

# RESEARCH PROGRAMME TO IMPROVE THE UTILIZATION OF HOME-GROWN FORAGES IN THE NETHERLANDS

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## ABSTRACT

In The Netherlands a research programme has been initiated by the Ministry of Agriculture, Nature Management and Fisheries to increase the proportion of high-quality home-grown forage in rations for dairy cows. This should result in a more sustainable dairy husbandry by improving the efficiency of utilization of nitrogen and phosphorus from home-grown forages (mainly grass and maize) on farm level. Research disciplines involved are plant breeding, forage harvesting and conservation and nutrition.

## KEYWORDS

Cattle, plant breeding, nitrogen, phosphorus, home-grown feed.

## INTRODUCTION

In areas with an intensive dairy cattle husbandry, like in many regions in The Netherlands, a relatively small proportion of the input of nitrogen, phosphorus and potassium is recovered in milk and meat. This results in high surpluses of these minerals on farm level (Aarts and Middelkoop, 1994). In a milk quatum system, the main method to reduce these surpluses of minerals is to minimize their input.

The main sources for the input of nitrogen, phosphorus and potassium are inorganic fertilizer and purchased concentrates. To reduce these inputs, these minerals should be utilized more efficiently within the soil-plant-animal system. Reduction of mineral input may have a negative effect on forage quality and animal performance thereby decreasing the efficiency of utilization. Integrated research has been started to study possibilities to increase the proportion of home-grown forages (grass and maize) in rations for dairy cows and to improve the utilization of nutrients.

## AIM OF RESEARCH PROGRAMME

The programme aims at reducing the input of inorganic fertilizer and concentrates on dairy farms by improving the utilization of nitrogen and phosphorus from grass and maize products. To obtain these improvements, studies are carried out:

1. to maximize the efficiency of nitrogen and phosphorus uptake by the plant;
2. to maximize the efficiency of nitrogen and phosphorus utilization by the animal;
3. to increase the intake of required nutrients from these forages.

## RESEARCH PROJECTS

### Maximizing the efficiency of mineral uptake by the plant.

Research on this topic mainly aims to study the genetic principles for variation in nitrogen and phosphorus use efficiency in grass and maize, respectively, as well as for the variation in nutritive value. Theoretically an improvement in nitrogen use efficiency of 10% is possible which may result in a reduction in nitrogen surpluses on a farm level, at similar or increased operating results (van Loo and Vellinga, 1994). New methods to evaluate the nutritive value of new plant varieties are being developed to obtain an applicable selection method for plant breeding programmes.

### Maximizing the efficiency of mineral utilization by the animal.

Protein in grass products is characterized by a high rate and extent of rumen degradation. In combination with a relatively high protein content (> 200 g crude protein per kg DM), this results in high nitrogen losses (van Vuuren, 1993). Improving the protein quality of grass is attempted by plant breeding, grass land management, (bio)technological methods during harvesting and storage and by feeding strategies (protein : carbohydrate ratio in the diet).

A reduction in phosphorus fertilizer may decrease phosphorus concentration in forages and consequently phosphorus intake by the animal. To prevent extra phosphorus input by concentrates, phosphorus requirements should be identified more accurately. Research is carried out to study phosphorus metabolism, focusing on the inevitable losses of phosphorus in dairy cows.

An important proportion of the nitrogen losses into the environment appears as ammonia, which emits from urea excreted in urine. The effect of nutrition on ammonia emission from urine is another research project in this programme.

**Improving nutrient intake.** Generally, protein and energy supply from forage only is insufficient for high-producing dairy cows, resulting in a requirement for purchased concentrates. Feed intake is regulated by various factors (Forbes, 1994; Ketelaars and Tolkamp, 1991; van Vuuren, 1994). In this programme the effect of variation in energy expenditure required for digestive processes, including chewing, is studied. Possibilities to improve the nutritive value of forages by (bio)technological methods during harvesting, ensiling and feeding are investigated. These techniques include matting and fractionating techniques and the use of inoculants and other additives in silages.

**Economical and environmental evaluation.** The influence of changes in land use and management, forage quality and feeding strategies on the economical revenues and on nitrogen and phosphorus balances on the farm level is also included in this research programme. For these studies a recently developed mathematical model will be used (van de Ven, 1996).

## APPROACH

This programme is carried out as a cooperation between four institutes of the Agricultural Research Department in The Netherlands (DLO-NL). Institutes involved are:

- DLO Institute for Animal Science and Health (ID-DLO),
- DLO Research Institute for Agrobiological and Soil Fertility (AB-DLO),
- DLO Centre for Plant Breeding and Reproduction Research (CPRO-DLO) and
- DLO Institute of Agricultural and Environmental Engineering (IMAG-DLO).

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