



SEARCH



Most people, including many scientists, seem to believe that worldwide consumption of fertilizers is continually increasing in an unsustainable and environmentally damaging way.

This view is particularly prevalent at the present time with farmers striving to increase crop yields to feed expanding world populations.

Because the availability of the key nutrients, nitrogen, phosphate and potassium (NPK), is often rate limiting for plant growth, it seems obvious that the steady increase in most crop yields that has taken place since the 1960s must involve a proportionate increase in NPK fertilizer use.

This belief in a global crisis of ever-increasing fertilizer use is one of the key arguments used against modern intensive agriculture.

In reality, however, the true situation is much more complex and multi-faceted than suggested by this rather simplistic viewpoint. According to data from the UN Food and Agriculture Organization (1), fertilizer use varies greatly in different parts of the world but in regions with relatively mature intensive farming systems (e.g. Europe and USA) fertilizer consumption has levelled off or even decreased relative to crop yield over the past two decades.

In contrast, in less agriculturally mature regions such as sub-Saharan Africa, fertilizer consumption is still only a tiny fraction of Western levels and urgently needs to be increased to provide food security to their rapidly expanding populations (2).

Historically speaking, farmers have used various organic and non-organic fertilizers since the dawn of agriculture over ten thousand years ago.

Organic materials such as manure, seaweed, and guano are rich sources of NPK, while non-organic chemicals such as lime are often essential to enable crops to be grown on the acid soils that are found in many parts of the world. Indeed the cultivation of soils in much of upland Europe depended (and still depends) on the liberal use of inorganic lime as a fertilizer.

In terms of food production one of the greatest advances of the modern era was the invention of methods for the inexpensive manufacture of inorganic NPK fertilizers.

A second key advance was the breeding of crops able to respond to such fertilizers by increasing grain yield rather than simply making more inedible vegetative biomass such as stalks and leaves.

In particular, the development of semi-dwarf cereal cultivars, and their use with fertilizers as part of the Green Revolution of the 1960s and 1970s, enabled developing countries in Asia to triple or quadruple production of key staple crops such as rice and wheat.

However, this involved a concomitant increase in fertilizer use and annual global consumption rose from 27 million tonnes in 1960 to over 144 million tonnes in the late 1980s (3).

While this increased application of chemical fertilizers undoubtedly underpinned the production of cheaper and more plentiful food in regions that were hitherto at serious risk of famine, there have also been some downsides to fertilizer use.

For example, in some developing countries even the relatively modest cost of fertilizers was beyond the reach of the poorest farmers who were therefore unable to participate fully in the yield gains of the Green Revolution.

Ironically, in richer countries the same fertilizers were relatively cheap, which has sometimes led to their overuse causing runoff of surplus fertilizer and pollution of watercourses.

So why has global fertilizer consumption decreased in relation to crop yield in recent years? There are several factors involved.

Firstly, much of the initial decline in fertilizer use in the 1990s was due to the collapse of the state farming system in the former Soviet Union that used fertilizers wastefully and inefficiently.

This was followed in many regions by improved management of fertilizer application as part of an increasing consciousness that its excessive use could be environmentally damaging. For example, many commercial farmers now use satellite imaging to direct fertilizer only to those parts of their land where it is most required.

In recent years, these and other measures to reduce fertilizer use have been made even more necessary by the dramatic rise in prices, mainly due to higher energy and commodity prices. In 2008-09, fertilizer prices more than doubled in many regions and although they subsequently decreased to some extent, prices are likely to keep rising in the foreseeable future.

Today, fertilizer use is in relative decline in those parts of the world where more intelligent management measures are used to apply it to cropland. However, there are a few regions, most notably China, where fertilizer overuse is still a major problem.

In contrast, in much of sub-Saharan Africa fertilizer use remains far too low and is one of the main causes of food insecurity and environmental degradation in the region. For example, data from the China Agricultural University show that farmers in Northern China use about 588 kg/ha nitrate fertilizer in contrast to the 7 kg/ha used in the mineral deficient soils of West Africa (4).

Part of the problem in China is the maintenance of low prices by government subsidy, which means that farmers tend to overuse their cheap fertilizers. The problem in Africa is exactly the opposite. Here, intelligent measures are urgently needed to promote fertilizer use, which, as shown above, is as little as one percent of the use in major agricultural areas of China.

The environmental consequences of fertilizer underuse in Africa were highlighted in an international report showing that between 2000 and 2005, forests were cut down at a rate of 4 million hectares per year, mainly due to the need for more cropland to sustain growing populations (5).

If African farmers had access to modest amounts of fertilizer (much less than is consumed in developed countries) the resulting increased crop yields would have made it unnecessary to destroy these irreplaceable forests.

Although fertilizer subsidies were introduced in Africa during the 1980s, these had limited impact often due to poor targeting or mismanagement and most programmes have now been suspended in the context of economic liberalization.

However, the potential impact of carefully targeted support of fertilizer use was demonstrated by the actions of the government of Malawi who brought back limited subsidies (against the strong advice of most Western aid donors) after a series of poor harvests in 2001-06.

The effect was dramatic as maize yields more than doubled enabling this very poor landlocked country to move from chronic dependence on food aid to being a food exporter within a single year (6).

In conclusion, the world is very far from experiencing a runaway increase in fertilizer use. In many, but not all, regions fertilizer use is in relative decline thanks to improved management methods.

However, the most important message is that agriculture in Africa urgently needs schemes to facilitate increased fertilizer use in targeted areas in order for crop yields to increase to global levels.

Such measures should form an indispensable element of future strategies to promote food security in this rich and diverse continent, which will experience the most rapid population growth during the remainder of the 21st century.

Denis Murphy, Professor of Biotechnology, University of Glamorgan, UK and Biotechnology Advisor, Food and Agriculture Organization, Rome.

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👤 Denis J Murphy

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