Title: Effect of multispecies fungal extract (BP) supplementation on the growth performance of beef steers fed backgrounding diets with varying forage inclusion rates.

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Objectives: Evaluate the effect of adding BP to backgrounding diets with different forage contents on growth rate, feed intake, and conversion efficiency of beef steers.

Background

The low digestibility of fibrous feeds included in cattle diets continues to limit the productivity and efficiency of beef operations. Therefore, strategies that effectively enhance fiber digestibility are needed. The utilization of fungal feed additives with high cellulolytic and hemicellulolytic activities has been extensively tested in the past as a means to improve fiber digestibility and feed efficiency of dairy cattle. However, the effect of fungal feed additives inclusion in beef cattle diets has been less documented. Recently, we evaluated the inclusion of BP to forage-based diets and observed growth performance and feed efficiency improvements of beef cattle (Pittaluga et al., 2023; Pittaluga et al., 2024). Nevertheless, further research is warranted to delineate most favorable dietary scenarios for BP supplementation to consistently attain growth performance and/or conversion efficiency improvements.

Materials and Methods

Animals, Treatments, and Housing

Angus × SimAngus crossbreed steers (n = 144; body weight [BW] = 324 ± 28 kg) were used in a randomized complete block design with a 2 × 2 factorial arrangement of treatments to evaluate the effect of BP supplementation on the growth performance of beef steers fed backgrounding diets with varying forage inclusion rates for 112 d. The factors examined were the forage content of the diet (**30% vs 55%**; dry matter [DM] basis; Table 1) and BP inclusion (**with vs without**). Steers initial BW, calculated as the average of a 2-consecutive day BW recorded on d -1 and 0 (relative to treatment administration) was used as the blocking criteria. On d 1, steers were randomly assigned to 1 of 4 dietary treatments (36 steers/treatment; 3 pens/treatment; 12 steers/pen), which were offered for *ad libitum* intake. The BP supplement (Biopremix Technologies LLC., Wilmington, DE) was included at 0.04% (DM basis) of the diets, where it was first incorporated to the mineral-vitamin premix and then mixed with the rest of the feed ingredients from the basal diet. Before the beginning of the experiment, steers underwent a 21-d adaptation to the GrowSafe bunks (GrowSafe®, GrowSafe Systems Ltd., Airdrie, AB, Canada) and a subsequent 10-d transition period to the experimental diets, after which the experiment was initiated. All experimental diets were formulated to sufficiently provide vitamins and minerals to meet animal requirements (NASEM, 2016). Steers were not implanted at any time during this experiment. A total of two steers were removed from the experiment as a result of mortality for reasons not related to the experiment.

Steers were housed in pens (7.3 × 37.2 m) that included an area covered by a metal roof (7.3 × 8.5 m) and an outside loafing area (7.3 × 28.6 m). The flooring material under the covered space was comprised of crushed, compacted limestone (screenings), and the outside loafing area was concrete. Pens were divided by a 1.5 m high wood fence with a 10 cm separation between rectangular rails. Each pen contained 2 GrowSafe bunks (0.91 m x 0.53 m x 0.38 m). Each GrowSafe bunk allowed only one animal to eat at a time and recorded individual feed intake daily based on an electronic ear tag.

Table 1. Ingredients and analyzed nutrient content of the diets fed to the steers during the 112-d backgrounding period.

Item	30% Hay	55% Hay
Ingredient, % of DM[1]		
DDGS[1]	5.000	20.000
Soy hulls	50.000	15.000
Dry rolled corn	5.000	-
Grass hay	30.000	55.000
Supplemental Premix[2]	10.000	10.000

[1] Abbreviations: DM: dry matter; DDGS: dry distiller's grains with solubles;
[2] 5.07% urea, 60.615% soybean meal, 11.41% limestone, 10.14% NaCl, 0.44% Se, 0.05% $CuSO_4$, 0.121% $ZnSO_4$, 0.011% $MnSO_4$, 0.003% $CoCO_3$, 0.087% vitamin A-30, 0.125% vitamin D-3, 0.004% vitamin E, 0.004% EDDI, 11.92% Av fat blend.

Sampling

Steers were weighed on 2 consecutive days at the end of the experiment for final BW determination, and at 28-d intervals throughout the experimental period. Each weighing was performed before the morning feeding and without withholding steers from feed or water. Individual DM consumption will be estimated with the GrowSafe feeding system. Feed samples were collected biweekly, pooled across all fortnights, and analyzed for nutrient composition analyses.

Statistical Analysis

All statistical analyses were conducted using the MIXED procedure of SAS 9.4 (SAS Inst. Inc., Cary, NC) and considering the pen as the experimental unit. Growth rate, feed intake, and conversion efficiency were analyzed as a randomized complete block design. The model was fitted with individual animal data and included BP supplementation, forage inclusion, and their interaction as fixed effects, as well as the random effect of the block and the pen nested within the block. Significance was declared at $P \leq 0.05$; and tendencies were declared at $P > 0.05$ and $P \leq 0.12$.

Results

Neither BP supplementation × forage inclusion interactions ($P \geq 0.40$), nor effect of BP supplementation were detected ($P \geq 0.40$) for any of the growth performance parameters evaluated herein (Table 2). However, steers fed diets with 55% forage and supplemented with BP tended to be heavier at the end of the experimental period than CON55 steers ($P = 0.11$). As expected by design, feeding diets with greater forage inclusion rates increased DM intake (DMI), average daily gain (ADG), and feed conversion efficiency ($P \leq 0.01$) of beef steers. In addition, at the end of the 112-d backgrounding period, steers fed diets with greater forage content were heavier ($P < 0.01$) than their cohort fed diets with a lower forage content.

Table 2. Effect of multispecies fungal extract (BP) supplementation on the growth performance of beef steers fed backgrounding diets with varying forage inclusion rates for 112 d.

	Treatment[1]					P-value		
Item	CON30	BP30	CON55	BP55	SEM[2]	TRT	FOR	TRT*FOR
n	35	36	36	35				
IBW[3], kg	322	326	322	326	16	0.15	0.86	0.98
FBW	507	511	461	472	17	0.11	<0.01	0.42
ADG[5], kg/d	1.66	1.65	1.24	1.31	0.04	0.57	<0.01	0.49
DMI[6], kg/d	12.5	12.7	10.59	10.72	0.35	0.42	<0.01	0.83
F:G[7]	7.58	7.76	8.62	8.29	0.30	0.80	0.01	0.40

Significance was declared at $P \leq 0.05$; and tendencies were declared at $P > 0.05$ and $P \leq 0.10$.
[1] CON30 = 30% forage inclusion (DM basis) with no BP; BP30 = 30% forage inclusion (DM basis) with BP; CON55 = 55% forage inclusion (DM basis) with no BP; BP55 = 55% forage inclusion (DM basis) with BP.
[2] Pooled standard error of treatments means.
[3] Initial body weight.
[4] Final body weight.
[5] Average daily gain.
[6] Dry matter intake.
[7] Feed to gain ratio.

Discussion and Implications

In a previous experiment performed at our lab (Pittaluga et al., 2023), adding BP at 0.04% of the diet DM increased the growth rate (9%) of beef steers and heifers fed a forage-based diet primarily by promoting DMI. In the following trial (Pittaluga et al., 2024), although not statistically different, BP included in a forage-based diet at a lower dose (0.02%; DM basis) improved feed efficiency by ~7%. In the current experiment, including BP at 0.04% of the diet DM increased by ~3.8% the feed efficiency of steers fed the backgrounding diet with a greater forage content. Additionally, at the conclusion of the 112-d backgrounding period, steers fed

diets with a greater forage content and supplemented with BP were 11 kg heavier than their non-supplemented cohort. Taken together, results from trials done in our lab suggest that BP might be an effective strategy to improve growth performance and feed efficiency of beef cattle fed forage-based diets.

Literature Cited

Pittaluga, A. M., and A. E. Relling. 2023. Effect of multispecies fungal culture extract supplementation on the growth performance and carcass characteristics of feedlot cattle. J. Anim. Sci. 101(Suppl. 3):268–269. (Abstr.) doi:10.1093/jas/skad281.321.

Pittaluga, A. M., and A. E. Relling. 2024. Inclusion of a multispecies fungal feed additive in forage-based diets fed to beef cattle: Effects on growth performance and ruminal fermentation. J. Anim. Sci. 102(Suppl. 2):214-215. ASAS Midwest Meeting. doi:10.1093/jas/skae102.243.