# Economic and environmental performance of French dairy farms through the scope of three farm economic strategies

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**Introduction**

- The environmental performances of French dairy farms are commonly compared according to their forage systems and geographic constraints (% maize, altitude) (Dollé et al. 2013a, 2013b, Gac et al. 2014)
- It has been observed in recent years that dairy farms engage in economic strategies to achieve high economic efficiency. Three farm economic strategies stand out (Fagon et al., 2017, Dervillé et al., 2018) :

Value addition

Cost reduction

Productivity


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## Data and method

Technical and economic data
2009-2017
n=1998 farm-year couples

Life cycle assessment model

CAP'2ER®

Moreau et al. (2016)

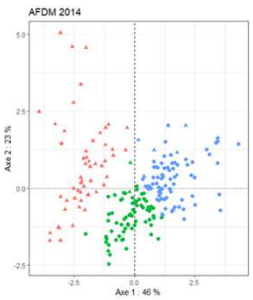
We use 6 variables to separate them through statistical analysis

FAMD + HCA

FactoMineR

We obtained three homogenous groups every year.

**82%** of constancy in the class.
Do they fit with observations ?





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## Description of the 3 resulting groups:

| | | Value addition | Cost reduction | Productivity |
|---|---|---|---|---|
| | **Average number of farms per year** | **55** | **85** | **82** |
| Structure | Forage and grassland area (ha) | 84 (41) | 78 (36) | 66 (27) |
| | Work units (WU) | 1.9 (0.8) | 1.8 (0.7) | 2.0 (0.8) |
| | Dairy livestock units (LU) | 92 (41) | 98 (37) | 107 (42) |
| | Work productivity (l $WU^{-1}$) * | 160,000 (62k) | 250,000 (83k) | 347,000 (114k) |
| | Land productivity (l $ha^{-1}$ of forage area) * | 4,100 (1,300) | 6,100 (2,000) | 9,800 (3,200) |
| Economic | Price of sold milk € 1000 $l^{-1}$ * | 478 (119) | 339 (23) | 333(17) |
| | engaged in official quality and origin signs * | 96.7% | 3.6% | 5.1% |
| | Husbandry, veterinary, bedding costs € $LU^{-1}$ * | 186 (65) | 178 (45) | 255 (61) |
| | Cost of the fodder system € $LU^{-1}$ * | 1,040 (297) | 995 (191) | 1,331(223) |
| | Dairy activity level: production cost € 1000 $l^{-1}$ | 508 (134) | 368 (68) | 369 (58) |
| Practices | Livestock density (dairy LU $ha^{-1}$ of forage area) | 1.1 (0.3) | 1.4 (0.4) | 1.7 (0.5) |
| | Grassland/forage area (%) | 95% (8%) | 78% (16%) | 62% (15%) |
| | Volume of milk per dairy cow (l) | 5,687 (1,075) | 7,007 (1,069) | 8,450 (844) |
| | Concentrates for dairy cow (g $l^{-1}$) | 196 (77) | 209 (73) | 234 (63) |
| | Autonomy in protein (%) | 79% (13%) | 69% (12%) | 55% (10%) |
| | Mineral fertilisation kg N $ha^{-1}$ dairy area | 12 (18) | 52 (30) | 79 (38) |
| | Time at grazing (milking herd) (days $year^{-1}$) | 175 (48) | 142 (55) | 118 (61) |

Means of 9 annual means (Sd)


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## Environmental performances of the three groups

| | VA | CR | P |
|---|---|---|---|
| GHG emissions (kg $CO_2$-eq $l^{-1}$ FPCM) | $0.98^a$ | $0.98^a$ | $1.00^c$ |
| GHG emissions – SOCS by permanent grassland (net kg $CO_2$-eq $l^{-1}$ FPCM) | $0.64^a$ | $0.80^b$ | $0.92^c$ |
| N balance – kg N $ha^{-1}$ | $60^a$ | $95^b$ | $125^c$ |
| Potential nitrogen loss to the water kg N $ha^{-1}$ | $24^a$ | $34^b$ | $42^c$ |
| Potential nitrogen loss to the air kg N $ha^{-1}$ | $19^a$ | $48^b$ | $77^c$ |
| Direct and indirect energy use MJ $l^{-1}$ FPCM | $2.6^a$ | $2.5^a$ | $2.9^c$ |

$^{a\,b\,c}$ two different letters indicate a significant difference α= 0.05, Tukey test)


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## Discussion and conclusion

- We have built a **robust methodology** to assign an economic strategy to a dairy farm
- The economic strategies of dairy farms imply **different practices** that in turn lead to **different environmental impacts**.

- Results are in line with literature ➔ **grass-based dairy systems** (represented here by VA and CR farms) show **lower risk of nitrogen losses** (Dollé et al., 2013a, Peyraud et al. 2009) and have **lower net carbon footprint** when taking SOC sequestration into account for permanent grassland (Dollé et al., 2013b) and **when not**

- Results suggest that maize-based dairy systems do not emit less GHG per litre of milk if they do not adopt a **CR strategy that limits their use of inputs**.