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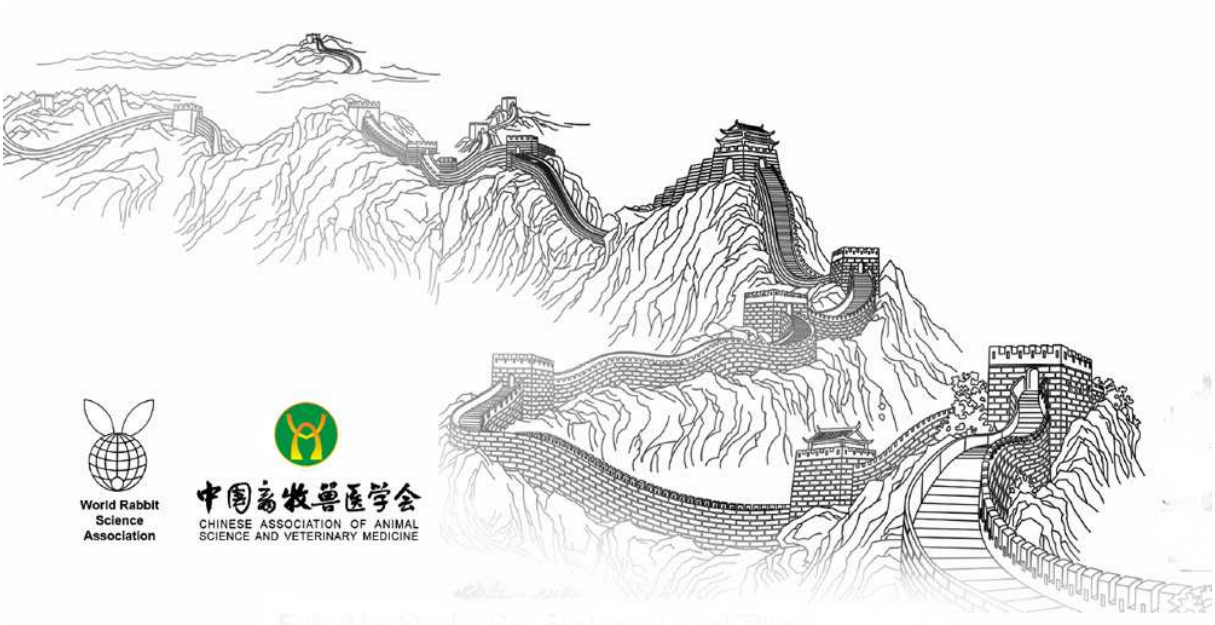

PASTURE FINISHING OF ORGANIC RABBIT: GRASS INTAKE AND GROWTH – FIRST RESULTS

Duprat A.[1], Goby J.P.[2], Roinsard A.[3], Van Der Horst F.[4], Le Stum J.[2], Legendre H.[1], Descombes M.[1], Theau J.P.[5], Martin G.[5], Gidenne T.[1*]

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ABSTRACT

This study aimed to obtain original technical references on fattening rabbits on pasture. Six trials were conducted on three sites (Oceanic, Semi-Mountain and Mediterranean climates) and two seasons (spring, autumn). For each trial, rabbits were allotted at weaning (around 52 d) in 6 movable cages (3 m² with 6 to 7 rabbits per cage) placed on pasture. Feed intake (grass and hay freely fed, and pellets given restricted) and growth was measured for 7 weeks (around 100 d, age at sale for French organic regulation). The total daily feed intake averaged 125 g dry matter "DM" (348 g fresh matter "FM"). Grass intake averaged 265 FM and 51 g DM/ rabbit/d, but varied greatly according to pasture biomass availability and quality (19 and 559 g FM/rabbit/d). There was an inverted exponential relationship between pasture biomass and grass intake. On a DM basis, the forage (grass and hay) intake corresponded to 35 to 60% of the whole DM intake. Rabbits reached at least 2.3 kg at l00 days old (growth: 22 g/d.). Pasture quality was an important factor for growth, since in the same site (M) and time, a 60% higher growth rate (17.2 vs 28.5 g/d) was obtained for rabbit grazing a sainfoin (legume) compared to a tall fescue pasture.

Key words: Organic rabbit farming, pasture management, grass intake

INTRODUCTION

Organic agriculture is developing worldwide. In Europe, the land under certified organic farming is increasing continuously since 1985 and has reached 11.5 million ha in 2013 (Willer and Schaak, 2015). As a result of the related increase in organic grain and forage production, between 2007 and 2013, organic animal husbandry has increased substantially for poultry (+78%), pigs (+32%), beef and dairy cattle (+50%) and sheep (+29%). Rabbit breeding on pasture is a very old practice, and was developed in France by C. Thermeau with the establishment of the specifications for organic rabbit meat production. Movable cages on grassland, based on the Morant model (1883), were mostly used by organic rabbit breeders (Margarit et al. 1999, Lebas *et* al., 2002, Mc Nitt *et al*. 2003), but more recently (from 2012) systems based on movable pens were developed. In France, most of pastured rabbits are presently produced under organic farming certification, but remains limited to about 20 farmers. This activity constitutes a rupture with conventional rabbit systems (battery farming), but is locked by the lack of basic technical and economical references, such as rabbit intake and growth at grazing and identification of main variation factors. Thus, we aimed to produce first and primary data to characterize herbage intake, feed intake and growth rate of rabbits raised on grasslands, under different environmental and management contexts (weather conditions, grassland type, feed supplementation). It focuses on herbage intake regulation which has never been studied for the growing rabbit.

MATERIALS AND METHODS

Experimental design

Since the environmental contexts should be a major factor of variation of pasture intake, study was run on three locations: oceanic (O), continental-hill (Ch) and Mediterranean (M) climates (near cities of Rennes, Egletons,

and Perpignan), and for two seasons (6 trials in all): spring 2014 (S1) and autumn 2014 (S2). In O, the same pasture was used in spring (O.S1) and autumn (O.S2): it contained *Trifolium repens*, *Medicago sativa*, *Lolium perenne*, *Poa pratensis*, *Bromus*, *Cynodon*, *Alopecurus pratensis*. In Ch, the same pasture was used in spring (Ch.S1) and autumn (Ch.S2): it contained *Lolium perenne*, *Trifolium repens*, *Trifolium pratense*, *Festuca*. In M, trials were run in a natural grassland in spring (M.S1) with *Avena fatua*, *Festuca arundinacea*, *Lolium perenne*, *Elymus repens*; then in autumn, in two almost pure stand in parallel: one with tall fescue (*Festuca arundinacea*, Mf.S2) and the other with sainfoin (*Onobrychis viciifolia*, Ms.S2).

Implementation

Rabbits were born and raised till weaning at the trial sites, and came from a mix of traditional breeds. At weaning (around 52d), rabbits were weighed individually and allotted into 6 movable cages on grassland, with a fixed density of 1 rabbit/0.4 m² till the end of the trial (9 weeks long) around 100d old (minimum age at slaughter for the French organic certification). For each trial, 6 to 7 rabbits were allotted (litter origin and weaning weight) in each of the 6 cages, placed in parallel in the pasture with a distance in-between cages of 0.5 m, and moved daily to provide fresh herbage. To measure the grass intake, samples of pasture were cut with an electric grass shear at two areas (0.25m²) of each cage: (i) between the cage and the neighboring one, to measure herbage allowance at grazing, and (ii) after moving the cage so as to measure herbage refusals after grazing. This was made weekly in M, and only three times per trial in O and Ch (at start, middle and end of trial) since worktime availability was low on these sites. Herbage samples were weighed fresh and then dried during 48 h at 60°C to calculate the intake by difference between allowance and refusals, for both fresh and dry matter (FM and DM). To be close to the practices in organic rabbit production, hay was provided *ad libitum* (top dress on the cage roof) and an organic complete pelleted feed was given daily, at a rate of 80g/rabbit (except for Mf.S2 and Ms.S2: 60g/rab. and without hay). Refusals (pellets of hay) were weighed every week, and when a rabbit died the refusal were weighed again.

Data Analysis

Data analysis started with normality analysis of the dataset to detect outliers. For instance, 12% of the data on herbage dry matter intake values were considered as outliers and dropped because of negative value, below 5 g or above 70 g of dry matter per kg of metabolic weight (MW) of rabbit and per day.

RESULTS AND DISCUSSION

In spring and among the 8 weeks of the fattening trials, in O.S1 and S.S1 biomass offered by the pasture increased greatly at the beginning, then reached the maxima at 30th d (3.5 and 7.4 t DM/ha respectively), and finally decreased slightly (Figure 1). In contrast, biomass of M.S1 increased slightly and peaked at the end (+2.3 t DM/ha from the 44th day). Compared to spring, biomass was about 20% lower for Ch site in autumn, but was 50 to 70% higher for O site. Along the trial, the available pasture biomass decreased gradually for O and Ch sites. In Mf.S2, biomass doubled within 3 weeks after start (from 0.9 to 2.1 t DM/ha), while it remained stable on the Ms.S2 (from 2.2 to 1.7 t DM/ha, Figure 1).

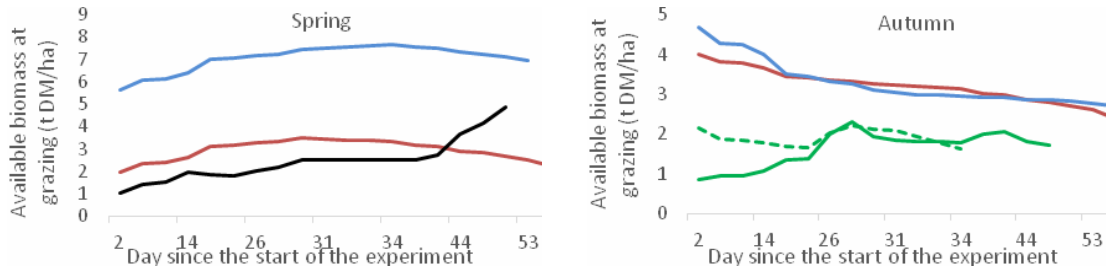

Figure 1: Available biomass (t DM/ha) over time in spring (left graph) and in autumn (right graph), in O (red line), Ch (blue line), M.S1 (black line), Mf.S2 (green line), and Ms.S2 (dashed green line).

The overall fresh grass intake ranged between 200 and 310 g FM/d/rab, and it reflected the intake capacity of the rabbit that could even reached a maximum ranging between 500 and 550 g FM per rabbit and per day. Expressed in dry matter, this corresponded to 30 and 80 g DM/rab./day, that was much higher than the hay intake (8 to 16g DM/d/rab). Globally the total forage intake ranged between 40 and 90 g DM/d/rab according to the sites, corresponding to 21 to 55 g DM/kg MW/d. The latter values were about half less than that observed by Cooke (2014) for wild rabbit (68 g DM/kg MW/d), since our rabbits also received 60 to 80g per day of a pelleted feed that reduced grass intake. As expected the grass intake (in g DM) varied according to the environmental conditions of each site (Table 1), and was very weakly related with the rabbit live weight (r^2=0.09, over the 6 trials). Because the pasture biomass is lower in autumn, the intake seemed lower compared to spring, but standard deviations were too high to detect a significant season effect (neither interaction between site and season).

Table 1: Intake and growth performances according to season and pasture site.

	Season 1			Season 2			
Site	**O**	**Ch**	**M**	**O**	**Ch**	**Mf**	**Ms**
Rabbit age (d) and live weight (g)							
Age at trial start	43	59	55	45	55	56	56
Age at the end	101	121	103	108	118	100	88
Weight at start	1693	1685	1333	1819	1360	1496	1572
Weight at the end	2554	3028	2590	2744	2645	2250	2459
Growth (g/d)	16.1±5.5^{b}	25.8±2.4^{e}	26.2±4.0^{e}	15.4±4.9^{a}	20.4±3.7^{d}	17.2±2.7^{c}	28.5±4.3^{f}
Mortality (deads/total)	2/36	2/42	2/41	2/36	0/42	0/14	1/15
Fresh grass intake (g FM/rab/d)*	287±75	254±105	310±68	219±45	210±183	202±36	255±48
*DM intake (g/d/rabbit)**							
Grass	55±18^{b}	39±27^{a}	78±11^{d}	35±16^{b}	31±13^{a}	51±7^{c}	51±11^{c}
Pelleted feed	72	71	69	72	71	52	52
Hay	8	6	16	6	5	-	-
Total	140	123	163	120	103	103	103

Means with different letters on the same row differ significantly (P<0.05); *: values eventually corrected for dead animals

The high variability in grass intake sourced mainly from individual (between cages) and over time variations. Indeed, grass intake varies greatly during fattening: maximal and minimal values are 7 and 152 g DM/rabbit/d respectively (or 19 and 559 g FM/rabbit/d, the latter being 1/4 of an adult rabbit weight). The variability over time is due to many factors: variation of rabbit weight, and variation of biomass and quality of pasture. For the M site, weekly measurements allowed us to calculate a linear relationship between the grass intake and the biomass availability (Figure 2). Since the range of biomass availability was larger in M.S1, it is also possible to fit the data by an inverted exponential curve (Figure 2), likewise the studies by Short (1985) and Falkenstein et.al. (1995) show that: GI=GIs x [1-exp(-(B-Br)/Bs)], with GI the grass intake, GIs the maximum one to be at satiety, B the biomass, Bs the biomass for which rabbit ingests 63% of GIs (satiety threshold), and Br the residual biomass after grazing. GIs value in our test (58 g DM/kgMW/d) lacks of precision because of few data at high biomass, but it is close to these results (68 and 40 g DM/kgMW/d resp.). From figure 2 (M.S1) we calculated that the grass utilisation rate by the rabbits ranged from a minimum of 80% at start (week 1) to 96% (weeks 5), and averaged 89% over the 8 weeks of fattening. This agrees with the low height of the grass after grazing: refusal height ranged from 2.1 to 3.0 cm that was limited by the mesh floor of the movable cage (about 2 cm height from the soil). This suggested that 0.4m² of pasture (defined as a minimum for organic certification) was not enough to cover the grass intake capacity of one growing rabbit, even complemented with 80g of a pelleted feed. The biomass availability would be thus a driving factor of grazing. Globally, in our pasture systems, the rabbits graze as low as possible, and the residual biomass (Br) in M.S1 was 0.3 t DM/ha. To reach good growth performances, the pasture should provide enough biomass so that rabbit can reach GIs. In M.S1 trial, with a fixed allowance (0.4 m²/lap.) this correspond to a biomass over 4 t DM/ha corresponding to a grass height (first leave) between 15 and 25 cm, and about 300 rabbits could be fattened on one hectare.

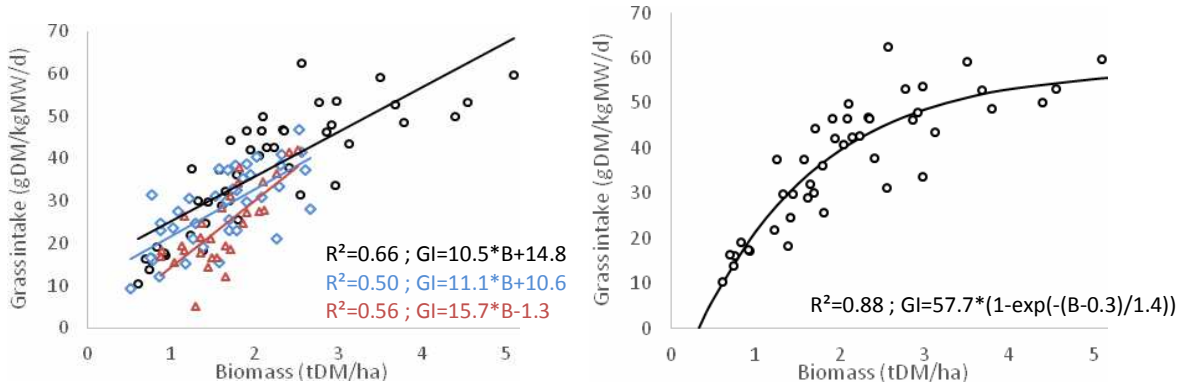

Figure 2: Relation between biomass and grass intake: linear regression (left graph) and exponential regression (right graph) for the trials M.S1 (black), Mf.S2 (blue), and Ms.S2 (red).

On average, growing rabbit ingested 353 g FM/rabbit/d, with 76% of pasture, 21% of complete pelleted feed, and 2% of hay. Although the hay was given freely it was of low consumption (6 to 16 g DM/rabbit/d). On a dry matter basis, the forage (grass and hay) intake corresponded to 35 to 60% of the whole DM intake (Table 1). Mortality was rather low (<7%), and final live weight ranged from 2.3 to 3.0 kg for more than 100d old rabbits (according to French organic standards). Mean growth was 21.7 g/d, close to value reported by Mc Nitt et al. (2003). Nevertheless, growth varied greatly, with an effect of the interaction: site/season. However, for O and Ch sites the growth was higher in spring, since the biomass availability was higher as well pasture quality, thus leading to a higher energy intake. Additionally the lower temperature in autumn could contribute to increase energy expenditure for maintenance rather than for growth. O has the lowest growth for both seasons, because of heavy weights at weaning and poor pasture quality (too aged). Pasture quality was an important factor for growth, since we measured at the same site (M) and time, a 60% higher growth rate (+9.2 g/d) for rabbit grazing a Sainfoin (legume) pasture compared to a tall fescue pasture (MF.S2).

CONCLUSIONS

The growing rabbit is able to ingest large amount of grass, until ¼ of its live weight. A good management of pastured growing rabbits should first take into account the pasture biomass availability and quality (age of grass, legume vs grass), and second the level of supplementation with a complete feed. Further studies are necessary to confirm these first original data, with more diversified climatic and pasture conditions, to elaborate recommendations for pasture finishing rabbit.

ACKNOWLEDGEMENTS

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PASTURE FINISHING OF ORGANIC RABBIT: GRASS INTAKE AND GROWTH – FIRST RESULTS

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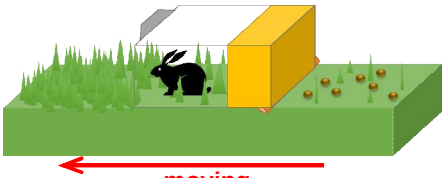
Context

- Organic agriculture is developing worldwide, but very few for rabbit breeding (n=30 rabbit organic breeders in France)
- Rabbit is an herbivore => link with soil => grazing
- Two systems : movable cages or small pens
- Lack of knowledge : pasture intake, impact of breeding environment, health management

Aims of this study

- Produce first data on herbage intake and growth rate for movable cages system
- Characterize factors involved in herbage intake regulation

Methods



- 3 sites : O, Ch, M
- 2 seasons : spring & autumn
- 6 movables cages, per site

Pastures in O and CH : multi-species pastures

Pastures in M : pure stands
Festuca compared to sainfoin

Trial = 9 wks : 52d (weaning) **to 110d** (slaughter)

7 rabbits per cage = 1 rab/0.4 m²

(=minimum rate according to the French regulation f organic rabbit breeding)

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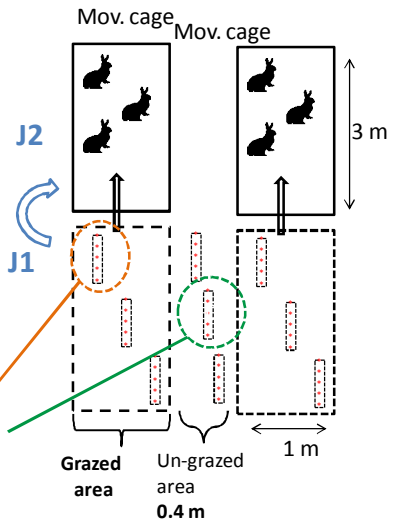
Methods

Grass intake : by difference between offer and refusal

Offered grass = sampling between cage
Refused grass = sampling after grazing



Sampling = cutting 0.25m² strands + weight

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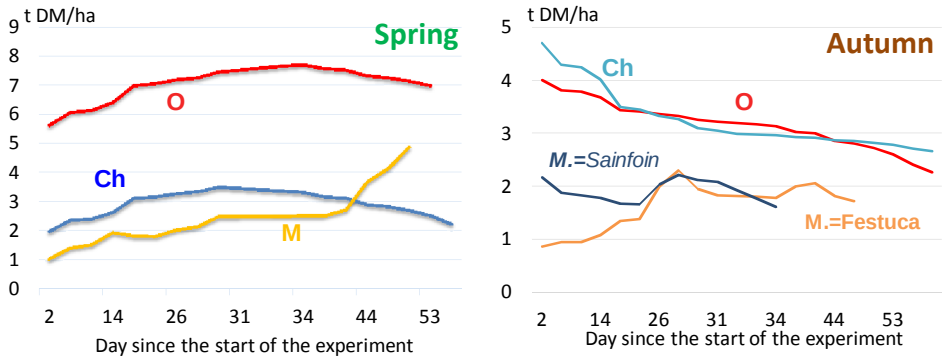
Results

Season effect on biomass availability



INTAKE

Fresh grass intake : **200-300** gFM/d/rab. (max. 550g)
FM basis = **76%** pasture (21% pellet+2%hay)

DM intake ñherbà 30 to 80 gDM/d/r
Hay intake : 8 to 16 DM/d/r
DM basis = 30-60% pasture

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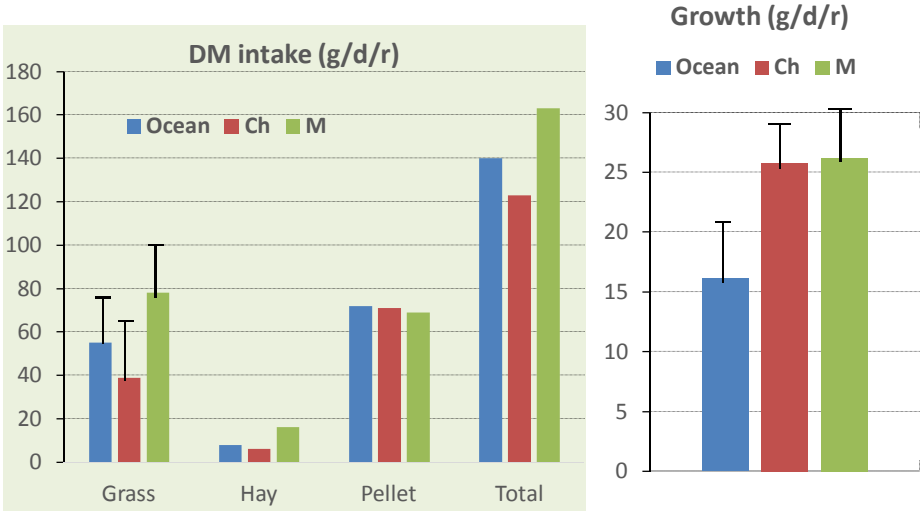
Feed intake and growth, according to sites, in spring



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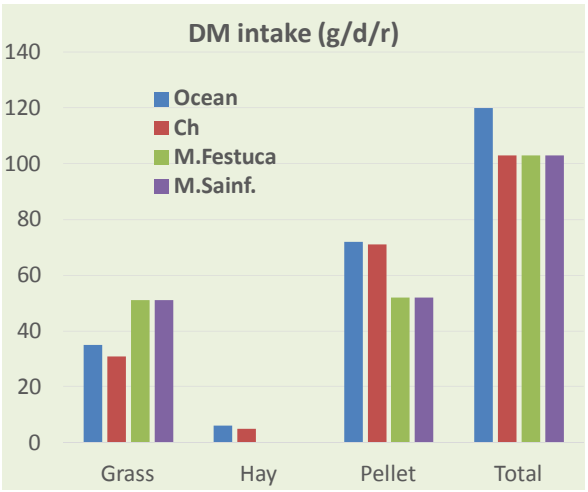
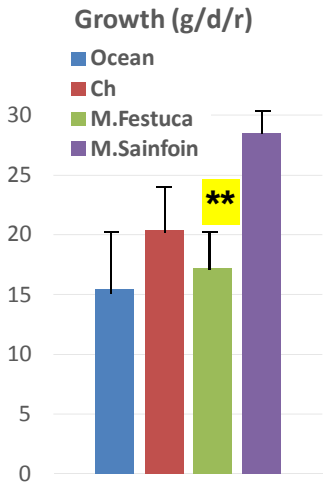
Feed intake and growth, according to sites, in autumn





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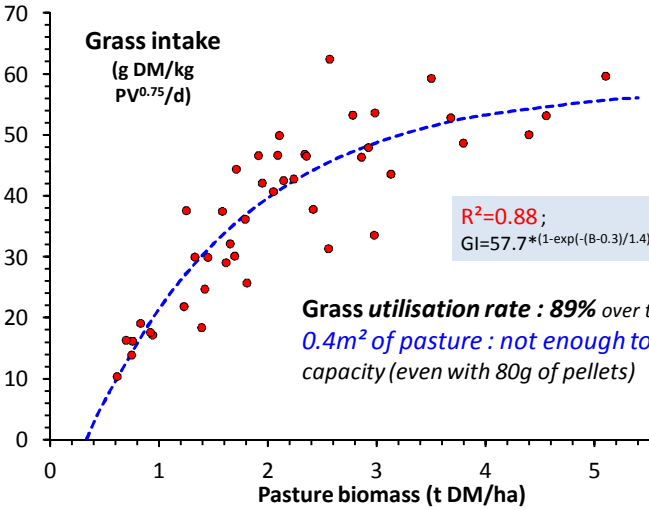
Relationship between the grass intake and the biomass availability



Data from M. in spring

Weekly measurements

R^2=0.88 ;
GI=57.7*(1-exp(-(B-0.3)/1.4))

Grass *utilisation rate : 89%* *over the 8 weeks of fattening.*

0.4m² of pasture : not enough to cover the grass intake capacity (even with 80g of pellets)

GI : grass intake, GIs the maximum GI to be at satiety, B the biomass, Bs the biomass for which rabbit ingests 63% of GIs (satiety threshold), and Br the residual biomass after grazing.

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Martin *et al.*, 2016 (Animal) *Short (1985) and Falkenstein et.al. (1995)*

.08

Take home message

- Pasture intake: **200-300 g FM OR** 30-80g DM/d/r
- Growth = 16-28 g/d, with large variations (site/season, pasture quality).
- Live weight : 2.3 to 3.0 kg at 100-110 d old rabbits.
- **Pasture quality =** important factor for growth (60% higher with a **legume** "Sainfoin")

Sainfoin stand (M site)

Conclusions

- YES : pasture fattening gives proper performances
- **Need**: a good management of pasture
- Level of supplementation with a pellet : could be decreased
- **To be continued**, prior elaborations of recommendations for pasture finishing rabbit

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