# An overview of wished recording requirements to satisfy to the current evolution of milk recording organizations and selection programs in France

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# Aims of the presentation

- Present the context of Milk Recording in France and the requests for changes (flexibility, cost,…)

- Summarize 3 studies realised between 2003 & 2013 and show how it meets the needs of evolution to maintain a high level of quality

→ Propose evolution of ICAR guidelines on milking schemes

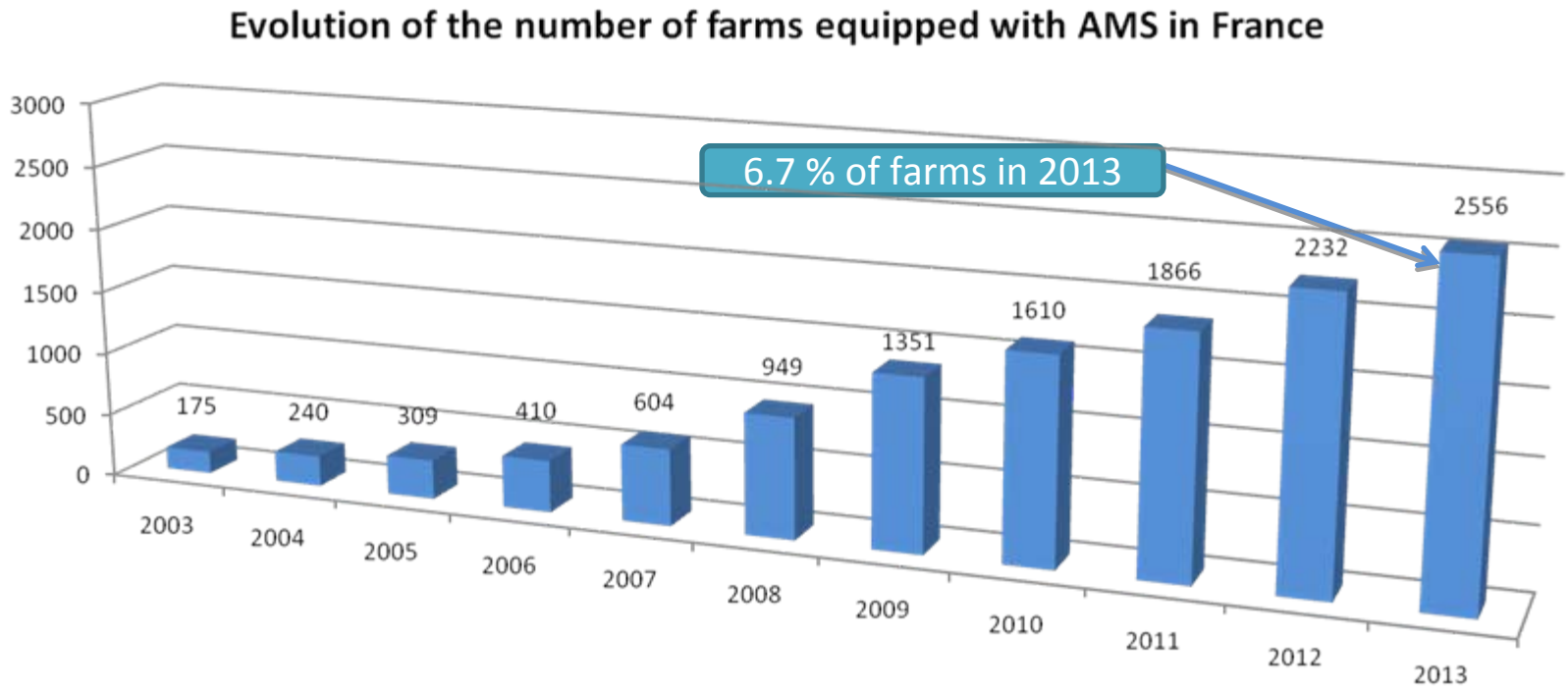
# Definition of 8 milking schemes in France

- A : supervised 24 hours milking
- AT : supervised alternative milking
- B : unsupervised 24 hours milking
- BT : unsupervised alternative milking
- AR : supervised 24 hours robotic milking
- BR : unsupervised 24 hours robotic milking
- CZ : supervised / unsupervised 24 hours (sampling one milking)
- BZ : unsupervised 24 hours with sampling one milking

# Evolution of the penetration rate, herd size, milking schemes in France

| Year | Penetration rate | Herd size | % of dairy herds recorded according to milking schemes | | | | |
|---|---|---|---|---|---|---|---|
| | | | A | AT - BT | B | AR - BR | CZ - BZ |
| 2003 | 66 % | 40.4 | 90.1 % | 9.8 % | / | 0.1 % | / |
| 2005 | 68 % | 41.5 | 85.5 % | 13.6 % | / | 0.9 % | / |
| 2007 | 66 % | 41.5 | 78.4 % | 16.7 % | 2.3 % | 1.0 % | 1.6 % |
| 2009 | 68 % | 46.1 | 73.2 % | 17.8 % | 3.6 % | 2.9 % | 2.5 % |
| 2011 | 69 % | 48.1 | 68.2 % | 18.9 % | 5.6 % | 4.6 % | 2.7 % |
| 2013 | 69 % | 52.1 | 65.6 % | 19.0 % | 6.0 % | 6.7 % | 2.7 % |
| | = | ↗ | ↘ | ↗ | ↗ | ↗ | ↗ |

# The environment is changing…




+ 300 to 400 AMS per year in France

# Challenges and requests

- **Maintain a high penetration rate**
  - To ensure a selection base as wide as possible
  - To collect classical and new traits (fatty acids,…)
- **Maintain a sufficient quality for genetic evaluation**
- **Develop new milking schemes**
  - To reduce costs of milk recording
  - To limit the constraints of milk samples collection
  - To improve flexibility by different approaches (increase or decrease of recording intervals, length of sampling period…)

→ 3 studies have been realised between 2003 and 2013

# Datasets used (1)

- **Dataset 1 : AT and CZ schemes from A1 method**

  -Data were collected on one experimental farm

  -Daily registration of morning / evening milk (+ sample collection one day per week) (13 574 TD on 290 cows with a milking interval of 10/14 hours)

  - Cows were registered during a long period (complete lactation)

- **Dataset 2 : AT and CZ schemes with and without adjustments from A4/A5 methods**

  -Data were collected on 286 commercial farms with lactocorder

  -Morning / evening sampling analysed separately (89 828 TD on 18 101 cows)

  - Individual milking times

# Datasets used (2) and average performance

- **Dataset 3 : Reduce the sampling period to 12 hours on robotic scheme**

  -Data were collected on 268 commercial farms with AMS

  -52 361 TD from 19 783 cows

  - With all samples collected on 12 hours sampling period

- **Average yield performance**

| | Dataset 1 | Dataset 2 | Dataset 3 |
|---|---|---|---|
| **Specificity** | **Lactation study** | **EMM with milking time** | **Robotic Milking** |
| Mean Milk (kg) | 20.1 | 27.9 | 26.9 |
| Mean Fat (kg) | 0.850 | 1.116 | 1.084 |
| Mean Protein (kg) | 0.659 | 0.901 | 0.873 |

# Methods used for adjustment on dataset 2

**Dataset 2 : AT and CZ schemes with adjustments**

**For AT model** :

- used the adjustments estimated as proposed by Liu and al (2000) for milk, fat and protein (yield)
- considering separate regressions for every combination of parity *i*, milking interval *j*, lactation stage *k :*

$$y_{ATadjust.}^{[ijk]} = b_0^{[ijk]} + b_1^{[ijk]}\, y_{AT}^{[ijk]}$$

**For CZ model** :

- extension of the AT adjustments for fat and protein (yield) by including the other milking of a test-day as covariate for

**Morning** : $y_{Adjust}^{[ijk]} = b_0^{[ijk]} + b_1^{[ijk]}\, y_{AT\text{-}am}^{[ijk]} + b_2^{[ijk]}\, Milk_{\text{-}pm}^{[ijk]}$

**Evening** : $y_{Adjust}^{[ijk]} = b_0^{[ijk]} + b_1^{[ijk]}\, y_{AT\text{-}pm}^{[ijk]} + b_2^{[ijk]}\, Milk_{\text{-}am}^{[ijk]}$

**On both case** : 2 parity (first vs 2nd and later)
5 milking interval (of 30 minutes)
12 lactation stage (of 30 days)

# Results : Impact of proposed milking schemes on the *daily* yield



# Correlation ($R^2$) between A reference and estimated daily yields

| | | | Milk | | Fat | | Protein | |
|---|---|---|---|---|---|---|---|---|
| Scheme | Dataset | Adjust. | AM | PM | AM | PM | AM | PM |
| AT | 1 | No | 0.955 | 0.908 | 0.802 | 0.824 | 0.949 | 0.897 |
| AT | 2 | No | 0.939 | 0.914 | 0.865 | 0.863 | 0.928 | 0.902 |
| AT | 2 | Yes | 0.959 | 0.940 | 0.894 | 0.874 | 0.952 | 0.933 |
| CZ | 1 | No | | | 0.856 | 0.932 | 0.996 | 0.996 |
| CZ | 2 | No | | | 0.903 | 0.896 | 0.993 | 0.990 |
| CZ | 2 | Yes | | | 0.931 | 0.916 | 0.994 | 0.991 |
| R | 3 | No | | | 0.965 | | 0.995 | |

# Summary of results on the daily yield

- **CZ scheme increases accuracies vs AT**
  - on milk, fat and protein yields in comparison with AT schemes
  - milk is 1.00 by construction and protein is over than 0.99
- **Adjusted scheme increases accuracies**

  **For AT scheme :**
  - on milk, fat and protein yields
  - but the accuracy remains lower than 0.90 for fat yield

  **For CZ scheme :**
  - on fat yield (accuracy is greater than 0.91 for fat yield)

- **With robot milking, the accuracy level is acceptable**
  - higher than 0.96 for fat yield
  - higher than 0.99 for protein yield

# Results : Impact of proposed milking schemes on the *lactation* yield



# Number of milk recording necessary to reach $R^2$ of 0.95 and 0.98 between a tested milking scheme and A4 reference one

| | | | Milk | | Fat | | Protein | |
|---|---|---|---|---|---|---|---|---|
| Scheme | Dataset | 1st recording | $R^2$ | | $R^2$ | | $R^2$ | |
| | | | 0.95 | 0.98 | 0.95 | 0.98 | 0.95 | 0.98 |
| AT | 1 | AM | 2 | 4 | 7 | Never | 2 | 5 |
| AT | 1 | PM | 2 | 4 | 5 | Never | 3 | 6 |
| CZ | 1 | AM | | | 3 | 7 | 1 | 1 |
| CZ | 1 | PM | | | 2 | 6 | 1 | 1 |

# Summary of results on the lactation yield estimation

- **With AT scheme :**
  - high level of correlation (0.98) are reached quickly for milk yield
  - for protein yield, the situation is worse than milk yield
  - for fat yield, 5 or 7 test-day are needed to reach $R^2$ of 0.95

- **With CZ scheme :**
  - for protein yield, the first recording is sufficient to reach $R^2$ of 0.98
  - for fat yield, 2 or 3 monthly test-day are needed to reach $R^2$ of 0.95 , 6 or 7 test-day for 0.98.

- **The comparison of AT and CZ shows a clear advantage of recording milk yield on 24 hours to improved the estimation of fat and protein yields**

# Conclusion

- **These French studies show that:**
  - CZ scheme is an alternative between A scheme and AT scheme
  - Adjustment in AT and CZ schemes improve the accuracy
  - Robot scheme is less accurate than A scheme for fat yields

- **The schemes developed since the last 10 years allowed:**
  - to maintain a high rate penetration of milk recording
  - to reduce the cost of milk recording
  - the progression of "low demanding" schemes

- **There are alternative solutions to A scheme. Alternate schemes with adjustments (AT, CZ) are interesting ways that meet the needs of farmers, technical support and genetic evaluation.**

# Thank you for your attention