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To cite this article: Enrico Sturaro, Marzio Quassolo & Maurizio Ramanzin (2005) Factors affecting growth performance in beef production: an on farm survey, Italian Journal of Animal Science, 4:sup3, 128-131, DOI: 10.4081/ijas.2005.3s.128

To link to this article: https://doi.org/10.4081/ijas.2005.3s.128

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Published online: 02 Mar 2016.

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Factors affecting growth performance in beef production: an on farm survey

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ABSTRACT

This study aimed to investigate sources of variation of average daily gain in beef cattle, with an on farm approach, in the Veneto region. Data of 38707 animals fattened in 29 farms and belonging to 5 genotypes (Charolais, Charolais Female, French Crossbred, Limousin and Polish Friesian) were analysed considering type of farm, farm nested within type, genotype, housing system, arrival live weight, percentage of dead and injured animals, season of sale and diet. Genotype, farm, percentage of unhealthy animals and season of sale significantly affected average daily gain. Charolais and French Crossbred showed the highest values of average daily gain, Charolais Female the lowest. The effect of farm suggests that management is very important for growth performance in beef cattle. Moreover, batches of animals with high percentage of dead and injured presented lower values of average daily gain. In spring-summer 2003 an extremely hot climate was unfavourable for growth performance.

Key words: Growth performance, Beef production, Average daily gain, On farm survey

Introduction

Growth performance is a characteristic of relevant economic importance in beef cattle production system, one of the most developed agricultural sector of UE. A number of authors studied growth performance in beef cattle, and in particular daily gain (Schwartzkopf Genswein et al., 2004; Bruns et al., 2005). In general these researches are based on experimental plans, and only few considered on farm surveys. This study aimed to investigate variability and sources of variation of daily gain in some beef cattle genotypes widespread in Veneto region, with an on farm approach.

Material and methods

This research involved an analysis of growth performance for 5 genotypes (Charolais, Charolais Female, French Crossbred, Limousin and Polish Friesian) of beef cattle fattened in the Veneto region. Data were collected in 29 farms associated to AZOVe (Associazione Zootecnica Veneta), and included information about characteristics of the farm and of the batch of animals, growth performance during fattening, sanitary and nutritional aspects. Homogeneous batches of animals were identified by genotype, farm, fattening period and characteristics of the diet. Every single batch was the reference unit for descriptive and statistical analysis. Final database included 583 batches for a total of 38707 animals, fattened from 2000 to 2003.

Data were analysed by using the SAS package (1990). Continuous variables included in statistical analysis were classified in fixed effects: percentage of dead and injured animals was grouped in three classes (low, moderate, high) on the base of standard deviation by genotype; arrival live
with the aim to investigate the effects of characteristics of the diet on the ADG of considered batches of animals.

Results and conclusions

In Table 1 descriptive statistics for growth performances by genotype (583 batches) are reported. Charolais was the most widespread genotype, whereas French Crossbred and Polish Friesian were the genotypes with the lowest number of batches farmed. Average weight at the arrival ranged from 283 (Polish Friesian) to 385 kg (Charolais) with a moderate variability between batches of the same genotype. Charolais and French Crossbred showed the highest values of final average weight, Charolais Female were more light than the other genotypes. ADG presented the same trend, with higher values for Charolais and French Crossbred and lower values for Charolais Female.

Detailed information about diet was available for a sub-sample of 268 batches, for which percentage of starch, protein, ensiled pressed sugar beet pulps, and corn silage of the diet were known. These variables were included in the general linear model as covariates (corrected for genotype) with the aim to investigate the effects of characteristics of the diet on the ADG of considered batches of animals.

Table 1. Descriptive statistics for growth performances by genotype (583 batches).

| Genotype       | N. batches | Average weight at arrival (kg) | Final average weight (kg) | Average daily gain (kg/d) |
|----------------|------------|--------------------------------|---------------------------|--------------------------|
|                |            | mean  SD                        | mean  SD                  | mean  SD                 |
| Charolais      | 253        | 385.1  48.4                      | 675.4  30.6               | 1.37  0.10               |
| Charolais Female | 109   | 303.1  29.1                      | 494.1  23.6               | 0.95  0.08               |
| French Crossbred | 43    | 374.1  37.3                      | 646.3  26.6               | 1.28  0.10               |
| Limousin       | 153        | 305.4  39.3                      | 580.0  32.9               | 1.20  0.09               |
| Polish Friesian | 25     | 283.1  23.1                      | 539.4  33.4               | 1.16  0.06               |

Table 2. Sources of variation for ADG (583 batches).

| Source of variation       | DF | Mean square | F     | P   |
|---------------------------|----|-------------|-------|-----|
| Type of farm              | 3  | 0.007       | 1.14  | ns  |
| Farm (type of farm)       | 25 | 0.038       | 6.20  | *** |
| Genotype                  | 4  | 1.057       | 171.51| *** |
| Housing system x space    | 3  | 0.009       | 1.42  | ns  |
| Class of arrival live weight | 2 | 0.004       | 0.58  | ns  |
| Class of unhealthy         | 2  | 0.023       | 3.73  | *   |
| Season of sale            | 11 | 0.026       | 4.26  | *** |
| R^2(%)                    |    | 83.3        |       |     |

ns = not significant, *** P<0.001, * P<0.05
In Table 2 results of ANOVA performed for ADG are reported. The model had a very high coefficient of determination (83.3%). Farm nested within type, genotype, class of unhealthy and season of sale significantly affected ADG, whereas type of farm, class of arrival live weight and interaction between housing system and space were not significant.

Statistical significance of type of farm effect was tested using the mean square of farm nested within type as error term, and this test confirmed that type of farm did not affect significantly ADG. The strong effect of genotype was expected and it confirms the descriptive statistics reported in Table 1, with high values of ADG for Charolais and French Crossbred, intermediate for Limousin and Polish Friesian and low for Charolais Female (least square means, data not shown in table). The statistically significant effect of farm suggests that management has an important role on variability of growth performance. ADG was lower for batches with a high percentage of unhealthy (dead and injured) animals with respect to batches with low or moderate percentages (Figure 1).

In Figure 2 least square means for season of sale on ADG are presented. ADG showed a moderate variability between seasons of different years, except for 2003 when the values of ADG were significantly lower than for the other years, especially in Spring, Summer and Autumn. It can be due to the extremely hot climate in that year, unfavourable for growth performance of the animals.

Characteristics of the diets were similar for Charolais, French Crossbred and Limousin, which differed from Charolais Female and Polish Friesian (Table 3). Within genotype, variability was generally low, indicating a homogeneity of feeding standards within AZOVe. The ANOVA performed for this sub-sample did not show any significant effect of diet on ADG (data not shown in table).

These results confirm that ADG is strongly related to genotype, and that, with the range of variability used in practice, feeding and housing have a minor importance. The fact that performances remain highly variable within farms and are affected by percentage of unhealthy animals indicated that strategies to improve performances should aim primarily to identify gaps in management practices. Also climate (summer high tem-

| Genotype            | N. | Daily dry matter intake (kg /100 kg) mean SD | Starch (% of DM) mean SD | Protein (% of DM) mean SD | Corn silage (% of DM) mean SD | Pulps (% of DM) mean SD |
|---------------------|----|---------------------------------------------|--------------------------|----------------------------|-----------------------------|--------------------------|
| Charolais           | 109| 1.75 0.12                                    | 29.5 2.2                 | 14.3 0.6                   | 8.0 2.1                     | 4.7 2.2                  |
| Charolais Female    | 46 | 1.91 0.10                                    | 16.0 5.6                 | 16.0 0.3                   | 5.0 2.6                     | 9.6 3.6                  |
| French Crossbred    | 20 | 1.76 0.16                                    | 28.7 1.8                 | 14.2 0.7                   | 8.1 1.6                     | 2.6 2.1                  |
| Limousin            | 80 | 1.79 0.14                                    | 29.4 2.4                 | 14.4 0.7                   | 5.0 2.8                     | 3.1 1.9                  |
| Polish Friesian     | 13 | 2.01 0.12                                    | 24.7 5.1                 | 14.0 0.7                   | 7.4 3.4                     | 5.0 4.2                  |
peratures) appears to be a potential limiting factors. The inclusion in this analysis of other batches of animals should provide further insight into the relationships between farm system and growth performance of beef cattle in different genotypes.

Authors are grateful to G. Borin, L. Tondello, G. Dalle Rive, C. Ceccato, E. Florian and P. Lanza of AZOVe (Associazione Zootecnica Veneta) for their support to the research.

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