5-21-2001

Effects of Stable Flies (Diptera: Muscidae) on Weight Gains of Grazing Yearling Cattle

J.B. Campbell
West Central Research and Extension Center, University of Nebraska, North Platte, NE

S.R. Skoda
USDA-ARS

Dennis Berkebile
USDA-ARS, DENNIS.BERKEBILE@ars.usda.gov

D. J. Boxler
West Central Research and Extension Center, University of Nebraska, North Platte, NE, dboxler1@unl.edu

G.D. Thomas
USDA-ARS

See next page for additional authors

Authors
J.B. Campbell, S.R. Skoda, Dennis Berkebile, D. J. Boxler, G.D. Thomas, D. C. Adams, and R. Davis

Effects of Stable Flies (Diptera: Muscidae) on Weight Gains of Grazing Yearling Cattle

J. B. CAMPBELL,[1] S. R. SKODA,[2] D. R. BERKEBILE,[2] D. J. BOXLER,[1] G. D. THOMAS,[2] D. C. ADAMS,[1] AND R. DAVIS[1]

J. Econ. Entomol. 94(3): 780–783 (2001)

ABSTRACT Differences in weight gains caused by stable flies, *Stomoxys calcitrans* (L.), on grazing yearling steer/calves averaged 0.2 kg per steer in a 3-yr study on canyon range pastures in West Central Nebraska. Stable fly numbers averaged 0.85 per front leg on treated calves and 3.64 per front leg on control calves. In 2 of the 3 yr after the grazing trials were completed, the calves were placed in a feedlot and fed a finishing ration. Compensatory gain did not occur in the feedlot after the stable fly stress was removed.

KEY WORDS *Stomoxys calcitrans*, stable flies, cattle, grazing cattle weight gains

THE STABLE FLY, *Stomoxys calcitrans* (L.), has long been known as a serious pest of confined cattle in feedlots and dairies (Bruce and Decker 1958; Cutkomp and Harvey 1958; Miller et al. 1973; Campbell et al. 1977, 1987, 1993; Berry et al. 1983; Schwinghammer et al. 1986; Wieman et al. 1992). However, in the last two decades, the stable fly has become a serious pest of grazing cattle in pastures and rangeland in the Northern Great Plains (personal communication with entomologists, Rick Meyer, North Dakota State University; Mike Catangui, South Dakota State University; Jack Lloyd, University of Wyoming; Frank Peairs, Colorado State University; Ken Holscher, Iowa State University; and Alberto Broce, Kansas State University). This problem was first noted in the literature by Hall et al. (1982).

The economic losses in terms of weight gains to grazing cattle as a result of stable flies have not been researched previously. A previous study dealt with the weight gain losses of a biting fly complex [horn flies, *Hematobia irritans* (L.), stable flies] on grazing cattle (Cutkomp and Harvey 1958), but no studies report on the stable fly alone. It is not surprising that there is a paucity of data on this problem. The stable fly is very mobile, and control of the fly on pasture cattle is very difficult to achieve. Its primary feeding site is on the front legs of cattle (Berry et al. (1983)), a location not effectively treated with self-treatment devices such as dust bags, oilers and insecticide impregnated ear tags are commonly used for horn fly and face fly, *Musca autuumnalis* (De Geer). Use of pesticide sprays on animals does not provide satisfactory control either. Campbell and Hermanussen (1971) sprayed cattle that were fed in a lot daily, then were allowed to go to pasture. Sprays were short-lived because the insecticide was washed from the front legs of cattle when they walked through wet grass or stood in ponds. The stress to cattle associated with spraying could probably offset the stress caused by the stable flies. However, recent concern by ranchers and veterinarians about this problem served to initiate the research. Our objective was to determine what effect stable flies (as the only fly pest) had on weight gains of grazing yearling steers.

Materials and Methods

This study was conducted for 3 yr with 42, 41, and 46 yearling steers in 1997, 1998, and 1999, respectively, obtained from the University of Nebraska Gudmundsen Sandhills Laboratory herd, Whitman, NE. The steers were crossbreds whose dams were composites consisting of Hereford, Angus, Simmental, and Gelbvieh; and the sires were Angus. Allocation of the calves to each of two treatments was done on a modified random basis. The calves were weighed and allocated to treatment based on weight, i.e., the heaviest was assigned to treatment I, the next heaviest to treatment II, until all were assigned. After assignment, the two groups were moved to separate pastures at the University of Nebraska West Central Research and Extension Center, North Platte, NE. These pastures were ≈25 ha in size and are described as Nebraska canyon range, sandsage, and mixed prairie. The dominant grasses were little blue stem, *Andropogan scoparins* Michx., blue gramma, *Bouteloua gracilis* (H.B.K.) Log. × Stend., buffalo grass, *Buchloe dactyloides* (Nutt.) Engelm., and Western wheatgrass, *Agropyron smithii* Rydb. Common forbes included western ragweed, *Ambrosia psilostochya* D.C., snow-on-the-mountain, *Euphorbia marginata* Pursh, leadplant, *Amorpha cane-*

This article reports the results of research only. Mention of a proprietary product does not constitute endorsement or a recommendation by the USDA or the University of Nebraska.

[1] West Central Research and Extension Center, University of Nebraska, Route 4–Box 46A, North Platte, NE 69101.
[2] USDA-ARS Midwest Livestock Insects Research Laboratory, Department of Entomology, University of Nebraska, Lincoln, NE 68583.

Table 1. Average weight gains and fly counts on insecticide-treated steers and untreated steers during summer grazing trials

Treatment	No. calves	Initial Wt, kg	1st 28-d period		2nd 28-d period		3rd 28-d period		Avg gain	
			ADG	ANF	ADG	ANF	ADG	ANF	ADG	ANF
					1997					
Sprayed[a]	21	304	1.35a	1.43a	0.63a	0.59a	1.33a	1.12a	1.12a	0.76a
Control	21	301	1.39a	2.82b	0.45b	3.57b	0.78b	4.11b	0.88b	3.56b
					1998					
Sprayed	20	279	1.76a	1.43a	0.87a	0.95a	0.72a	0.86a	1.12a	1.08a
Control	21	273	1.21b	5.56b	1.04a	4.77b	0.46b	5.47b	0.90b	5.26b
					1999					
Sprayed	23	256	1.81a	0.95a	1.26a	1.08a	0.33a	0.13a	1.13a	0.72a
Control	23	253	1.79a	2.90b	0.80b	1.90b	0.33a	1.51b	0.98b	2.10b
					Average					
Sprayed	64	280	1.64a	1.27a	0.92a	0.87a	0.79a	0.70a	1.12a	0.85a
Control	65	276	1.46b	3.76b	0.76b	3.41a	0.52b	3.76b	0.92b	3.64b

Within a column means followed by different letters were statistically different ($P > 0.05$). ADG, average daily gain; ANF, average number of stable flies per leg.

[a] Sprayed with 0.015% permethrin 1.9 liter per calf three times per week.

scens Pursh, buckbrush, *Symphoricarpos orbiculatus* Moench, common sagewort, *Artemesia ludoviciana* Nutt., and Arkansas rose, *Rose arkansansa* Cockerell. These pastures were ≈2 km apart, and cattle groups within them were from 2 to 4 m apart. Range condition and animal unit grazing capacity of pastures were evaluated in the spring each year by J. Volesky, range scientist for the Center. The study was initiated in the first or second week of June each year, and the stocking rate was slightly above moderately grazed all 3 yr of the study.

Water, salt, and mineral supplements were available to the cattle ad libitum. In addition, about 3/4 of an 18.9-liter bucket of cottonseed cake pellets was poured in a line in each pasture out in front of the cattle daily for the cattle to eat. This facilitated counting stable flies on the pastured steers because the counter could walk down the line of feeding cattle and count stable flies on the legs. Fly counting was done between 1000 and 1400 hours once daily, except Sunday, generally by the same technician. In this study, because of feeding the cottonseed pellets, we could get close enough to the cattle to count all of the flies on each front leg, and the total was added and termed *flies per front legs.* In the feedlot study, flies were counted on the outside of one front leg and the inside of the other and termed the *total flies per leg* (McNeal and Campbell 1981). Flies were counted on a minimum of 15 animals.

With confined cattle at feedlots, an average of five stable flies per front leg is considered the economic threshold (Campbell et al. 1987). Stable fly populations infesting range cattle were observed to be more variable than is the case for confined cattle. Therefore, we tried to maintain a minimum mean stable fly population level of five flies per front leg on the untreated group of yearlings by releasing colony-reared flies near and upwind from these cattle when necessary. We also tried to maintain the average number of stable flies on the treated cattle at <1 stable fly per front leg.

One group of yearlings was selected for treatment I, and these were not treated for control of stable flies but were treated with insecticide impregnated ear tags (two/animal) for horn fly and face fly control. The ear tags used in 1997 were double barrel VP (6.8% lambdacyhalothrin + 14% pirimiphos methyl, Mallenchkrodt Veterinary, Mundelin, IL). The same tags were used in 1998, but were replaced with Warrior Tags (30% diazinon + 10% chlorpyrifos, Y-Tex, Cody, WY) at the second weight period. The latter tag was also used in 1999, but these were replaced with Python ear tags (ZETA cypermethrin 10% + piperonal butoxide 20%, Y-Tex) at the second weight period. The other group was assigned to treatment II, which consisted of a spray three times per week with 1.9 liter per steer of 0.05% (AI) permethrin (Durvet 10% permethrin 0.75 lb/gal Durvet, Blue Springs, MO). Permethrin was applied with a Fimco model LG-10 d Sprayer (Sioux City, IA) at 207 kg/psi three times/wk. The steers from **group II** were brought from the pasture into a holding area and sprayed while in a squeeze chute. The steers in treatment II were not treated with insecticide ear tags because the sprays eliminated any horn flies or face flies that might be present.

Calves from both groups were weighed at 28-d intervals throughout the 84-d trial period. Calves from treatment I were transported to the weigh station in a stock trailer. These steers were not sprayed, but if horn flies exceeded an average of 25 per calf (whole animal count) during the weigh period, they were retagged with new insecticidal ear tags while the steers were weighed. The insecticide ear tags may have impacted stable flies slightly but were not considered a factor because of stable fly releases.

Trials were started on 9, 10, and 4 June, respectively; and the average weights for the calves for the 3-yr trial was 279 kg for the sprayed and 276 kg for the untreated (Table 1). In the second and third year of the study, the yearlings were placed in the feedlot after the grazing trial to be finished for slaughter. This was done

Table 2. Weight gains of insecticide treated and untreated steers on finishing rations in a feedlot after exposure to or protection from stable flies during summer grazing studies

Treatment	No. steers[a]	Weigh period I ADG, kg	Weigh period II ADG, kg	Weigh period III ADG, kg[b]	Study Avg ADG, kg
1998					
Sprayed[c]	20	0.99a	2.25a	2.33a	1.86a
Control[d]	21	1.11a	2.29a	2.53a	1.92a
1999					
Sprayed	22	1.39a	2.36a	—	1.88a
Control	22	1.21a	2.31a	—	1.77a

Means followed by the same letter within the same column are not significantly different ($P < 0.05$).
[a] Steers were divided into two pens for treated and two pens for control for feeding ease.
[b] Study was terminated due to lack of pen space in feedlot in 1999.
[c] Sprayed during summer grazing study for stable fly control with (1.9 liter of 0.05% permethrin).
[d] Control steers were not sprayed during summer grazing study.

to determine if the stable fly-infested calves would have compensatory gains after the stable fly stress was removed. Each group was divided in half and randomly assigned to one of four feedlot pens to avoid any pen effect. In 1998, the steers were fed for 84 d but only 56 d in 1999 because of Department Animal Science need for the pen. When grazing steers are placed into a feedlot for finishing for slaughter, their feed ration must be gradually increased to a high-energy finishing ration through a series of about five stages, with each stage lasting from 3 to 5 d. If the high-energy ration is increased too rapidly, they will develop an intestinal problem termed acidosis, and they will reduce feed intake dramatically. In these trials, the steers were started on a ration consisting of 30% corn, 8% silage, 32% protein supplement, and 65.56% ground alfalfa on a dry matter basis. The final finishing ration consisted of 78.4% corn, 7.83% silage, 32% protein supplement, and 7.0% ground alfalfa.

Statistical analysis of the data consisted of a multivariate repeated measures of an analysis of variance (ANOVA) $P = 0.05$, SAS Institute 1996.

Results and Discussion

In 1998 and 1999, the horn fly numbers reached an average of ≈25 per steer just before the second weighing, so they were retagged with new insecticide-impregnated ear tags. Face flies were seldom noted on any of the steers during the 3 yr of the study and never averaged >0.1 fly per steer.

We were unable to maintain our goal of an average of five stable flies per front leg per steer on the control group except in the year 1998, a year when stable fly populations were high. The number of stable flies on untreated animals in that year was slightly above our goal of >1.0 per front leg per steer but was below that number the other 2 yr (Table 1).

The impact of stable flies on weight gains of grazing steers 0.2 kg/day/steer surprised us somewhat (Table 1). Previously, we had seen significant weight losses on feedlot cattle from stable fly populations that averaged less than three per front leg (Campbell et al. 1987). In this study, we expected stress from the frequent spraying (three times/wk) would offset the stable fly stress. However, after moving the calves through the spray regime a few times, they became more docile and appeared less stressed than we anticipated.

Unexpectedly, releasing stable flies at a rate of several thousand per week near the control cattle did not increase the number feeding on them more than our counts indicated. However, we were counting flies on these cattle for only 15–20 min during the 10 or more hours that feeding occurs in summer months.

Berry et al. (1983) counted flies on the front legs, back legs, and whole body of the animal. In this study, each fly feeding on the inside of one front leg and the outside of the other front leg represented 2.81 total flies feeding on the animal. Consequently, our stable fly counts represented some fraction of a larger, unknown number that were actually feeding on the cattle.

Bruce and Decker (1958) studied the impact of stable fly feeding on dairy cattle and reported that each stable fly decreased milk production by 0.64%. Berry et al. (1983), using the values determined by Campbell et al. (1977), estimated weight reductions by feedlot cattle of 0.652% for each stable fly per front leg. In this study, weight gains by grazing cattle were reduced an average of 0.20 kg per steer per day by an average of 2.79 flies per leg more on the control steers than on the sprayed steers (Table 1). This represents a 19% reduction in weight gain or ≈7% per stable fly observed at the counting time. The weight gain reduction resulted in the control steers weighing 16.8 kg less than those protected by spraying. If steer prices averaged $1.98/kg, the loss would be valued at $33.26 per animal or 2.33 cents per fly. These calculations, however, do not include the cost of spraying steers (36 times during the 12-wk trials). However, the purpose of this research was to determine weight gain reductions on grazing cattle as a result of stable fly attack. Clearly, what is needed is a stable fly management program for grazing cattle that is economically far superior to spraying.

The feedlot component of this study was undertaken to determine if compensatory weight gains occurred when the stable fly stress was removed. The study was initiated in 1998 because pen space was not available earlier. The results recorded for year 1998 in the 84-d trial indicated only a slight numerical difference (nonsignificant) with the control cattle gaining 0.06 kg/day more than the sprayed cattle (Table 2). The feed-gain ratio (kg feed:kg weight gain) was 7.46:1.0 for the control cattle and 7.63:1.0 for the sprayed cattle (data not presented), but neither of these indicated compensatory gain. The 1999 feedlot trial was conducted for only 56 d because of restricted availability of pen space. The weight gains in the 1999 trial were slightly higher for the sprayed cattle than the control cattle but were not significant (Table 2). The feed-gain ratio in this trial was 8.83:1.0 for the treated cattle and 10.16:1.0 for the untreated cattle. The data from these two feeding trials indicate that compensatory gain for grazing steers under attack by stable flies does not occur when the stable fly stress is removed and cattle are placed on a high nutrition diet.

Further research needed on the problem of stable flies feeding on grazing cattle is the development of better control methodologies. Research is also needed on the impact of stable flies on weaning weights of calves in cow–calf herds and to determine the breeding sources of stable flies that are attacking grazing cattle.

Acknowledgments

We thank the entomology and beef cattle staff of the West Central Research and Extension Center, University of Nebraska for technical support. The research was supported in part by the University of Nebraska Research Division and a USDA-ARS Specific Cooperative Agreement No. 58-5440-8-124. The research is a component of Regional Research Project S-274. This is Journal Series 13015 of the Nebraska Agricultural Research Division and contribution 1065 of the Department of Entomology, University of Nebraska, Lincoln.

References Cited

Berry, I. L., D. A. Stage, and J. B. Campbell. 1983. Populations and economic impacts of stable flies on cattle. Trans. Am. Soc. Agric. Engl. 26: 873–877.

Bruce, W. N., and G. C. Decker. 1958. The relationship of stable fly (*Stomoxys calcitrans*) abundance to milk production in dairy cattle. J. Econ. Entomol. 51: 269–274.

Campbell, J. B., and J. F. Hermanussen. 1971. Efficacy of insecticides and methods of insecticidal application for control of stable flies in Nebraska. J. Econ. Entomol. 54: 1188–1190.

Campbell, J. B., R. G. White, J. E. Wright, R. Crookshank, and D. C. Clanton. 1977. Effects of stable flies on weight gains and feed efficiency of calves on growing or finishing rations. J. Econ. Entomol. 70: 592–594.

Campbell, J. B., I. L. Berry, D. J. Boxler, R. L. Davis, D. C. Clanton, and G. H. Deutscher. 1987. Effects of stable flies (Diptera: Muscidae) on weight gain and feed efficiency of feedlot cattle. J. Econ. Entomol. 80: 117–119.

Campbell, J. B., M. A. Catangui, G. D. Thomas, D. J. Boxler, and R. Davis. 1993. Effects of stable flies (Diptera: Muscidae) and heat stress on weight gain and feed conversion of feeder cattle. J. Agric. Entomol. 10: 155–161.

Cutkomp, L. K., and A. L. Harvey. 1958. The weight responses of beef cattle in relation to control of horn and stable flies. J. Econ. Entomol. 51: 72–75.

Hall, R. D., G. D. Thomas, and C. E. Morgan. 1982. Stable fly, *Stomoxys calcitrans* (L.) breeding in large round hay bales: Initial associations (Diptera: Muscidae). J. Kans. Entomol. 55: 617–620.

McNeal, C. D., Jr., and J. B. Campbell. 1981. Insect pest management in Nebraska feedlots and dairies: a pilot integrated pest management project. Univ. Nebr. Dep. Entomol. Rep. 10.

Miller, R. W., L. G. Pickens, N. O. Morgan, R. W. Thinsijan, and R. L. Wilson. 1973. Effects of stable flies on feed intake and milk production of dairy cattle. J. Econ. Entomol. 66: 711–713.

SAS Institute. 1996. User's guide 6.12. SAS Institute, Gary, NC.

Schwinghammer, K. A., F. W. Knapp, J. A. Boling, and K. K. Schillo. 1986. Physiological and nutritional response of beef steers to infestations of the stable fly (Diptera: Muscidae). J. Econ. Entomol. 79: 1294–1298.

Wieman, G. A., J. B. Campbell, J. A. DeShazer, and I. L. Berry. 1992. The effects of stable flies (Diptera: Muscidae) and heat stress on weight gain and feed efficiency of feeder cattle. J. Econ. Entomol. 85: 1835–42.

Received for publication 31 May 2000; accepted 1 February 2001.