

## DEVELOPMENTS ON FERTILIZER CONSUMPTION OF THE WORLD AND TURKEY

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Geliş Tarihi: 17.08.2005

**ABSTRACT:** World fertiliser consumption as pure N, P, K basis in 2002 was 141.6 million tons of which 64% was used by developing countries, 35% by developed countries. Total fertiliser consumption of America, Asia and Europe accounted for 95% of world fertiliser consumption (WFC). With 39.6 million tons fertiliser consumption, China has 28% share in the world total consumption. Due to hazardous effects of fertilisers, in particular nitrogen, on the environment and human health, some measurements restricting fertiliser use were taken by many countries, especially by EU(15) and USA. Many EU(15) countries reduced their fertiliser use at rate of ranging from 3% to 38% during 1992 to 2001 years. Fertiliser consumption of Turkey in 2002 was 1.74 million tons. Its fertiliser application per hectare is 67.2 kg, which is lower than the world average. It is not possible to alleviate the detrimental effects of fertiliser only by reducing fertiliser amounts used. It is necessary that some management practises not only increasing fertiliser use efficiency but also reducing nutrient leaching have to be used. Also new varieties using nutrient efficiently must be developed.

**Keywords:** Consumption, fertilizer, Turkey, world

### DÜNYA VE TÜRKİYE'DE GÜBRE TÜKETİMİNDEKİ GELİŞMELER

**ÖZET:** Dünya gübre tüketimi 2002 yılında saf N, P, K bazında 141.6 milyon tona ulaşmış olup, bunun %64'ü gelişmekte olan, %35'i ise gelişmiş ülkeler tarafından kullanılmıştır. Amerika, Asya ve Avrupa kıtalarının kullanmış olduğu gübre miktarı dünya tüketiminin %95'ini oluşturmaktadır. Çin 39.6 milyon ton ile dünya gübre tüketiminde %28'lik bir paya sahiptir. Gübrenin, özellikle azotlu, çevre ve insan sağlığı üzerindeki olumsuz etkilerinden dolayı, bazı gelişmiş ülkeler özellikle Avrupa Birliği ve Amerika Birleşik Devletleri gübre tüketiminde sınırlamaya gitmektedirler. AB ülkelerinde 1992 ve 2001 yılları arasında %3'ten %38'e kadar değişen oranlarda gübre tüketiminde azalma görülmektedir. Türkiye'nin 2002 yılı gübre tüketimi 1.74 milyon tondur. Hektara uygulanan gübre miktarı ise 67.2 kg olup, dünya ortalamasının altındadır. Azotun zararlı etkisini sadece kullanılan miktarın azaltılması ile azaltmak mümkün görülmemektedir. Azotun kullanım etkinliğini artıracak ve yıkanmayı azaltacak yetiştirme tekniklerinin kullanımı yanında, azotu daha etkin olarak kullanacak çeşitlerin geliştirilmesi de büyük önem taşımaktadır.

**Anahtar Kelimeler:** Dünya, gübre, tüketim, Türkiye

#### 1. INTRODUCTION

Fertiliser is one of the most important input in agricultural production. While deficit use of fertiliser causes yield and quality losses, excessive use causes serious environmental hazard which has adverse effects on human health, directly or indirectly (Owen and Jurgens-Gschwind, 1986; Byrnes, 1990; Hatipoglu et al., 1996). Farmers mostly prefer to use over than normal rate of fertiliser to avoid yield losses. In view of detrimental effects of fertiliser on human health and environment, some measurements were taken in some developed countries especially in Europe (EC Directive, 1991). OECD countries have extensive experience with pesticide and fertiliser taxes. Although there have been some difficulties in implementation of tax in some countries, great success was obtained by some countries in Europe. For instance, in Sweden the fertiliser tax reduced demand for fertiliser in 1991-92 by 15-20% and also reduced financially optimal dosages by about 10 per cent (Pearce and Koundouri, 2003).

Fertilizer consumption had shifted towards developing countries especially after 1990s. The main forces held responsible for this shift were the introduction of environmental legislation restricting the use of fertilizer in many developed countries especially in European Community (EU15). In ten

years, from 1992 to 2001, nitrogenous fertiliser consumption of some EU countries reduced considerably, e.g in Denmark, -38%; Greece, -34%, and the Netherlands, -26%. Some others EU countries as Belgim-Luxembourg, Finland, Italy, Portugal, and Sweden reduced their nitrogenous fertiliser consumption at a rate of ranging from 3% to 9%.

Data used in this paper derived from FAO sources (FAO, 2005). The amount of fertilizer applied per hectare was calculated by dividing total fertiliser consumption to total arable land.

#### 2. FERTILIZER CONSUMPTION

##### World

According to FAO figures, world total fertiliser consumption increased linearly from 31.2 million tons in 1961 to 116.7 million tons in 1980 (FAO, 2005). This increase continued up to 1990 year reaching 137.8 million tons. In the last ten years there was a slight decrease in fertiliser consumption in the world (Figure 1). The fall at the beginnings of the 1990s was due to the collapse of fertiliser consumption in the countries of Central Europe and Former Soviet Union, following structural changes and economic problems. Another reason was the concern on environmental issues. Expansion usage of alternative agriculture

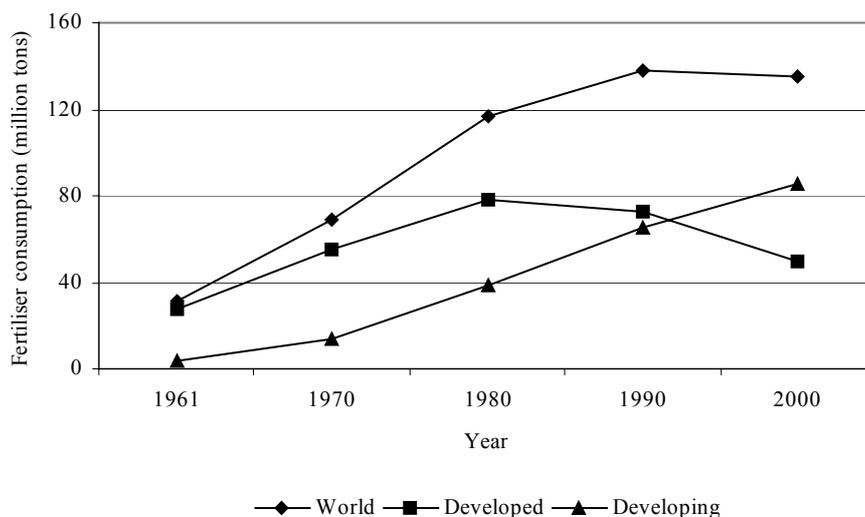


Figure 1. Total fertiliser consumption of the world, developed and developing countries (FAO, 2005)

production techniques as organic farming and sustainable agriculture was of great importance on that fall.

In 2002 total fertiliser consumption of America, Asia and Europe accounted for 95% of the world fertiliser consumption (WFC). Asia alone utilised 54% of WFC, of which 28% consumed by China, and 11.4% by India. Total fertiliser consumption in Oceania was 2% of WFC, most of which used by both Australia and New Zealand. Approximately the same figures are valid for when evaluated in consumption of N, P and K fertilisers. The United States of America (55%) and Canada (7%) accounted for 62% of America fertiliser consumption. Of the total fertiliser used by Europe, 68% utilised by EU(15). France, Germany, The UK, Spain, and Italy are the largest fertiliser consumer. Africa utilised 3% of WFC (Figure 2). Three country, Egypt (30%), South Africa (23%), and Morocco (9%) accounted for 62% of Africa total fertiliser consumption.

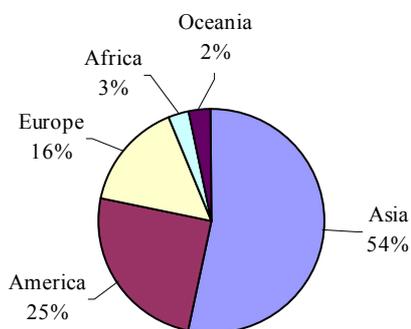


Figure 2. World total fertiliser consumption in 2002

### Developed Countries

Fertiliser consumption of the developed countries increased from 27.5 million tons in 1961 to 77.9 million tons in 1980 (Figure 1). However their share

in the total world fertiliser consumption fell from 88% to 67% during the same period. Since 1980 there has been a decline in fertiliser use of developed countries. Their usage in 2002 averaged 50 million tons nutrients or 35% of world total of which 68% consumed by both EU(15) and USA. Fertiliser consumption of EU(15) from 1961 to 1980 showed an increase with 11.3 million tons to 21.1 million tons (Figure 4). Its share in the world total fell from 36.2% to 18.1% during the same period. In 2002 its share was 10.5% of WFC. In 2002 each EU(15) country used 0.70% of WFC. In EU(15) the largest fertiliser consumer is France, followed by Germany, The UK, Spain, and Italy. But Ireland and The Netherlands are by far the largest fertiliser consuming countries in EU (15) when taken into account their fertilizer application per hectare (Table 1). Fertilizer application of all EU(15) countries is over the world average (100.8 kg ha<sup>-1</sup>).

Another larger fertiliser consuming developed country is the USA. Its consumption increased from 7.6 million tons in 1961 to 21.5 million tons in 1980. Its share in the world total decreased from 24% to 18% of WFC in the same period. After 1980, there was a decline in fertiliser use of USA, accounting for 14% of WFC (Figure 3). According to the latest figure its share fell to 13.6% of WFC in 2002.

When looked at the last ten-year figures from 1992 to 2001, it can be seen that between 1992-94 there was a decline in fertiliser use in developed countries. Between 1994 and 2002 their fertiliser consumption was under the 60 million tons. In developing countries, whereas, there was a continuous increase from 1993 to 1999, reaching over 80 million tons (Figure 4).

### Developing Countries

Since 1961, fertiliser consumption in the developing countries has increased more or less

Table 1. Fertiliser consumption of EU countries, Turkey and the world in 2002

	Total		N		P		K	
	kg ha <sup>-1</sup>	%*	kg ha <sup>-1</sup>	%	kg ha <sup>-1</sup>	%	kg ha <sup>-1</sup>	%
Avustria	149.7	0.15	84.8	0.14	33.8	0.14	31.1	0.19
Belgium-Luxembourg	353.7	0.20	200.7	0.19	55.1	0.13	97.9	0.34
Denmark	130.5	0.21	88.6	0.24	14.5	0.10	27.4	0.27
Finland	133.2	0.21	73.7	0.19	23.6	0.15	35.9	0.34
France	215.1	2.80	123.5	2.69	39.5	2.17	52.0	4.13
Germany	220.0	1.83	151.6	2.11	27.7	0.97	40.7	2.06
Greece	149.1	0.29	93.1	0.30	39.4	0.32	16.6	0.19
Ireland	523.6	0.41	321.1	0.42	86.5	0.29	115.9	0.56
Italy	172.9	1.01	94.8	0.93	44.9	1.11	33.2	1.18
Netherlands	366.8	0.24	310.0	0.34	56.8	0.15	-	-
Portugal	104.0	0.15	50.8	0.12	29.1	0.17	24.1	0.21
Spain	157.2	1.53	77.9	1.26	43.8	1.79	35.5	2.10
Sweden	100.0	0.19	70.5	0.22	13.8	0.11	15.7	0.18
UK	313.1	1.27	198.5	1.35	49.2	0.84	65.4	1.62
EU(15)	200.2	10.5	120.0	10.5	38.3	8.47	41.9	13.4
Turkey	67.2	1.23	46.1	1.41	18.3	1.41	2.8	0.32
World	100.8		60.4		23.8		16.6	

(\*): represent % of world fertiliser consumption; Source: FAO (2005)

continuously. With their rapidly increasing populations, many developing countries are compelled to give agricultural production and the development of fertiliser use in high priority. In 1961 total fertiliser consumption of developing countries was only 12% of WFC. Their share increased linearly especially from 1970 to 2000, reaching 63% of WFC (Figure 1). The Least developed countries had only 0.3% of WFC in 1961 with 0.1 million tons. In 2002 their fertiliser consumption reached over 2.5 million tons (1.7% of WFC). To give the figure like this, it may be not reliable because of that each group has different number of countries. According to FAO data developed countries include 56 countries, developing 159, and the least developed 48. So it will be much more informative to give the fertiliser consumption (FAO, 2005) per country per group. According to that, in 2002 each developed country accounted for 0.63% of WFC, developing ones for 0.40%, and the least developed ones for 0.03%. Each industrialised country used 1.1% of WFC in the same year.

China has been by far the largest fertiliser consumer in the world accounting for 28% of WFC with 39.6 million tons in 2002. In a 40-year period from 1961 to 2000 consumption of all three fertiliser increased from 0.7 million tons net nutrient to 34.2 million tons, an increase from 2.2% of WFC to 25.2% of WFC (Figure 4). India is another developing country of which fertiliser utilisation increased from 0.3 million tons (1% of WFC) in 1961 to 16.7 million tons (12% of WFC) in 2000 (Figure 3). In 2002, with 16.1 million tons, it consumed 11.5% of WFC.

Turkey, with 23.8 million hectare arable land is an important fertiliser consumer in the world. Fertiliser consumption of Turkey increased from 0.07 million tons in 1961 to 2.1 million tons in 2000. In 2002 its share in world total was 1.2% of WFC with 1.74 million tons. There was a fall in consumption about 16.5% from 2000 to 2002. Its fertiliser consumption per hectare is lower than both the world and the EU(15) average (Table 1). Local demand is expected to increase in the next five to ten years, particularly following the South-east Anatolia Project (SAP), which is expected to boost demand by 25 percent. When the project is completed, arable land in Turkey is expected to increase by 1.7 million hectare. Fifty-five percent of project is expected to be completed by 2005 adding 894.000 hectare of land to agricultural production (Kazgan, 1992).

### 3. FERTILIZER APPLICATION

#### World

Fertiliser application per unit area in the continents and the world are given in Table 2 (FAO, 2005). Asia is in the first place in fertiliser application per hectare (150.7 kg ha<sup>-1</sup>). It is followed by America (95.2 kg ha<sup>-1</sup>), Europe (76.2 kg ha<sup>-1</sup>) and Oceania (62.8 kg ha<sup>-1</sup>). Fertiliser utilisation per hectare is too lower in Africa (23.1 kg ha<sup>-1</sup>) when compared to the other continents and the world average (100.8 kg ha<sup>-1</sup>). Nitrogenous fertiliser application is the highest in Asia (97.3 kg ha<sup>-1</sup>). Fertiliser N usage is under the world average in the other continents. In two continents, Asia and America potassium supply are over the world average (16.6 kg ha<sup>-1</sup>).

Table 2. Fertiliser use per hectare in the world in 2002 (kg ha<sup>-1</sup>)

	Total	N	P	K
Asia	150.7	97.3	35.9	17.4
America	95.0	48.1	23.8	24.4
Europe	76.2	46.5	13.9	15.8
Oceania	62.8	25.7	29.6	7.41
Africa	23.1	14.9	5.4	2.9
World	100.8	60.4	23.8	16.6

Source: FAO (2005)

**Developed and developing countries**

Fertiliser application of developed and industrialised countries is over the world average (Table 3). Developed countries supply 82 kg total fertiliser per hectare, industrialised countries 116 kg ha<sup>-1</sup>, developing countries 115 kg ha<sup>-1</sup>. Least developed countries use too much lower fertiliser per hectare (19 kg ha<sup>-1</sup>). Developing countries have applied more nitrogenous and phosphorus fertiliser per hectare than those of developed countries. In some developing countries, plant nutrition has become unbalanced in favour of nitrogen (Figure, 5). When considered world total fertiliser consumption, nitrogen

accounted for 60%, phosphate 24%, and potassium 16% in 2000. In developed countries the share of N, P, and K in total fertiliser consumption was 57, 22, and 21%, respectively. Whereas in developing countries these figures were 62, 25, and 13%, respectively, showing lower fertiliser K usage.

In terms of per hectare use there have been great differences among countries. New Zealand (568.6 kg ha<sup>-1</sup>) and Ireland (523.6 kg ha<sup>-1</sup>) are by far the largest fertiliser user countries, followed by Egypt (438 kg ha<sup>-1</sup>), The Netherlands (366.8 kg ha<sup>-1</sup>), and Japan (291 kg ha<sup>-1</sup>). Per hectare use is also higher in EU(15) countries, especially in Ireland, the Netherlands, Belgium-Luxembourg, and the UK. However since the 1992 reform of the CAP (Common Agricultural Policy) there have been great changes in fertiliser use of EU(15) countries. For instance, from 1992 to 2001 there was a great decline in nitrogenous fertiliser use in Denmark (-38%), Greece (-34%), and the Netherlands (-26%). Also it is not much like these countries, some others as Italy (-9%), Portugal (-8%), Finland (-5%), Belgium-Luxembourg (-5%), and

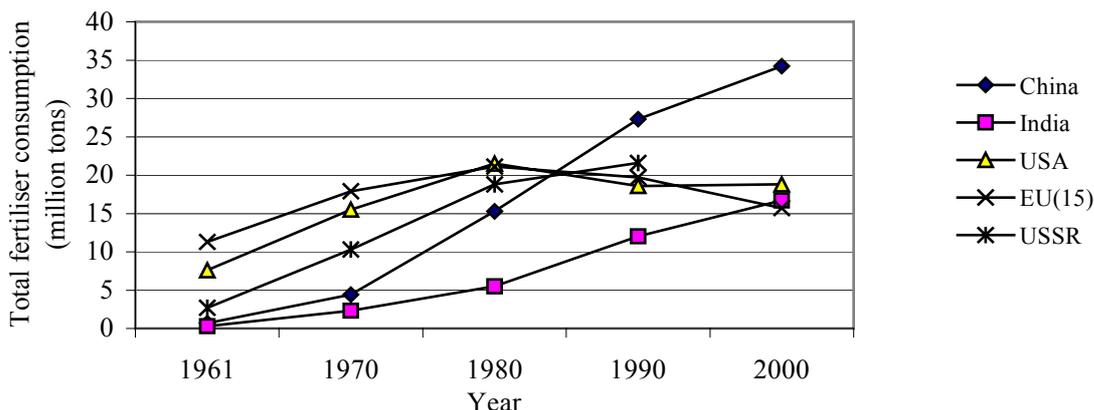


Figure 3. Some larger fertiliser consumer countries in the world (FAO, 2005)

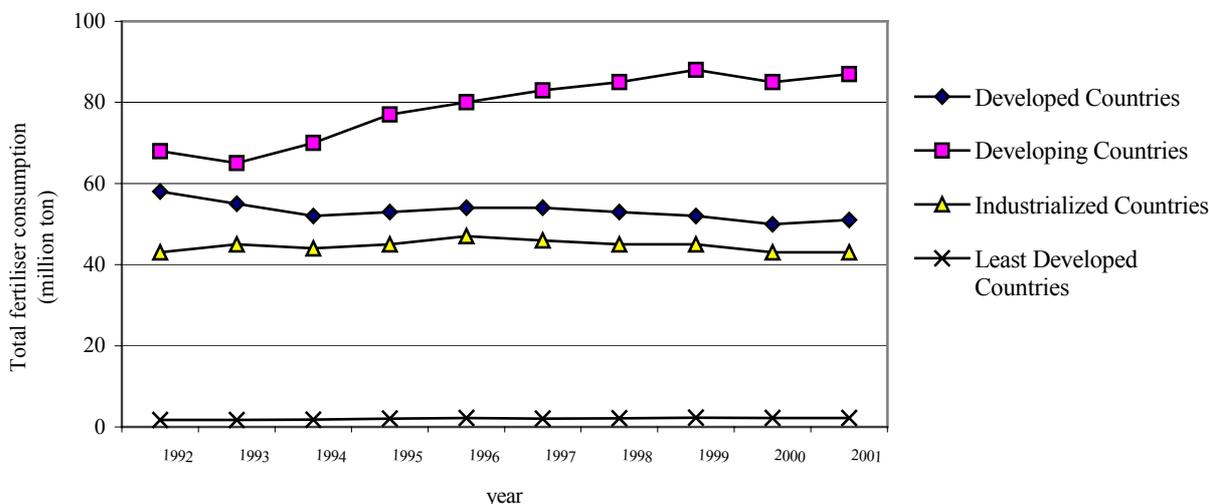


Figure 4. Changes in fertiliser consumption of the developed and developing countries (FAO, 2005)

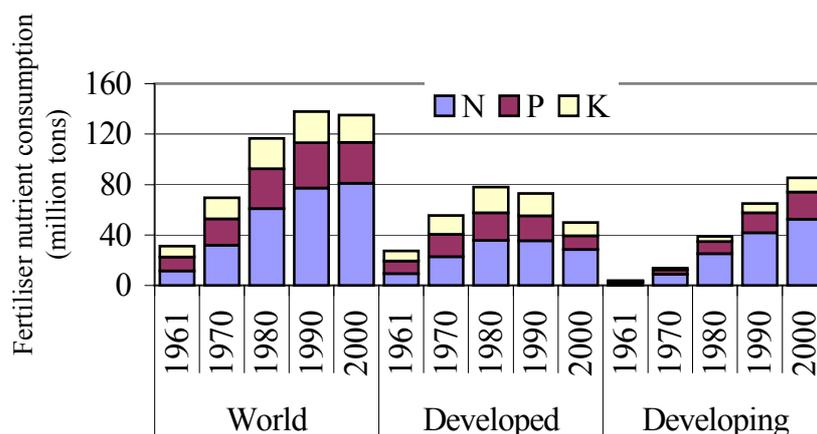


Figure 5. Changes in N, P and K fertiliser usage in the world, developed and developing countries (FAO, 2005)

Table 3. Fertiliser application in developed and developing countries in 2002 ( $\text{kg ha}^{-1}$ )

	Total	N	P	K
Developed countries	82	47	18	17
Industrialised countries	116	65	26	25
Developing countries	115	70	29	16
Least developed countries	19	13	4	2
World	100.8	60.4	23.8	16.6

Source: FAO (2005)

Sweden (-3%) reduced their fertiliser consumption since 1992.

Another EU(15) country, Spain increased its consumption (+36%) during the same period, of which per hectare use is lower when compared to the other EU(15) countries except for Denmark, Finland, Greece, Portugal, Sweden, and Australia.

In Turkey, fertiliser use per hectare is  $67.2 \text{ kg}$ , which is lower than the world average ( $100.8 \text{ kg ha}^{-1}$ ). Although over 50% of total fertiliser amounts are used for cereals, industry crops ( $175 \text{ kg ha}^{-1}$ ) and vegetables ( $194 \text{ kg ha}^{-1}$ ) receive greater amount of fertiliser per unit area (Hatipoglu et al., 1996). This situation is valid for most of the other countries.

#### 4. CONCLUSION

Fertilisers, especially nitrogenous, can cause serious environmental problems by leaching to the ground water and by accumulating as nitrate in the plant, which both have adverse effects on human health. Also large amounts of nitrogen is released into the atmosphere by nitrous oxide emission which led to great climate changes. In view of detrimental effects of fertilisers, most developed countries made regulations restricting fertiliser use. Even though in developing countries fertiliser consumption has increased continuously, their fertiliser use per unit area, especially in African countries, still is lower than developed countries. However to increase the amounts of fertiliser should not be a sole solution. Because the big problem with nitrogen is lower fertilizer use

efficiency (Neeteson et al., 1999; Rahn, 2002). Fertiliser sources are not used efficiently in agricultural systems, and plant uptake of fertiliser N seldom exceeds 50% of the N applied (Finck, 1992; Peoples et al., 1995). In view of the large quantities involved, inefficiencies in fertiliser use represent a substantial economic loss. For example, given that about 82 Mt of N were used in the world agriculture in 2001, a 20% loss with a wholesale price of US dollar 0.66 per kg of N in urea, amounts to US dollar 10.8 billion. In conclusion much can be achieved by improving management practices, one of which is fertiliser application methods (Nielsen and Jensen, 1990; Shepherd et al., 1993; Davis, 1994). Such as fertigation holds promise for supplying nitrogen to coincide with nitrogen demand, thus reducing leaching losses. A greater plant uptake can also be achieved by new varieties (Barker, 1989).

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