3.5.Transformation of gastro-intestinal parasites management scheme in the context of suckling herd conversion to organic farming

A comprehensive approach of breeders practices : from concepts learning towards a coherent modification of the systems of practices

Daniel Jamar, Pierre Stassart, Virginie Decruyenaere, Didier Stilmant

1 Context

In a first hand, we have identified, based on the driving forces that have led to suckling farms conversion to organic farming, three mains types : The ones who have made their conversion for the "market", "environment" and the "holistic" conversion (**Chap. 3.6.** "Link between market access and environmental pressure of organic beef production systems"). In a second hand, some tensions, between organic rules and agro-food chain expectations (**Chap. 3.2.** "Missing protocols and legitimacy systems"), have been highlighted by breeding practices close by organic rules limits and focussed on the knowledge, the coherence and the competencies of the conventional frame of references. Indeed, face to this conventional frame of reference, the organic frame and its actors remain, from a conceptual and a technical point of view, are not well fitted out (**Chap. 1.1.** "Equipping sustainable production chains").

1.1 The tensions in link with the animal health and the grazing managements

From the organic rules point of view (EU regulation 1992), it is prohibited to administer allopathic treatment in a preventive way and the herbivores have to graze as soon as the soil and climate allow it.

- ***ANN.I.B.5.4.****b : If the product aforementioned (not allopathic) are not efficient enough to fight against the disease* ***and*** *if the care are essential to reduce animal distress and pain, it is possible to use, under the responsibility of a veterinarian, allopathic veterinarian drug from a chemical origin or antibiotics, (…)*
- ***ANN.I.B.5.4.c*** *: the use of allopathic veterinarian drug from a chemical origin or of antibiotics to perform preventive treatments is prohibited. [is considered as preventive : … all the treatments performed without or before any symptom manifestation by the animal….*
  - *… treatment applied without or before that the health problem have been diagnosed*
  - *… treatment applied in a repetitive and collective way on an animal group (AMB)* [(3)]*]*
- ***ANN.I.B.8.3****.1 : ….. herbivores have to have free access to grasslands as soon as the conditions allow it.*
- ***ANN.I.B.8.3.****4 : as a derogation to the point 8.3.1., the final phase of cattle fattening … can take place in the cowshed if the time spent inside does not*

[(3)] Belgian Ministerial Order

exceed one fifth of animal lifetime and, in any case, a period higher than three months …

1.2. Hypothesis and objectives

The following hypothesis can be drawn from these observations :

1) In link to their re-conversion mode (**Chap. 3.6.** “Link between market access and environmental pressure of organic beef production systems”), breeders will face the parasitism problem and develop different practices more or less in coherence with the conventional approach.
2) The analysis of the grazing management of these groups of farmers will inform us about their perception of the parasitism problematic.
3) There is a difference between the means obligations of the organic rules and their translation in the field that the under-equipment of the organic frame of reference does not allow to face.
4) A re-conceptualisation, through cross learning process, of the triangular relation existing between the cattle, the parasites and the grassland is necessary to equip organic farmers with coherent and efficient practices, and this more especially during the re-conversion phase.
5) Such learning process re- questions (1) the pertinence of organic system to answer the environmental challenge and (2) the tensions existing between the agri-food chain (convention of qualification and convention of effort) (**Chap. 3.2.** “Missing protocols and legitimacy systems”) and the organic convention (agri-environmental premiums, certification) (**Chap. 3.6.** “Link between market access and environmental pressure of organic beef production systems”).

In this context, the aims of this research are (1) to identify the diversity and coherence of the parasite management practices, (2) to understand breeder conceptions under-leading these practices, (3) to interpret them, together with some co-constructed alternatives, in terms of farming system management, environmental pressure, food-chain management and product qualification.

2 Material and methods

This research, even if “eco-centered”, is in keeping with the “holo-centered” research intervention (Hubert 2004) performed in the field of a super-market organic meat agri-food chain. However, the breeding taken into account in this work are not limited to the furnishers of this chain.

2.1 Heifers follow up during the grazing season

Fifteen suckling farms, representative of different Walloon agricultural areas and from different re-conversion mode to organic farming (**Chap. 3.6.** “Link between market access and environmental pressure of organic beef production systems”) (table 1), were followed up.

Table 1 : Typology of the 15 farms followed up in linked to their location and conversion mode

	Location					
Conversion mode	*Hesbaye Limoneuse*	*Condroz*	*Famenne*	*Gaume*	*Ardenne*	*Ardenne Liégeoise*
Market				MER	PIE, LOT,DEL, DEL, ANN, BUR, GUI	STE
Environment	DUM	GRE	HER, DEC			
Holistic	PAQ			HAY	KIE (meat and milk production)	

Within each of these farms, heifers groups were followed up from weaning till covering during two seasons : 2003 and 2004. Each animal was weighed at turnout (April-May), during the grazing season (July-August) and at the end of this season, in November. Each weighing was coupled to the sampling of blood and faeces for, respectively, an analysis of the pepsinogen content within the serum (Vercruysse) and coproscopic analysis, both by floating and Baerman methods in order to quantify the eggs of the main parasite groups and the larvae of the dictyocolus parasite responsible of the pulmonary bronchitis.

Grazed grasslands were visited monthly in order to characterize grass availability, through sward surface height measurement, and quality, through the characterization with NIRS technique of the feeding value of a grass sample picked up in a transect of the grassland. A mixed sample of fresh faeces was also picked up in order to perform the same coproscopic analyses as presented here over. Farmer practices (treatment, animal rotation on the different grazed grasslands batching, supplementation, mowing, refusal cutting, ...) were recorded all along these two grazing seasons.

2.2 Recurrent intervention with the farmers and learning groups

We have reaped advantage from the sampling and weighing process to maintain, in a recurrent way, an interactive and close contact between the different actors and heifers within a informal group composed of technicians, researcher, farmer, veterinarian,... The aim of these interactions, going beyond the weighing frame, was to allow us to highlight, to identify the conceptions existing behind these practices, their justification as the question they generate. In fact we did not want to define the common rules existing across the different systems of production but, at the opposite, to identify the particularities, the surprises that do not find some explanations in the conventional frame of reference in order to draw new hypotheses, to open new perspectives in terms of herd – environment and of breeder-consumer interactions.

In an other side, learning groups, including breeders, popularizers and experts, had been organized on thematics such as parasitism management, grassland quality evaluation, ...To modify principles well established in the collective experience in order to favor cross-learning phenomena is an unusual work in term of knowledge implementation, in term of actors networking and in term of scale shift.

1) <u>Time scale</u> : from the instantaneous scale of the coughing animal to the period during which it get thinner, from the animal getting thinner to its breeding career, from its life to the herd dynamic;

2) Space scale : from the parasite to the animal, from the animal to the grassland[24], from the grassland to farm and from farm to territory and European Union management;

3) Management scale : from the infected lung to the coughing animal, from the animal to the group of cattle sharing the same grassland and the same history, from the animal group to farm herd, from herd to farm management and from farm management to the corresponding agri-food chain management.

Such permanent scale shift needs an outbreak towards other forms of knowledge mobilization and networking, forms having to face the closure of the conventional and shared referential. So it was necessary in the learning groups setting up to operate a displacement in a double move : one move allowing to have a distant view of the problem through the introduction of new competencies, images, models or projects in regard to the shared referential[25] and, simultaneously, a move, induce by the introduction of new relations[26], allowing to set side by side the knowledge so mobilized and the previous, actual or future experience of these different actors. In order to allow such a double learning move, it is fundamental to meet two conditions of work : (1) to stand such intervention on some 'tensions', to say on some questions that are real stakes for the actors involved in the research, and (2) to evolve in 'protected condition', to say out of the short term and of its menace of detrimental and irreversible consequences.

2.3 Interpretation and results analysis

Due to the high systems’ diversity, in terms of breed, stocking rate, type of end product, pedoclimatic conditions, …these results did not allow the establishment of statistical analysis and comparison. We focused our attention on graphical and so qualitative representation of the interaction existing between the grasslands and the stock which valorized it including the observed parasitic pressure. This in order to understand, to develop and to present practices allowing parasite problematic management in organic systems.
In order to allow such representation and comparison, a synthetic index of the parasitic pressure (IPP) exerted by gastro-intestinal worms was established on the basis of the results of the coproscopic analyses and of worm species fertility and virulence..

IPP=[(OEST*2)+(TRIC+COOP+NEMA+STGO+STGU)]*2
with OEST, TRIC, COOP, NEMA, STGO, STGU are the semi-quantitative quotation, on a 1 to 5 scale, of the eggs densities observed in the faeces, respectively for the worms of the groups OESTERTAGIA, TRICHOSTRONGYLUS, COOPERIA, NEMATODIRUS, STRONGYLOÏDES.

The Dictyocolus presence index (IPD) takes the value 0 or 1 if the Baerman’s test is, respectively, negative or positive. An index of internal parasitic pressure (IPA) was also defined as the pepsinogen content within the cattle serum (Utyr).

24 A grassland 'in state' doe not develop the same biodiversity, the same landscape than a grassland in 'bad state'.
[25] Homeopath, natural grassland from naturalist point of view, autonomous model, ….
[26] Relations between breeders and veterinarians, breeders and their stocks, …

3 Results

3.1. Parasitism representation inherited from the conventional referential (Chap. 1.1. "Equipping sustainable production chains")

These approaches have confirmed at which extend organic farmers have conserved the conventional representation of the parasitical problematic, specific to the Belgian Cattle Breeding sector. This specificity was confirmed by independent evidences from three professionals outside of the local frame of reference.

Breeders are aware of the forms taken by the parasites within their stocks; external parasites such as mites, intestinal or pulmonary worms, liver or rumen fluke; but not of the forms taken by these parasites in the grassland. In particular, the mites responsible of the scab is a crucial problem in Belgian Blue Breeding system as this breed, with a very thin skin, is highly sensitive to this parasite. In a few weeks, exasperated by the itching sensation, the skin consumed by these microscopic mites, the animal covers itself from black scabs that are bleeding slightly and have a putrefaction odor. Such view is totally incompatible with the breeder's image of the animal in good state. Defenseless, face to this mite, the animal "tired out" quickly loses weight. To control this pest, the breeder has to perform a triple intervention : to shave the animal, to 'wash' it with a product killing mites through a contact action and to inject a double dose of a product with some ivermectin acting in a systemic way. Such treatment allow to improve, temporarily the animal health status and performances till next scab crisis that can reach young as well as adult Belgian blue cattle, needing a permanent attention from the breeder side.

We insist on this parasite, even if organic breeders have, for the greater proportion of them, initiated the re-conversion of their cattle herd towards breeds with a high level of scab resistance, because we observed that this scab model is the reference for these breeders and, as a reference, it define the way the breeder represent themselves the other types of cattle parasites, their virulence in the animal and the efficient way to control them. However, gastro-intestinal parasites have, with the grassland and the herd, a complex interaction, very different from the one developed by scab mites : eggs or larvae are disseminated through the faeces in the sward where, once they have evolved towards infestant forms, they 'wait' to be ingested by grazers to start a new cycle within their host. Cattle is mainly sensitive to such parasite during the two first years of its live during which it develops an immunity without memory. Such cyclic, eco-centered, representation of worm live is difficult integrate by veterinarians and breeders focused on scab model. From the animal suffering from external and perceptible parasites, breeder shifts to the animal suffering from internal parasites. From this conceptual model, breeder imagine a defenseless cattle, with digestive guts 'crawling with worms', and have some difficulties to apprehend the complexity of the host-parasite-grassland interaction. Now this model is in harmony with their perception of a good grazed grassland, close from the over-grazing, favoring worms pressure. So, the grazing cattle, without any immunity, any competence to face its parasites, had to be 'protected' while the parasite has to be extirpated from its host and eradicated : a good parasite is a dead parasite !

Breeders and veterinarians have a wide panel of anti-parasitic product or vermifuge, to be use to extirpate all the internal parasites from the ruminants. In order to promote the use of such products, in the field, animal health industry use some representation on which you can see young cattle without defense aside with all the panel of isolated parasites, magnified more than 100 times, focusing, in this way, on the polarity existing between the parasite virulence and the animal disease, without any place for the role played by the grassland. In consistency with this shared model, searchers, veterinarians and breeders have developed the knowledge, the know-how and the tools necessary to perform preventive, systemic and highly persistent, wide spectra, vermicide treatment schemes. The performance of such scheme is measured by the absence of gastro-intestinal worms and by a good "animal state". The concept of total parasite control has led to the development of the bolus concept in order to 'protect' the cattle against 'parasite aggression" during all the grazing season or, in a more radical way, to the zero-grazing concept.

So, an healthy cattle is a "protected" animal, "in condition", without parasite. He does not cough and has regular performances (milk yield, liveweight gain, ...). All these criteria allow, to the veterinarians and to the breeders, to manage the parasite problematic in an efficient way in an eradication scheme in coherence with their perception of "a good parasite". Nevertheless, such perception, in preventing the expression of cattle immunity and of the complex relations existing between the herd, the grassland and the parasites, has an opacity effect on other human and no human knowledge

3.2 Possible modifications, in terms of representations and practices, following the conversion to organic farming

Such perception is not coherent with organic rules principles leading to practices flirting with the limits of minimalist translation of organic rules. However, in the organic referential, these practices, reliable to the parasite perception within the conventional frame of reference, loss their coherence and efficiency without to emerge on new coherence allowing to reach both organic norms and an efficient parasite management. In such intermediary and uncomfortable situation, breeders have developed three parasitism conceptions in link to the driving forces that led them to convert their system to organic **(Chap. 3.6.** "Link between market access and environmental pressure of organic beef production systems").

The <u>"market" breeder</u>, who does not find any efficient alternatives, comes back to practices very close from conventional ones with :

- Systematic treatments, i.e. for the heifers, qualified as curative on the basis of faeces analysis or of veterinarian prescription;
- Important grassland access restriction for the fattened bulls.

His parasitism perception as his performance criteria remain unaltered. He remains in the conventional frame of reference to perform his learning.

The "<u>environmentalist" breeder</u> remains in an intermediate position and let the nature make its job. Without taking into account preventive measurement, recommended in the organic principles, he has to face, some years, some diseased animals needing curative allopathic intervention. His practices, more extensive, on the one hand, limit the pressure exerted by the parasites and, on the other hand, could accept some delay in the development of the heifers, going even till a highest calve mortality. His performances criteria shift from the individual conformation and average daily gain (ADG) to the herd rusticity with a simplification of the management rules in order to insure himself a good quality of life. The main responsibility, in term of parasitism management, lies on the herd that performed the

greater part of the learning process. In such a way, on long term, the “environmentalist” breeder selects a more rustic and resistant herd.
The “holist” breeder goes further than simply the respect of organic rules. He wants to develop some practices to avoid all the allopathic treatments against the parasites while vouching good animal performances and a minimum number of sick animals. Herd rusticity is high enough to be treated by methods accepted in the organic rules such as the homeopathy or the phytotherapy. Such practices evolution lies on an holistic representation of the parasitic problematic allowing a new interpretation of this problematic in which cattle and parasites are indissociable and in which the breeder can sustain the animal in its ‘learning’ process. So, he accepts that an animal losing some weight or coughing does not necessarily has digestive guts 'crawling with worms' and that this is not necessarily good for this animal to give it an anti-helminthic product. Such a representation of this problematic must be associated to new performances criteria : animal health reflected by its career in the herd, herd health reflected across the generations,… The grassland is also taken into consideration in this representation and grazing management may modify host-parasite interaction at cattle benefit. Refusal is not the reflect of a bad grazing management but well a reflect of the host-parasite interaction…

3.3 Identification of four functional types of grazed grasslands

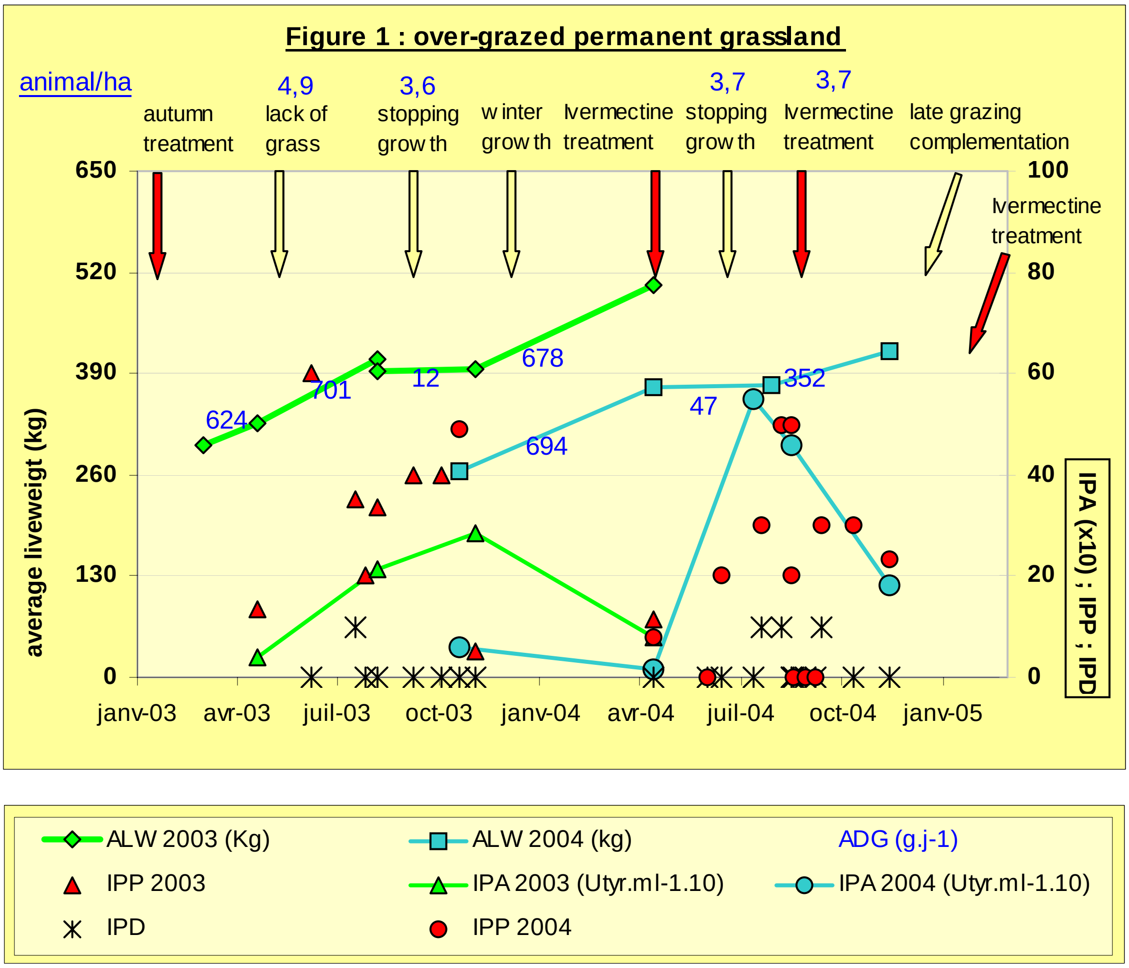
Across the two seasons we followed up, in the 15 farms, 16 heifers groups per year, evolving in 16 grasslands. Each grassland may be, in some cases, divided in several parcels and is integrated in a farming system in interaction with (1) its soil and climatic conditions and (2) its commercialization channel (calve sold at weaning, fattened animal, short or long channel, …). We did not choose to work on a representative farms sample allowing cross comparison but well on heterogeneous systems in order to apprehend model and point of view diversity and, in this way, to stimulate cross learning and knowledge emergence. Such knowledge is not an experimental demonstration, supported by a rigorous statistical scheme, but some hypotheses and concepts, to be experimented, reflecting the observations. The description of these 15 organic farms, with cattle meat production, will not be developed. We focused our attention on the heifers as they allow an analysis of the mechanisms mobilized in parasitism management and as they are a common point allowing a formal link between the different systems.

A typology performed across these 16 grasslands have identified four main functional types describe hereafter on the basis of four representative systems selected within the farms followed up. We described, in a first step, the farmer conception of his grasslands with his objectives and performance criteria. In a second step, we focused our attention on the evolution of animal performances and of the parasitic pressure (gastro-intestinal worms) in 2003 and 2004. We have to keep in mind that 2003 was dry and warm; conditions unfavorable to parasitic worms development; while 2004 was wet and warm and so, especially favorable to parasitic worms development and survival in grassland.

3.3.1 The over-grazed permanent grassland

Such grasslands are typical for systems with "market" based conversion with more intensive practices inherited from the conventional frame of reference. In particular, these breeders have some difficulties to reduce their cattle number when shifting from conventional to organic farming. So, without surface increase and following the reduction of their surface productivity, there is an effective increase of the grazing pressure. Grassland management lies on a strict segregation of the cut and grazed grasslands. The first breeder's target is to control, by grazing, grass growth. He performs early turnout and adjusts the animal stocking rate (increase in spring, decrease and/or herd supplementation in autumn) in order to limit the extension of refusal zones. His performance is to maintain a close-cropped grassland all along the year ('zero refusal at turn in'), with a young and rich grass. From his point of view, this target is more difficult to reach in organic system as he observes refusal, in spite of a high stocking rate, and weeds (thistle and broad-leaves dock) development. Weeds that he can not manage with herbicides. So, to reach his target, he performs several refusals mowing all across the season.

***Figure 1** : Heifers performances and parasitic pressure evolution, during 2003 and 2004, in an over-grazed permanent grassland (DELMOGE)*



The breeder representative of this group shifted his breed from the Belgian Blue to the Parthenais and Limousin breeds. In 2003, 19 heifers (327 kg of liveweight; 13,3 months old); 10 Belgian Blue, 4 Parthenais and 5 Limousin; were allowed to graze, since the 20 of April, a parcel of 3,9 ha. In the context of our intervention, with regular animal performances and parasitic pressure follow up, the farmer agreed to adjust his treatment to the analyses results.

First of all, in 2003, he suppressed the first treatment, in the spring, at turn out. Due to the ivermectin treatment performed in autumn 2002, at turn in, the heifers revealed a low level of parasitic pressure (IPA = 0,4Utyr.ml^{-1}) in 2003 spring. From May till August the heifers valorized a good grass, available in quantity and quality, as reflected by their good performances : 701 g.d^{-1}. Nevertheless, the eggs excretion, quantified by the IPP and reflecting the level of grassland contamination, quickly reached a 60 value in June. However, in July, the dry conditions had stopped the evolution of the infesting larvae and reduced the classical pick of infestation observed in August/September (Mage 2004). Indeed, during this period, eggs excretion remained moderated (20 < IPP < 40). So the heifers had tolerated a moderate pressure of the parasites in their fourth stomach, as highlighted by the pepsinogen content (IPA) remaining under 2,0 Utyr.ml^{-1} till July and under 3,0 Utyr.ml^{-1} till November, before to decrease during the winter period. Under such conditions had allowed them to develop their immunity even without anti-helminthic treatment. From the animal performance point of view, the dry conditions had decreased grass availability since the mid of August leading to very low liveweight gain of 12 g.d^{-1}, this in spite of a reduction of the heifer stocking rate, from 4,9 to 3,6 heifers.ha^{-1}, and a late supplementation. Across all the graing season thes performances were of 119 g.j^{-1} and grassland productivity was of 0,549 kg liveweight(LW).ha^{-1}. d^{-1}. Once in cowshed, the heifers performances increased till 678 g. d^{-1}. So, they reached, at 24-25 months, liveweight close from 500 kg at first insemination.

In 2004, at turn out, the 22 of April, a new group of 14 heifers (13,4 months, 373 kg LW) was put on the same grassland (3,7 heifers.ha^{-1}, 1394 kg LW.ha^{-1}) after winter performances of 694 g.d^{-1}. This time, unsatisfied from the performances observed during the preceeding season, that the farmer assigned to the occurrence of parasite; the analyses being positives ; the farmer decided to perform an anthelmintic treatment at turn out.

The mild 2003-2004 winter allowed the survival of numerous eggs excreted in autumn, so the grassland remained infested in spring. So the heifers ingested the infesting larvae and started a new excretion cycle in June, as underlined by an IPP of 20. As the climatic conditions allowed a good parasite survival in grassland, they infested the heifers in a massive way (IPA = 5,5 Utyr.ml^{-1}) leading to a permanent increase of the excretion till the end of August (IPP = 50). Dyctyocolus, favored by wet and moderately warm conditions, was observed since the end of July with some light cough symptoms. Animal performances were low during these four first grazing months (47 g.d^{-1}), this in spite of good grass availability.

At the end of August, the farmer decided to perform a new treatment (ivermectine) stopping directly all excretion. Now this excretion started again 4 weeks later underlining the quick cycle of the parasite and the moderate but permanent heifer re-infestation (1,8 Utyr.ml^{-1}). In parallel to this treatment and in spite of good grass availability (sward surface height of 5,7 cm + 30 % of refusal area), the farmer started to supplement his animal with 1,5 kg of cereal.$heifers^{-1}$.d^{-1} and to cut the refused areas. These different measures led to moderate animal performances with 325 g.d^{-1}. So, at the end of the 7 months of the grazing season, grassland productivity was of 0.818 kgLW.d^{-1}.ha^{-1} with mean liveweight gain of 222 g.d^{-1}. Heifers reached a mean liveweight of 426 kg at 20,1 months, needing some performance as high as 1132 g.d^{-1}

if the breeder want to reach his target of 550 kg at 24 months, for the first insemination. In spite of a third treatment performed at turn in and an important supplementation, such high performances are vey difficult to reach. Moreover, these heifers, without any parasite pressure during all the winter, had to stimulate their immunity during the next season, during their period of gestation or at calving, period during which immunity reaction are very weak.
This analysis highlights that such grazing management did not allow, during these two grazing seasons contrasted from the climatic point of view, to reach breeder targets. In 2004, three treatments, among which two were performed in a preventive way, did not control the parasitic pressure in an efficient way. And, overall, did not reach the organic rules principles allowing to stimulate cattle immunity reaction.

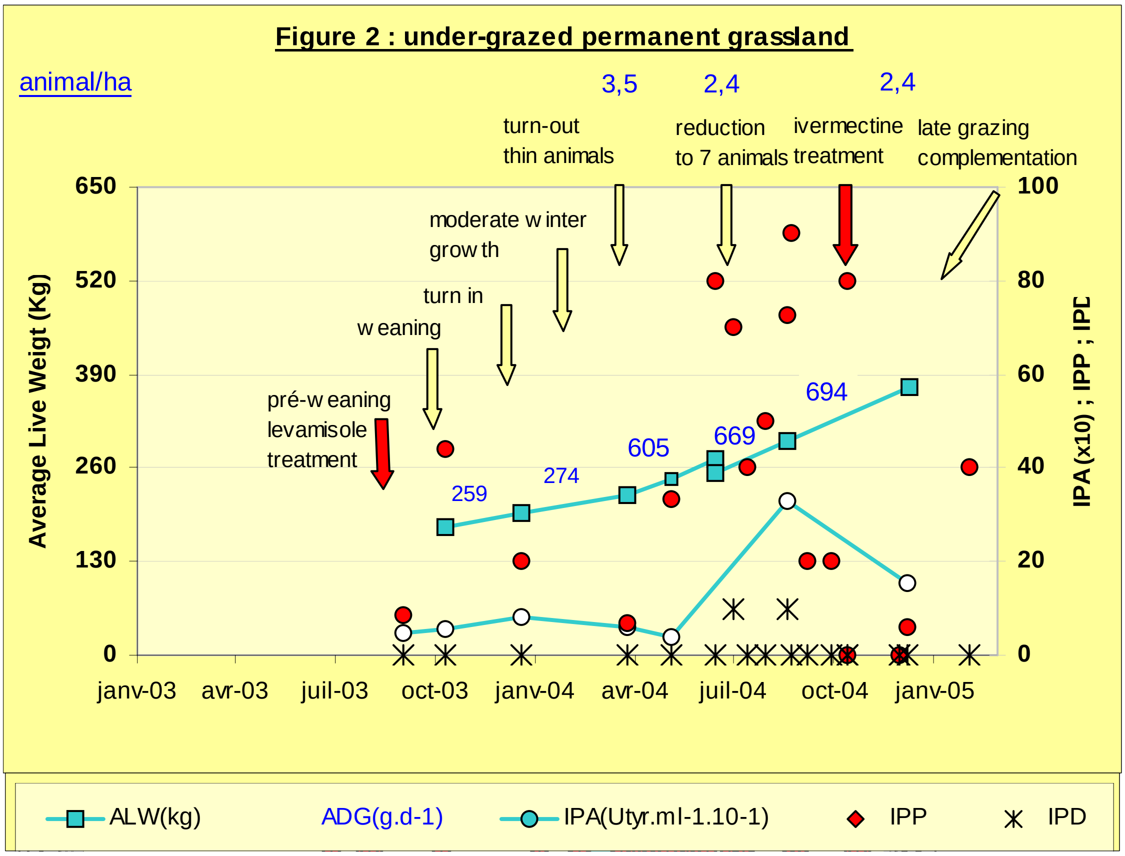
Based on these observations, the breeder has to make a choice. Either he comes back to the coherence of the conventional frame of reference, with persistent and systematic treatments in order to protect the animal while sharply reducing the level of grassland infestation, or, face to the inefficiency of the punctual treatments, he tries to understand and to represent himself the host-parasite-grassland interactions, to learn some new performance criteria and practices in phase with organic farming frame of reference. However this frame of reference is not stabilized. We can find, within it, different ‘truths’, once infirmed, once confirmed.

3.3.2 The under-grazed permanent grassland

Such grasslands are found in systems with “environmental” based conversion. Their Utile Agricultural Surface integrates mainly permanent grasslands with a low stocking rate. These farmers manage wet grasslands, grasslands included in a landscape with a high variety, grasslands without farming lease, … In all these situations, farmer aims is to adjust animal stocking rate to a level low enough that to be sure that, whatever the climatic conditions and the season, he will not have to intervene for example to decrease the stocking rate, to supplement his stock, … Usually, there is a late turn out to insure grass availability and the establishment of grass reserve ‘on feet’ to cover dry periods. These grasslands receive a low level of fertilizer and graminae are the dominant species. A late turn in is usually observed.

The breeder representative of this group shifted from a crossed Belgian Blue * Charolais herd to the Blonde d’Aquitaine and this through a progressive incorporation. In his grasslands management, he distinguished cut temporary grasslands in rotation with cereal crops, permanent grassland exclusively cut and permanent grassland exclusively grazed. His forage stocks were higher than his herd needs. He considered this situation as securising. Finally, his farm is broken up in a high number of small parcels : the 70 ha of the Utile Agricultural Surface included 49 parcels. This increase the complexity of grazing management in term of group size *versus* parcel surface ad equation : “if I do not take care I spent all the season to move the groups from one field to the other”.

***Figure 2** : Heifers performances and parasitic pressure evolution, during 2003 and 2004, in an under-grazed permanent grassland (PIERMOGE)*



The 2nd of September 2003, while young calves, of less than 2,8 months, remained under their mother, the pepsinogen concentration in the calves blood was at a normal level of 0,5 Utyr.ml^{-1} underlining a low level of fourth stomach infestation by the worms. Parasite eggs excretion was linked to tricostrongle occurrence. These parasites, with a low level of virulence, colonize the small intestine of young cattle. Due to a hot and dry summer, Dyctyocolus was not identified, nevertheless the breeder, being in the habit to perform a treatment with the Levamisole (non persistent drug), did it : "each year I make it, at this season, when calves cough... Three to four days later this is over, they don't cough any more. Usually they start to cough at the beginning of august".

One month later, the 10th of October, the calves were weaned. They weighed 197 kg at 4 months. The parasitic pressure in the fourth stomach remained low (IPA = 0,6 Utyr.ml^{-1}) while the excretion (IPP) reached levels as high as 44 but always with a high tricostrongle occurrence that was not interrupted by the Levamisol treatment. These calves remained in grassland till the mid of December. At turn in, the pepsinogen level had lightly increased (IPA = 0,8 Utyr.ml^{-1}) while the IPP decreased till a level of 20. After weaning, the calves performances were, in mean, of 259 g.j^{-1} and stabilized themselves at 274 g.d^{-1} during the winter.

In spring 2004, the 25 of marsh, a group of 10 heifers, weighing 223 kg at 9,5 months, were turned out on permanent grassland of 2,87 ha. With 779 kg LW.ha^{-1}, The animal stocking rate was low, half than the one observed in the over grazed grassland, but the potential of parasite dissemination was highest as we have 3,5 young, not immunized, animals per hectare. In agreement with the farmer, the treatment usually performed at turn out was suppressed : the level of excretion (IPP = 7) and of fourth stomach infestation (IPA = 0,6 $Utyr.ml^{-1}$) being low.

There was plenty of grass, with a sward surface height of 6,7 cm at turn out, and the stocking rate was not high enough to control grass growth; the refusal covered 58 % of the surface the 7th of July; leading to a sharp decrease of the feeding value. From May till June, in spite of grass excess, the levels of excretion (IPP = 80) and infestation (IPA close from 1,8 $Utyr.ml^{-1}$) quickly increase. This confirmed that these young heifers were not immune and so were quickly infested. Dyctyocolus was detected twice : the 1st of July and the 19th of August with some light cough symptoms.

Following the low performances observed during the preceding winter, the Breeder expected a good compensatory growth. From his point of view, with 605 $g.d^{-1}$, the performances observed were too low. So he decided to reduce the stocking rate (2,4 $animal.ha^{-1}$; 614 $kgLW.ha^{-1}$) rather than to perform an anti-helminthic treatment: three heifers were discarded. The refusal of 25 % of the parcel was cut. In spite of these actions, grassland infestation still increased with an IPP of 90 the 19th of August. The IPA was of 3,3 $Utyr.ml^{-1}$ while animal performances reached 669 $g.d^{-1}$. From the breeder point of view, the heifers did not grow, they "got dirty" on their hindquarters, their hair was not nice, they needed a treatment he performed the 12 of October with a long lasting product : the ivermectine. At this time the grass was in excess, with refusal covering more than 60 % of the field, however, in order to improve the performances the breeder supplemented his heifers with $2kg.heifers^{-1}.d^{-1}$ of a breeding concentrate and, since the mid of November, with pre-wilted silage.

Following the anti-helminthic treatment parasite eggs excretion stopped to start again 7weeks later while the fourth stomach infestation was also reduced to reach 1,5 $Utyr.ml^{-1}$ at turn in, the 20th of December. This level of infestation can be high enough to maintain animal immunity for next grazing season. In spite of this treatment, the complementation and the grass availability, the performances remained unchanged with 694 $g.d^{-1}$. Nevertheless, the breeder was satisfied as animal appearance was better. Grassland productivity, for the all grazing period (285 days), was of 1,808 $kgLW.ha^{-1}.d^{-1}$ while the mean ADG was of 653 $g.d^{-1}$, to say, more than twice the values observed, during the same season, in the over-grazed grassland.At turn in, the breeder was obliged to mow the grass excess in order to insure sward quality and grassland perenniality.

When the breeder using over-grazed grassland asks himself if this is not better to come back to the conventional way to manage parasitic problems, the breeder using the under-grazed grassland questions his management scheme : "How to explain these poor performances ? I had make every thing right, they had all what they needed and my heifers did not grow well… ? We can argue as much as we like, … young cattle are sensitive to worms,… when they have worms they do not growth anymore ! Next year I will perform the treatment earlier ! … This is an experience to take into consideration, … a so low stocking rate, to be oblige to mow the grassland at the end of the season…I will not make this again !". However, at the end, he wants to come back to more conventional treatment schemes : a litigious treatment (preventive with a long lasting drug) was performed in 2004 and he wants to come back to systematic treatments.

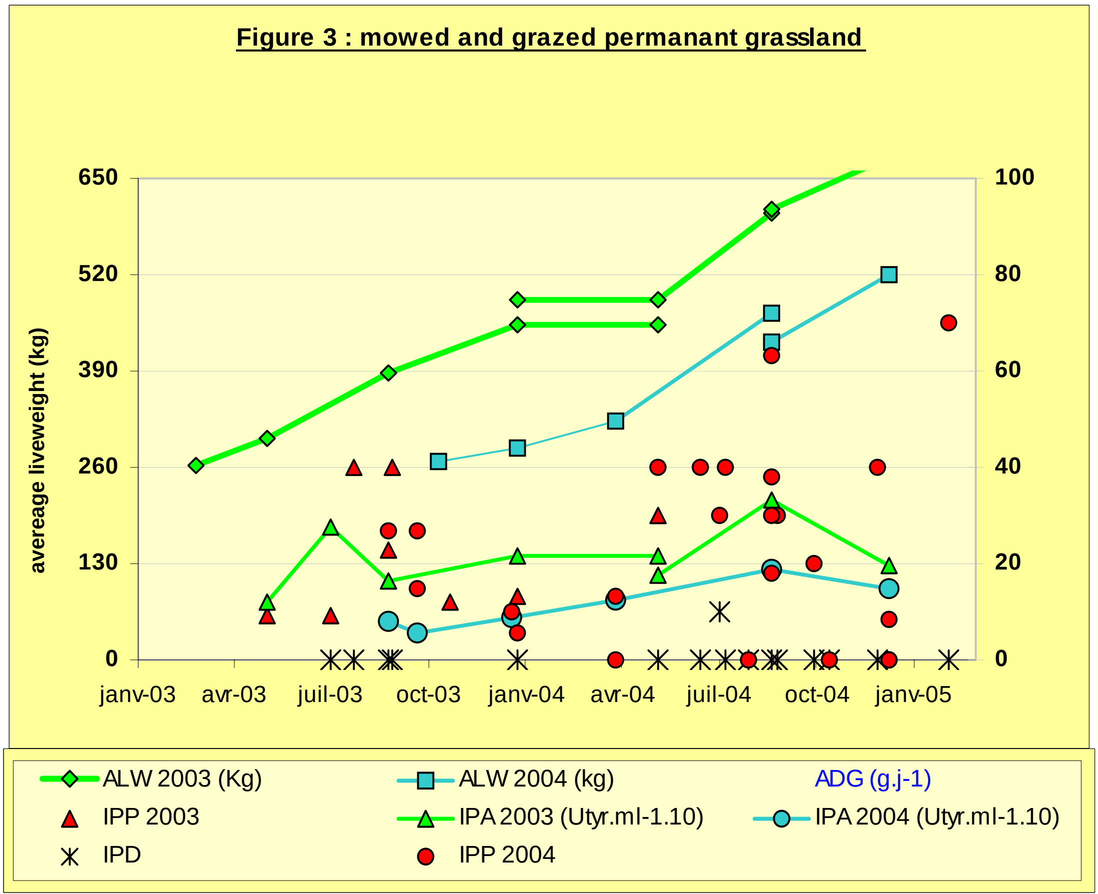
3.3.3. Mowed and grazed grassland

Such grasslands are found in some systems with "market" based conversion in Ardenne. These systems have large size fields easy to access for silage or hay making. These breeders work with a high stocking rate and manage their grassland intensively, harvesting every grass excess. Initially, they imported the greater part of their winter feedstuffs. However, following the feedstuff price increase coupled to a decrease of the stock value, they were pushed to produce a greater part of their winter feedstuffs and to reduce the stocking rate of their system. This was done by stabilizing the herd size while increasing the utile agricultural surface. The best parcels are exclusively mowed and reseeded at regular interval while the herd valorizes "mowed and grazed" permanent grasslands.

Such grassland management lies on the adjustment of the stocking rate to the autumnal production. An early turn out, allowing to depress lower the grass, is also performed together with the mowing of the spring excess on surfaces removed from the grazing rotation. In order to maintain grassland homogeneity, there is an alternance of the removed surface from year to year. If needed, a reduction of the stocking rate or an early turn in may be done in autumn while the supplementation is avoided. All over-grazing is avoided at the end of the season as the farmer is aware that such phenomenon will delay grass growth and so turn out in spring.

Breeder performance is to maintain a young and short grass, *ad libitum*, all over the season with a homogenous grazing and this together with a low workload. The sward is rich in perennial ryegrass and white clover.

Figure 3 *: Heifers performances and parasitic pressure evolution, during 2003 and 2004, in a mowed-grazed permanent grassland*



The breeder representative of this group shifted his breed from the Belgian Blue to the Blonde d'Aquitaine. In 2003, among the 15 heifers of 12,3 months, 5 were F1 cross (Belgian Blue * Blonde), 4 were F2 cross ((Belgian Blue * Charolais) * Blonde) and 6 were pure Blonde d'Aquitaine. They grazed a field of 6,8 ha leading to a stocking rate of 2,1 animal.ha^{-1} or 618 kg LW.ha^{-1}.

After a moderate winter growth (536 g.d^{-1}), with a forage-based diet, the heifers with a low level of parasite infestation (IPA= 1,5 Utyr.ml^{-1}) got in the grassland the 2nd of May. They received no anti-helminthic treatment since weaning, in September 2002. Half of the parcel is subtracted from grazing, on the 20 of May, in order to be mowed. This double the stocking rate with 4,2 heifers.ha^{-1}. The conditions were close from the 'over-grazed grassland' ones. So, in spite of dry conditions, heifers were quickly infested in June (IPA shifted from 1,2 to 2,8 Utyr.ml^{-1}) and excreted a high among of eggs in July (IPP ranged from 40 to 60). After mowing, on the 30th of June, the animals had again access to the 6,8 ha. The dry and hot summer led to a reduction of both the level of heifers infestation (IPA = 1,8 Utyr.ml^{-1} at the end of August) and parasite eggs excretion (IPP shifted from 50, in July-August, till 10, in September-October. Dyctyocolus was not identified at all. Under such conditions, animal performances reached, in mean, 755 g.j-1 from May till September.

At the end of August, thistles patches were crushed at a height of 15 cm. Sward surface height, in autumn, was relatively low leading to an increase of the level of heifers infestation (2,1 Utyr.ml^{-1}), mainly with encysted larvae as no excretion increase was observed while the level of pepsinogen remained high during the winter. Turn in was late. It occurred at the end of December, always without supplementation. Animal performaces reached 555 g.d^{-1} from October till December. So, they were, in mean, of 652 g.d^{-1} for the all grazing season of 235 days. During winter, these heifers maintained their performances.

Mean grassland productivity was, for the 2003 grazing season, of 1345 g LW.d^{-1}.ha^{-1} with, in addition, 4200 kg of dry matter.ha^{-1} of conserved forage (0,6 UFV and 68 PDIN). Taking into account an apparent conversion efficiency of 150 g of LW per UFV, this forage would have allowed the production of 804 g of LW ha^{-1}.d^{-1}. Total productivity was then equivalent to 2150 g LW.ha^{-1}.d^{-1}. At turn in, the mowed fraction of the grassland was grazed in a short and uniform way (Grazed Sward Surface Height < 2 cm; Refused Sward Surface Height = 12 cm (5 %)) while the exclusively grazed fraction was grazed in a more heterogeneous way (Grazed Sward Surface Height < 2 cm; Refused Sward Surface Height = 13 cm (30 %)).

In the spring 2004, 6, out of the fifteen heifers from the preceding group, with some inseminated ones, took part to a new sub-group of 9 heavy heifers (GDGE : 486 kg at 26,3 months, the 4th of May 2004). This group was mixed with a group of light heifers (MOGE : 320 kg at 13,8 months, the 25th of Marsh), in first grazing year, on the mowed and grazed grassland described here above. After one winter, with an outdoor access, the occurrence of encysted parasite remained unchanged (IPA= 1,8 Utyr.ml^{-1}) in the GDGE sub-group. Early in the spring, these parasites restarted their evolution towards the adult stage. So, in April, eggs excretion restarted, under 'good' hot and wet conditions, to reach levels as high than 30 to 40 in May-June. Dyctyocolus was identified once in July without cough symptom.

The MOGE sub-group followed the same evolution but with some delay : the maximal excretion was recorded at the mid of August (IPP = 60) while the infestation level remained moderated (IPPmax = 1,9 Utyr.ml^{-1}). Even if 40 % of the surface was mowed in July, a good grass availability led to performances close from 1000 g.d^{-1} till the mid of August.

The 19th of August, the breeder sorted his animals. He took 3 heifers, to be inseminated, out of the MOGE sub-group and 3 heifers, in calf since 4 to 5 months, out of the GDGE sub-group. So the grazing pressure shifted from 2,3 to 1,5 animal per hectare. The two sub-groups GDGE (608 kg LW at 30,4 months) and MOGE (430 kg LW at 17,7 months) had grazed, without any supplementation, till the 7th of December with performances of, respectively, 644 and 825 g.d^{-1}. At this time, the excretion had a tendency to diminish while the level of infestation was clearly in regression with values of 2,0 and 1,5 Utyr.ml^{-1} respectively for the GDGE and MOGE sub-groups. At turn in, the mean animal liveweights were of 679 and 521 kg respectively for the GDGE and MOGE sub-groups, giving full satisafaction to the farmer. The mean performances of these heifers were of 928 g.d^{-1} across the 257 days of the grazing season.

Total grassland productivity was, calculated on the same basis than here above, equivalent to 2325 g LW.ha^{-1}.d^{-1}. As in 2003, the mowed fraction of the grassland was grazed in a short and uniform way (Grazed Sward Surface Height = 2,1 cm; Refused Sward Surface Height = 6,5 cm (5 %)) while the exclusively grazed fraction was grazed in a more heterogeneous way (Grazed Sward Surface Height = 2,6 cm; Refused Sward Surface Height = 10 cm (40 %)) leading to refusal mowing in December.

3.3.4 Rotational grazing

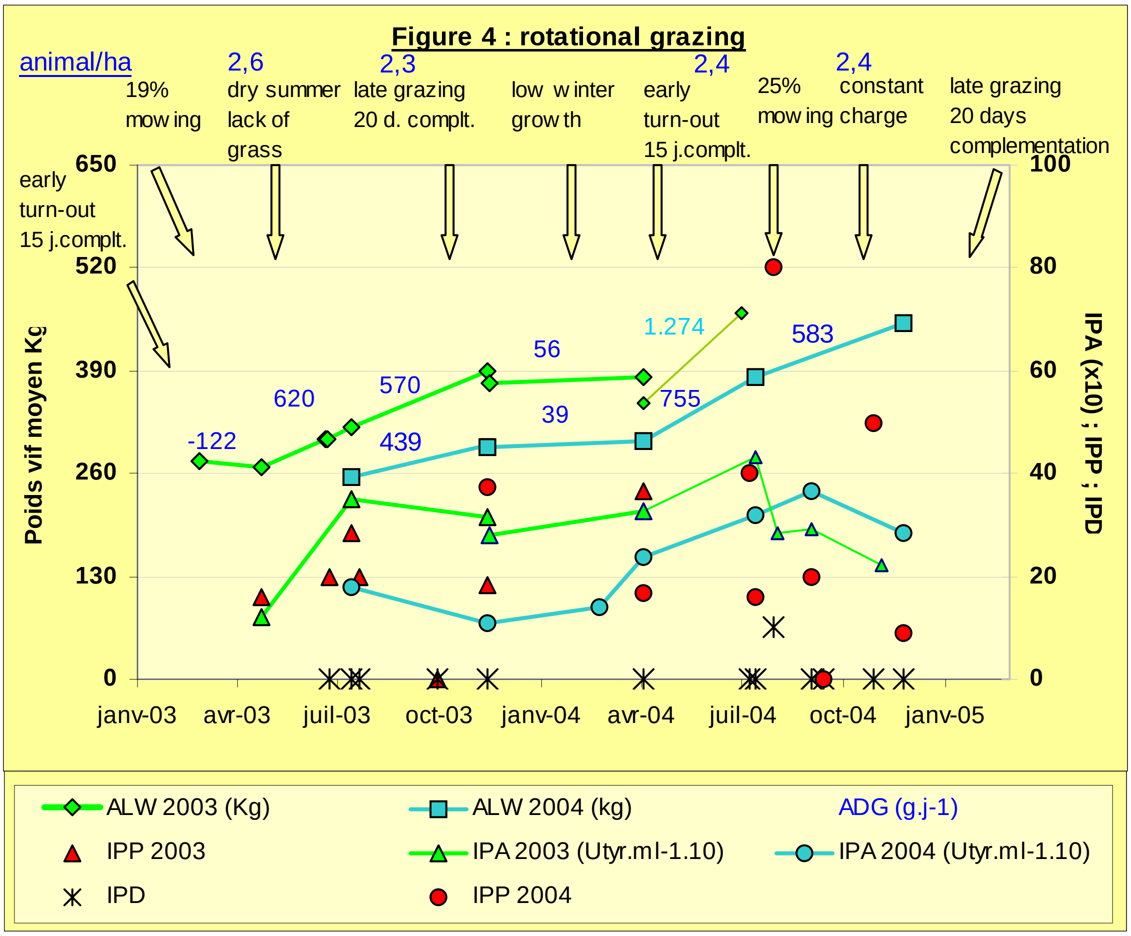
Such grazing system, inherited from the dairy model, aims to control grass growth with a synchronization of grass availability, in quantity and quality, and cattle needs. It wants to control seasonal variations linked to differential grass growth in order to maintain and intensified animal production. Nevertheless, it is more complex to manage asking more anticipation capacities and daily reaction from the breeder. This explains its easiest adoption in dairy farms, maintaining there high producing cows under grazing, than in suckling ones, where the fattened animals are in cowshed.

In segregating, in a recurrent way, the animal from its parasites, rotational grazing may participate to the control of parasite pressure in adjusting grazing cycle to parasite cycle. However, among the 14 farms followed up, only one “holist” breeder, with a mixed suckling (Third generation of Blonde d’Aquitaine crossing on the initial Belgian Blue herd) and dairy (Normand Breed) herds, applied such grazing scheme for his young stock. His motivations did not lye in the intensification of his production but well in the valorization of small and marginal parcels (forest skirt, grasslandwith strong slopes, …) at the merge of his farm and in the management of the parasite problem, on growing animals, without anti-helminthic treatment.

<u>During the first grazing season</u>, the young cattle group followed up was heterogeneous : 6 heifers from the suckling herd, 3 Normand heifers, 5 crossed steers and 3 Normand steers. In order to allow the comparison with the preceding grazing systems, we will focus our attention on the performances from the heifers of the suckling herd while taking into account the entire group for the expression of the other parameters. The grazed grassland, with a total surface of 11 ha, included 10

paddocks. Among these paddocks, 5, for a total of 1,3 ha (19 %), were mowed before to be grazed while others were removed from the rotation once grazed. When we perform a mean of the surfaces occupied by the group of interest balanced by the proportion of the grazing season it occupied them, we conclude that this group valorized, in reality, 6,66 ha all across the season. This grazing system had a quick rate of rotation : the animals stayed, in mean, 7,6 days in a paddock while the resting period was of 31 days. Such configuration led to 31 paddock shifts.

***Figure 4** : Heifers performances and parasitic pressure evolution, during 2003 and 2004, in a rotational grazing system*



The pedo-climatic conditions of this Jurassic Area allow an early turn out, occurring, in 2003, the 23rd of Marsh. However, during a transition phase, lasting 15 days, a supplementation was performed. The animals (270 kg LW at 11 months) had a grazing pressure of 2,6 (or 687 kg LW) animal.ha^{-1} and a low parasite load (IPA=1,2 Utyr.ml^{-1}).In spite of a winter period with low performances, compensatory growth, at turn out, remainded moderated (ADG = 620 g.d^{-1}). In August, there was low grass availability with Sward Surface Height of 3 cm, leading to an increase of the levels of fourth stomach infestation (IPA= 3,5 Utyr.ml^{-1}) and eggs excretion (IPP = 29). Nevertheless no disease symptom was detected and the performances were of 570 g.d^{-1}. The IPA had progressively decreased from August till December to reach a stable level of 3,1 Utyr.ml^{-1} during the whole winter, underlining the occurrence of a high number of encysted parasite in the fourth stomach during this period. In spite of a quick rotation and of the valorization of grass regrowth, after forage making, during 31 % of the season, the level of infestation reached quite high levels.

During the winter period, the stock received only poor forage and, so, reached only poor performances (ADG = 56 g.d^{-1}). They were transferred, in spring, in grassland situated in a richer area : the Condroz. High level of, both, fourth stomach infestation and eggs excretion were quickly observed (IPA= 43 Utyr.ml^{-1} and 40<IPP<80). Nevertheless, good levels of animal performances, to be linked to compensatory growth, were also recorded (ADG=1.274g.d^{-1}). This was only during July 2004 that a regression of the infestation level was observed under the normal value of 2,5Utyr.ml^{-1}. So, under such pedo-climatic conditions, a rotational grazing and a lack of treatment had allowed to develop the immunity of the 27,4 months old animals This immunity was reached without a high reduction of the animal performances reaching, in mean across the 237 days of the 2003 season, 583 g.d^{-1}, with a grassland productivity of 1,504 kg LW.d^{-1}.ha^{-1}. At the end of the grazing season, all the paddocks have been well (over-) grazed (2cm<HH<3,5cm) without refusal.

The 23rd of Marsh 2004, a group of 17 young stocks (8 heifers from the suckling herd, 2 Normand heifers, 5 steers from the suckling breed and 2 Normand ones’, had followed a rotational scheme on 13 paddocks for a global surface of 12 ha 48. 25 % were mowed before to be grazed while, as in 2003, others were removed from the rotation once grazed leading to a equivalent surface of 6,95 ha. Stocking rate was of 2,4 animal.ha^{-1} or 718 kg LW.ha^{-1}. The heifers, from the suckling herd, had a mean weight of 201 kg at 12,7 months

Resting time was of 5,9 days while the grass regrowth, between two grazing phase, was, in mean, of 20 days. At turn out, the young stock infestation (1,3 Utyr.ml^{-1}) was light, however it increase quickly during the spring till the end of August when it reached its maximum value (3,7 Utyr.ml^{-1}). Thereafter it regressed to a value of 2,9 Utyr.ml^{-1} at turn in, in November. Eggs excretion (IPP) followed the same evolution with a maximum of 80 in July/August. So, under good conditions for parasitism development, a rotational grazing including more than 40 of grass regrowth do not reduce drastically the parasitism development. However the mean performances, over the 247 grazing period, were of 664 g.d^{-1}). Heifers reached liveweight of 450 kg at 20,8 months while grassland productivity reached, with 1,829 kg LW.ha^{-1}.j^{-1}, value close from the under-grazed grassland ones, and this without grass excess as in this last situation. This underlined the low level of productivity of these surfaces.

4 Discussion

If it is easy, from an eco-centered point of view, to understand the observations performed on the over-grazed grassland in which the under-feeding led to a reduction of the immunity while amplifying parasites cycle. Parasite that remained under control (IPA< 3,0 Utyr.ml^{-1}), even if animal performances were nil, during dry season such as 2003, while it exploded under wet climatic conditions (IPA>50 Utyr.ml^{-1}) and remained difficult to control even with an allopathic treatment.

We observed that preventive treatments were inefficient to control the parasitism problematic at grassland but it proved their usefulness at turn in leading to compensatory growth... not under grazing but during the winter period at cowshed! Such situation reinforces the breeder in its options: to reduce the use of the permanent grazed grassland; becoming more a range; at the advantage of the temporary grasslands producing the forage for the winter phase. It reinforces also its representation of the animal without any defense face to the parasite and leads necessarily to an eradication strategy without any possibility for the animal or the breeder to develop new managing competencies through learning process. The conversion to organic and the breed shift had no impact on the coherence of this representation.

In the under-grazed grassland the breeder limits the winter performances to profit from the compensatory growth phenomenon under grazing. In such system, parasite pressure and the excretion level were similar to the ones observed in the over-grazed grassland but they did not reach a level high enough to block animal growth, that remained moderate, while this level allowed the development of animal immunity. However a huge difference was observed between grass availability and animal performances with the formation of large areas of refusal. Such situation led to over-grazed area, between these refusals. Nevertheless, such refusals could also be linked to the occurrence of parasites in the animal digestive track. Indeed, Hutchings *et al* (1998) and Forbes *et al* (2000) demonstrate, respectively on sheep and cattle, that the level of animal infestation modifies the grazing behavior and the occurrence of the refused area. They claim that high infestation leads to a reduction of the appetite and to an avoidance of the area close from the faeces. Can we translate that the anti-helminthic treatment transform a trained animal back to a naïve one's as it conducts to the refusal intake? Provenza (2003) says that the animal does not avoid but select some forage in accordance to their physiological status. These three alternatives, appetite modification, rejection of some areas or, at the opposite, the selection of other areas, lead to different interpretation of what was observed in the under grazed grasslands.

5 Conclusions

Through this exploration of the parasitism problematic in organic systems, we illustrate how the research intervention can contribute to the identification of the diversity of the alternatives and technical referentials mobilized by the actors to face a problem. This phase is necessary in the construction of innovative techniques needed in the development of new food-chain frame of reference.

Such holocentered posture, where we explore the 'world' heterogeneity, diversity and contradiction (interactions between the different frames of reference), leads the research on new conceptual coherence, yet flexible, opening new representations and practices.

However, from a scientist point of view, such new alternatives must be validated through techno-centered experimentation while, from the actors point of view, shared experience is necessary.

Bibliography References

Forbes A.B., Huckle C.A., Gibb M.J., Rook A.J., Nuthall R., (2000). Evaluation of the effects of nemathode parasitism on grazing behavior, herbage intake and growth in young grazng cattle. Veterinary parasitology, 90, 111-118

Hubert, B. 2004. Pour une écologie de l’action. Savoir agir, apprendre, connaître. Editions Arguments, 430 p.

Hutchings, M.R., Kyriazakis, I., Anderso, D.H., Gordon,I.J., Coop, R.L., 1998. Behavioral strategies used by parasitized and non-parasitized sheep to avoid ingestion of gastro-intestinal nemathodes associated with faces. Anim. Sci. 67, 97-106.

Mage, Ch. 2004. Connaître et gérer les parasites. Institut de l’Elevage. 1-36

Moulin, C. (2006). Une méthode pour comprendre les pratiques d’alimentation des herbivores domestiques, analyse du fonctionnement des systèmes d’alimentation par enquêtes en élevages-guide méthodologique. Paris, institut de l’élevage. 1-99.

Provenza, F.D., Villalba, J.J. Dziba, L.E., Atwood, S.B. Banner R.E. (2003) Linking herbivore experience, varied diets, and plant biochimical diversity. Small Rum. Res. 49, 257-274