FERTILIZER USE IN SOUTH ASIA

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Keywords: Fertilizer, demography, cropland, irrigation, crop-nutrient

Contents

1. Introduction

1.1. Geographical Setup

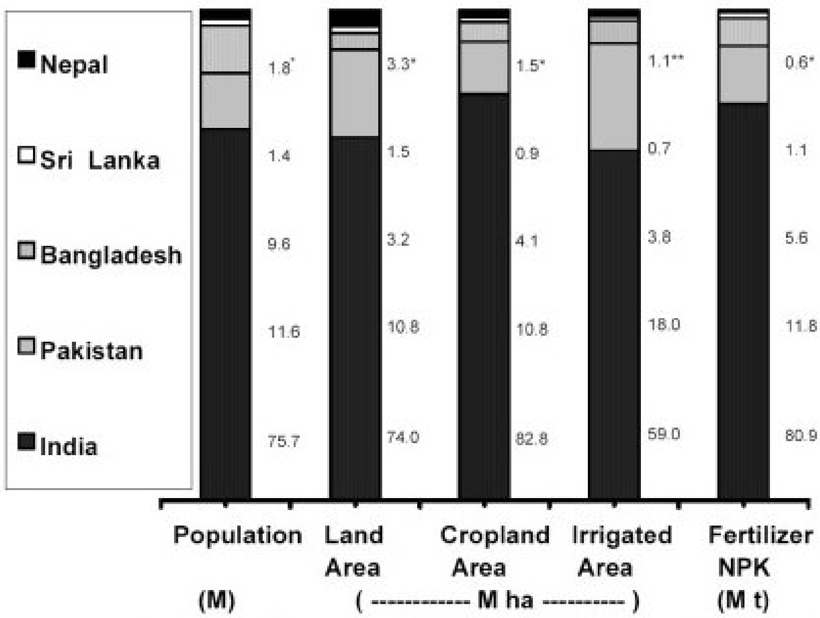
As per the South Asian Association for Regional Cooperation (SAARC), the South Asia Region comprises of seven countries: India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and Maldives. Contrary to this delineation, conventional statistics on the state of agriculture and agriculture-dependent population include India, Pakistan, Bangladesh, Sri Lanka and Nepal to designate South Asia Region (FAO, 1999). Hence, merely on the grounds of their relatively small geographical area and their small agriculture-dependent populations, Bhutan and Maldives are excluded from the preview of this report on the South Asia Region.

1.2. Demography

In 1998, 1319 million (M) people inhabited South Asia (UNDP, 1998). With 3.5% of the world area and 22% of the world population this region remains very densely populated (297 persons/km^2) (Figure 1). It is predicted (UNDP, 1998) that relative to 1998, by 2020 the population of South Asia will be enhanced by a further 460 million people—a gain of 35%. Presently, 25% of the inhabitants are poor and an equal number is food insecure (FAO, 1999). Another important feature of the South Asian population is that the majority (almost 70%) is village based. With the possible exception of Sri Lanka, for two out of three workers agriculture is the source of employment.

1.3 Cropland and Soil Fertility

South Asia occupies a total land area of 444 million hectares (M ha). Of this, in 1998 (since annual statistics on agriculture are spread over two partial years, in this report a Julian year, say 1998, corresponds partially to 1998 and 1999), 205 M ha was devoted to cropland (Figure 2). Thus, with 13.5% of the world's cropped area and 22% of the population, South Asia has a food gap to fill (c. 4 M tons extra food per annum). Additionally, burgeoning population in future will necessitate more intensive use of a relatively fixed cropland area (Figure 2). This is likely to leave less opportunity time for land to rejuvenate, typically when devoted to arable farming. Then poor small and marginal farmers, who dominate agriculture in South Asia, have few options except to raise food crops in quick succession and that too with non-commensurate use of restorer inputs (like fertilizers). Hence, depletion in soil fertility is expected to accelerate further. So serious is going to be the threat to soil fertility that among various constraints to sustainable productivity, we believe that it will overtake all others in extent and intensity.



	Population (M)	Land Area (M ha)	Cropland Area (M ha)	Irrigated Area (M ha)	Fertilizer NPK (M t)
South Asia	1319	444	205	83	20.8
World	5901	13000	1512	271	137.3

(* : % ; ** : Actual)

Figure 1: Distribution of population, total, cropland and irrigated area and fertilizer consumption in countries of South Asia, and the world ,1998

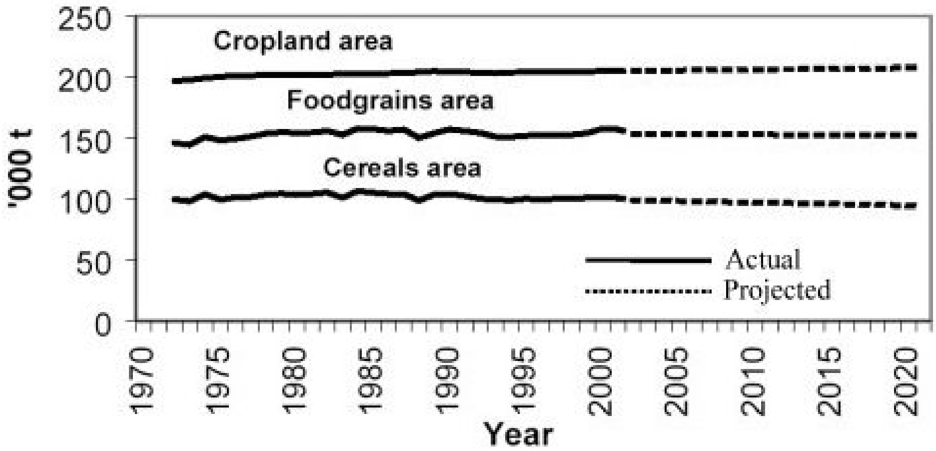


Figure 2: Trends (actual and projected) in area under cropland, foodgrains and cereals in South Asia

As is common with area-expansive traditional farming methods, soil fertility constraints acan be alleviated by organic manure additions and by strengthening of soil biological practices.

However, the nutrient depletion problem with intensive agriculture is so severe that it may not be practical to cover all of it with these low and uncertain approaches alone.

Synthetic fertilizers with their instant ability to refurbish depleted nutrients in appropriate quantities and forms have come to be recognized as a key component of sustainable soil fertility management.

Not only that, it is the enhanced use of fertilizers (along with irrigation water and seeds of high-yielding varieties) that provided the foundations of the so-called Green Revolution in South Asia and elsewhere.

While there is no doubt about the role of fertilizer in raising crop productivity, concerns have been expressed on their declining efficiency i.e., units of additional economic yield per unit of fertilizer nutrient (Figure 3). A falling efficiency heralds greater loss of fertilizer nutrients.

This makes fertilizer use economically more prohibitive. Typically, small and marginal farmers are hit hard. Moreover, inefficient use of fertilizers is liable to produce adverse effects on the environment, since lost nutrients either pollute the hydrosphere or the biosphere.

Environmental pollution arising from the use of fertilizers is a matter of serious concern because of its links with global warming (nitrous oxide triggered), ecological harm (eutrophication) and health hazards (nitrate or heavy metal related). This dark side of fertilizers casts doubts on the sustainable development of agriculture involving their use.

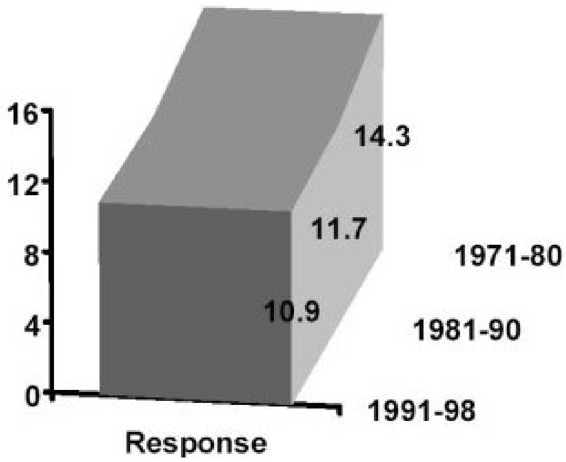


Figure 3: Marginal response to NPK (kg foodgrain / kg NPK) in South Asia

Bearing in mind the aforementioned concerns, the fertilizer use situation is reviewed for the South Asia region. The role of fertilizers—weighed and balanced as blessings (yield enhancing effect) and banes (environmental risks)—in sustainable development of agriculture forms the central theme of this article.

2. Fertilizer Use in South Asia

2.1 Consumption and production

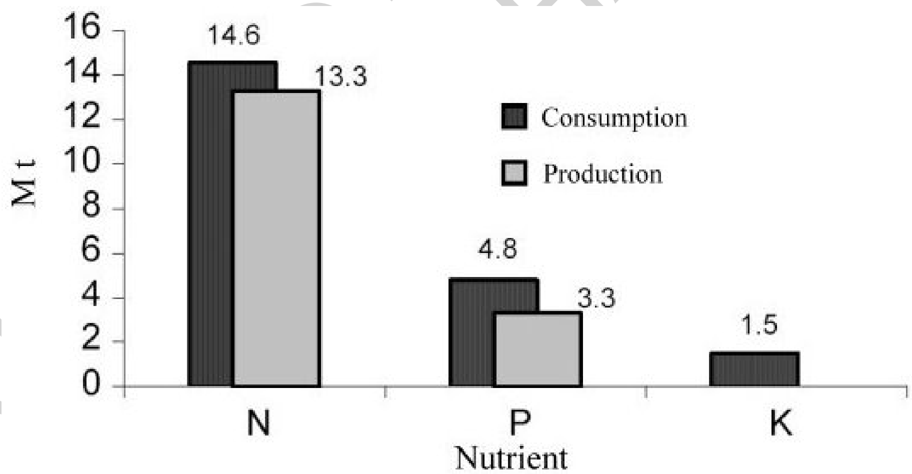


Figure 4: Consumption and production of N, P and K in South Asia, 1998

In 1998, South Asia used 20.8 M tons of fertilizer nutrients (in this article, unless otherwise specified, fertilizer, fertilizer nutrients or NPK means sum of N, P_2O_5, and K_2O). This is about 15% of the fertilizers consumed worldwide (137.3 M tons) (Figure 1). On an overall basis, 80% of the fertilizers consumed are produced locally. However, wide distortions surface when nutrient-wise production or consumption data are reviewed (Figure 4). Currently, 91% N and 70% P are of indigenous origin. In contrast, the entire consumption of 1.5 M tons of K_2O is met through imports.

Over the years, fertilizer nutrient use (crop area times rate of fertilizer NPK application ha^{-1}) has increased steadily (Figure 5).

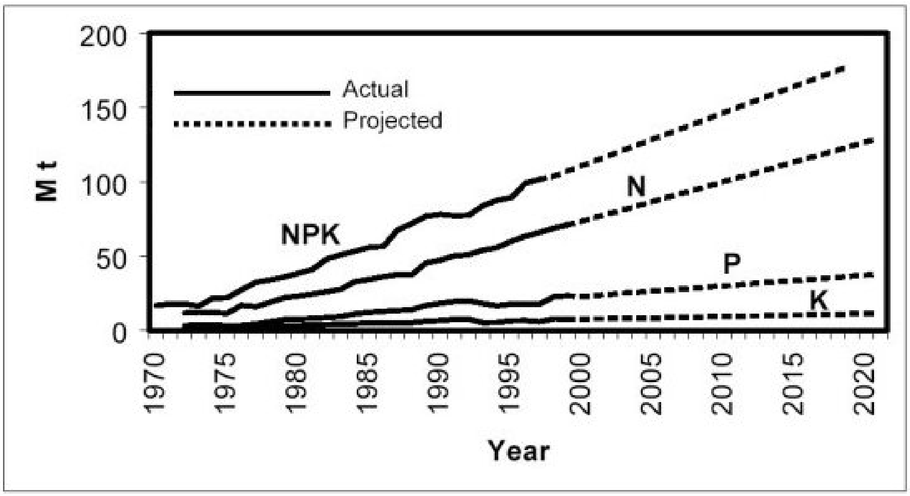


Figure 5: Trends (actual and projected) consumption of fertilizer (NPK) in South Asia

From 1971 to 1998, in South Asia it multiplied fourfold. However, vitiated by crop area variations, total fertilizer consumption data do not allow comparisons between countries on the adequacy of fertilizer use and crop productivity. Intensity of use (kg NPK ha^{-1} $annum^{-1}$), on the other hand, is a more acceptable index of nutrient consumption and crop productivity.

Currently, intensity of fertilizer use ranges between 41 (Nepal) and 141 (Bangladesh) kg NPK ha^{-1} $annum^{-1}$ (Figure 6). Since 1971, the linear growth rate in intensity of fertilizer use (3.3 kg NPK ha^{-1} $year^{-1}$) has been higher than any other region or the world as a whole. So phenomenal has been the rise in fertilizer use intensity, which otherwise lagged behind the world until 1994, that South Asia has emerged as the leader since then (see Figure 7). Its 1998 average consumption of 102 kg NPK ha^{-1} $year^{-1}$ was more by 3, 10 and 20 kg NPK ha^{-1} $year^{-1}$ than that in developing and developed countries and world, respectively.

2.2 NPK consumption pattern

The proportion of N, P and K comprising the 102 kg NPK ha^{-1} is not equally shared among the three nutrients. This is not unexpected, since neither the requirements of diverse crops for these nutrients are uniform nor is their deficiency in soils universal. Not necessarily tuned to crop needs, but generally in accordance with the extent and intensity of deficiency in soils, N use far exceeds that of P and more typically of K. In 1998, respective consumption of N, P and K corresponded to 71, 23 and 8 kg ha^{-1}.

Expressed in terms of N:P:K ratio, currently N and P use is, about nine and three times higher than that of K. A continuing tilt towards N fertilization rather than P and K (Figure 5) is expected to influence soil fertility, crop yields and quality and the sustainability of agriculture in the long run. Although we do not subscribe to an assumed ideal NPK ratio of 4:2:1 (NAAS, 1996), we do believe that widening in the ratio of NPK is against the tenets of balanced fertilization (equalizing supply of all nutrients and their offtake with a high yielding crop) and thus a matter of concern for sustainable development of agriculture. For example, in India, the drop-off in response, accompanied by declining growth rates in production and productivity, is considered to be largely a result of unbalanced nutrition leading to multiplication of nutrient deficiencies. On this count, the situation in other countries of the region is no exception (NFDC, 1998). Currently, NPK use ratio is widest in Nepal (49:18:1) and narrowest in Sri Lanka (2.3:0.6:1).

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