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Effect of Dry Distillers Grains on Productive Performance of Steers Fed with Low or High Forage Diets

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Abstract: Sixteen crossbred beef steer (340±3.6 kg initial weight) were used in a 120 days feeding trial for to evaluate the interactions between Dry Distillers Grains plus Soluble (DDGS) and forage level in growing-finishing diets on productive performance of beef steers in feedlot. Two DDGS levels (0 vs. 15%) and two forage levels (35 vs. 65%) were evaluated in a 2×2 factorial arrangement of treatments. There were interaction between forage and DDGS level on final BW and Average Daily Gain (ADG) ($p<0.05$). In steers fed with low forage diets (35%) final BW and ADG increased with the DDGS addition (6.8 and 9.4%, respectively). No interactions between DDGS and forage level in intake Dry Matter (DMI) and Feed Efficiency (FE) were observed ($p>0.05$). DMI decreased with DDGS inclusion in both forage levels ($p<0.05$). Final BW, ADG, FE were improved by DDGS supplementation in cattle fed low forage diets.

Key words: Growing-finishing, feedlot, factorial arrangement, beef, DDGS

INTRODUCTION

The growth of the ethanol industry has resulted in large increases in the supply and use of Dried Distillers Grains plus Solubles (DDGS) in livestock rations. Feeding with DDGS in feedlots is used to minimize feed costs. Likewise, DDGS are an excellent and potentially lower cost feedstuff than other more traditional feed sources to the cattle feeding industry. However, the DDGS must be provided within certain limits to maximize feedlot performance and efficiency. When DDGS are fed at levels of 6-15% of diet DM their primary purpose is to serve as a protein source, however when fed at greater levels, DDGS become a source of energy (Klopfenstein, 2001). Although, recent studies have suggested that inclusion at 20-25% of the ration DM is optimal for finishing cattle (Benson *et al*., 2005; Buckner *et al*., 2008, 2009). Researchers have demonstrated DDGS can be effectively included in growing and finishing diets, replacing partially corn in the diet (Ham *et al*., 1994; Peter *et al*., 2000). Nevertheless, there are high variability of results on use of DDGS in the literature some research has shown favorable response in steers fed with DDGS (Al-Suwaiegh *et al*., 2002) while others have shown that the feeding value of distillers grains (wet or dry) were lower than traditional feeds or corn grains (Lodge *et al*., 1997; Vasconcelos and Galyean, 2007; May *et al*., 2010).

Some studies have shown an improvement in growth performance and carcass quality by including of DDGS in the diet over traditional high grain feedlot diets (Larson *et al*., 1993; Vander Pol *et al*., 2009). When DDGS was supplemented to cattle consuming low and high quality forages, weight gain and feed conversion increased (Loy *et al*., 2008). Nevertheless very little research has evaluated DDGS in low or high forage diets and the effects on growth performance. Thus, researchers hypothesized that DDGS inclusion in low forage diets increases feed efficiency and average daily gain of cattle. Therefore, the purpose of this study was to evaluate the interactions between DDGS and forage level on productive performance of beef steers in feedlot.

MATERIALS AND METHODS

The feeding trial was carried in feedlot at a 23°51'N y 104°15'O and 1730 m with 15.5°C and 450 mm of temperature and rainfall, respectively. Laboratory analyses were performance in Faculty of Veterinary Medicine and Husbandry of Juarez University of Durango State.

Sixteen crossbred beef steer (340±3.6 kg initial weight) were used in a 120 days feeding trial. Steers were allotted by BW to a 2×2 factorial arrangement of treatments (4 steers/treatment). Composition experimental

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diets are shown in Table 1. Diets were balanced to provide 17.1±0.1% CP (NRC, 2000). On arrival at the feedlot, steers were staying in individual pens (16 individual pens equipped with automatic drinkers and single fence) and vaccinated against bovine rhinotracheitis, bovine viral diarrhea, parainfluenza-3, bovine respiratory syncitial virus, *Haemophilus somnus*, Pasteurella and Clostridia (Cattle Master-4, Bar Somnus 2P, Alpha-7, respectively Pfizer, Exton, PA) as well as treated with IVOMEC (Merial, Duluth, GA) for internal and external parasites.

Steers were allowed *ad libitum* access to experimental diets. Feed was offered twice daily at 08:00 and 16:00 h and feed refusals were recorded daily for each animal. Every 28 days the BW was calculated as an average of BW obtained on 2 consecutive days. Feed efficiency was calculated as daily BW gain (g) divided by daily DMI (kg).

Data obtained of growth performance were analyzed with a factorial design 2×2 using MIXED procedure (SAS, 2003). The animal was the experimental unit and BW block was used as the random effect. The model included level forage, level DDGS and interactions between both effects. Treatments averages were determined using MEANS procedure and a $p<0.05$ was declared significant.

Table 1: Composition experimental diets fed to steers

	Treatments			
Ingredient DM (%)	1	2	3	4
Alfalfa hay	35.000	35.000	65.00	65.000
DDGS	0.000	15.000	0.00	15.000
Cottonseed meal	19.000	8.000	11.00	0.000
Dry-rolled corn	45.500	41.500	23.50	19.500
Mixed mineral	0.500	0.500	0.50	0.500
Nutrient composition (DM basis)				
NEm (Mcal kg^{-1})	1.500	1.300	1.400	1.300
NEg (Mcal kg^{-1})	0.977	0.722	0.966	0.725
CP	17.200	17.000	17.100	17.000
EE	2.300	2.700	2.800	2.100
NDF	40.200	40.200	50.000	52.400
ADF	22.600	22.800	29.700	29.800
Calcium	0.720	0.640	1.100	1.100
Phosphorus	0.490	0.410	0.360	0.330

Trace mineral salt contained: Based on tabular values for individual feed ingredients (NRC, 2000)

RESULTS AND DISCUSSION

The influence of forage level on 120 days growth performance response of feedlot steers to supplemental DDGS is shown in Table 2. There were interaction between forage and DDGS level on final BW and ADG ($p<0.05$). In steers fed with low forage diets (35%) final BW and ADG were increased with the DDGS addition (6.8 and 9.4%, respectively) whereas in steers fed high forage diets (65%) final BW and ADG decreased as DDGS level increased. In a performance study similarly to the present study, Uwituze *et al.* (2010) did not observe interactions between forage and DDGS level with respect to final BW and ADG. Likewise, Schoonmaker *et al.* (2010) did not registered effects on the final BW of cattle fed with high and low forage diets and corn distillers grains. Nevertheless, Al-Suwaiegh *et al.* (2002) observed 10% improvement in ADG with addition of distiller grain to the diet. Meanwhile, Benson *et al.* (2005) observed a quadratic increase in steers fed with three levels of DDGS (15, 25 and 35%). Griffin *et al.* (2012) reported that final BW and ADG increment quadratically with increase DDGS these results were obtained by meta-analysis studies. No interactions between DDGS and forage level in DMI and feed efficiency were observed. Moreover, the DMI decreased with DDGS inclusion in both forage levels ($p<0.05$). Logde *et al.* (1997), Larson *et al.* (1993) and May *et al.* (2008) mentioned that DMI was not affected by inclusion of corn distillers grain in diets for feedlot cattle.

In this study, feed efficiency increased 10.8 and 5.8% with addition of DDGS in animals fed with 35 and 65% of forage, respectively ($p<0.01$). These results disagree with (Depenbusch *et al.*, 2009) who did not observe effects on feed efficiency with addition of DDGS in growing-finishing diets. Likewise, May *et al.* (2008) not observed differences in feed efficiency in steers supplemented with 40 years 25% of distillers grains. However similar tothe result, Ham *et al.* (1994) and Al-Suwaiegh *et al.* (2002) reported increases in the feed efficiency when distillers grains were added to finishing diets based on dry rolled corn. The uses of DDGS in diets for finishing cattle are controversial. This variability can be attributed to chemical composition

Table 2: Effect of Dry Distillers Grains (DDGS) concentration in low and high-forage diets on cattle growth performance

	Forage level (%)							
	35 (DDGS)		65 (DDGS)			p-values		
Diets	0	15	0	15	SEM	F	DDGS	F×DDGS
Final BW (kg)	522.50	526.10	520.30	518.30	6.50	0.38	0.14	0.03
ADG (kg day^{-1})	1.43	1.58	1.45	1.41	0.06	0.67	0.18	0.02
DMI (kg day^{-1})	9.60	9.50	9.90	9.70	1.20	0.03	0.05	0.98
FE	148.00	166.00	146.00	155.00	0.90	0.10	0.01	0.33

ADG: Average Daily Gain, DMI: Dry Matter Intake, FE: Feed Efficiency (g of BW gain/kg of DMI); F: Forage

and nutritional value of DDGS (Chrenkova *et al*., 2012). Several possible explanations on effects of the DGS on cattle productive performance have been proposed (Xu *et al*., 2013) how the moisture content of distillers grains (Nuttelman *et al*., 2010), type grain (May *et al*., 2010) and processing method (Corrigan *et al*., 2009). Protein availability of DDGS also can be different among ethanol plants presumably due to differences in heating (Klopfenstein *et al*., 2008). Therefore, DDGS may be deficient in rumen degradable protein and consequently not meet metabolizable protein requirements of cattle.

CONCLUSION

The results indicate that final BW, ADG, feed efficiency were improved by DDGS supplementation in cattle fed diets low forage. However, the addition of DDGS in high forage diets reduced productive performance of steers in feedlot.

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