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ORGANIC RABBIT FARMING: SHOULD WE BE AFRAID OF GASTRO-INTESTINAL PARASITES?

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Abstract: Gastro-intestinal parasitism in pasture raised rabbits was studied during three seasons: winter 2014, summer 2015, spring 2016. For every season, two groups of five movable cages (3 rabbits/ cage) were disposed from weaning to 100d. old, on a sainfoin or on a grass plot. A high prevalence of *Trichostrongylus* sp. (93% of rabbits) and a 50% increase in the fecal excretion of oocysts was found in spring, particularly in sainfoin pasture (6.5 M. OPG) where the rotation times was shorter. No diarrhoea was observed during the trial; at slaughter (100d old), no intestinal macro-lesions in were found, but 64% of the livers had whitish nodules (*E. stiedae).* Infection by *Trichostrongylus* sp. was negatively correlated to the daily weight gain. Fecal excretion of *E. flavescens* may explain partly the lower daily weight gain (-5 g/d) in spring. Our results suggested to increase the pasture rotation delay over the two months requested by current organic rabbit farming regulation.

Introduction: The management of parasitism is one of the major obstacle to the development of organic rabbit farming (Roinsard et al., 2013) which relies on grazing. Rabbits with access to grazing are *a priori* subject to a greater risk of parasitic infection compared to indoor conventional rabbit farming (wire mesh cages), and in particular with strongyles of stomach (*Graphidium strigosum*) or small intestines (*Trichostrongylus retortaeformis, Trichostrongylus* sp.), with possible consequences on the digestive physiology and growth of the host. Coccidiosis (genus *Eimeria*) is also an important parasitosis in grazing and indoor rabbit breeding systems, but their characterization remains to be determined for outdoor systems. Therefore, our goal was to study gastrointestinal parasitism in grazing rabbits, to improve the knowledge of the parasitic risk of grazing and to consider recommendations for prevention

Material and methods: The trial was conducted on the experimental farm of the University of Perpignan, in accordance with the French regulation for organic rabbit farming, during winter 2014/2015, summer 2015 and spring 2016. At each season, 30 rabbits were allotted (according to weaning weight and litter origin) at weaning (between 41 and 48 days of age) in two groups of 15 and housed in movable cages (3 rabbits per cage, figure 1) for 9 weeks, disposed either on sainfoin or a grass plot, with a daily grazing area of 0.4 m² per rabbit. Weekly, a sample of feces was collected for each movable cage. For each sample, counts of nematode eggs (EPG) and of Eimeria oocysts (OPG) by the modified Mc Master method was performed. Every two weeks, Eimeria oocysts were identified at the species level, according to a list of morphological criteria. At slaughter (around 100 days of age), the digestive tract (stomach, small intestine, cecum and colon) of some rabbits (Winter: 10, Summer: 20, Spring: 28) was stored at -20° C until parasitic assessment. The liver was examined for the presence of whitish nodules, characteristic of *Eimeria stiedai*

An analysis of variance for repeated measurements was performed using R software on nematode egg counts after logarithmic transformation ($\log_{10}(x+1)$). Total oocystal excretion during the fattening period was analysed by the area under the curve method, calculated for each cage, between the day of age and OPG. A linear regression between the number of *Trichostrongylus* sp. (after logarithmic transformation) and average daily gain (ADG) with the type of pasture (mostly grass or sainfoin) as fixed effects was performed using the Jamovi software. For significant correlations ($P < 0.05$)

between total and specific oocystal excretion for each mobile cage and growth rate, a linear regression with factors of season and type of grazing was calculated. A Chi² test was set up using the R software to compare the proportions.
Results: Nematode egg excretion was almost null during winter 2014/2015 and summer 2015. No effect of grazing on egg excretion was detected (P = 0.70) during the spring period (2016). In spring 2016, the total oocystal excretion level doubled from previous season (+ 50%) especially on the "sainfoin" grazing (6.5 vs. 4.2 M.OPG) where the return period on the plot was shorter (<3 months). One of the most pathogenic *Eimeria* species, *E. flavescens* was identified during the summer of 2015 and the spring of 2016.
While the prevalence was low in winter 2014/2015 and in summer 2015, spring 2016 was characterized by the high prevalence of *Trichostrongylus* sp. (93% of rabbits). The prevalence of *Passalurus ambiguus* was still above 70%. *Graphidium strigosum* was only found in two rabbits grazing sainfoin in spring 2016. The spring season has favourable weather conditions (humidity and temperature) for the Trichostrongyloidea and Emerian cycles, which can explain the high level of infection compared to winter 2014/2015 and summer 2015.
The return time on sainfoin (<3 months) was much lower than that for tall fescue, and is probably a determining factor in the increase in *Trichostrongylus* sp. in spring, and observed pattern of oocystal excretion. It should also be added that, the sainfoin plot was irrigated by sprinkling, probably increasing the humidity of grass and parasites multiplication.
The oocystal excretion of *E. flavescens* was correlated with the rabbit growth rate (P <0.05, r = 0, 485, df = 28, Figure 2). A significant negative correlation between infestation intensity with *Trichostrongylus* sp. and the growth rate [ADG = 1.1 log (*Trichostrongylus* sp. intensity) + 20.8] was detected, but with a low incidence (r = 0.275, df = 56, P <0, 05). This corroborated by the demonstration of the effect of the level of infestation on the overall growth rate (P <0.05), which decreases by 5 g/d between the spring of 2016 and the other periods where *Trichostrongylus* sp. had hardly been found.
No signs of diarrhoea or macro-lesions were observed during the study. Liver examinations revealed a high proportion (64%) of whitish nodules attributable to *E. stiedai;* after the end of the study, the proportion of liver with nodules decreased (unpublished data). Post-weaning mortality was less than or equal to 10%, and did not increase in the spring of 2016. Nevertheless, the limited numbers of replicates do not make possible the statistical analysis of this relationship.
Discussion: The lower weight gain in spring would be related in part to the increase in nematode populations, without it being possible to rule out a less favourable effect of environmental conditions during the trial or during the pre-weaning period on the resilience of the rabbits (Seltmann et al., 2019; Mykytowycz, 1962). Increasing in the humidity level of the pasture (e.g sprinkling) may induced differences in vertical mobility of larvae of Trichostrongyloidea, and thus higher risks of infestation (Niezen et al., 1998). For Mykytowycz (1962) *E. stiedai* largely fluctuates in rabbit, thus explaining our variability in frequency of liver macrolesions according to seasons. To conclude, spring presented the higher risk of parasitic infestation for rabbits, with reduction of the growth rate. We suggest to increase the return time of rabbits on the same grazing area, beyond the two months recommended in the French specifications of organic rabbit farming
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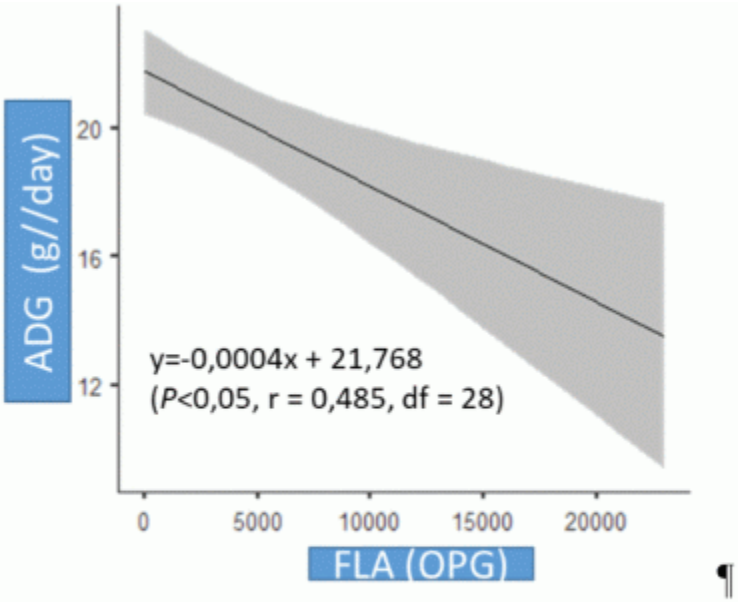
Image:

Figure·1·-·Mobile·cages·on·sainfoin·plot·(Spring·2016)¶

Image 2:



Figure· 2· –· Relation· between· fecal· oocystal· excretion· of· E. flavescens·(FLA)·and·average·daily·gain·(ADG,·95%·CI)·from weaning·to·slaughter.¶

Disclosure of Interest: None Declared

Keywords: rabbit farming, parasitism, pasture, season, coccidiosis