RFI divergent lines in sheep and relationship with TMR RFI : first results

(Residual feed intake, Total mixed ration)

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background

- Lamb Production costs (fixed costs excluded) :
    - Feeding costs = 60 to 80 %
- Meat sheep selection programmes : traits such as growth and body composition
- One way to improve sheep industry: to increase the efficiency of feed transformation
- indirect response : growth, body composition
- go further :
    - ➢ Feed intake
    - ➢ Feed Conversion Ratio = FI/ADG
    - ➢ Residual Feed Intake
        - ❑ different diets

feed intake phenotypes

- concentrated diet intake *ad libitum*

- automatic feeders, 1 feeder for 20-25 sheep

- young rams undergone to individual test for selection on
  - liveweight (LW)
  - growth
  - and body composition (us scan)

- between 90 and 150 days of age

- h^2=0,43 (François *et al*, 2002)

residual feed intake

Feeders provide detailed data
         each meal : ram identity, intake (g), duration(sec)
         allowing computation of daily feed intake (DFI)

Since DFI strongly correlates with LW (Rg=0.85), growth (Rg=0.83) and body composition
multiple linear regression of DFI on these traits was performed
and residual feed intake (RFI) was expressed as the residue of the regression

diet	RFI h²	References
Concentrate + hay	0.30 ± 0.06	François et al, 2002, 7WCGALP
Low energy concentrate	0.46 ± 0.04*	François et al, 2006, 8WCGALP
Low energy concentrate	0.23**	François et al, 2012, EAAP

*low estimate of ADG h²=0.16
**realised heritability

"Well, interesting for fattening lambs", but breeders say : "what is the impact for feeding the flock (majority ewes) with different diets including fodder ? "

What about the relationship between RFI_cc and RFI_tmr ?

2013: no sheep feeder-recorder for total mixed ration (TMR) on the market

the institute has been developing one through the "FOURRAGRO" INRA-funded project

Total mixed ration sheep feeder prototype

TMR : mixing trailer for feeding indoor ewes
fodder (chopped hay) + concentrate

continuous trough weighing

Infra-red sensor:
presence detection (data event),
starts weighing events recording

Electronic Id:
tags, antenna

Data system

Trough and RFID antenna

Protocol and device adjustments

- Nb sheep/feeder: 10 then 8
- TMR composition 65 % fodder 35% cc :

                    goal ADG 100 g / sheep LW60 kg

- data reliability: quick successive visits may induce deviations

    3 events recorded/s, 4s are needed to have weights stability: due to abnormalities of weighing data events, 5 % visits were considered as not reliable

    1 % visits were rejected because of multiple id : IR sensor having not detected new animal

    solution: slow down animal flow by a door with sensor (and remove the IR sensor)

    increase of reliability to 99, 8 % (0,2% data rejected)

- early 2016: lower quality fodder, sheep takes it
 but waste stems under it
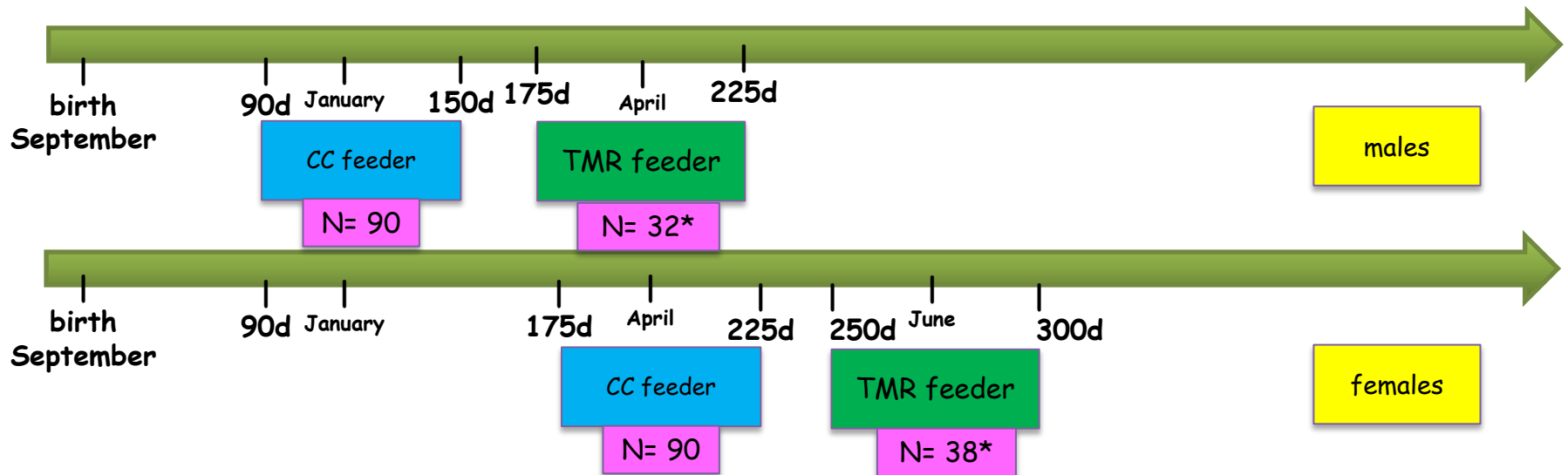 adopted solution: restrict width of the head passage

divergent lines

- breeding Values estimated for males for LW, Average Daily Gain, Body composition (Conformation and Backfat), RFIcc

- extended RFIcc EBV for the whole flock (rams & ewes)

- based on RFIcc EBV, two divergent lines have been established in the experimental flock in 2014 with 5 rams and 60 ewes per line

Time schedule 2015 batches

- 4 feeders have been developped
- feed intake TMR measurements have started with the lambs of the two lines born in 2015 following this schedule

birth September | 90d | January | 150d | 175d | April | 225d

CC feeder N= 90

TMR feeder N= 32*

males

birth September | 90d | January | 175d | April | 225d | 250d | June | 300d

CC feeder N= 90

TMR feeder N= 38*

females

* 32 or 38 selected as extremes among 90 following divergent lines & RFIcc

first results
2015 males batch

variable	Unfavorable RFI_cc (N=14) Mean ± std [min ; max]	Favorable RFI_cc (N=16) Mean ± std [min ; max]
ADG (g)	174 ± 62 [98 ; 266]	164 ± 58 [75 ; 284]
Final weight (hg)	715 ± 84 [591 ; 858]	704 ± 65 [612 ; 819]
DFI (g/j)	2351 ± 332 [1694 ; 2924]	2077 ± 342 [1394 ; 2685]
RFI_tmr (g/j)	124 ± 190 [-121 ; 415]	-108 ± 225 [-425 ; 301]

first results

2015 males batch

- Significant line effect
- R (RFI_cc, RFI_tmr)= 0.41

2015 females batch

- 1st CC feeder females data
- TMR

females	Weeks	ADG (g)		DFI (g/j)	
Feeder\line		Unf.	Fav.	Unf.	Fav.
CC feeder	6	250	262	1830	1766
TMR feeder	5	63	66	1558	1766

- Non significant line effect
- R (RFI_cc, RFI_tmr)= 0.17

2016 phenotypes in progress

Conclusion

Correlation between RFI concentrate and RFI TMR was 0.41 for males and 0.17 for females suggesting that probably DFI of both diets should be phenotyped to improve genetics of feed efficiency

Prospects

- add a convoyer to fill the trough
- description of feeding behaviour
- link RFI with microbiota diversity
- link RFI with methane emissions