Nuevas claves para aumentar la conversión de alimento en carne y leche: taninos.

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En el contexto actual, es fundamental mejorar la eficiencia de conversión como medio para mejorar el resultado del negocio, tanto en carne como en leche. Disminuir el costo del kg o litro producido a través de la mejora de la eficiencia de conversión es imprescindible para aumentar la rentabilidad del productor. Para lograrlo, históricamente se han utilizado diferentes tipos de aditivos, muchas veces antibióticos o con presencia de hormonas.
Desde hace unos años, la Sociedad Americana de Ciencia Animal (American Society of Animal Sciences, ASAS) en su Encuentro Anual en Denver (EEUU), destaca la importante presencia de estudios sobre Aditivos Naturales, (no – antibióticos, no - hormonales) para la alimentación, entre los cuales los taninos ocupan un sitio preponderante. Nuestra empresa, Nowet Nutrición Animal, inició los primeros ensayos en nuestro país sobre su utilización en nutrición de rumiantes. Aquí los resultados, en Argentina y luego, a nivel internacional, de los trabajos realizados en bovinos de carne y de leche, que fueron presentados en dicho Congreso Norteamericano.

Bovinos de Carne

Investigación Nacional

El primer trabajo en Argentina sobre utilización de taninos en nutrición de bovinos en engorde se realizó en el marco de un convenio entre la Universidad Nacional de Lomas de Zamora, Silvateam y Nowet S.A. en el feedlot Don Corral (Ruta 3, km 162.5, Las Flores, BA, Arg.). El producto: Silvafeed BYPRO. Es un mix de extractos de diferentes materias primas vegetales obtenidos de diferentes maderas, que tiene la propiedad de atrapar las proteínas contenidas en el alimento y transformarlas en proteína by-pass. De esta forma, reduce fuertemente el ataque de la micro flora ruminal sobre las mismas y las libera en el intestino delgado para su absorción. Una vez allí, enlentece el pasaje de las proteínas debido a sus

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propiedades astringentes. Así, los animales pueden lograr una mejor absorción de proteínas.
Los resultados obtenidos se presentaron en el congreso de la *Cámara Argentina de Empresas de Nutrición Animal* en el año 2008, dentro de los que se destacaron un incremento en el peso final (+6%, P=0.11) y en una mayor área de ojo de bife (+6%, P=0.15) en las terneras tratadas con Bypro, con una mejora numérica de 5% en la ganancia diaria de peso vivo y del 8% en eficiencia de conversión.
Estas conclusiones fueron los que estimularon la realización de ensayos y trabajos en distintos centros de investigación del país y el exterior.

Investigación internacional.

México: El Comportamiento productivo en Feedlot de Toros en crecimiento, suplementados con Taninos Condensados.

Dr. Barajas Cruz y colaboradores, Universidad de Sinaloa.

Se realizó un ensayo productivo, sobre toritos en feedlot (categoría para consumo utilizada en Mexico). La dieta se basó en grano de maíz quebrado, harina de colza y urea como proteicos, con paja de maíz como fibra y un concentrado proteico – mineral con monensina.
Los tratamientos fueron dietas iguales en los nutrientes básicos (isoenergéticas, isoproteicas), diferenciadas por la inclusión o no de Taninos y el porcentaje de urea.
El esquema de los tratamientos es el siguiente:

	TRATAMIENTO		
INSUMO	CONTROL	TANINO UREA NORMAL	TANINO ALTA UREA
Bypro	Sin bypro.	0.2% base MS	0.2% base MS
Urea	0.57 base MS	0.57 base MS	1.14% base MS

La idea central fue probar el efecto de la inclusión de Taninos, y si esta inclusión permite utilizar más Urea, para disminuir el costo de la proteína de la ración.

Resultados:
Los toritos tratados con Bypro presentaron mayor peso final (+6%, P<0.01), mayor ganancia total de peso (+14%, P<0.01), y mayor ganancia diaria de peso (+13.5%, P<0.01), independientemente del nivel de urea.

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El consumo de materia seca no fue afectado significativamente, por lo cual la eficiencia de conversión mejoró, disminuyendo el índice en un 8.5% (tendencia a diferencia significativa, P<0.1). La tabla de resultados se traduce a continuación.

Tabla. Influencia de la adición de taninos condensados en la dieta de engorde de toritos en feedlot.

Variables	Tratamientos			ESM	*Valor P*	Contrastes	
	Control	Taninos	Taninos + Urea extra			Taninos	Urea
Urea dietaria, base %MS [1]	0.57	0.57	1.14				
Animales, nro.	20	20	20				
Repeticiones por corral, nro.	4	4	4				
Dias en experimento, nro.	84	84	84				
Consumo de taninos condensados							
Consumo diario, g/dia	0	18.22	18.22				
Como porcentaje de la dieta, %	0	0.22	0.23				
Peso vivo dia 1, kg	183.75	184.15	183.91	0.22	0.46	0.34	0.86
Peso vivo dia 84, kg	295.15 b	312.05 a	309.31 a	3.19	0.05	< 0.01	0.19
Ganancia de peso, kg	111.40 b	127.90 a	125.41 a	3.32	0.02	< 0.01	0.20
Ganancia media de peso, kg/dia	1.326 b	1.523 a	1.493 a	0.04	0.05	< 0.01	0.20
Consumo de MS, kg/dia	7.821	8.225	7.998	0.18	0.34	0.22	0.91
Eficiencia de Conversión, kg/kg	5.904	5.421	5.371	0.21	0.11	0.08	0.28
N Ureico en sangre, mg/100 mL [2]	7.91 [a]	6.44 [b]	8.09 [a]	0.35	< 0.01	0.15	0.05

[1] Calculado de valores de tabla (NRC, 2000). [2] Muestras compuestas de los días 28 y 56. [a, b, c] Medias con diferente letra en la misma fila, difieren estadísticamente entre sí para el valor P declarado en su columna correspondiente.

Conclusiones:

La inclusión de Taninos mejoró la utilización del Nitrógeno y, gracias a esto, la performance de esos animales en feedlot.

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Brasil: Uso de Taninos condensados en dieta de novillos

Dr. Mezzomo, R y colaboradores, Universidad de Viçosa, Minas Geráis.

Se realizaron dos ensayos sobre la utilización de taninos condensados en la dieta de novillos para carne, alimentados con dietas altas en concentrado, en las siguientes variables:

- Eficiencia de uso de la proteína;
- Rendimiento de proteína microbiana producida en rumen;
- Balance de Nitrógeno y Características de la fermentación ruminal;
- Asimismo, de sus efectos en el Consumo,
- Digestibilidad Ruminal y Total; y
- Excreción Urinaria de Urea y Nitrógeno Total.

Cabe aclarar que la eficiencia de uso de la proteína es un tema candente en la actualidad en los países centrales, por una doble motivación:

1. la disminución de los costos de alimentación, de los cuales el costo de la proteína es uno de los de mayor importancia,

2. la fuerte presión de la política ambiental de no contaminación, en la cual el Nitrógeno excedente del metabolismo proteico es uno de los principales factores.

Las dietas (isoenergéticas e isoproteicas) se basaron en maíz partido, bagazo de caña, semilla de algodón y una premezcla mineral con monensina. Los tratamientos se diferenciaron por la presencia o ausencia de Bypro y de harina de soja.

Los tratamientos entonces fueron 4, según el siguiente esquema:

	TANINOS	
SOJA HARINA	SIN	CON (4% Base MS)
SIN	BASAL (BS)	TN
CON	SM	SMT

Resultados

Los animales tratados con Taninos Bypro presentaron lo siguiente:

- El consumo de nutrientes fue igual en ambos tratamientos.

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- No afectó el nivel de acidez ruminal (pH) la concentración de Acidos grasos volátiles, ni la concentración de Amoníaco Ruminal.
- La síntesis de proteína microbiana (proteína de menor costo) no se vio alterada.
- La utilización de Taninos mejoró la eficiencia ruminal de uso del Nitrógeno (P<0.1).
- La Degradación Ruminal de la proteína fue menor cuando se combinaron Harina de Soja y Taninos (P<0.1), por lo que incrementó (+37%, P<0.1) el flujo de proteína no degradada desde el rumen al intestino (efecto By-Pass) en presencia de harina de soja.
- Generó un incremento (+26%, P<0.1) en la proporción de la proteína total que pasó a ser proteína metabolizable, en la dieta con harina de soja.
- Incrementó la digestibilidad de los lípidos (P<0.1).
- Disminuyó la excreción urinaria de Nitrógeno ureico y Nitrógeno total (- 34% y -16% respectivamente, ambos P<0.1).

Conclusiones:
En síntesis, se puede decir que los taninos demostraron trabajar maximizando la captación de proteína de calidad de la soja, de alto costo, sin afectar negativamente la síntesis de proteína microbiana, proteína esta de menor costo.
Esta mejora en el aprovechamiento conlleva a una disminución en la excreción de Nitrógeno al ambiente, disminuyendo la carga contaminante de la explotación.

Bovinos de Leche

Investigación Internacional

EEUU: Efecto de taninos en la performance productiva, fermentación ruminal y en la partición de Nitrógeno.

Aguerre, M. J. y colaboradores, Universidad de Wisconsin – Madison.

Aquí presentamos dos investigaciones: "ENSAYOS EN VACAS LECHERAS EN LA UNIVERSIDAD DE WINSCONSIN, MADISON" y "*EFECTO DE UNA MEZCLA DE EXTRACTOS DE TANINOS DE QUEBRACHO Y CASTAÑO, EN LA PERFORMANCE PRODUCTIVA, FERMENTACIÓN RUMINAL, Y EN LA PARTICIÓN DE NITRÓGENO EN VACAS EN LACTANCIA ALIMENTADAS CON DIETAS DE DOS NIVELES PROTEICOS.*"

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Ambas hacen foco en la utilización y el destino del Nitrógeno dietario en vacas lecheras, donde, como en toda explotación intensiva, hay presión por bajar los niveles de emisión de Nitrógeno amoniacal a la atmosfera y napas.
Se prueba la utilización de Bypro en combinación con dos niveles de proteína total dietaria, en la producción y fermentación ruminal.

TRATAMIENTOS				
NIVELES DE PROTEINA BRUTA (base MS)	NIVELES DE BYPRO® expresados en porcentaje base materia seca (MS)			
	SIN	BAJO (0.45%)	MEDIO (0.90%)	ALTO (1.80%)
BAJO (15.5%)	BP ST	BP BT	BP MT	BP AT
ALTO (16.8%)	AP ST	AP BT	AP MT	AP AT

El objetivo fue evaluar la posibilidad de bajar el tenor proteico de la dieta, hipotetizando que al eficientizarse su digestión con los taninos, niveles inferiores de proteína total dietaria, no se ve afectada la producción y disminuye concomitantemente la emisión de Nitrógeno. O, al menos, derivar ese Nitrógeno hacia las heces, donde es más fácil de fijarlo como orgánico, aprovechable a modo de abono.

Resultados:
El uso de Taninos produjo lo siguiente:

- El consumo de materia seca decreció a medida que el nivel de taninos aumentó (aprox. 1.5kgMS por cada 100 grs de taninos, P<0.07)
- Como resultado, la eficiencia de conversión de alimento a leche tendió a crecer con la inclusión de Bypro (P<0.15, equivalente a 250 grs extra de leche corregida al 3.5% de grasa butirosa por cada 50 grs de Bypro® incluido en la dieta).
- También pudo apreciarse una mejora en el tenor proteico de la leche y en la cantidad de proteína producida por dia, (P<0.05) con Bypro a dosis baja.
- Se registró un incremento en la ganancia de peso de las vacas, correspondiente a la inclusión de Bypro® (P<0.11).
- Los taninos actuaron de la misma manera en todas las variables, independientemente del nivel de proteína dietaria.

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- Bajar la proteína de la dieta no afecto la producción, pero si bajó el N ureico en rumen y en sangre.
- La producción de leche no fue afectada por la inclusión de taninos (promedio aprox. 40.5lts, P>0.1)
- Los parámetros de urea plasmática y láctea disminuyeron significativamente con la dosis alta de Bypro®
- La utilización de Bypro® disminuyó la eliminación de N por orina, incrementándola en heces, también con la dosis alta del producto.

Conclusiones

Finalmente, la utilización de taninos de quebracho y castaño a dosis bajas tiene efectos benéficos en los índices productivos, mientras que los parámetros ambientales mejoran a dosis superiores.

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A continuación se adjuntan los originales presentados en dicho Congreso.

Proceedings, Western Section, American Society of Animal Science
Vol. 61, 2010

CONDENSED TANNINS SUPPLEMENTATION ON FEEDLOT PERFORMANCE OF GROWING BULLS

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ABSTRACT: To determine the influence of condensed tannins on feedlot performance of growing bulls, an 84-days feedlot experiment involving sixty bull-calves 183.94 ± 1.2 kg was performed. Animals were blocked by starting weight and in groups of five placed in ground flour pen (2 x 12 m). Experiment was conducted Agreement with a randomized complete block design. Treatments were: 1) Feedlot diets without additional tannins containing 0.56% of additional urea (CTRL); 2) Diets with 0.56% additional urea, added with equivalent of 0.20% of condensed tannins (TAN); and 3) Diets with 1.12% additional urea and 5% less canola meal than CTRL diets, and added with equivalent of 0.20% of condensed tannins (TAN-U). Supplementary condensed tannins were provided in form of an extract of condensed tannins from quebracho trees (SilvaFeed ByPRO; Indunor, S.A., Buenos Aires, Argentina). Both diets containing tannins increased ($P < 0.01$) ending weight, and average daily gain respect to bull-calves fed the unsupplemented CTRL diets. The ADG of TAN and TAN+U treatments were 14.8% and 12.6% higher ($P = 0.05$) than control, respectively. DMI was not affected by treatments ($P > 0.15$). Feed/gain ratio was enhanced ($P = 0.08$) by the two tannins contained treatments. TAN treatment reduced ($P < 0.01$) in 18.5% blood urea nitrogen in relationship to CTRL, while BUN values in TAN+U were similar ($P > 0.10$) to CTRL bull-calves. It is concluded, that supplementation with 0.2% of condensed tannins of quebracho trees improves feedlot performance of growing bull.

Key words: Condensed tannins, bulls, feedlot-performance.

Introduction

In growing cattle, efficiency of nitrogen utilization increases when duodenal amino acid supply matches tissue requirements (Devant et al., 2001). Strategies to increase amount of amino acid arriving in to the duodenum includes effort to maximizing rumen microbial protein synthesis or add in the diet ingredients with limited amino acid profiles that are resistant to ruminal degradation (Merchen and Tigtmeyer, 1992). An alternative possibility is the use of condensed tannins to decreased ruminal degradation of protein from all constituents of the diet. Condensed tannins have the ability of lies proteins at pH near of neutrality, but this bonds can be dissociated under acid conditions (Frutos et al., 2004). Binding soybean meal with tannic acid, in vitro degradation of soybean meal-CP was decreased; however digestion on pepsin acid was no altered, in addition, daily gain and N retention of lambs was improved by tannins treatment (Driedger and Hatfield, 1972). Min et al. (2006) adding 1 or 2% of condensed tannins, observed a reduction of in vitro gas production

and an increment on ADG of grassing steers, respect to 0% added tannins treatment. The inclusion of condensed tannins in the diet, at 0.2% level increased growth performance of broilers chicks (Schiavone et al., 2008). The effect of condensed tannins-supplementation on the growth-performance of beef-cattle is not completely understood. This research was conducted with the objective of determine the influence of condensed tannins on feedlot performance of growing bulls

Material and Methods

Location

The experiment was conducted at Experimental Station for Beef Cattle in Dry Tropic Weather of the Universidad Autonoma de Sinaloa. The research facilities are located at Ganadera Los Migueles feedlot, S.A. de C.V. in Culiacan, Sinaloa situated in Northwest Mexico (24° 51' N. and 107° 26' W. ; 57 m o.m.s.l.; mean temperature 25 ºC, and 645 mm annual rainfall).

Animals Management

Sixty bull-calves (BW = 183.94 ± 1.2 kg) proximately 50% *Bos indicus* with remainder of Simmental, Angus Charolais, and Brown Swiss in undeterminate proportion were used. Bulls-calves were processed accord regular management of feedlot program, and received a trenbolona/estradiol implant on day 1 (Component TES with Tylan®; ELANCO Co.). Groups of five calves were randomly placed in 12 pens (6 x 12 m), each of them fitted with a 2.4 m feed bunk and 0.6 m waterer. Animals had *ad libitum* access to feed and water.

Treatments assignation

In accordance to a randomized complete blocks design described by Hicks (1973), inside each block, the bull-calves were randomly assigned to receive one of three treatments: 1) Feedlot diets without additional tannins containing 0.56% of additional urea (CTRL); 2) Diets with 0.56% additional urea, added with equivalent of 0.20% of condensed tannins (TAN); and 3) Diets with 1.12% additional urea and 5% less canola meal than CTRL diets, and added with equivalent of 0.20% of condensed tannins (TAN-U).

Experimental procedure

Supplementary condensed tannins were provided in form of an extract of condensed tannins from quebracho trees (SilvaFeed ByPRO; Indunor, S.A., Buenos Aires, Argentina), that contains 70% of tannins. For each tannins designated pen, Tannins extract in amount equivalent of respective daily dosage was thoroughly mixed with 1 kg ground corn; mixture was top dressed in the feed bunk and hand mixed with the diet. Calves in the CTRL treatment pens, 1 kg of ground corn was top dressed in the feed bunk, to homogenize daily ration composition respect to calves receiving supplemental tannins. Diet composition is presented in Table 1. Cattle had *ad libitum* access to the diets that were offered once daily (1600 h). Feed intake was measured as feed offered minus weekly refusals. Feed samples (4 kg) were collected weekly directly from mixer wagon, oven dried (105 °C for 24 h), and dry matter intake calculated. Blood samples were taken from jugular vein on days 28 and 56, serum was obtained and blood urea nitrogen concentration (BUN) was determined.

Statistical Analysis

The experiment was analyzed as a randomized complete blocks design (Hicks, 1973), considering each pen as the experimental unit. General AOV/AOCV procedure of Statistix® 8 program (Analytical Software, Tallahassee, FL); when statistical difference was observed, LSD procedure was used to separate the mean. Influences of tannins supplementation or urea level were probed by orthogonal contrasts.

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Results and Discussion

The influence of condensed tannins supplementation on feedlot performance of growing bulls is shown in Table 2. Both diets containing tannins increased (P < 0.01) ending weight, and average daily gain respect to bull-calves fed the unsupplemented CTRL diets. The ADG of TAN and TAN+U treatments were 14.8% and 12.6% higher (P = 0.05) than control, respectively. This data suggest that metabolizable protein flow to duodenum was increased, supplying enough amino acids for body build and reflected on bulls performance. DMI was not affected by treatments (P > 0.15). Feed/gain ratio was enhanced (P = 0.08) by the two tannins contained treatments. TAN treatment reduced (P < 0.01) in 18.5% blood urea nitrogen in relationship to CTRL, while BUN values in TAN+U were similar (P > 0.10) to CTRL bull-calves. As expected BUN of bulls fed diets with 1.12% of urea treatment (TAN +U) was higher (P = 0.05) than diets containing 0.56% of urea. BUN is a useful indicator of protein status and has a strong linear relationship with rate of nitrogen excretion (Kohn et al., 2005). Decreased of 1.47 mg/100mL on BUN in response to tannins addition, suggest that amount of protein-bound to tannins that resisted ruminal degradation could be represented the equivalent to 2% of dietary protein, accepting the affirmation that each 2-percentage units increase in the CP of the diet result in a 1 to 3 mg/100 mL increase in BUN of feedlot cattle (Vasconcelos et al., 2006).

Table 1. Composition of basal diets used in performance experiment.

Ingredients (%)	Diets	
	Basal	Basal+U
Corn straw	30.42	30.41
Canola meal	14.20	9.12
Ground corn	44.12	48.64
Sugar cane molasses	8.45	8.45
Premix [1]	2.82	2.82
Additional urea	-	0.56
Total	100%	100%
Calculated Analyses (DM basis) [2]		
Urea from premix, %	0.56	0.56
Additional urea, %	-	0.56
Total urea	0.56	1.12
CP, %	14.03	14.00
UIP, % of diet	5.05	5.14
UIP, % of CP	33.97	36.72
NEm, Mcal/kg	1.654	1.674

[1] Ganamin Total ® (Vitamins and mineral premix containing 25 g of sodium-monensin from Rumensin 200 ® (Elanco Animal Health), is a trademark (Técnica Mineral Pecuaria, S.A. de C.V.; Guadalajara, Jal, México).
[2] Calculated from tabular values (NRC, 2000).

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Implications

Results of this experiment suggest, that supplementation with 0.2% of condensed tannins of quebracho trees in the diet, is enough to decrease dietary protein degradation in rumen, improved N utilization and reflect these facts enhancing feedlot performance of growing bull.

Acknowledgments

Authors show gratitude to Ganadera Los Migueles, S.A. de C.V. and its owner Ing. Regulo Terraza, and to SilvaFeed, Indunor, S.A., Johe Productos Químicos, S.A. de C.V., Tecnica Mineral Pecuaria, S.A. de C.V., and PROFAPI-UAS, by the support to perform this research.

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Table 2. Influence of condensed tannins addition to the diet on feedlot performance of growing bulls

Variables	Treatments			SEM	*P*-value	Contrasts	
	Control	Tannins	Tannins + Urea extra			Tannins	Urea

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Urea in diet, % DM basis [1]	0.57	0.57	1.14				
Animals, n	20	20	20				
Pen, replicates n	4	4	4				
Days in trial, n	84	84	84				
Condensed Tannins Intake							
As daily intake, g/day	0	18.22	18.22				
As percentage of diet, %	0	0.22	0.23				
Body weight day 1, kg	183.75	184.15	183.91	0.22	0.46	0.34	0.86
Body weight day 84, kg	295.15 b	312.05 a	309.31 a	3.19	0.05	< 0.01	0.19
Body weight gain, kg	111.40 b	127.90 a	125.41 a	3.32	0.02	< 0.01	0.20
Average daily gain, kg/day	1.326 b	1.523 a	1.493 a	0.04	0.05	< 0.01	0.20
Dry matter intake, kg/day	7.821	8.225	7.998	0.18	0.34	0.22	0.91
Feed/gain ratio, kg/kg	5.904	5.421	5.371	0.21	0.11	0.08	0.28
BUN, mg/100 mL [2]	7.91 [a]	6.44 [b]	8.09 [a]	0.35	< 0.01	0.15	0.05

[1] Calculated from tabular values (NRC, 2000)

[2] Pooled data of samples taken days 28 and 56, respectively

[a, b, c] Means with distinct letter in the same row differs statistically at *P*-value of declared in corresponding column.

J. Anim. Sci. Vol. 88, E-Suppl. 2/J. Dairy Sci. Vol. 93, E-Suppl. 1/Poult. Sci. Vol. 89, E-Suppl. 1

M363. Influence of condensed tannin supplementation on intake, ruminal and total digestibility, rate of digestion, and urinary excretion of urea and total nitrogen of beef steers fed high concentrate diet.

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This trial was conducted to evaluate the effect of condensed tannin (TN) associated or not with a true protein source on intake, ruminal and total digestibility, ruminal digestion rate and urinary nitrogen excretion in beef steers fed high concentrate diet (87% of DM). Four crossbred steers (407 kg BW) fitted with rumen cannula were assigned to a 4x4 latin square design, arranged in a 2x2 factorial arrangement. Steers were fed a basal diet based on cracked corn, whole cottonseed, sugar-cane bagasse, mineral mixture and one out of 4 supplements: soybean meal with condensed tannin (SMT); soybean meal without condensed tannin (SM); condensed tannin without soybean meal (TN) and a treatment without both soybean meal and condensed tannin (BS). Quebracho extract were used as tannin source, included to provide 4 g of tannin/100 g of diet DM and all diets were formulated to be isonitrogenous. Intake of DM and nutrients was not affected ($P > 0.10$) by TN supplementation. However, there was an effect ($P < 0.10$) of TN supplementation on ether extract digestibility. A smaller ($P < 0.10$) excretion of urinary urea nitrogen (71.94 vs. 53.62 g) and total nitrogen (86.43 vs. 74.07 g) was observed in the animals supplemented with TN. Serum urea nitrogen concentration did not differ ($P > 0.10$) among treatments. There was an interaction ($P < 0.10$) between condensed tannin and soybean mean on ruminal digestibility and digestion rate of crude protein (CP). When soybean meal was provided in the diet TN caused a reduction on CP ruminal digestibility from 46.92 to 33.46%, leading to a smaller digestion rate of CP. No differences in DM passage rate were observed ($P > 0.10$) among treatments. Urinary urea nitrogen and total nitrogen excretions were higher in the animals supplemented with soybean meal. The use of condensed tannin as an additive in cattle fed high concentrate diet using soybean meal as true protein source decreases the digestion rate and ruminal degradability of crude protein without affecting feed intake.
Key Words: feedlot, protein, RUP

J. Anim. Sci. Vol. 88, E-Suppl. 2/J. Dairy Sci. Vol. 93, E-Suppl. 1/Poult. Sci. Vol. 89, E-Suppl. 1
M371. Influence of condensed tannin supplementation on protein efficiency, microbial protein yield, nitrogen balance and ruminal fermentation characteristics in beef steers fed high concentrate diet.
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This trial was conducted to evaluate the effects of condensed tannin (TN) associated or not with a true protein source on protein efficiency, microbial protein yield, nitrogen balance and ruminal fermentation characteristics (RFC) in beef steers fed high concentrate diet (87% of DM). Four crossbred steers (407 kg BW) fitted with rumen cannula were assigned to a 4x4 latin square design, arranged in a 2x2 factorial arrangement. Steers were fed a basal diet based on cracked corn, whole cottonseed, sugar-cane bagasse, mineral mixture and one out of 4 supplements: soybean meal with condensed tannin; soybean meal without condensed tannin; condensed tannin without soybean meal and a treatment without both soybean meal and condensed tannin. Quebracho extract were used as tannin source, included to provide 4 g of TN/100 g of diet DM and the diets were formulated to be isonitrogenous. The nitrogen balance indicated that the use of TN improved the efficiency of nitrogen utilization ($P < 0.10$), however, no differences were observed when soybean meal was added to the diet ($P > 0.10$). There was an interaction ($P < 0.10$) between condensed tannin and soybean mean supplementation on the flux of rumen undegradable protein (RUP), metabolizable protein (MP) and on the ratio MP:CP. In the presence of soybean meal the addition of TN increased the flux of RUP (302.24 to 416.02 g/d), M.P. 9467 (540.23 to 671.03 g/d) and improved the ratio MP:CP (58.69 to 46.54). Microbial protein yield and microbial efficiency did not differ among treatments ($P > 0.10$). There was no effect of TN supplementation ($P > 0.10$) on ruminal pH, VFA and ammonia (N-NH3) concentration. N-NH3 increased and ruminal pH decreased with the inclusion of soybean meal ($P < 0.10$) in the diet. The utilization of condensed tannin as an additive in cattle fed high concentrate diet using soybean meal as true protein source implies in positive effects on efficiency of N utilization, increasing the flux of metabolizable protein.

Key Words: Quebracho extract, feedlot, RUP

Effect of Quebracho-Chestnut Tannin Extracts at Two Dietary Crude Protein Levels on Nitrogen Partitioning in Lactating Dairy Cows

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The objective of this study was to determine the effects of a dietary tannin mix on lactating cow performance and rumen fermentation, and whether any responses were affected by dietary CP. Eight ruminally cannulated and 16 non-cannulated multiparous Holstein cows (669 ± 55 kg BW; 89 ± 36 DIM) were randomly assigned to a diet of 15.5 or 16.8% CP (%DM) and to one of four levels of tannins in three 4 x 4 Latin squares within each level of dietary CP. Rice hull was removed from 50:50 forage to concentrate ratio (%DM) total mixed rations as a tannin extract mixture from Quebracho and Chestnut trees was included at 0 (control), 0.45, 0.90 and 1.8% of dietary DM. There was no interaction between dietary CP and tannin supplementation. Reducing dietary CP had no effect on measurements, except for reducing milk urea N (MUN; 18.8 vs. 15.6mg/dL, P<0.05) and ruminal NH3-N (11.0 vs. 9.3 mg/dL, P<0.05). Overall, milk yield (40.4 kg/d), 3.5%FCM (40.3 kg/d), milk fat and lactose content and yield, and ruminal pH were not affected by tannin. The P values for a linear increase in BW gain (0.46 kg/d), a linear increase in feed efficiency (1.68 kg milk/kg of DMI) and a linear decrease in DMI (24.4 kg/d) with incremental levels of tannin extracts in the diet were 0.11, 0.15 and 0.07, respectively. Relative to control (2.87%), milk true protein content increased to 2.91% (P<0.05), did not change (2.86%) and decreased to 2.83% (P<0.05) when tannin was 0.45, 0.90 and 1.8% of dietary DM respectively. Also, relative to control (1.14 kg/d), milk protein yield did not change with inclusion of tannin, but it was higher (P<0.05) at the 0.45 than the 0.9 or 1.8% inclusion level (1.16, 1.12 and 1.11 kg/d, respectively). Relative to other treatments, the 1.8% tannin in the diet lowered MUN (13.8 vs, 12.9 mg/dL, P<0.05) and rumen NH3-N (10.6 vs. 8.1 mg/dL, P<0.05). Results indicate that regardless of dietary CP, 0.45% tannin extract in the diet had a small positive effect on milk protein content independently of a reduction in ruminal protein degradation, which was observed along with a reduction in MUN, only at the 1.8% level of inclusion.
Key Words: Tannin, Performance, Protein

Effect of Quebracho-Chestnut Tannin Extracts at Two Dietary Crude Protein Levels on Nitrogen Partitioning in Lactating Dairy Cows

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Our objective was to determine the effects of a dietary tannin mix on nitrogen (N) partitioning and whether any responses were affected by dietary CP. Eight multiparous Holstein cows (708 ± 41 kg of BW; 125 ± 41 DIM) were randomly assigned to a diet of 15.5 or 16.8% CP (%DM) and to one of four levels of tannins in three 4 x 4 Latin squares within each level of dietary CP. Rice hull was removed from 50:50 forage to concentrate ratio (%DM) total mixed rations as a tannin extract mixture from Quebracho and Chestnut trees was included at 0 (control), 0.45, 0.90 and 1.8% of dietary DM. Nitrogen mass balance was conducted by total fecal and urinary collection. There was no interaction between dietary CP and tannin supplementation. Reducing dietary CP had no effect on N intake, milk N and apparent N efficiency (milk protein N/N intake) but increased fecal N (214 vs. 257 g/d, P=0.07) and decreased (P<0.05) urinary N (232 vs. 167 g/d), urinary urea N (164 vs. 99 g/d) and apparent N digestibility (65.4 vs. 57.2 %). Tannin addition did not affect N intake (613 g/d), milk N (172 g/d) and apparent N efficiency (28 %). Relative to control (214 g/d), fecal N linearly increased to 234, 245 and 250 g/d (P<0.05) when tannin was 0.45, 0.90 and 1.8% of dietary DM respectively. Also, relative to control (213 g/d), urine N did not change with inclusion of tannin at 0.45 and 0.9% of diet DM, but it was lower (P<0.05) at the 1.8 % inclusion level (201, 207 and 177 g/d, respectively). Although manure N (fecal N + urinary N) was unchanged (435 g/d), urinary N to fecal N ratio was decreased by 31% for cows fed the 1.8% tannin diet compared with the control. Results indicate that regardless of dietary CP, adding tannin extract in the diet was effective in altering N partition in the body of the cow.

Keywords: Tannin, nitrogen, manure.

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