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**DESCRIPTIVE STUDY OF SPEED OF FATTENING RABBITS' DAILY FEED
INTAKE IN CONSTANT AND PROGRESSIVE HOURLY FEEDING
WITH TWO NUTRITIONAL LEVELS OF FEED**

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DESCRIPTIVE STUDY OF SPEED OF FATTENING RABBITS' DAILY FEED INTAKE IN CONSTANT AND PROGRESSIVE HOURLY FEEDING WITH TWO NUTRITIONAL LEVELS OF FEED

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ABSTRACT

This study describes the speed of daily feed intake of 168 fattening Hyplus rabbits assigned to 3 groups of 56 rabbits : the first group had a standard feed during 10h per day (10h STD), the second group had the same standard feed with a progressive hourly feeding, according to 6h per day at the beginning of fattening period and an increase of one hour per week (6h+1 STD) and the third group had the same feeding plan than the second group but with a concentrated feed (6h+1 C+). Speed of daily feed intake (SDFI) was determined for 3 periods: P1 (37-39 days old), P2 (52-54 days old) and P3 (67-68 days old). For each period, feed intake was measured 1 h, 2h, 3h, 6h and 10h after the feed distribution. Between P1 and P2, the average SDFI of the 3 groups increased by 51%, from 12.7 to 19.2 g/h in average. However, between P2 and P3, it tended to be stable around 19g/h in average (-6% to +4% according to groups). This evolution was due to age, but also to weight because when it is expressed in g/h.kg of live weight (LW), the SDFI of the 3 groups slightly decreased between P1 and P2 (-0.4 g/h.kg LW) then decrease much more between P2 and P3 (-2.7 g/h.kg LW). During fattening, throughout the day, rabbits hourly restricted consumed feed about 2.5 times quicker the first hour after distribution (in average 36.8g/h versus 14.8 g/h for the following hours). More the hourly restriction level increased and more the average SDFI was enhanced: in P1, 6h+1 STD group consumed additional 1.5 g/h in comparison with 10h STD group. The SDFI was higher the first hour after feed distribution because the 6h+1 STD group consumed 5.5 g more than 10h STD group. The feed concentration slightly decreased the SDFI by regulating feed consumption, knowing that this moderation appear throughout the day and it decrease throughout the fattening : respectively -0.3, -0.5 and -1.2 g/h for P1, P2 and P3 comparing 6h+1 C+ to 6h+1 STD groups.

Key words: rabbit, hourly feeding restriction, nutritional level, speed of feed intake

INTRODUCTION

In France, feed restriction is commonly used in rabbit farms during the fattening period, for sanitary reasons (decrease of some digestive disorders) and technical reasons (reduction of the feed conversion ratio) (Tudela and Lebas, 2006). Two main feed restriction methods exist: quantitative feed restriction which consists to give rabbit a precise quantity of feed per day, and hourly feeding by reducing the access duration to the feed (Gidenne *et al.*, 2015). Several studies were made about speed of feed intake of rabbits fed *ad libitum* and rabbits with a quantitative feed restriction. Thus, Martignon (2010) showed that the speed of daily feed intake of restricted rabbits was irregular and synchronized to the feed distribution period, contrary to rabbits fed *ad libitum*, which had a more regular feed intake throughout the day. On the other hand, Lebas (2009) and Simoes Nunes (1981) observed that speed of daily feed intake of restricted rabbits was as high as the quantitative restriction was severe. However, only few studies give feed intake and none give indications on speed of feed intake of hourly restricted rabbits. This study aims to study in details speed of feed intake of fattening rabbits fed restricted with a constant and a progressive hourly feeding, with the use of two feed concentrations.

MATERIALS AND METHODS

The trial was conducted at the experimental station of Saint Symphorien (France) with 168 Hyplus rabbits of 32 days old assigned to 3 groups : 10h STD group - non medicated standard feed (calculated Digestible Energy 2325 Kcal/kg, Crude Protein 15%, Crude Fiber 17%, Crude Fat 3.4%) during 10h per day for the whole fattening period, 6h+1 STD group – non medicated standard feed with a progressive hourly feeding (6h per day at the beginning of fattening period with an increase of one hour per week), and 6h+1 C+ group - non medicated concentrated feed (calculated Digestible Energy 2400 Kcal/kg, Crude Protein 15.4%, Crude Fiber 16.7%, Crude Fat 3.5%) with the same progressive hourly feeding than 6h+1 STD group. 8 cages of 7 rabbits were allocated to each group according to individual weight, litter and previous feed. For each group, measures were done for 3 periods: between 37 and 39 days old (P1), between 52 and 54 days old (P2) and between 67 and 68 days old (P3). For each day of these periods, feed intake was measured 1 hour (h), 2h, 3h, 6h and 10h after feed distribution. Weighing of the rabbits was also carried out in each of the 3 periods. Data were analyzed descriptively.

RESULTS AND DISCUSSION

All the figures are presented in Table 1.

Throughout fattening period

Regardless the feeding plan (duration and feed nutritional concentration), between P1 and P2 rabbits of the 3 groups strongly increased their average speed of daily feed intake (SDFI) from 12.7 to 19.2 g/h (+51%, similar for 3 groups) in average. However, between P2 and P3, it tended to be stable, from 19.2 g/h to 18.9 g/h in average for the 3 groups with respectively +4%, -2% and -6% for 10h STD, 6h+1 STD and 6h+1 C+ groups. (Figure 1a)

It seems that SDFI was mostly influenced by live weight (LW) of rabbits (Figure 1b) because with a constant feed distribution duration (10h STD group), SDFI was less variable when expressed in kg LW : 8.7 g/h.kg LW in P1, 8.3 g/h.kg LW in P2 and 6.5 g/h.kg LW in P3, when in g/h the speed of feed consumption is 11.8 g/h, 17.9 g/h and 18.6 g/h respectively for P1, P2 and P3.

To our knowledge, no study has been published about the SDFI expressed in g/h.kg LW. However, Foubert *et al.* (2007), studying the consumption in hourly feeding between 32 and 53 days old, observed that the SDFI calculated with available data showed a SDFI of 10.8 g/h for a feed access of 10h (around 14.9g/h in this study for 10h STD group), but when this speed is expressed in g/h.kg LW the difference between the 2 studies is reduced : 8g/h.kg LW for Foubert *et al.* and 8.5 g/h.kg LW for this study.

Even if it was more stable in g/h.kg LW, there was also an effect of age because the speed of feed consumption decrease along the fattening, slightly between P1 and P2 (-3.7%), and more importantly between P2 and P3 (-22.0%).

Throughout the day

The evolution of the SDFI during fattening was the result of an evolution of SDFI throughout the day (Figures 2). Regardless the feeding strategy and the age of animals, hourly restricted rabbits consumed feed quicker during the first hour (36.8 g/h in average), and then regulated their intake for the next hours (14.4 g/h in average), i.e. a ratio of 2.6. These results are in accordance with Martignon (2010), who showed that rabbits with quantitative feed restriction had an irregular SDFI, which was synchronized to the feed distribution period.

Restriction level

The severity of hourly feeding impacted the SDFI : in P1 the average speed of 10h STD group is 11.8 g/h versus 13.3 g/h for 6h+1 STD group, i.e. +12.7%. And, logically, this difference of speed decreased as the

difference of access duration to the feed between the 2 groups reduced : for P2, the difference is +12.3% when 6h+1 STD group had 8h of access, and for P3 only +5.4% when the 2 groups had both 10h of access (Table 1, Figure 1a). This observation can be linked to Lebas (2009) and Simoes Nunes *et al.* (1981), which showed that SDFI of quantitative restricted rabbits was as high as the quantitative restriction was severe. We can assume that the level of hourly feeding modified the SDFI as the quantitative feed restriction does. These results are also true when expressed in g/h.kg LW, and similar than speeds calculated from data of Foubert *et al.* (2007): in their study, the SDFI was respectively 8 g/h.kg LW, 9.5 g/h.kg LW and 11.4 g/h.kg LW for 10h, 8h and 6h of feed access, whereas in our study, on nearly the same period, the SDFI was respectively 8.5 g/h.kg LW and 10.3 g/h.kg LW for 10h STD group (10h of feed access), and 6h+1 STD group (6.6h of feed access on the period).

The SDFI was modified by the restriction level for the first hour following feed distribution because during P1, the 6h+1 STD group consumed 5.5 g more (+23.6%) than 10h STD group, while both groups had similar feed consumption for the next hours (only 4% of difference between the 2 groups) (Figures 2).

Feed concentration

The nutritional level of feed also modified the SDFI because the rabbits from 6h+1 C+ group, with a more concentrated feed, ate more slowly than the rabbits from 6h+1 STD group, and the difference increased with animal's age : for P1 13.0 g/h versus 13.3 g/h respectively, i.e. -2.3% ; for P2 19.6g/h versus 20.1 g/h, i.e. -2.5% ; for P3 18.6 g/h versus 19.6 g/h respectively, i.e. -6.1%. This reduction of the SDFI depending of the feed can be due to the regulation of rabbits' feed intake with the feed concentration. Otherwise, as described by Gidenne *et al.* (2009), rabbits with a quantitative feed restriction adapt their feed intake to the feed nutritional level, slightly the two first fattening weeks and more pronounced at the end of fattening.

Contrary to the restriction level, the feed concentration seemed to have an impact throughout the day, and not only for the first hour after feed distribution (Figures 2).

Table 1: Speed of daily feed intake throughout the day during fattening (g/h and g/h.kg)

period		P1 (37-39d)			P2 (52-54d)			P3 (67-68d)		
groups		10h STD	6h+1 STD	6h+1 C+	10h STD	6h+1 STD	6h+1 C+	10h STD	6h+1 STD	6h+1 C+
Speed of daily feed intake (g/h)	H1	23.3	28.8	28.6	37.6	42.8	43.4	41.2	43.2	42.3
	H2	11.4	11.0	10.8	16.9	17.4	16.8	18.8	19.6	18.7
	H3	9.8	9.0	8.7	15.8	15.0	13.8	20.9	18.5	18.2
	H4-6	9.9	10.2	10.0	12.8	16.0	15.4	12.5	14.3	12.9
	H7-10	11.1	/	/	17.6	18.8	18.4	17.0	18.0	16.5
	Daily average	11.8	13.3	13.0	17.9	20.1	19.6	18.6	19.6	18.4
Body Weight (g)		1369	1256	1265	2146	1999	2003	2871	2818	2790
Speed of daily feed intake (g/h.kg LW)		8.7	10.6	10.3	8.3	10.0	9.8	6.5	7.0	6.6

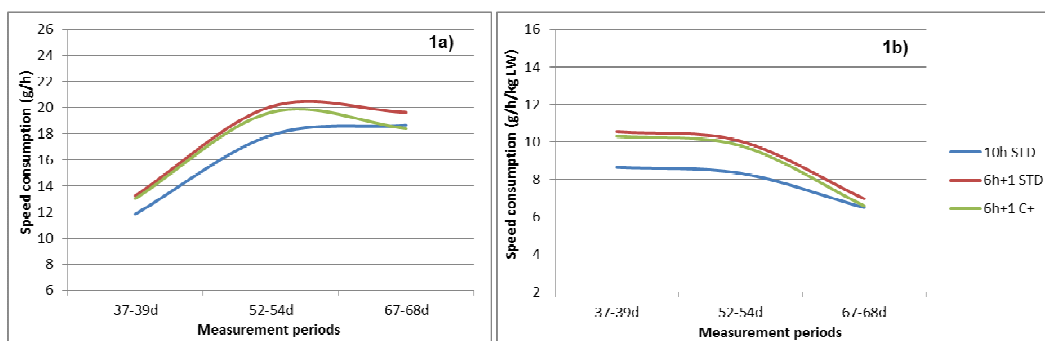


Figure 1: Speed of daily feed intake in g/h (1a) and in g/h.kg LW (1b) depending on the period

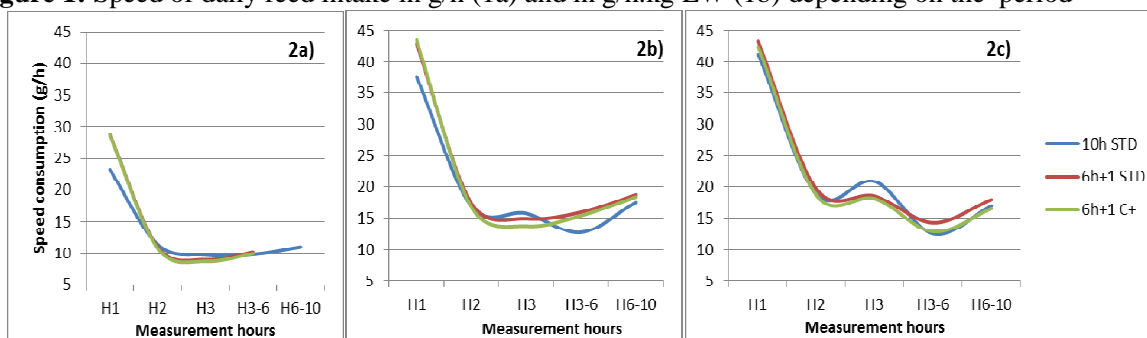


Figure2: Speed of daily feed intake throughout the day in g/h at 37-39d (2a), 52-54d (2b) and 67-68d (2c)

CONCLUSIONS

During fattening, the average speed of daily feed intake of hourly restricted rabbits increases with the live weight of animals or the restriction level. On the contrary, the speed decreases with rabbits' age or feed concentration. Throughout the day, rabbits with progressive hourly feeding consumed around 2.5 times quicker during the first hour following feed distribution, and then more consistently for the next hours. The significant increase of feed intake speed by the feed restriction level is mostly observe the first hour following feed distribution whereas the moderate drop of ingestion speed by the feed concentration seems to happen throughout the day and increases along the fattening. This study, that helps to better understand some behaviors and technical results obtained in hourly restriction, should be considered when designing news feeding strategies for optimizing technico-economical performances of rabbit farms.

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***Descriptive study
of speed of fattening rabbits feed intake
in constant and progressive hourly feeding
with two nutritional levels of feed***

G. REBOURS
J. RAFFIN, P. VASTEL, S. REYS



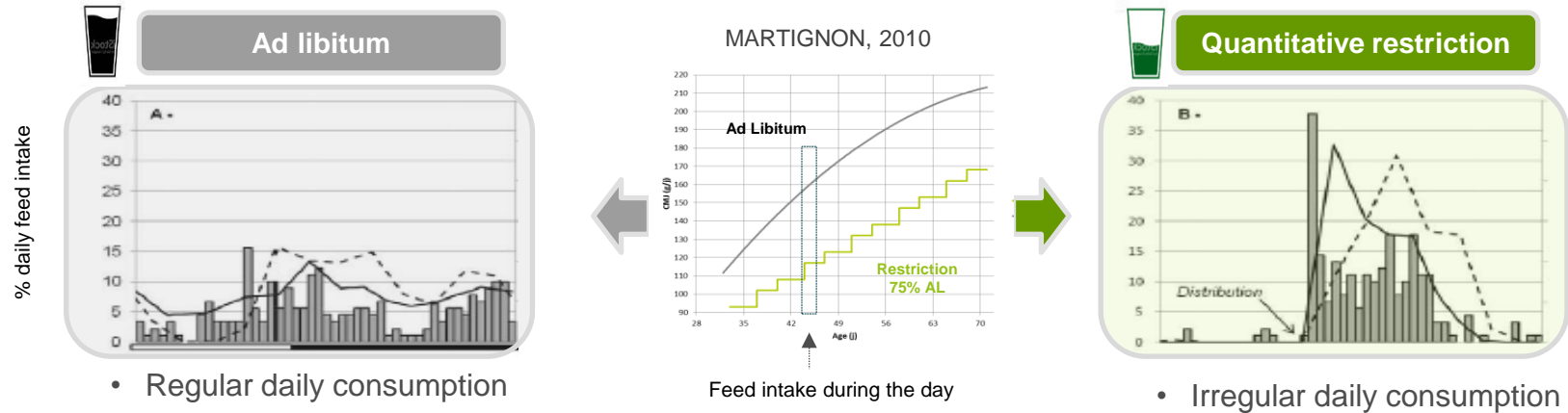
World Rabbit Congress
Nantes, November 2021

Introduction

- Some studies show that quantitative feed restriction influences feeding behavior and speed of feed consumption compared to ad libitum feeding.

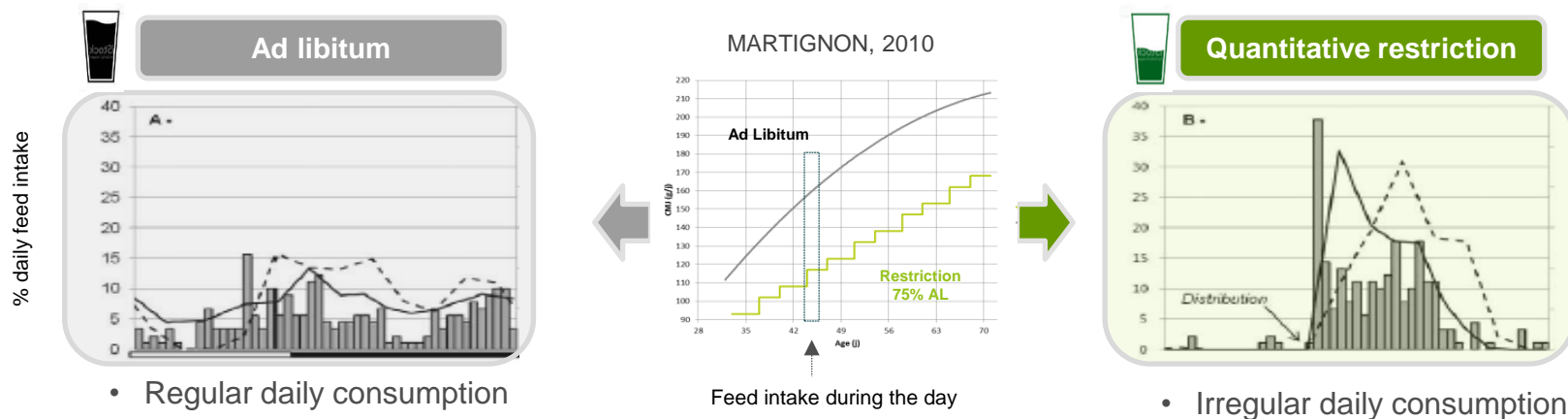
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Introduction

- Some studies show that quantitative feed restriction influences feeding behavior and speed of feed consumption compared to ad libitum feeding.



- No study on speed of feed consumption of rabbits hourly restricted.
- This work aims to study speed of daily feed intake of fattening rabbits restricted with a constant and a progressive hourly feeding, with two feed concentrations.

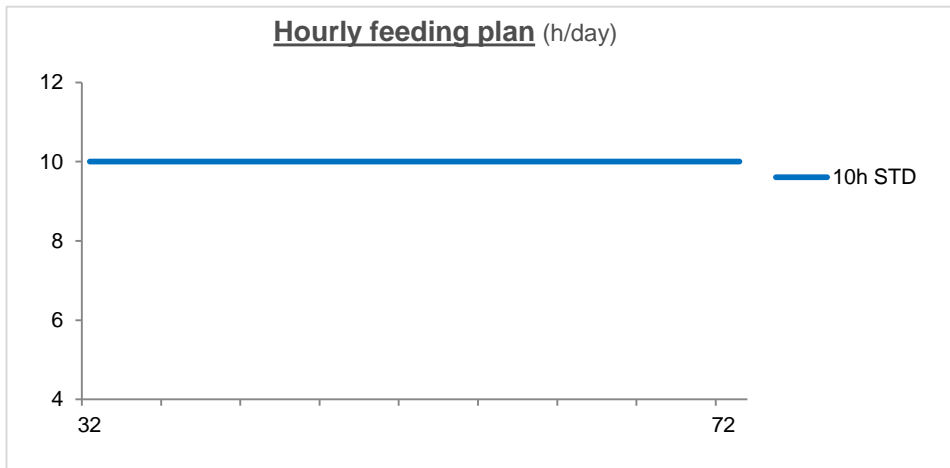


Material and Methods

- **Place** : French Experimental station
- **Groups** : 168 fattening rabbits, 32 to 72 days old, assigned to 3 groups :

Material and Methods

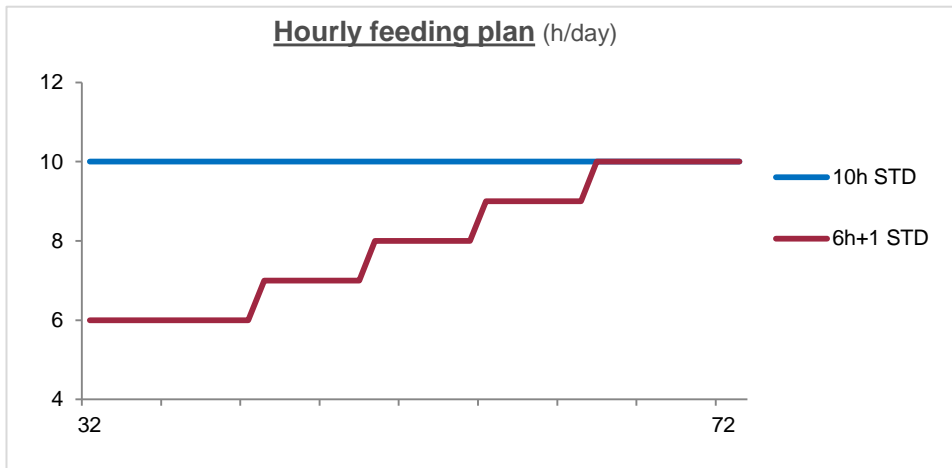
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Diets	STD
Calculated DE (kcal)	2325
Crude Protein (%)	15.0
Crude Fiber (%)	17.0
Crude Fat (%)	3.4

Material and Methods

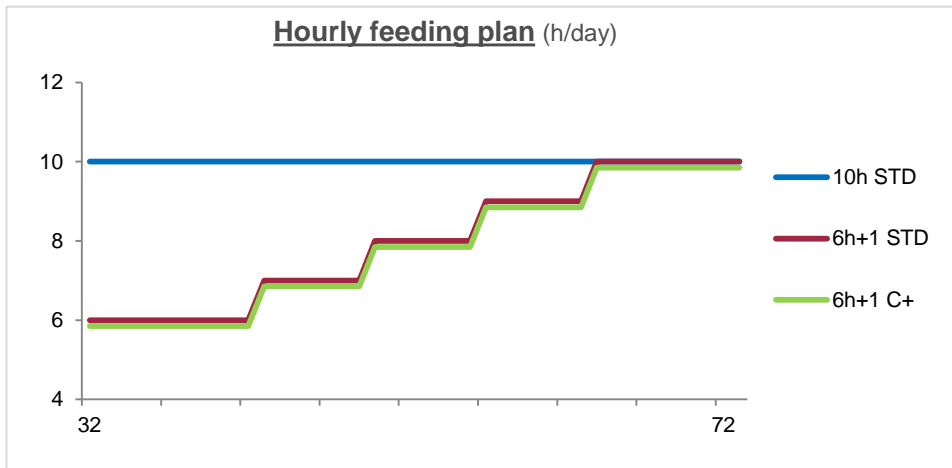
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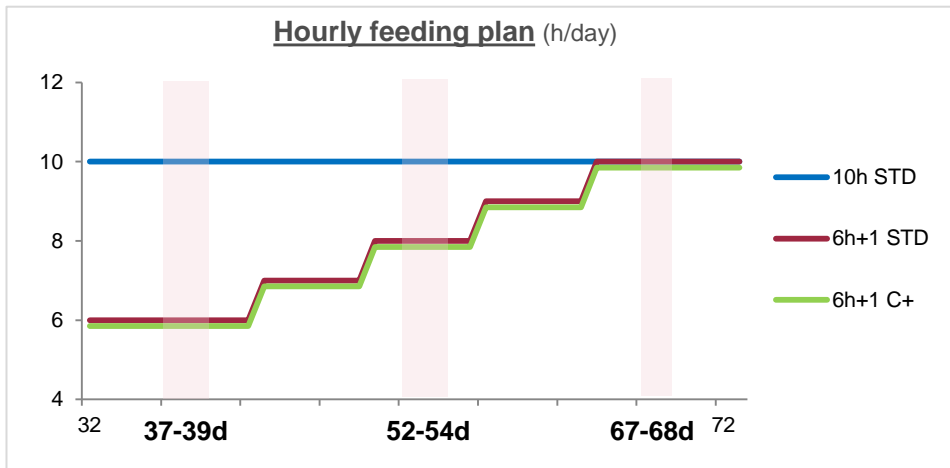
- **Place** : French Experimental station
- **Groups** : 168 fattening rabbits, 32 to 72 days old, assigned to 3 groups :



Diets	STD	C+
Calculated DE (kcal)	2325	2400
Crude Protein (%)	15.0	15.4
Crude Fiber (%)	17.0	16.7
Crude Fat (%)	3.4	3.5

Material and Methods

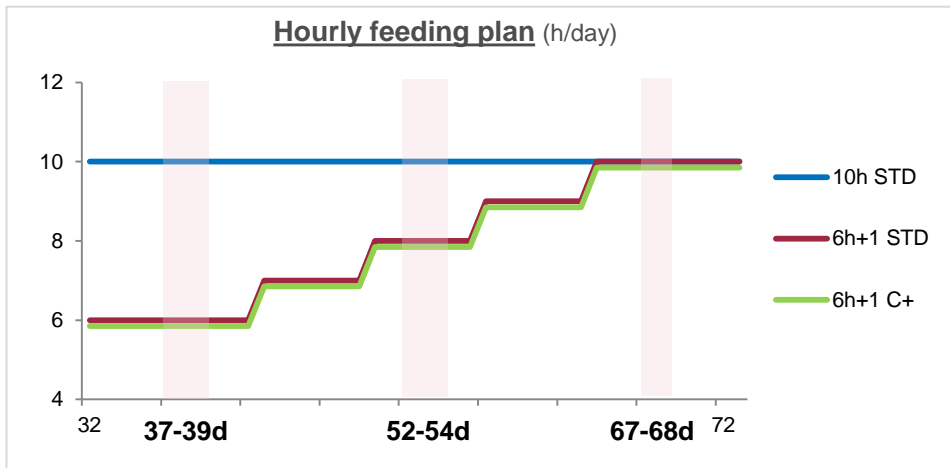
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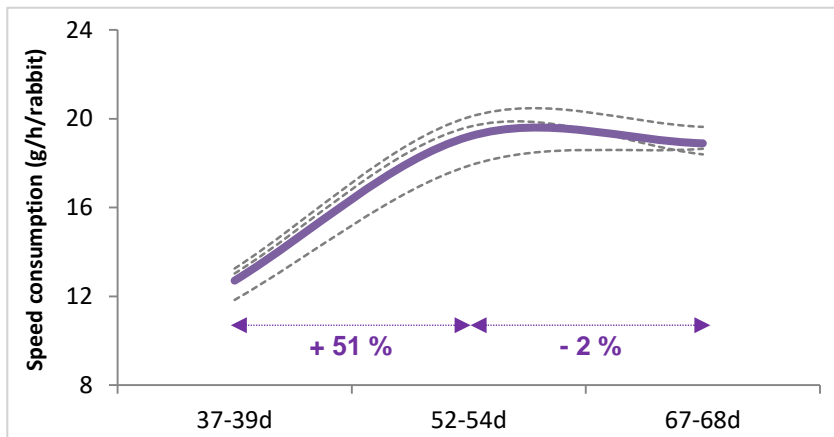


Diets	STD	C+
Calculated DE (kcal)	2325	2400
Crude Protein (%)	15.0	15.4
Crude Fiber (%)	17.0	16.7
Crude Fat (%)	3.4	3.5

- **Measures** :
 - Feed intake 1h, 2h, 3h, 6h and 10h after feed distribution, for each day of studied periods
 - Body weight at 39, 53 and 68 days old
 - Speeds of daily feed intake (SDFI) calculated (per rabbit and per Kg LW)

Results and Discussion

- **Throughout fattening period** : Regardless the feeding strategy

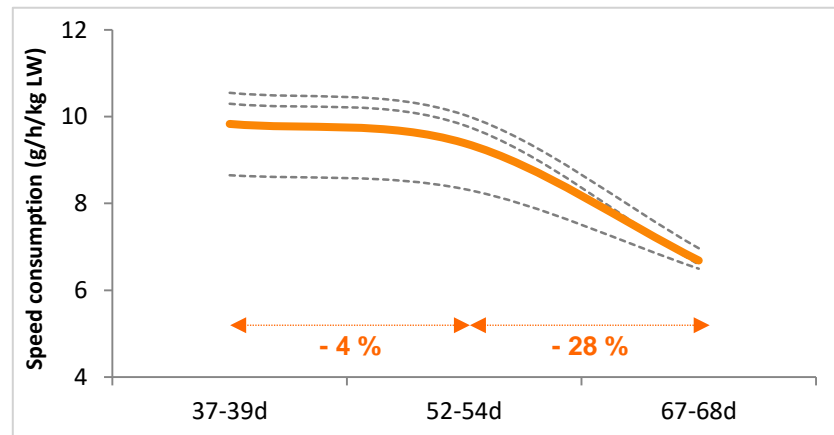
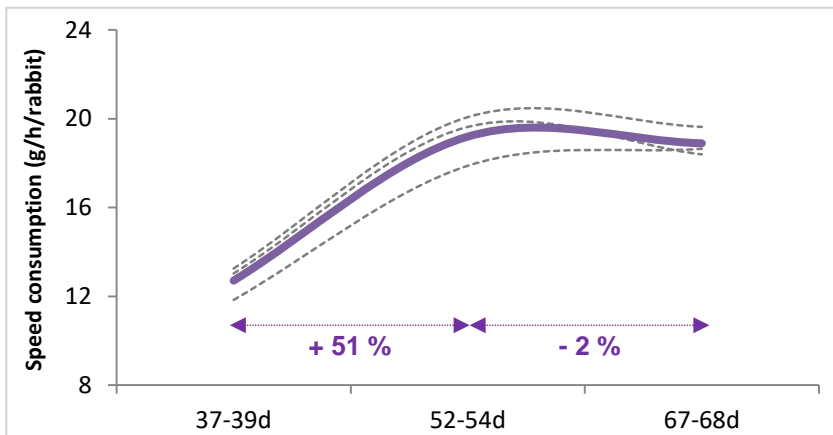


Speed of daily feed intake (SDFI) in **g/h/rabbit**

- Average SDFI strongly increases and then tend to be stable,

Results and Discussion

➤ Throughout fattening period : Regardless the feeding strategy

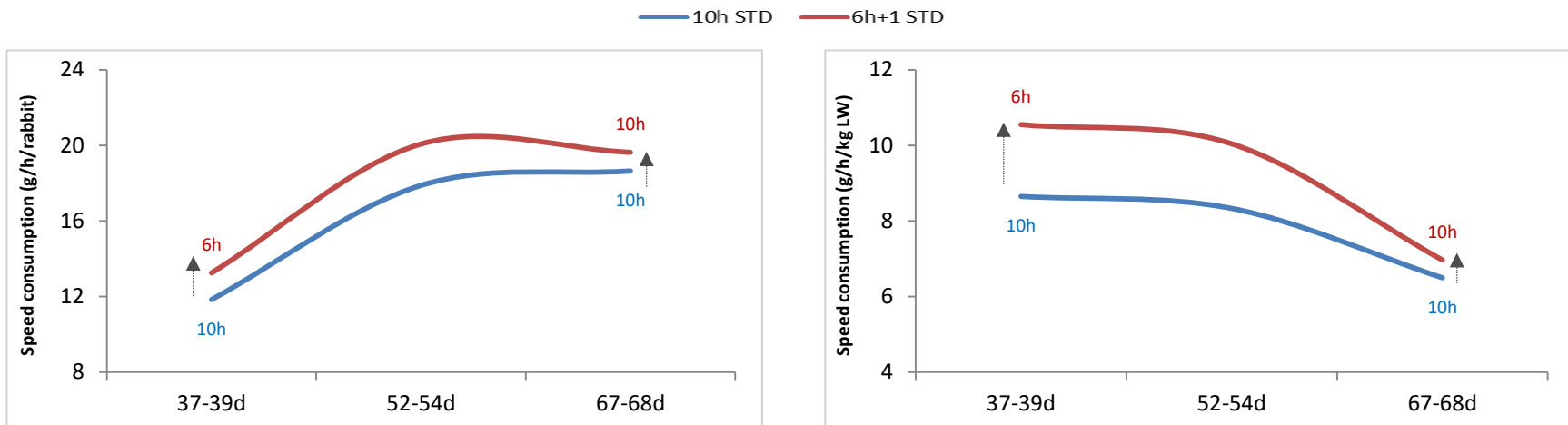


Speed of daily feed intake (SDFI) in **g/h/rabbit** and in **g/h/kg LW** depending on the period

- Average SDFI strongly increases and then tend to be stable,
- Weight exemption allow to deduce that SDFI strongly influenced by animal weight with an effect of age,
- Same trends for the 3 strategies studied, with difference of speed according to groups.

Results and Discussion

- Throughout fattening period : effect of restriction level (**10h STD** versus **6h+1 STD**)

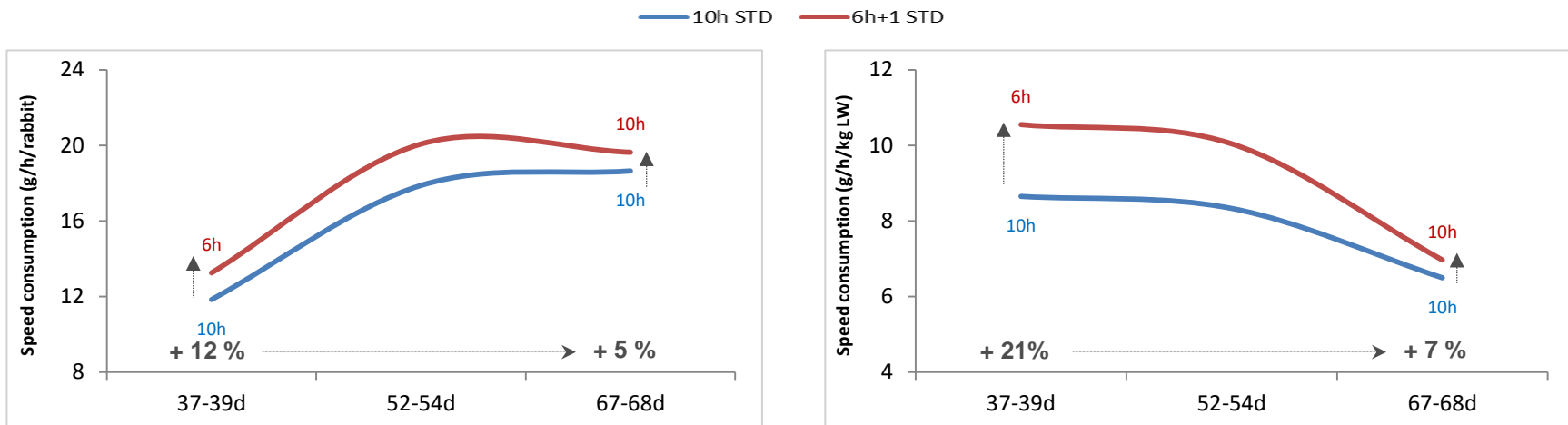


Speed of daily feed intake in g/h/rabbit and in g/h/kg LW depending on the period

- A more restriction of feed increase SDFI (per rabbit and per Kg LW)

Results and Discussion

- Throughout fattening period : effect of restriction level (**10h STD** versus **6h+1 STD**)

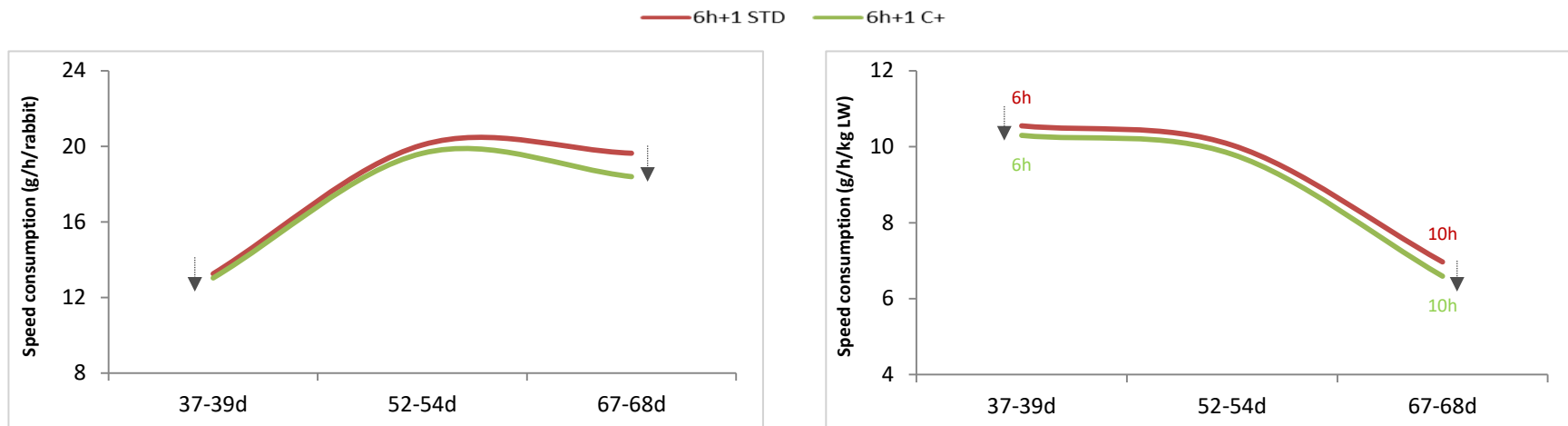


Speed of daily feed intake in g/h/rabbit and in g/h/kg LW depending on the period

- A more restriction of feed increase SDFI (per rabbit and per Kg LW)
- Difference of speed between **10h STD** (8.5 g/h/kg LW) and **6h+1 STD** (10.3 g/h/kg LW), decrease as the difference of feed access reduced between groups.

Results and Discussion

- Throughout fattening period : effect of feed concentration (**6h+1 STD** versus **6h+1 C+**)

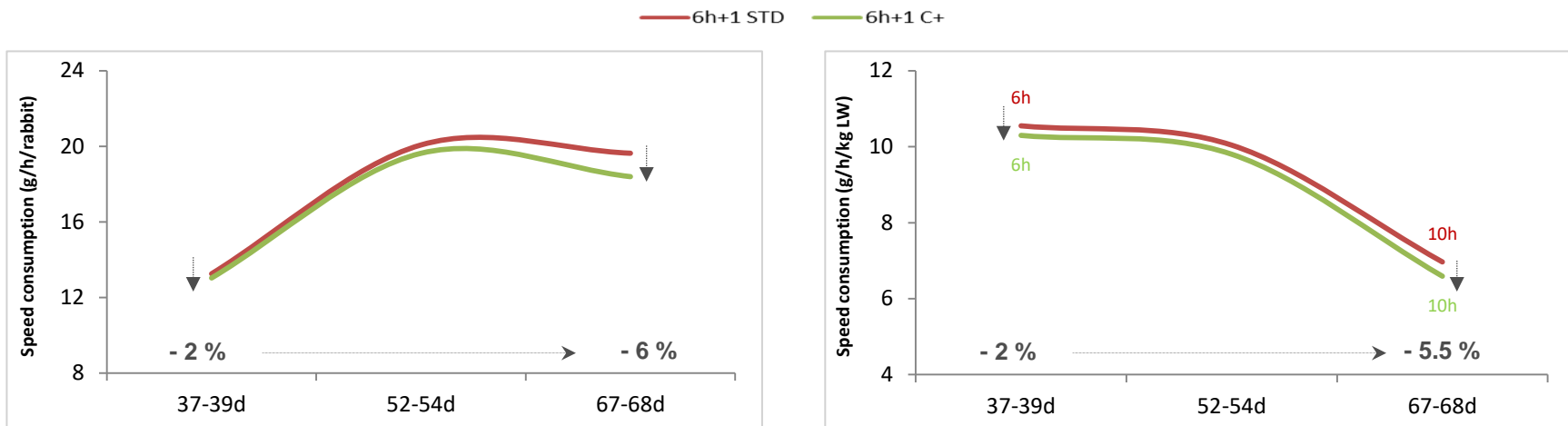


Speed of daily feed intake in g/h and in g/h/kg LW depending on the period

- A more concentrate feed, tends to decrease speed of feed consumption (per rabbit and per Kg LW)

Results and Discussion

- Throughout fattening period : effect of feed concentration (**6h+1 STD** versus **6h+1 C+**)

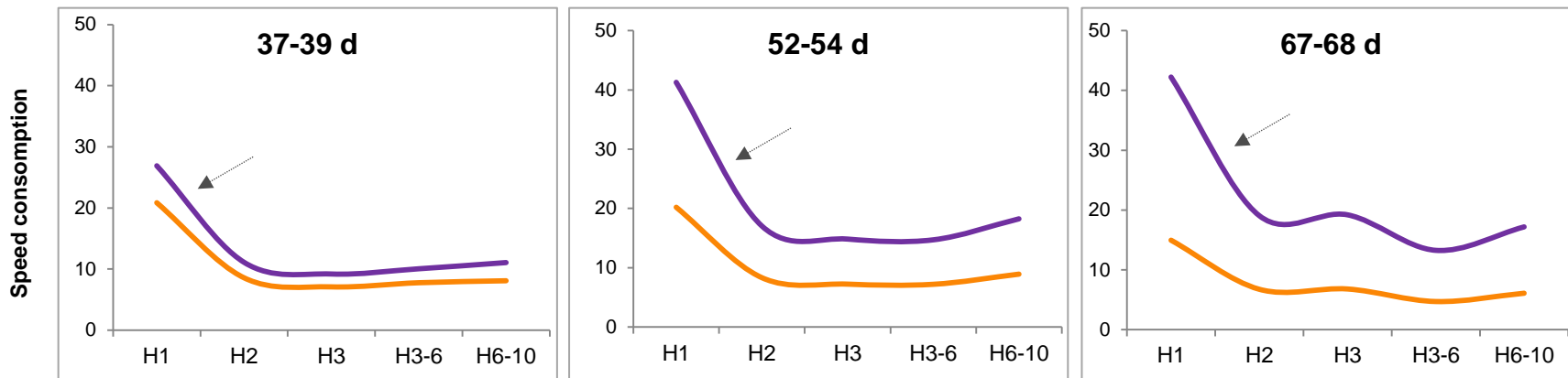


Speed of daily feed intake in g/h and in g/h/kg LW depending on the period

- A more concentrate feed, tends to decrease speed of feed consumption (per rabbit and per Kg LW)
- The difference of speed increased with animal's age.
- Probable regulation of feed intake to nutritional level, as described by Gidenne *et al.* (2009) : regulation quite small during 2 first weeks, and bigger at the end of fattening.

Results and Discussion

➤ Throughout the day : Regardless the feeding strategy

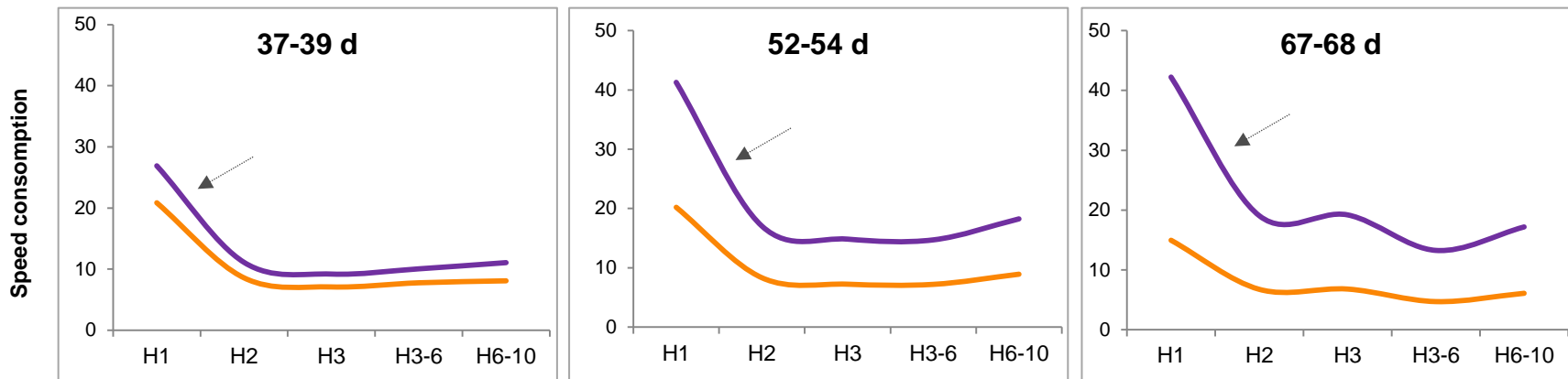


Speed of daily feed intake throughout the day in **g/h/rabbit** and in **g/h/kg LW** at 37-39d, 52-54d and 67-68d

- Regardless the age, the feeding strategy, and the expression of speed (per rabbit and per Kg LW) :
 - Higher speed of feed intake the 1st hour, then regulation for the next hours

Results and Discussion

➤ Throughout the day : Regardless the feeding strategy

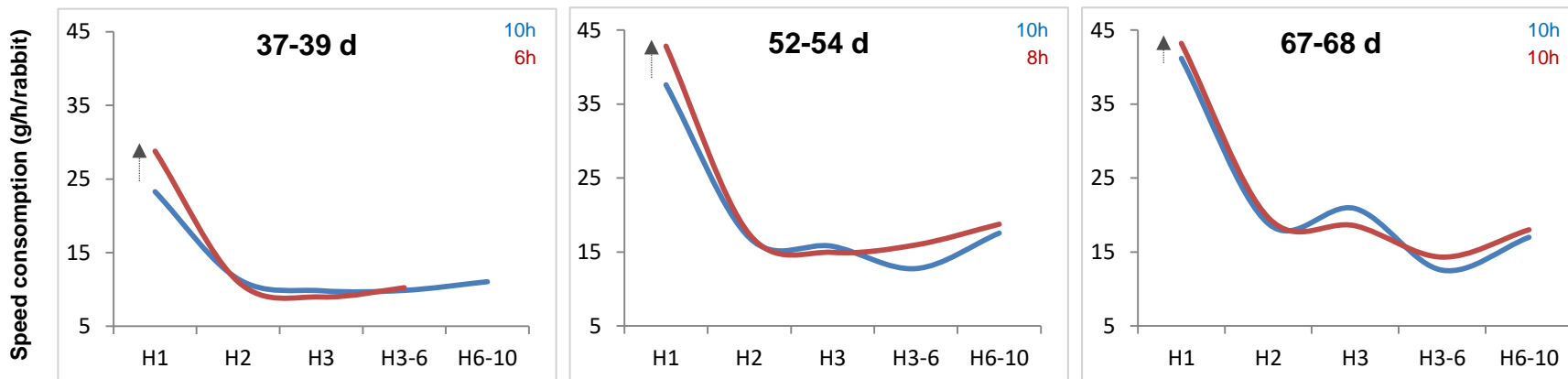


Speed of daily feed intake throughout the day in **g/h/rabbit** and in **g/h/kg LW** at 37-39d, 52-54d and 67-68d

- Regardless the age, the feeding strategy, and the expression of speed (per rabbit and per Kg LW) :
 - Higher speed of feed intake the 1st hour (x 2.5), then regulation for the next hours
- Same observation than in quantitative restriction noted by Martignon (2010) : rabbits had an irregular speed of feed intake, synchronized to the feed distribution period.

Results and Discussion

➤ Throughout the day : effect of restriction level (**10h STD** versus **6h+1 STD**)

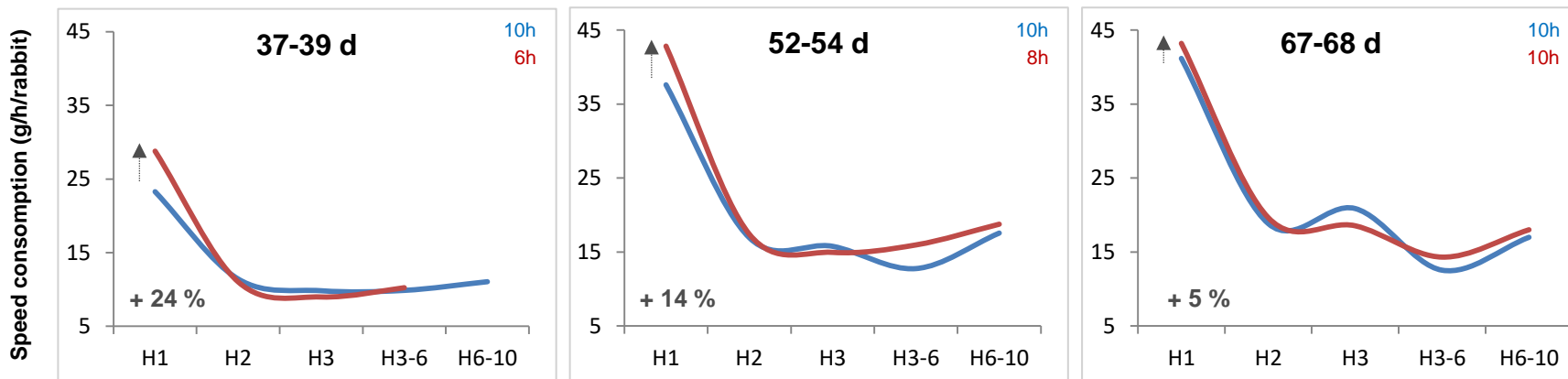


Speed of daily feed intake throughout the day in g/h at 37-39d, 52-54d and 67-68d

➤ The progressive hourly feeding increase the speed of feed intake, only of the first hour

Results and Discussion

➤ Throughout the day : effect of restriction level (**10h STD** versus **6h+1 STD**)

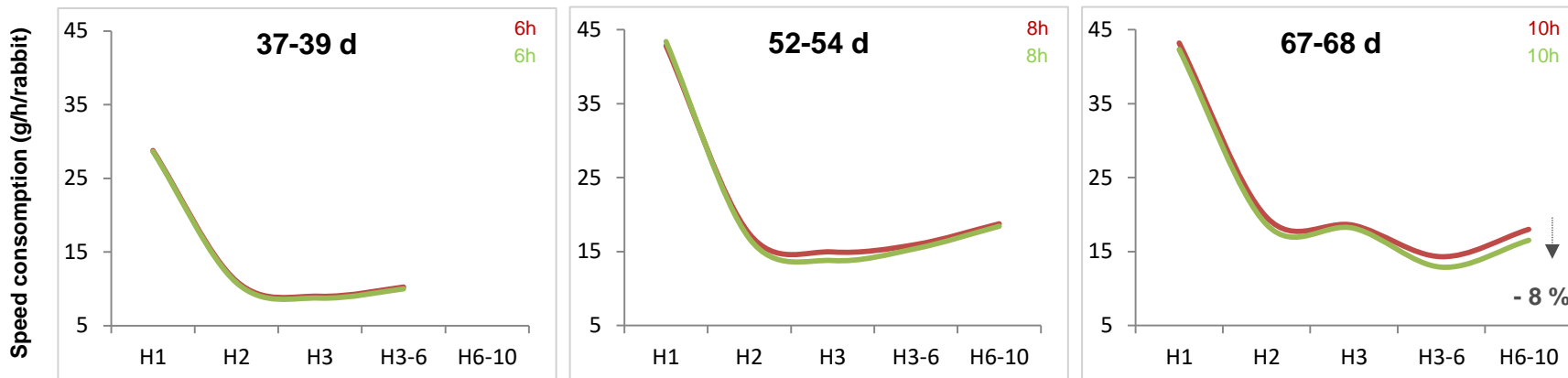


Speed of daily feed intake throughout the day in g/h at 37-39d, 52-54d and 67-68d

- The progressive hourly feeding increase the speed of feed intake, only of the first hour
 - During 37-39d, the **6h+1 STD** group consumed 5.5g/h more than **10h STD** group ($\approx +24\%$)
 - During 67-68d, speed of feed intake is nearly similar while both groups had 10h of access

Results and Discussion

➤ Throughout the day : effect of feed concentration (6h+1 STD versus 6h+1 C+)



Speed of daily feed intake throughout the day in g/h at 37-39d, 52-54d and 67-68d

- The more concentrate feed tend to lower the speed of feed intake throughout the day, but moderately and mainly at the end of fattening period ($\approx -8\%$) .

Conclusions

During fattening :

- In hourly feeding, the average SDFI is influence by several factors :
 - More live weight of animals or hourly restriction level increase, more the SDFI increase
 - Unlike more rabbits' age or feed concentration increases, more the SDFI reduce

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During fattening :

- In hourly feeding, the average SDFI is influenced by several factors :
 - More live weight of animals or hourly restriction level increase, more the SDFI increase
 - Unlike more rabbits' age or feed concentration increases, more the SDFI reduce

Throughout the day :

- Regardless the hourly feeding strategy, rabbits consume around 2.5 more quicker the hour following feed distribution, compare to the next hours.
- The effect of hourly feed restriction level on speed intake is mostly an effect on the first hour of the feeding program.
- The feed concentration has moderate influence on speed intake, that increases along the fattening (regulation of feed intake).

Conclusions

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 - More live weight of animals or hourly restriction level increase, more the SDFI increase
 - Unlike more rabbits' age or feed concentration increases, more the SDFI reduce

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- The effect of hourly feed restriction level on speed intake is mostly an effect on the first hour of the feeding program.
- The feed concentration has moderate influence on speed intake, that increases along the fattening (regulation of feed intake).

Results to be considered to better understand some behavior and technical results and to design new feeding strategies.



***Thank you
for your
attention***



Descriptive study of speed of fattening rabbits feed intake in constant and progressive hourly feeding with two nutritional levels of feed