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Effect of mixing time of the total mixed ration on beef cattle performance

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BACKGROUND

In beef cattle production the **improvement of animal feed efficiency** is crucial:

- ✓ To improve profitability

- ✓ To decrease its impact on the environment

But

- ✓ Animal feed efficiency **is very variable**
- ✓ and **is affected by multiple factors**

FACTORS AFFECTING ANIMAL FEED EFFICIENCY

Group factors
(diet, management, etc.)

Individual factors
(metabolic-related mechanisms, immunity, etc.)

- ✓ **With the increase of the application of technologies at farm level there is a rise of the amount of data available**
- ✓ **Very often, conditions of animal farming and feeding which look the same between two or more groups of animals, considerably differ to a closer observation**
- ✓ **After doing some audits on TMR preparation in commercial beef farms** we wondered what could be the **effect of a not homogeneous TMR on animal performance and feed efficiency**, compared with the effect of an homogenous TMR

AIMS

The aim of this study was to assess the effect of the processing time of TMR in the mixer wagon

Long mixing time (LMT, 30 min)

Standard mixing time (SMT, 20 min)

VS

to verify their effectiveness on:

TMR

- Nutrient composition
- Particle length distribution
- Consistency over time

Animals

- Dry matter intake (DMI)
- Feed sorting
- Average daily weight gain (ADG)
- Feed conversion ratio (FCR)
- Rumination
- Activity

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LOCATION, ANIMALS AND HOUSING

Farm

- ✓ **Location:** Veneto (RO), Italy
- ✓ **Extension:** 800 Ha
- ✓ **N° animals/year: 6000**

Period

- ✓ **Dates:** 1st of June – 2nd August
- ✓ **Duration:** 63 days
- ✓ Backgrounding - Transition phase

Housing

- ✓ Roofed facility with an open front
- ✓ 11 pens (14 x 5 m)
- ✓ Space allowance (7.78 - 8.75 squared meters)

ANIMALS

- ✓ **Number: 98** young bulls
- ✓ **Breed:** Charolais
- ✓ **Age**: 433±60 days
- ✓ **Weight:** 476±36 kg

EXPERIMENTAL DESIGN

Period 1

Group 1
6 pens (from 1 to 6)
54 animals
+
SMT

Group 2
5 pens (from 7 to 11)
44 animals
+
LMT

Cross-over design

Period 2

Group 1
6 pens (from 1 to 6)
54 animals
+
LMT

Group 2
5 pens (from 7 to 11)
44 animals
+
SMT

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DIET, MEASURES AND ANALYSES

Upon arrival animals **were fed hay and maize silage for 3 days**

Total mixed ration

Ingredients	(g/kg DM)
Maize silage	371
Weat bran	147
Maize meal	133
Pressed beet pulps	132
Protein, vitamin and mineral mix	82.4
Straw	70.7
Soybean meal	63.9

Sampling and analyses on TMR

- ✓ Samples of both TMRs were collected from each pen, every 5 days, (N = 132) to be analyzed for:
  - ✓ chemical composition
  - ✓ particle length distribution (PSPS)
- ✓ 24 h leftovers were weighed and analysed for particle length distribution.

MEASURES AND ANALYSES

Young bulls

- ✓ Were vaccinated and treated for parasites and fitted with SCR collars
- ✓ Were **weighed** at the beginning and the end of each period (ADG)
- ✓ Were checked for individual daily **rumination** and **activity**
- ✓ were assessed for (pen based):
  - ✓ **DMI**
  - ✓ **Sorting activity**
  - ✓ **FCR**

STATISTICAL ANALYSES

- Before analyses, **all data were tested for normality** with the Shapiro–Wilk test (for values > 0.9 data were considered normally distributed).

- All data were submitted **to a mixed ANOVA model** using the pen as random effect and period, mixing time and their interaction as fixed effects.

- **The differences on TMR composition** between pens and consecutive days within each diet, were tested using **a GLM model** with pen and day as fixed effects.

- To test whether sorting activity for or against particles of different length was significantly different from 100, data on sorting activity were submitted to a t test

RESULTS : TMR AND SORTING ACTIVITY

Table 1 Composition, particle length distribution and level of sorting activity on the long mixing time (LMT) and short mixing time (SMT) total mixed rations in periods P1 and P2

	TMR		Period		SEM[f]	P-value	
	LMT	SMT	P1	P2		TMR	Period
Composition (g/kg DM)							
DM (g/kg)	532	531	533	530	10.1	0.985	0.868
CP	124	124	123	125	3.54	0.967	0.668
Starch	326	325	324	327	9.2	0.966	0.767
NDF	329	330	331	329	4.67	0.902	0.777
peNDF	**184**	**217**	201	200	2.89	<0.001	0.762
Particle length distribution (%)							
GML (mm)	**4.12**	**5.08**	4.55	4.65	0.06	<0.001	0.047
> 19 mm	**6.93**	**13.3**	9.86	10.4	0.302	<0.001	0.182
8-19 mm	26.2	26.7	25.9	26.9	0.495	0.206	0.028
4-8 mm	**22.5**	**20.5**	22.3	20.7	0.292	<0.001	<0.001
Bottom pan	**44.4**	**39.5**	41.9	42	0.32	<0.001	0.7657
Sorting activity of particles of different length (%)							
> 19 mm	**99.8**	**96.3**	97.8	98.2	0.759	0.005	0.672
8-19 mm	101	101	101	100	0.364	0.295	0.106
4-8 mm	**99.3**	**94.6**	98.2	95.7	1.04	0.008	0.042
Bottom pan	**101**	**103**	101	102	0.575	0.013	0.199

LMT had a significantly **lower peNDF, particles geometric length**, a lower content of long particles and a higher content of short and fine particles than SMT

Animals fed on LMT did not sort against long particles and short particle and **sorted for fine particles with less intensity**

*The interaction between diet and period was never significant

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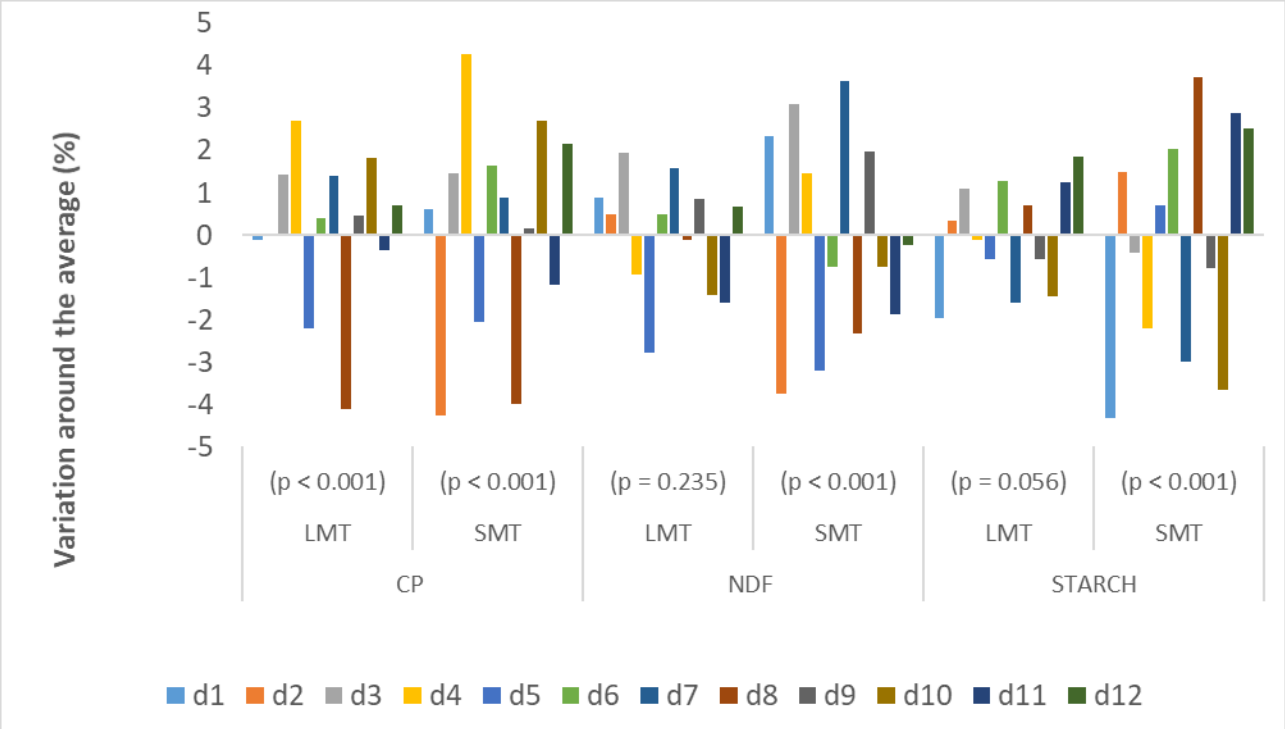
TMR CONSISTENCY

Fig. 1. Variation around the average in crude protein (CP), neutral detergent fibre (aNDF) and starch of LMT and SMT diets collected during the sampling days (d1-d6 for P1 and d7-d12 for P2).



TMR composition in SMT diet was less consistent over time than LMT **for NDF and starch**

DMI, ADG, FCR, RUMINATION AND ACTIVITY

Table 2

Effect of total mixed ration mixing time (LMT and SMT), period (P1 and P2) on dry matter intake (DMI), average daily gain (ADG) and feed conversion ratio (FCR)

	TMR		Period		SEM	P-value	
	LMT	**SMT**	**P1**	**P2**		**TMR**	**Period**
DMI (kg/d)	9.7	9.95	9.64	10	0.299	0.412	0.227
ADG (kg/d)	**1.96**	**1.87**	**2.04**	**1.78**	0.05	0.035	< 0.001
FCR	**4.97**	**5.39**	**4.72**	**5.64**	0.144	0.036	< 0.001

The higher ADG and FCR of LMT attained with LMT diet are probably due to it's higher consistency over time

Table 3

Effect of total mixed ration's mixing time (LMT and SMT), period (P1 and P2) on daily activity, daily rumination, index of dishomogeneity in activity (DA) and index of dishomogeneity in rumination (DR)

	TMR		Period		SEM	P-value	
	LMT	SMT	P1	P2		TMR	Period
Daily activity (bit)	492	497	494	494	8.79	0.262	0.999
Daily rumination (min)	380	382	381	381	5.95	0.571	0.974
DA	**0.083**	**0.095**	**0.078**	**0.1**	0.007	0.012	<0.001
DR	0.153	0.154	0.149	0.157	0.005	0.842	0.100

*The interaction between diet and period was never significant

CONCLUSIONS

- ✓It can therefore be stated that the **longer TMR mixing time, in addition to reducing particle size, led to a greater uniformity of TMR** over time.

- ✓This greater uniformity of the TMR **led to a higher ADG and to a better FCR**, compared with animals fed on a less homogeneous TMR.

- ✓**These effects are attributable to a greater consistency** over time of TMR which **could have enhanced the efficiency of microbial metabolic activity at ruminal level**.

- ✓Further research is warranted to deepen the knowledge on this subject.

THANK YOU!

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SCR by Allflex
Make every cow count

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