of two treatment groups.

1. Control - to receive salvage treatment as considered necessary on humane grounds. In Trial 5, Group 1 cattle were treated with a topical organophosphate on Day 0.
2. Ivermectin 1% solution (IVOMEC® Injection for cattle, Merck AgVet) administered by subcutaneous injection (200 mcg per kg bodyweight), at the start of the trial (Day 0). In Trials 1 to 3, a grazing period treatment was administered between Days 50 and 70 and in Trial 4 a second treatment was administered prior to commencement of the breeding season.

Observations

In all trials, bodyweights were measured at regular intervals, first at the time of allocation, through the start of mating. Fecal egg and pasture larval counts were conducted for determination of nematode challenge. In Trials 1 to 4, manual pregnancy tests were carried out approximately 42 days after the end of the breeding season, and 77 days after the end of mating in Trial 5. In Trials 1 to 4, fetal age was recorded.

RESULTS

In Trials 1 to 4, mean daily weight gains of ivermectin-treated heifers were significantly greater than those of control heifers. In Trial 5 there was no significant difference between groups (Table 1). In this trial, mean body condition scores for both groups on Day 0 were 6.1 and on Day 184, at the start of mating, mean condition scores of treated and control heifers were 6.5 and 6.4 respectively.

Table 1: Mean daily bodyweight gains (kg)

Trial	Controls	Treated
1.	0.45	0.53*
2.	0.59	0.72*
3.	0.55	0.60*
4.	0.33	0.35*
5.	0.65	0.64

* difference between groups significant ($p<0.05$)

Clinical parasitism was not observed in any animal in any of the studies. The results of fecal egg counts are shown in Table 2. In Trials 1, 2 and 3, results of fecal cultures indicated that the major parasite was *Ostertagia ostertagi* with some *Cooperia* present. In Trial 4 the major species present was *Cooperia* spp with some *Haemonchus* and *Ostertagia* identified. The major proportion of the increase in egg output in control heifers in Trial 5 was associated with infection with *Nematodirus* species.

Table 2: Mean fecal egg counts on Day 0 and on the day of maximum counts after treatment (eggs per gram)

	Trial	Control	Ivermectin
1.	Day 0	153	479
	Max after Day 0	188 (Day 23)*	31 (Day 134)
2.	Day 0	204	325
	Max	175 (Day 112)	38 (Day 232)
3.	Day 0	89	115
	Max	78 (Day 70)	47 (Day 238)
4.	Day 0	22	27
	Max	29 (Day 133)	26 (Day 77)
5.	Day 0	2	8
	Post-treatment	22	8

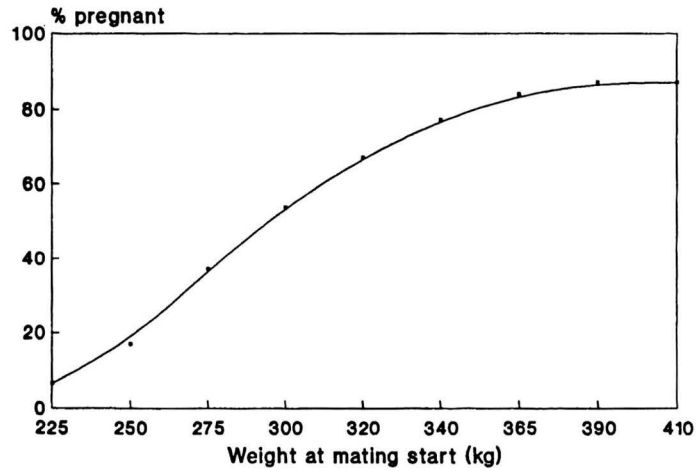
* ( ) day of maximum count

Conception rates, based on manual pregnancy testing, are included in Table 3. A significant positive correlation ($p < 0.05$) between bodyweight and conception was demonstrated in Trials 1 to 3 (Figure 1), but a significant effect ($p < 0.05$) of treatment on conception rate was demonstrated in Trial 4 only. Analysis of fetal age, undertaken in Trials 1 to 3, indicates that a higher proportion of ivermectin treated heifers conceived in the first three weeks of the mating period (Figure 2). This trend was also observed in Trial 4.

Table 3: Percent conception in a limited breeding season

	Control	Treated	
Trial 1	73	63	
Trial 2	68	72	
Trial 3	69	66	
Trial 4	26	58	($p<0.05$)
Trial 5	63	76	

Figure 1: Relationship of bodyweight with conception rate

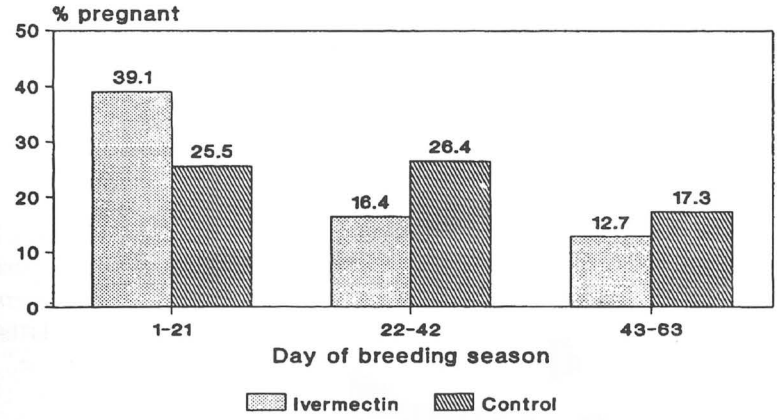


Trials 1, 2 and 3

DISCUSSION

The significantly better mean daily weight gain of ivermectin treated heifers in Trials 1 to 4 indicates that, even where the effects of parasitism are not clinically evident, effective parasite control allows heifers to reach CMW sooner. Although no improvement in overall pregnancy

Figure 2: Pattern of conception by 21 day cycles in the breeding season



Trials 1, 2 and 3

rate associated with treatment was detected in Trials 1 - 3, in these and in Trial 4, there was a difference in timing of conception in favor of the treated groups. The significant improvement in bodyweight gains and the trend to earlier conception is consistent with the findings of Zajac *et al* (2). In Trial 4, weight and conception performance of heifers in both groups was poorer than in the other trials. It may be that the impact of restricted nutrition was exacerbated by a relatively low level of parasite infection.

These results demonstrate that elimination of subclinical parasitism by strategic ivermectin treatment can significantly enhance growth rate in heifers to allow earlier achievement of CMW. Although further studies, under a range of conditions, are needed to confirm the effect, the results indicate that the improved weight gain will in turn lead to improved conception rates within a limited breeding season.

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SUMMARY

To determine if parasite control obtained with strategic use of ivermectin would result in earlier achievement of critical minimum weight in heifers, five studies were conducted on three separate sites - three studies over consecutive years in Louisiana, and one study each in Kansas and Montana. Heifers containing varying percentages of *Bos indicus* and *Bos taurus* were used in Louisiana and *Bos taurus* breeds in Kansas and Montana. Under conditions of subclinical parasitism, ivermectin treated heifers in each Louisiana study and in the Kansas study showed greater weight gains ($p<0.05$) than untreated control heifers. In the Kansas study, a higher proportion ($p<0.05$) of ivermectin-treated heifers conceived. Although there were no significant differences in conception rates in other studies, results from Louisiana suggest that ivermectin treated heifers became pregnant earlier in the mating season. Over the three years of this study, there was a significant positive relationship between bodyweight and conception rate.

RESUME

Afin de déterminer si le contrôle antiparasitaire obtenu avec une utilisation stratégique de l'ivermectin permettrait à des génisses d'atteindre leur poids minimum critique à une date plus rapprochée, cinq études furent réalisées sur trois sites distincts: trois études annuelles consécutives en Louisiane, et une étude chacune dans le Kansas et le Montana. Les animaux étaient des hybrides contenant un pourcentage varié des races *Bos indicus* et *Bos taurus* en Louisiane, et des sujets de la race *Bos taurus* au Kansas et au Montana. Dans des conditions de parasitisme infraclinique, les génisses traitées à l'ivermectin dans chacune des études réalisées en Louisiane et dans l'etude du Kansas manifestèrent des gains de poids plus importants ($p <0.05$) que les génisses de contrôle non traitées. Dans l'étude du Kansas, une plus grande proportion ($p <0.05$) de génisses traitées à l'ivermectin concurent par rapport aux génisses de contrôle. Bien que les taux de conception relevés dans les autres études n'aient pas révéle de différences significatives, les résultats de Louisiane suggèrent que les génisses traitées à l'ivermectin etaient pleines à un stade antérieur de la période de monte. Sur les trois années que dura cette étude, une relation positive notable s'établit entre le poids corporel et le taux de conception.

RESUMEN

Para comprobar si gracias al control de los parasitos logrado con el uso estratégico de ivermectina las vaquillas alcanzan un peso mínimo crítico a una edad más temprana, se efectuaron cinco estudios en tres lugares diferentes tres de los estudios se realizaron en años consecutivos en Luisiana, un estudio en Kansas y otro en Montana. En Luisiana el estudio se hizo en razas hibridas de *Bos indicus y* en Kansas y Montana en la raza *Bo taurus*. Tanto en los estudios realizados en Luisiana como en el realizado en Kansas, las vaquillas con parasitismo subclínico tratadas con ivermectina registraron mayor aumento de peso ($p <0.05$) que las vaquillas del grupo de control que no fueron sometidas a tratamiento. En el estudio efectuado en Kansas, se comprobó que en el grupo de vaquillas tratadas con ivermectina el porcentaje de vaquillas que concibieron fue más elevado ($p <0.05$) que en el grupo de control. Aunque las tasas de concepción registradas en otros estudios no muestran diferencias significativas, los resultados obtenidos en Luisiana sugieren que en la época del apareamiento las vaquillas tratadas con ivermectina quedaron preñadas en una fecha más temprana. En el curso de los tres años que duró este estudio, se pudo observar una relación significativamente positiva entre el peso del cuerpo y la tasa de concepción.