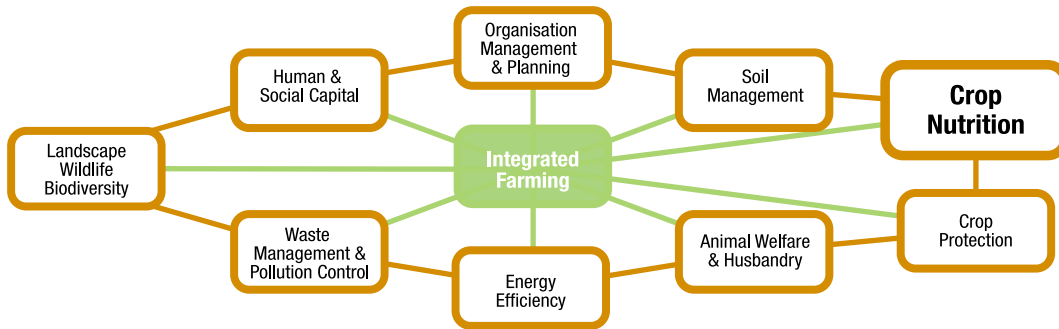


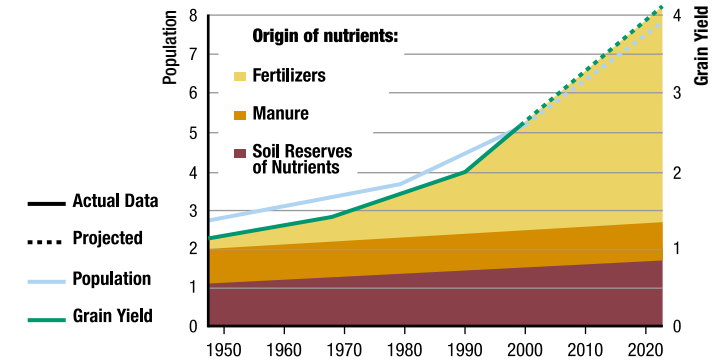
FARMING FOR THE FUTURE

How mineral fertilizers can feed the world and maintain its resources in an Integrated Farming System





Global trends in population growth (Population 1000 million), grain yield, and origin of plant nutrients (Grain Yield tonne/ha)



Source: Stapel (1982), UN (2002).

It is only with the use of mineral fertilizers that the continuously growing world population can be fed.

INTEGRATED FARM MANAGEMENT: THE WAY AHEAD

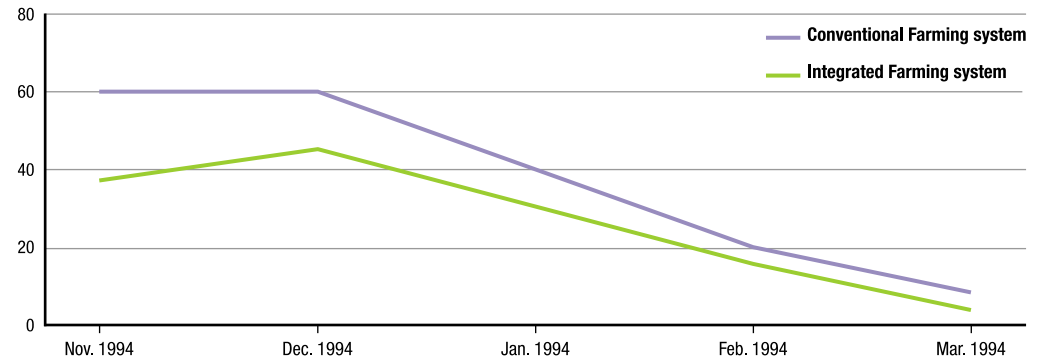
The world's growing population seeks to meet its economic and social needs without preventing future generations from doing the same. The first priority, however, is that people should be fed, and for this we must rely on the fertility of our agricultural soils. Modern farming systems need to enhance productivity and profitability for the farmer, yet still preserve the quality of the world's environmental resources – soil, water, air.

Therefore, we will need to depend on the best knowledge, technology and farming practices that are, or become, available.

Integrated Farm Management (IFM) shows the way to develop strategies to satisfy the crop's need for nutrients. Farmers who follow the principles of IFM are using nutrients in a responsible and environment-conscious way.



Nitrate Content of Field Drainage Water: Integrated vs Conventional Farming system (Water Nitrate mg/l)



Source: Hydro Agri from Focus on Farming Practice (FOFP) 10 year report.

Using the principles of Integrated Farm Management allows a better control of crop nutrition, and limits nutrient losses.

WHAT IS INTEGRATED FARM MANAGEMENT, HOW DOES IT WORK?



With their commitment to stewarding their products throughout their life-cycle, fertilizer manufacturers support and encourage farmers with practical and timely advice and services.

WHAT IS INTEGRATED FARM MANAGEMENT?

Integrated Farm Management takes a whole farm approach and finds the right way to deal with challenges on the farm which can, at times, be conflicting. It can ensure that farming is sustainable regardless of whether production is based on a high-input intensive system or one that is less intensive.

Most of all, IFM is dynamic. It is about the ability of decision makers on the farm to adapt commonly accepted principles according to the individual site and situation of their farm environment. It is not about a fixed set of instructions for farming, as these cannot be applied successfully to every circumstance, and in certain situations could actually prevent progress.

Instead, IFM is based on an understanding of the scientific processes in the farming environment, e.g. nutrient flows, factors influencing soil quality, and the application of this knowledge to identify aspects of the farming practice that need attention.

HOW DOES IT WORK?

Farm managers and employees plan, measure and monitor all aspects of the farming system. The farm manager can then review progress against a common set of objectives, and adjust farm practices accordingly. Different countries will measure and monitor in various ways, and prefer methods with varying degrees of sophistication. The core objectives are the same, however, and are based on sound science and policies which reflect the

legal framework and criteria for sustainable agriculture. As policies change over time, so can IFM.

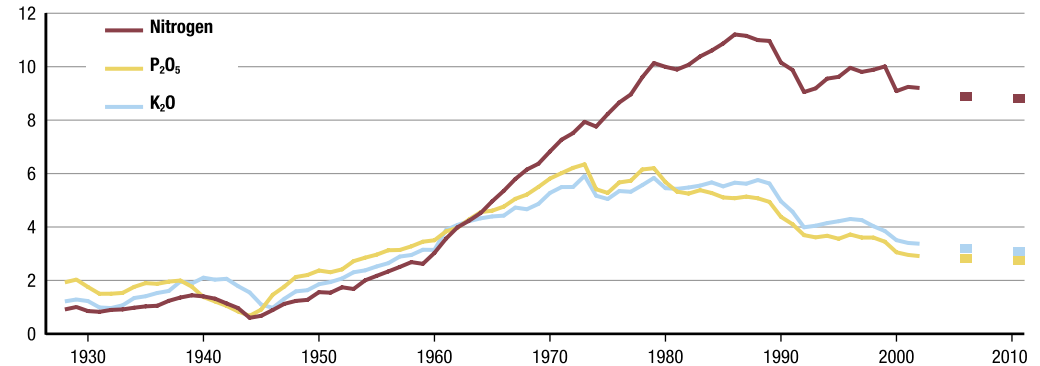
The shift in emphasis toward environmental issues has broadened agricultural policies, aiming to meet the demands of society through:

- producing sufficient high quality food, feed, fiber and industrial raw materials.
- maintaining viable farming businesses.
- caring for the environment; and
- maintaining natural resources.

IFM has to be capable of meeting these demands, and it can. At the same time, its dynamic management system provides a set of flexible working procedures and records for responding to society's needs and adapting to changing agricultural policy.



Fertilizer nutrient consumption in the European Union (million tonnes)



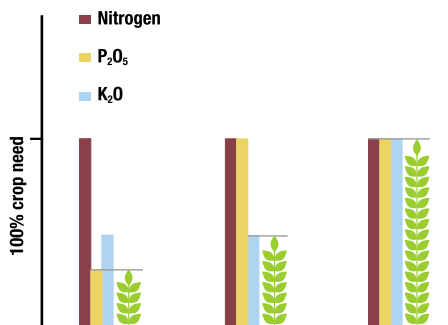
Source: EFMA

There is a downward trend in the use of mineral fertilizers, due to improved nutrient management on farms and the assimilation of more organic waste in farmers' nutrients balances.

HOW DOES IT WORK IN PRACTICE FOR NUTRIENT MANAGEMENT?



The Law of Minimum



Source: EFMA

A deficiency of any single nutrient is enough to limit yield: in the above cases 1 and 2, the insufficient quantity of phosphorus (case 1) or potassium (case 2) limit the yield, despite a sufficient quantity of nitrogen.

WHAT IS EXPECTED FROM IFM GROWERS IN TERMS OF NUTRIENT MANAGEMENT?

These principles, taken from those defined in the Common Codex for Integrated Farming published by the European Initiative for Sustainable Development in Agriculture (EISA), provide the basis for nutrient management in the IFM system:

- Farmers select the most effective crop variety and rotation to meet their environmental, agronomic and economic objectives;
- They are committed to monitoring and auditing as a basis for maintaining or improving economic or environmental performance;
- They use responsible soil and water management practices to preserve or improve soil condition, and safeguard natural water resources;
- They approach crop nutrition in a balanced and

measured way, taking into account the farm's organic resources;

- They manage energy efficiently to minimise wastage and limit their dependence on fossil fuels; and
- They follow principles of waste management, re-using or recycling waste products and protecting the soil, water and air against pollution.

HOW DOES THIS WORK IN PRACTICE?

Manures and fertilizers both have a role to play in sustainable agriculture. Manures are by-products, and their nutrient content should be recycled wherever possible. However, supplies are usually inadequate in amount and composition to meet the nutrient requirements of all crops. So mineral fertilizers should be used to make up for the deficit.

Fertilizer recommendations are designed to provide different nutrients in correct proportions, according to crop need. A deficiency of any nutrient is not only, in itself, detrimental to the plant, but it also affects the plant's ability to use the other nutrients effectively. (See Law of Minimum graph). Regular soil analysis helps the grower to decide the type and amount of fertilizer to use.

EFMA promotes the correct use of both manures and fertilizers as Good Agricultural Practice

Average nutrient content (kg/t harvest) of some important crops

	% dry matter	N nitrogen	P ₂ O ₅ phosphate	K ₂ O potash	MgO magnesium	CaO calcium	SO ₃ sulfate
Wheat grain	86	20	8.5	6	2	1	5.5
Wheat straw	86	5	3	17.5	2	4.5	4.2
Maize grain	86	14	8.5	5	2.5	2.5	-
Maize straw	86	7	6	20	3	6	-
Oilseed Rape grain	91	33	18	10	5	-	8.7
Oilseed Rape straw	86	7	3	25	2.5	-	3.0
Sugar beet beet	23	1.7	9.5	2.5	0.8	4	8.0
Sugar beet leaf	16	2.9	9.5	5.5	0.8	1.2	8.0
Potato tuber	22	3.5	1.4	6	0.6	0.3	0.5
Potato leaf	25	4	1.5	6	2	-	1.0

Source: EFMA

Nutrient requirements of crops vary considerably, and nutrient supply has to be carefully adapted to the needs of the plant.
Table 1

Manure production and nutrient content (kg/t slurry or manure)

Source	Manure t/year	% dry matter	Total nitrogen	Soluble nitrogen	P ₂ O ₅ phosphate	K ₂ O potash
1 dairy cow slurry	23.0	8.5	4.7	2.7	1.4	5.3
10 fattening pigs slurry	21.0	6.6	6.3	4.4	3.5	3.5
100 layer hens slurry	10.0	13.8	5.4	3.5	6.0	3.0
1000 chickens manure	2.3	71.0	21.7	5.9	36.0	20.0
1000 chickens manure	1.1	57.4	21.5	6.5	33.0	20.4

Source: Daniob Agricultural Information Office (1989)

Recycling of animal manure is a must in Integrated Farm Management, but the nutrient content of manure varies significantly, depending on many factors such as the animal species, diet, growth and age.
Table 2

1. Calculating the right mineral fertilizer recommendation

Recommendations for fertilizer use take account of the crop's needs. The nutrient uptake of the crop is calculated and the following is subtracted:

- the nutrient supply, already in the soil (from humus, crop residues and mineralized nutrients);
- the nutrient supply from farm manure.

The nutrient uptake of the crop:

The nutrient uptake of the crop is estimated according to field experiments and approved recommendations, which take account of crop variety, expected yield and nutrient supplies, as well as local soil and weather conditions. A crop's nutrient uptake can be calculated by multiplying its yield by its nutrient content per tonne (see Table 1).

The nutrient supply already in the soil:

Soil and plant analyses, together with the experience gained from previous cropping, soil type and local weather conditions helps to assess:

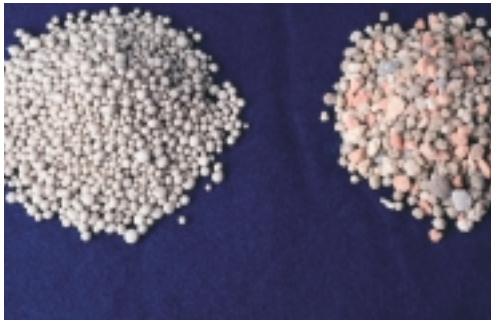
- the mineral nutrients content at the beginning of the cropping period, and;
- the nutrients made available from mineralization of soil organic matter.

The nutrient supply from farm manure

This varies according to collection and storage methods, feed composition and animal species. Not all nitrogen in manure is immediately available when required by the crop. Table 2 shows the nutrient concentration of some manures.

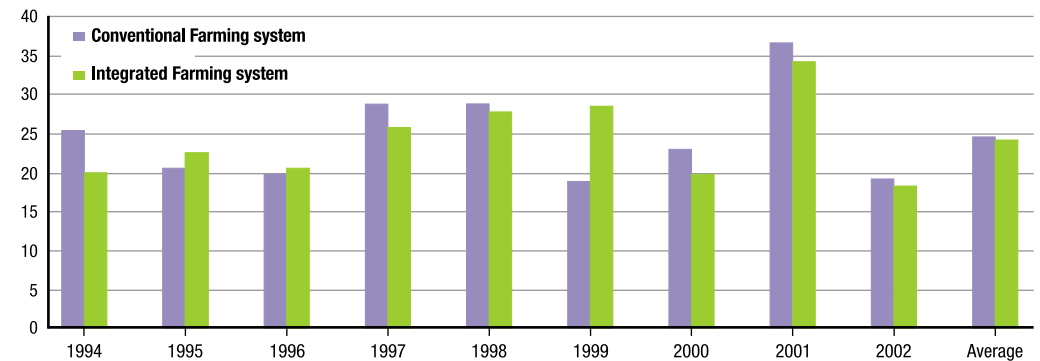
The chemical quality of mineral fertilizers ensures their effectiveness and the availability of nutrients. EFMA members use clear labeling and communicate with farmers and advisers.





Fertilisers manufactured to a high specification, whether blended or granular, are needed for even spreading and efficient use.

Efficiency of Nitrogen Use – Amount of Nitrogen Used per Tonne of Wheat grain only (Kg N/t)



Source: Hydro Agri from FOFP 10 year report.

The principles of Integrated Farm Management help to increase the efficiency of nitrogen use. (in 1999, exceptional weed competition).

2. Applying fertilizers in the appropriate way

It is important that the products used are spread as evenly as possible to avoid excessive application on parts of fields. Precautions should be taken to avoid spreading fertilizer into watercourses, hedgerows and other sensitive areas of the farm.

Timing: The right time to apply fertilizer is usually during, or just before, periods of fast growth, when the crop requires significant amounts of nutrient. Applications to waterlogged or frozen land should be avoided.

Amount of fertilizer to be applied: See the previous page for calculating the crop's total requirement. When necessary, it may need to be applied as several split dressings, especially for cereals, to maximize nutrient uptake and prevent losses. In irrigated systems, split dressings are applied after watering.

Type of fertilizer: Organic manures and certain types of nitrogen fertilizers may need to be injected or incorporated to minimize loss of ammonia gas into the atmosphere.

Spreading equipment: For maximum efficiency, equipment should be regularly maintained and carefully calibrated.

Precision farming: Precision farming technology enables optimum application of nutrients throughout the fields, and should be used when possible.

Guidance and training: Support advisory materials and training programs help operators to apply fertilizer efficiently, with minimal risk to the environment.



Careful quality control throughout manufacture and distribution produces mineral fertilizers which can be spread more evenly.



Field margins protect hedges and ditches from any possible effects from fertilizers, and contribute as habitat and food source for wildlife.

3. Storing and handling fertilizers in the right way:

EFMA members promote best practice with careful labeling of their products, and by providing clear recommendations for their appropriate handling and use.

When used and handled correctly, fertilizers present no risk to the environment, or to human health and safety.

As part of their Product Stewardship program, European fertilizer manufacturers set out detailed, practical instructions on the use and handling of their products, to ensure that the farmer reaps the benefits of the fertilizers he buys, in terms of improved crop yield and a protected environment.'

Fertilizers are stored at minimal risk to the environment and to the public, i.e.

- They are kept dry, out of direct sunlight and protected from a wide variation in temperature.
- Some nitrogen fertilizers are oxidizing agents, and should be stored away from organic materials or fuels. The authorities have to be notified of premises storing significant quantities of oxidizing materials.
- They are kept away from watercourses and drains to avoid direct contamination through spillage.
- Care is taken to stack fertilizer according to manufacturers' instructions.
- Product Safety Data Sheets are provided to ensure that all those who handle or use fertilizer are aware of any health and safety implications.



Photographs facilitated by
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