URUGUAYAN NATIONAL BEEF QUALITY AUDIT-2007: A SURVEY OF BEEF INDUSTRY RELATED TO QUALITY AND VALUE OF CATTLE

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Abstract- **The National Beef Quality Audit–2007 was conducted to assess the current status of quality and consistency of Uruguayan slaughtered cattle. Between October 2007 and June 2008, teams assessed breed-type, brands, horn and mud/manure (n=10,083), bruises (n=27,550), offal and carcass condemnation (n=27,498), and carcass quality (n=5,300) in 10 Uruguayan beef packing plants. Breed-types were Hereford (46.2%), British crosses (16.7%), Holstein (7.1%), Aberdeen Angus (6.9%), other breeds (7.1%) and other crosses (16.0%). Brand frequencies were one (59.3%), two (32.1%) or more than two (8.6%), and 78.2% of them were located on the butt. There were 61.9% of the cattle without horns, and 29.7% with horns bigger than 10 cm in length. Most cattle (89.3%) had no mud/manure on their hides. Most carcasses (68.2%) were not bruised and 14.1% of carcasses had major bruises affecting the product. Bruise location and incidence were round (18.5%), loin (3.6%), rib (6.0%), chuck (27.0%), brisket (4.5%), flank (7.7%) and plate (3.7%). Condemnation item and incidence were liver (46.7%), heads (1.1%), tongues (1.5%), tripe (1.6%) and carcasses (0.1%). Related to carcass classification, sex-classes were: steer (58.5%), heifer (6.7%) and cow (34.8%). Considering only steers, permanent incisor number distribution were zero (3.6%), two (14.8%), four (25.3%), six (26.4%) and eight (29.9%); overall maturities were A (66.3%), B (25.0%), and C or older (8.7%), AUSMeat fat color score 2-3 (48.5%), and dark-cutters (11.1%). Carcass traits were hot carcass weight (263.4 kg), fat thickness (0.9 cm), rib eye area (60.9 cm2). Marbling score distribution was Moderate or higher (0.67%), Modest (4.0%), Small (14.5%), Slight (49.4%), and Traces or lower (31.5%). Most of the steers were in Standard (46.1%) and Select (31.6%), USDA quality grade. This information will help to Uruguayan beef industry to know the progress in each trait according to market demand and promote future training and research activities.**

Key Words: beef quality, carcass, surveys, meat grades

I. INTRODUCTION

The first Uruguayan National Beef Quality Audit (UNBQA) was conducted in 2002, in collaborate project among Colorado State University, INAC e INIA and was an important benchmark to identify what the beef industry was producing, measuring and reporting cattle and carcass traits. Four audits were conducted in the U.S., the NBQA–1991 (Lorenzen et al., 1993), NBQA–1995 (Boleman et al., 1998), and NBQA–2000 (McKenna et al., 2002) and NBQA-2005 (Garcia et al., 2008). Canada also has conducted two beef quality audits: the Canadian Beef Quality Audit–1995-96 and 1998-99 (Van Donkersgoed et al., 1997 and Van Donkersgoed et al., 2001). Information from these studies has shown where improvements in genetics and management have been made and where they may still be needed. Many of the UNBQA-2002 findings were used as training practices for producer and packers, mainly those related with animal handling practices. But also some marketing demands have occurred since the last audit, not only in Animal Welfare area but also in individual animal identification as requirement for EU markets or in carcass aging period (36 hs) due to US market policies. Meanwhile, new certified branded programs were developed as Hereford and Angus Certified Beef, focusing in the age of the animals and meat quality attributes (marbling and tenderness levels) and the use of concentrate in the diet increased. This second one (UNBQA-2007) was done to quantify if these mentioned changes could improve the quality and consistency of the Uruguayan cattle and identify current issues for the beef industry.

II. MATERIALS AND METHODS

Ten packing plants were visited two days in two seasons, Spring(October to December 2007) and Fall (April to June 2008). A practice and correlation sessions were held before data collection was initiated to help ensure uniformity and consistency of measurements. Data were collected between Tuesday and Thursday of a given week. Mondays were avoided to prevent biases caused by carcasses receiving extended chilling due to being held over a weekend. *Harvest Floor Assessments – Before Hide Removal*. We sampled 36% percent of the cattle from each production lot for a total of 28,323 animals for the harvest floor assessments. Breed-type was classified based on visual characteristics of each breed (hide color, *Bos indicus* traits as dorsal thoracic humps), beside considering British cross and general crosses.

Incidence of hide brands was recorded based on quantity and location. The anatomical region were rump, round, loin, rib-plate, chuck and neck. Cattle were assessed visually for the presence of mud/manure. Horns, if present, were evaluated visually for approximate length (none, ≤10 cm, and >10 cm). *Harvest Floor Assessments – After Hide Removal*. Offal (liver, lung, tripe and intestinal tract), head, tongue, and whole carcasses were evaluated for wholesomeness by Livestock, Agricultural and Fish Secretary (MGAP) Veterinary Inspection Service personnel, and we recorded the number and reasons for condemnation made by them. Numbers of females carrying fetuses were evaluated at the viscera table. Cattle age was estimated through dentition by determining the number of permanent incisors present sex classes, following Uruguayan official grading system (INAC, 1997) and sex class as well (steer, heifer and cow) . Carcass bruises were assessed based on the number, location (round, loin, rib, chuck and flank plate/brisket), and severity (minor or major). Grubs and lesions for injection sites were collected. *Carcass Assessments*. Beef carcasses (n = 5,300) representing 18.5% of each production lot were selected randomly for determination of hot carcasses weight (HCW), AUSMeat fat color scale (1 to 8), USDA quality grade factors (overall maturity and marbling), ultimate pH and temperature, visual meat color. Rib eye area (REA, measured by blotting paper) and fat thickness (FT) were measured at ribbing between 10-11th rib. Most of these measurements were done by INAC and INIA trained personnel. *Statistical Analysis*. All analyses were performed using SAS (SAS Inst., Inc., Cary, NC). Mean, standard deviation, minimum and maximum values for each trait were generated using PROC MEANS. Frequency distributions were analyzed using PROC FREQ.

III. RESULTS AND DISCUSSION

Harvest Floor Assessments – Before Hide Removal

It was found that the major breed was Hereford (46.2%), since it is main beef breed in Uruguay, maintaining the observed frequency in UNBQA 2002 (data not shown). British crosses (16.7%), Holstein (7.1%), Aberdeen Angus (6.9%), other breeds (7.1%) and other crosses (16.0%) followed in decreased distribution. This assessment is different to US NBQA, where hide color provides an indication of predominant breed and because it is used in branded beef programs that emphasize Angus genetics and/or black-hided cattle (McKenna et al., 2002). We found that number of brand frequencies were one (59.3%), two (32.1%) or more than two (8.6%). Most of the brands (78.2%) are located on the butt (data not reported). This data is different from US NBQA-2005, García et al. (2008) reported that unbranded hides were 61.3% in this study.

Mud/manure is of great concern in cattle coming from feed lot due to carcass contamination. In Uruguay most of the cattle is fattening in pasture, determining that 89.3% of the cattle did not have visible mud/manure content. García et al. (2008) reported that animals without mud or manure were only 25.8%. In data not reported in tabular form, we found that 61.9% of the cattle had not horn, and 29.7% had horns bigger than 10 cm in length. García et al., (2008) and McKenna et al., (2002) reported that 22 to 23% of cattle had no horns, in the last two US NBQA. García et al., (2008) also found that 30.8% of the animals had horns > 12.7 cm in length.

Harvest Floor Assessments – After Hide Removal

Inspectors form MGAP Veterinary Services determined that 46.7% of the livers were condemned. This result did not show any improvements in the incidence of flukes in our production systems from 2002 to 2007. García et al., (2008) reported an incidence rate of 24.7% for liver condemnation in US NBQA 2005. Other viscera and carcass condemnations in UNBQA 2007 (head=1.1%, tongue=1.5%, tripe=1.6%, heart=1.6% and whole carcass=0.1%) had minor frequency than US NBQA 2005 (head=6.0%, tongue= 9.7%, tripe=11.6%, and whole carcass=0%), and similar to the results obtained in UNBQA 2002. The number of cattle that had fetuses was 13.4%. This observation is substantially different from US Audit due to the composition of sex classes.

Carcass bruise information was based on presence or absent, considering quantity and location when they were present. They were classified in minor (no tissue removal) or major (tissue removal affecting final product). It was found that most carcasses (68.2%) were not bruised (Figure 1). This is an important improvement from 2002, since the incidence of bruises was of 60.4% in that Audit. One of the reasons that could explain this change is related with the Animal Welfare programs applied in the last years, improving animal handling practices from the farm to the packing plant. This percentage is similar to the data reported by García et al., (2008). From the total carcass evaluation, 18.5% of them presented bruises on the round, 27.0% on the chuck, and 6.0% on the rib (6.0%). According to the severity of the bruises, 14.1% of the total animal evaluation showed major degree affecting the economical value of the cut. However this is in contrast to the UNBQA 2002 data, where 35.4% of the carcasses had this degree of bruises.

The Official Grading System (INAC, 1997) in Uruguay classifies the carcasses by sex-classes, dentition by the number of permanent incisor, degree of conformation (muscling) and degree of finishing, these last two variables by visual score. Related to sex-classes, the composition of the evaluated population was: steer (58.5%), heifer (6.7%) and cow (34.8%). Fattening cows is economical viable in Uruguay, being the reason to include them in the National Beef Quality

Audit. For INAC System, females with 0 to 4 teeth are classify as heifers meanwhile females with 6 and 8 teeth enter in cow category. García et al., (2008) reported that the sex-classes distribution in US NBQA-2005 was, steers=63.7%, heifers=36.2%, bullock=0.05% and cow=0.04. Considering only steers, permanent incisor number distribution in UNBQA 2007 were zero (3.6%), two (14.8%), four (25.3%), six (26.4%) and eight (29.9%). It was observed a 19% decrease in the proportion of 8 teeth steers from 2002, increasing the incidence rate of 4 and 6 teeth rate (9% in each category)

Carcass Assessment

Means for carcass traits and meat quality variables are shown in Table 1. The HCW mean for each sex-class was 263.4 kg for steers, 218.6 kg for heifers and 203.7 kg for cows. These HCW means were similar to UNBQA-2002; but lower than the values reported by Garcia et al. (2008) where cow and steer HCW were approximately 367 kg and heifer HCW was 342 kg. According to these weights differences in REA was observed comparing both Audits. UNBQA 2007 showed REA means of 60.9 cm2 for steers, 52.9 cm2 for cows and 52.4 cm2 for heifers. The REA mean was 86.7 cm2 for US steers. Difference in degree of finishing was observed due to the contrast growth pattern and feeding regimes between countries as it was expected. FT mean in Uruguayan Audit for steers was 0.9 cm. The score of fat color was 2-3 for 48.5% of the evaluated carcasses using AUSMeat scale.

Frequencies of marbling scores, carcass maturity and USDA Quality Grade are shown in Table 2. Steers showed the following distribution, Moderate or higher=0.7%, Modest=4.0%, Small=14.5%, Slight=49.4%, and Traces or lower=31.5%. It was not observed a tendency in levels of marbling by dentition. An improvement was observed in score of marbling from 2002, where carcass reaching Small o higher levels increased 7%. McKenna et al. (2002) reported the need to determine the number of carcasses that were Small[50] or higher because some of the American certified beef programs include such carcasses. Garcia et al. (2008) found that 23.6% of the carcasses had marbling scores greater than or equal to Small[50], which is numerically lower than that reported (36.6%) by McKenna et al. (2002) in NBQA– 2000. Over 66% of the steer carcasses were of A maturity and 25% of them were of B maturity. Crossing this information with the chronological age measured by dentition, 86% of steers with 0 to 4 teeth and 66% of those with 6 teeth were of A maturity (Table 2). It could be inferred that the growth given by the production systems in Uruguay during the first stages affect the degree of ossification. Applying USDA Quality Grade System, most of the Uruguayan steers were in Standard (46.1%) and Select (31.6%) grades, and only 13.5% of the steers reached Choice, including lower Choice.

In data not reported in tabular form, 11.1% of the carcasses were dark cutters. The age of the steers, the offered diet based on pastures and transport and lairage conditions could be explaining the level of dark cutters incidence. The dark cutter in US NBQA-2005 was 1.9%.

IV. CONCLUSION

National Beef Quality Audits are a mean to identify the main problems for the beef industry and how they affect the value of live cattle, carcasses or by-products. Some of the trends observed between both UNBQA (2002 and 2007) include fewer animals with horn, fewer carcasses with bruises, decreased of bruise severity, fewer steers with 8 teeth and increased in marbling score. These changes are explained by the implementation of Animal Welfare programs to improve animal handling practices from the farm to the packing plant, by new certified branded programs focusing in meat quality attributes (marbling and tenderness levels) and by increasing the use of concentrate in the diet. This information will help the Uruguayan beef industry to evaluate the beef quality progress and will provide a benchmark for future educational and research programs.

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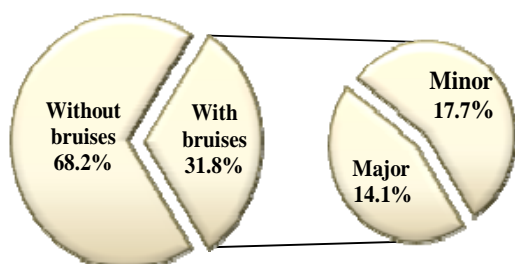Figure 1. Frecuency distribution of carcasses by presence and severity of bruises

Table 1 - Mean and Standard Deviation of carcass and meat quality traits.

Traits	Steer	Heifer	Cow
HCW (kg)	263.4 (38.4)	203.7 (33.6)	218.6 (33.3)
FT (cm)	0.90 (5.3)	0.74 (4.9)	0.97 (5.7)
REA (cm^2)	60.9 (9.3)	52.4 (8.0)	52.9 (8.8)

Table 2 - Frequencies of marbling scores,carcass maturity and USDA Quality Grade in steers and steers by dentition

Steers					
Marbling score	Freq (%)	Overall Maturity	Freq (%)	USDA Quality Grade	Freq (%)
Tr	31.5	A	66.3	Choice	13.5
Sl	49.4	B	25.0	Select	31.6
Sm	14.5	C	6.6	Standard	46.1
Mt	4.0	D	2.1	Commercial	0.2
Md	0.5	E	-	Utility	8.1
Sl A	0.1			Cutter	0.5

Steers by Dentition (Freq%)					
	0 (3.6%)	2 (14.8%)	4 (25.3%)	6 (26.4%)	8 (29.9%)
Overall Maturity					
A	86.0	89.8	82.2	66.4	36.9
B	10.5	7.8	15.4	28.5	41.4
C	1.8	1.5	1.6	4.2	16.4
D	1.7	0.9	0.8	0.9	5.3
Marbling score					
Tr	34.6	32.9	29.0	31.8	32.6
Sl	52.7	46.7	49.3	49.0	51.1
Sm	12.7	13.6	16.0	15.5	12.7
Mt	-	5.6	4.8	3.3	3.4