# Nitrogen efficiency on dairy farms

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## LARGE VARIATION IN NITROGEN EFFICENCY AMONG ORGANIC AND NON-ORGANIC DAIRY FARMS

## Objectives

N-efficiency and cause of variation in N-efficiency and N-surplus in organic and non-organic commercial dairy farms.

## Hypotheses

• Increasing amount of nitrogen in purchased fertilizer or feed per ha farmland decreases the N-efficiency and increases the N-surplus per ha and per unit produce.

• Variation in N-efficiencies is larger within farming systems than between the systems.

## Definitions

**Farmland**: Temporary grassland plus permanent pasture weighted by 0.3. Grazed rangeland is not included as farmland.
**Dairy farm:** Farmland and N-input used for dairy cattle.
**Dairy system**: The dairy farm plus the area and N-surplus off farm for production of purchased feed.
**N-produce**: N in sold milk plus net edible meat gain
**N-purchase**: N in purchased feed, fertilizer, manure and litter
**N-surplus of N-purchase on dairy farms**: net N-purchase minus net N-produce
**N-Surplus of N-purchase on farm**: net N-purchase minus net N-produce
**N-Surplus of N-supply on farm**: net N-supply (including N from Biological nitrogen fixation (BNF) and atmospheric deposition and N-purchase) minus net N-produce
**N-efficiency of N-purchase on farm**: net N-produce/ net N-purchase
**N-surplus per unit of N-produce**: (total N-surplus of the dairy system) / N-produce. Total N-surplus = N-Surplus of N-supply on farm + N-surplus off farm

## The farms


- 10 organic and 10 non-organic dairy farms on the Norwegian west coast.
- Most of forage were produced on farms.
- All farms imported concentrate mixtures.
- Grazing in summer time, either on farm or in rangeland.
- Data were collected for the years 2010 to 2012
- Data from the Norwegian agricultural authority, the Norwegian Dairy Herd Recording System, farm advisors, farm accounts and farmers


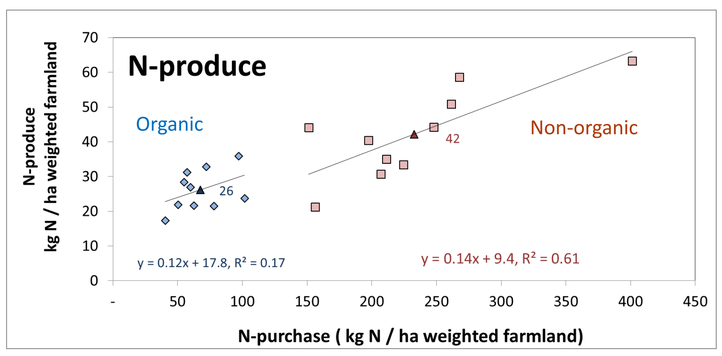


Fig. 1. **N-produce** (milk and meat) on dairy farms versus N-purchase to the farms. The triangles indicate mean values for organic and non-organic production

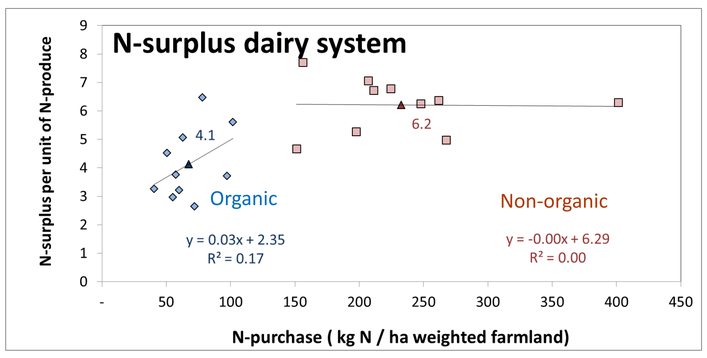


Fig. 3. **N-surplus per unit of N-produce** (milk and meat) versus N-purchase to the farms estimated as total surplus for the dairy system. The triangles indicate mean values for organic and non-organic production

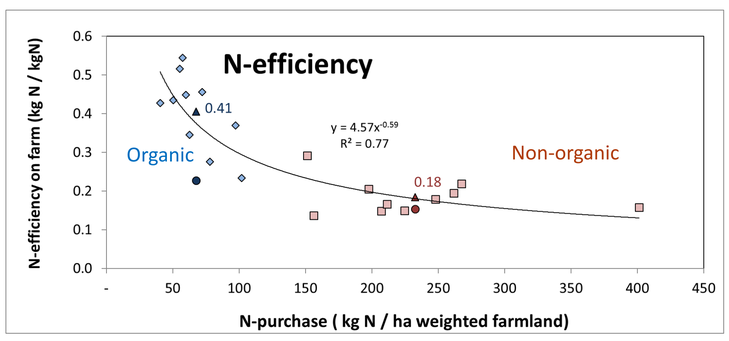


Fig. 2. N-efficiency on dairy farm versus N-purchase to the farms. **N-efficiency of N-purchase on farm** is indicated by diamonds, squares, triangles and regression line. The triangles indicate mean values for organic and non-organic production. The circles indicate corresponding mean values for **N-efficiency of N-supply on farm** (N from BNF and atm. dep. included).

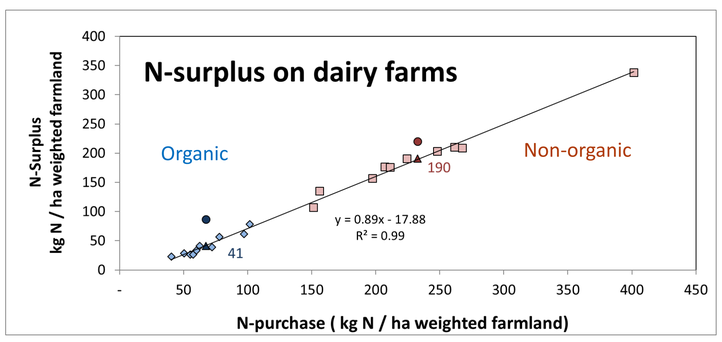


Fig. 4. N-surplus on dairy farms versus N-purchase to the farms. **N-Surplus of N-purchase on farm** is indicated by diamonds, squares, triangles and regression line. The triangles indicate mean values for organic and non-organic production. The circles indicate corresponding mean values for **N-Surplus of N-supply on farm** (N from BNF and atm. dep. included).

## Discussion

Increasing **N-purchase** increased **N-produce**, but the large variation among the farms show that other factors contribute to the productivity of the farms (Fig.1). This is also reflected in the large variation in **N-efficiency** of N-purchase (Fig.2). As expected, the **N-surplus on the dairy farms** per ha increased with N-purchase (Fig.4). **The total N-surplus from the dairy system per unit of N-produce** was lower on most organic farms than on non-organic farms. On organic farms, the N-surplus per produced unit increased with N-purchase, while on non-organic farms it fluctuated around 6 kg N per kg N-produce (Fig.3). The N-surplus per unit N-produce decreased with increasing proportion of feed in the total N-purchase (data not shown). This is not surprising as feed is at a higher trophic level than N in fertilizer or slurry, and losses occur from fertilization to harvest, and from harvest to feeding (Bleken et al. 2005). Likely reasons for the large variations between the farms are differences in the feeding efficiencies, utilization of own manure, losses from field to feeding, animal health and soil conditions.

## Conclusions

• Increasing amount of N-purchase increased the farm N-surplus per ha and tended to decrease N-efficiency, but not on non-organic farms. The correlation between the N-surplus per unit of N-produce and N-purchase was weak.

• The organic farms had lower N-surplus per ha than the conventional farms, had higher N-efficiency of N-purchase on farm and lower N-surplus per unit of produce, caused by an overall better utilization of N-purchase.

• Within farming systems, the variation in estimated N-efficiencies is larger than the differences between the averages of these two systems.

*Referance:*
*Bleken, M. A., Steinshamn, H., & Hansen, S. 2005. High nitrogen costs of dairy production in Europe: worsened by intensification. AMBIO: A Journal of the Human Environment, 34, 598-606*

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