

TABLE 8  
The main Ukrainian crops from 2000 to 2004

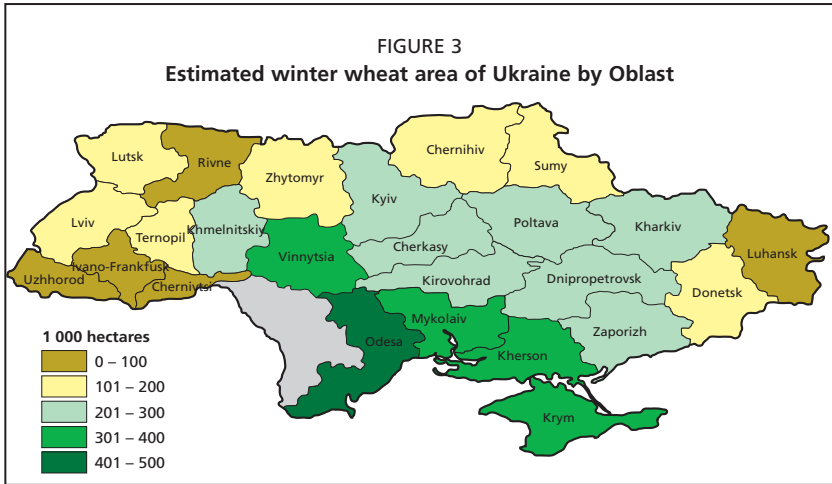
Year	2000	2001	2002	2003	2004*
	Production ('000 tonnes)				
Cereals	24 459	39 706	38 792	20 234	41 718
Wheat (included in cereals)	10 197	21 348	20 549	3 599	17 517
Maize for grain	3 848	3 641	4 180	6 875	8 793
Sugar beet	13 199	15 575	14 376	13 392	16 502
Sunflower seeds	3 457	2 251	3 270	4 254	3 052
Potato	19 838	17 344	16 619	18 428	20 754
Vegetables	5 821	5 907	5 825	6 546	6 935
Fruits and berries	1 453	1 106	1 211	1 698	1 631
Grapes	514	336	359	505	373
	Yield (tonnes/ha)				
Cereals	1.94	2.71	2.73	1.82	2.83
Wheat	1.81	3.0	3.04	1.46	3.16
Maize for grain	3.01	3.24	3.52	3.46	3.83
Sugar beet	17.7	18.3	18.8	20.2	23.61
Sunflower seeds	1.22	0.94	1.2	1.12	0.89
Potato	12.2	10.8	10.4	11.63	13.34
Vegetables	11.2	12.3	12.4	13.92	14.81
Fruits and berries **	3.84	3.05	3.65	5.6	5.84
Grapes	5.17	3.54	3.94	5.9	4.52

\* Preliminary data; \*\* In terms of the area of fruit-bearing plants.

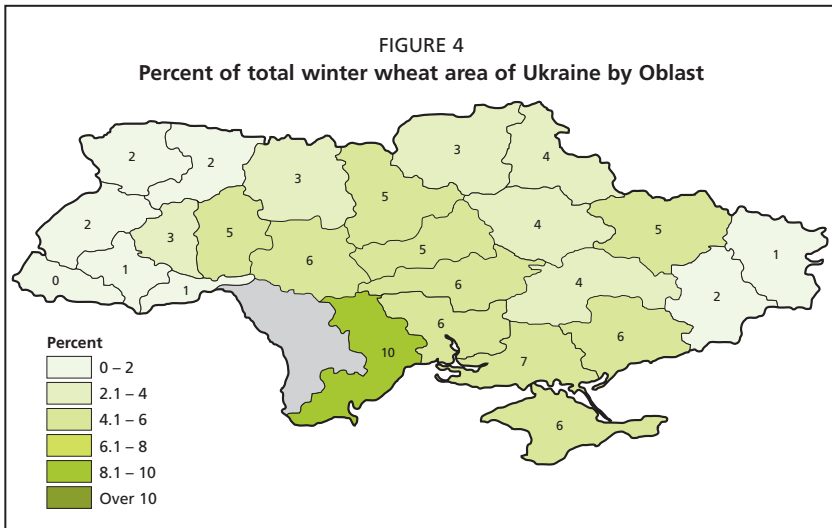
Source: SCS.

On average, approximately 15 percent of autumn-planted crops fail to survive the winter. The amount of winter kill varies widely from year to year, from 2 percent in 1990 to a very high 65 percent in 2003 (Figure 5), when a persistent ice crust smothered the crop.

During the final years of the Soviet era, winter wheat was the focus of an “intensive technology programme”, which was marked by the use of improved varieties and the increased use of fertilizers and plant-protection chemicals. Yields increased substantially in response to the improved management practices. The intensive technology programme came to an end during the early 1990s, when the collapse of the Soviet Union marked an end to high State subsidies for agriculture. Farms were forced to struggle with serious cash shortages, a crumbling agricultural infrastructure and sharp increases in fertilizer prices.

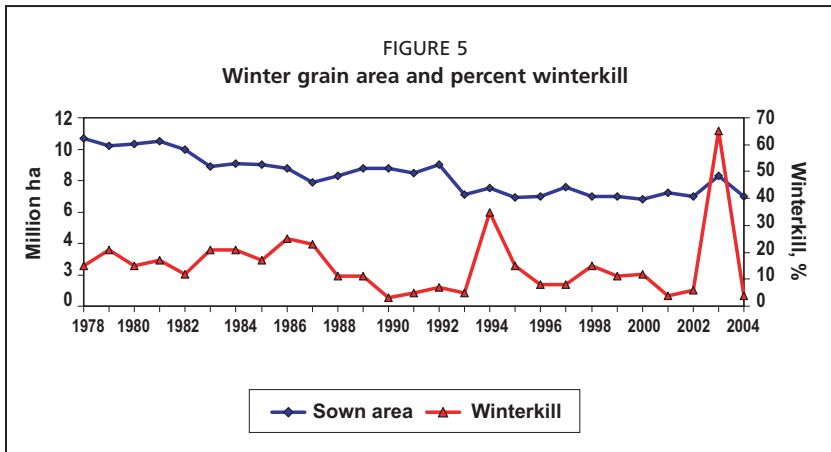


Source: Production Estimates and Crop Assessment Division, FAS, USDA, 2005.



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As farms tried to cope with their financial difficulties, the use of fertilizers and plant-protection chemicals fell sharply. With generally favourable weather and a modest but steady improvement in the financial



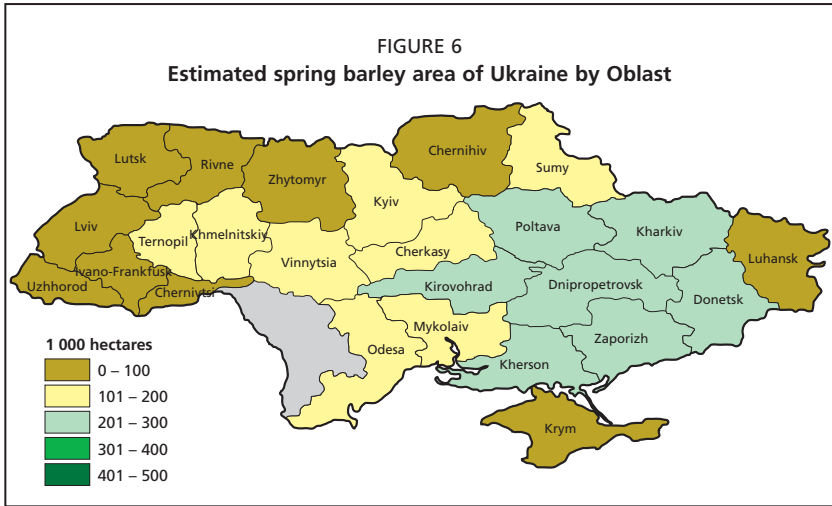
Source: Production Estimates and Crop Assessment Division, FAS, USDA, 2005.

situation of many farms, wheat production has rebounded in recent years, except in 2003/04 when the crop was badly affected by severe winter weather.

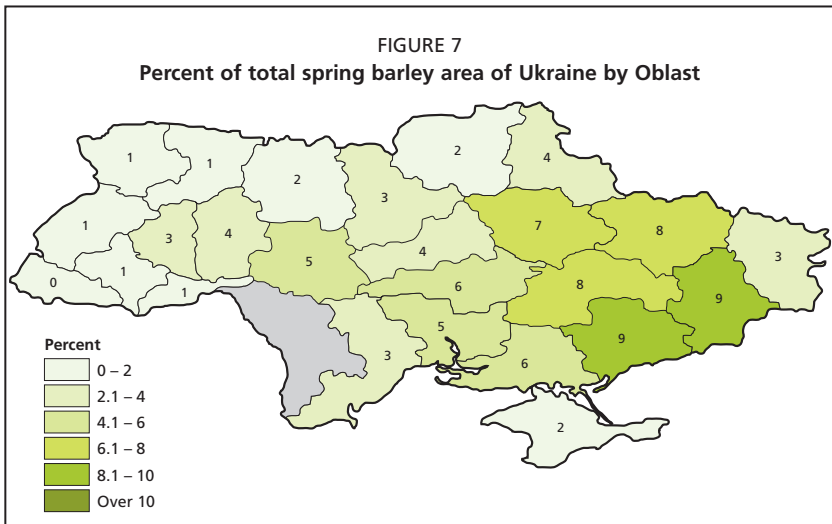
Ukraine produces mainly hard red winter wheat (bread wheat). In a typical year approximately 80 percent of the domestic wheat output is considered to be of milling quality according to Ukrainian standards. The consumption of wheat for fodder dropped sharply during the 1990s, from over 12 million tonnes to less than 5 million tonnes. Food wheat consumption remained steady at around 10 million tonnes.

*Barley* has been the main feed cereal in Ukraine for most of the past ten years in terms of consumption, surpassing wheat in the early 1990s. Spring barley accounts for over 90 percent of the barley area, the main production region being eastern Ukraine (Figures 6 and 7). Spring barley is planted typically in April and harvested in August. It is the crop most frequently used for the spring reseeding of damaged or destroyed winter-cereal fields. The area is inversely related, to some degree, to the area of winter wheat. Winter barley is the least cold-tolerant of the winter cereals and production is limited to the extreme south.

*Maize* is the third most important fodder cereal in Ukraine. The planted area has increased despite several constraints such as obsolete and inadequate harvesting equipment, high cost of production (especially



Source: Production Estimates and Crop Assessment Division, FAS, USDA, 2005.



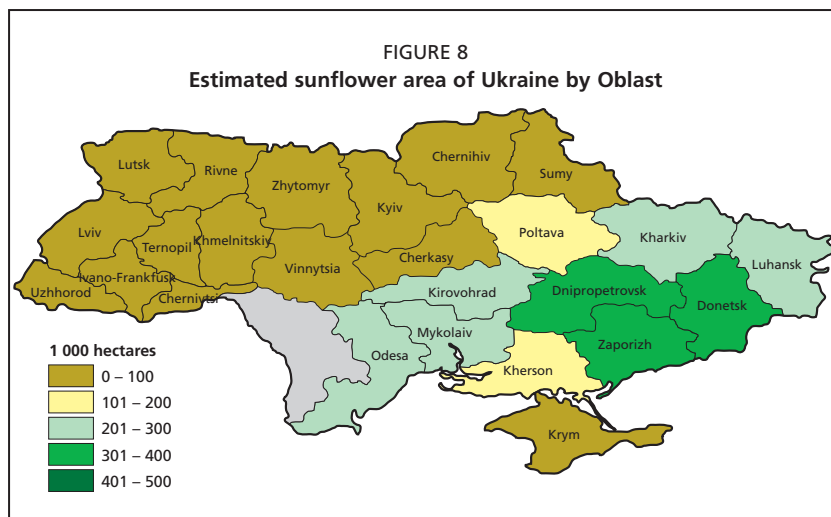
Source: Production Estimates and Crop Assessment Division, FAS, USDA, 2005.

post-harvest drying costs) and pilferage. The main production region is eastern and southern Ukraine, although rainfall in some oblasts in the extreme south is too low to support maize production. Maize is typically planted in late April or early May. Harvest begins in late September and is

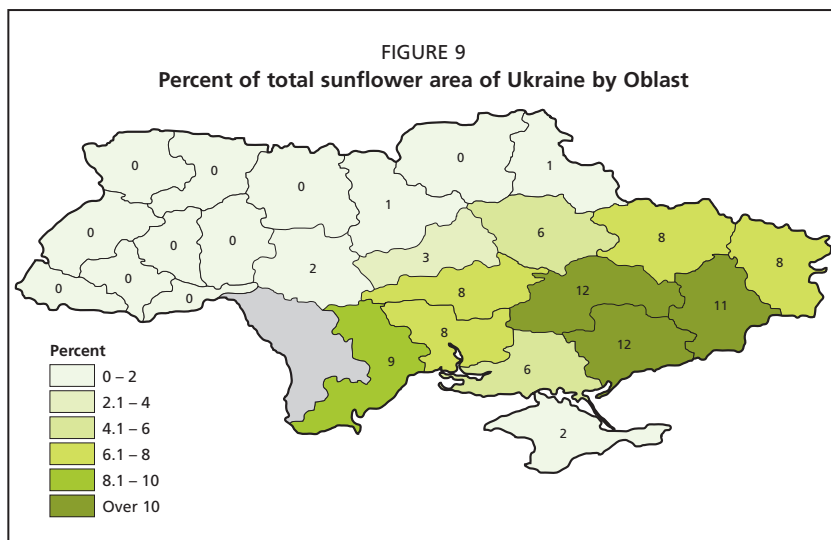
usually nearing completion by early November. Only 25 to 50 percent of total maize area is harvested for grain, the remainder being cut for silage, usually in August.

*Sunflower seed* is Ukraine's main oilseed crop. Production is concentrated in the southern and eastern oblasts (Figures 8 and 9). Sunflowers are typically planted in April and harvested from mid-September to mid-October. Because of a combination of high price, a relatively low cost of production and high demand, sunflower has become one of the most consistently profitable crops. Its high profitability has resulted in a significant expansion in planted area, beginning in the late 1990s. Many farmers abandoned the traditional crop rotation practices recommended by the agricultural advisers who advocated the planting of sunflowers no more than once every seven years on the same field. The aim of the 1-in-7 rotation is to prevent soil-borne fungal diseases and to reduce the depletion of soil moisture and fertility. Because of their deep rooting system, sunflowers reportedly extract higher amounts of water and nutrients from the soil than other crops in the rotation.

*Sugar beet* is grown primarily in central and western Ukraine. Sugar beet is planted in late April and early May and harvested from mid-



Source: Production Estimates and Crop Assessment Division, FAS, USDA, 2005.



Source: Production Estimates and Crop Assessment Division, FAS, USDA, 2005.

September until the end of October. Production has been declining since the early 1990s, mainly as a result of low profitability compared to cereal and sunflower production. Between 1994 and 2003, the planted area declined by 50 percent to less than 0.8 million hectares and production fell from 28.1 to 13.4 million tonnes.

On private household plots, however, the sugar beet area increased during the same period. Sugar beet production requires a significant amount of manual labour and remains a viable option for small household farms with limited access to agricultural machinery. Household plots now account for approximately 25 percent of Ukrainian sugar beet output compared with only 3 percent in 1995.

### Crop Rotations

Farmers in Ukraine follow a variety of crop rotations, some with four or more crops, some with only two. A six-year crop rotation in the winter grain region often includes two consecutive years of wheat and one season of fallow, during which no crop is sown. The main reason for including fallow in the rotation is to replenish soil moisture reserves. Fallow is more widely used in south eastern Ukraine where drought is not uncommon. A

typical crop sequence might be: fallow, winter wheat, sunflowers, spring barley and maize. Wheat almost always follows fallow. According to farm directors, this enables the wheat, which is typically the priority crop, to benefit from the reduced weed infestation. Fields are ploughed several times during the fallow season.

Some crop rotations include several consecutive years of a forage crop. An example of such a rotation would be: fallow, two years of winter wheat and four years of perennial forage. The perennial forage is usually alfalfa; farmers obtain three to four cuttings per year, five if the crop is irrigated. In southern Ukraine, fallow is frequently omitted and a crop rotation will often include sugar beet and/or sunflower, the region's main industrial crops. A typical seven-year rotation might be: winter wheat, winter barley, sugar beet, winter wheat, winter barley, sunflowers and maize.

Overall, 26 percent of the private farmers have difficulties in following crop rotations. In the Ivano-Frankivsk oblast the proportion is almost twice as high, at 46 percent. The observation of a crop rotation seems to be a bigger challenge for smaller farms in the Western region of Ukraine (Characteristics of Farming Production, 2003).

The non-observation of crop rotations may have serious negative consequences in the future, such as lower soil fertility and soil degradation. This non-observation occurs even though the majority of the producers (68 percent) are well aware of the benefits of crop rotations.

Agricultural enterprises are more likely to observe the crop rotations, 78 percent of enterprises versus 66 percent of private farms. Almost half of the producers in Ivano-Frankivsk oblast (49 percent) regularly observe a crop rotation. The proportion is the highest in Poltava oblast, where it reaches 87 percent. Twenty six percent of private farmers stated they observe crop rotations from time to time, while the managers of only 11 percent of agricultural enterprises said they comply only irregularly with crop rotation rules. In Ivano-Frankivsk, the proportion of producers observing rotations only from time to time is the highest among the surveyed oblasts, reaching 43 percent.

In the majority of cases, producers do not observe crop rotation patterns deliberately. They explain that they need to grow crops giving a high profit and no longer need to observe crop rotations. The last

explanation is most frequently given by private farmers. However, it can be assumed that the true reason for the neglect of crop rotations is not the absence of the need but rather a failure to realize, due to the lack of skills and knowledge, the importance of sound agronomic practices.

The vast majority of field crops, including grains, sunflowers, and sugar beet, are not irrigated. Traditionally, irrigation is used only on forage crops and vegetables. Roughly five percent of the grains and ten percent of potatoes, vegetables, and forage crops are irrigated.

### **ORGANIC FARMING AND USE OF MINERAL FERTILIZERS**

Private farms appear to be more prepared to produce crops organically, provided the purchase price is higher and reliable distribution channels are available. Organic produce is a more exclusive commodity produced typically in small amounts and by small production units, the production process being more labour-intensive. The farmers of Kherson oblast expressed most readiness to farm organically, primarily for vegetable and fruit growing. Assuming that consumer demand will grow gradually, organic produce could fill a niche in the Ukrainian market.

However, the development of organic farming and of demand for organic produce remains to a large extent a long-term objective. It is the effective usage of mineral fertilizers that would improve profitability and yields today.

Nitrogen fertilizers are most used, by 61 percent of farmers: 57 percent of private farms and 82 percent of the agricultural enterprises. As regards the rates of application, 30 percent of the farmers report that the rates have not changed in recent years. However, 17 percent of the farmers increased and 14 percent decreased the amounts applied. Producers tend to use potassium and phosphorus fertilizers to a lesser extent: 35 percent and 39 percent respectively in the case of private farms and 54 percent and 59 percent respectively in the case of agricultural enterprises. In recent years, farmers reported that the rates of application of these mineral fertilizers have not changed much; only 7 percent of farmers stated that they have increased application of potassium fertilizers, while only 9 percent reported an increase in the use of phosphorus fertilizers.

As regards use of organic manure and mixtures of mineral fertilizers, the trend is similar. Agricultural enterprises tend to use them in much larger



amounts than their private farmer counterparts: 66 percent of agricultural enterprises use organic fertilizers and 45 percent use mineral mixtures, compared with 44 percent and 34 percent respectively of private farms. The proportion of enterprises in the Ivano-Frankivsk oblast applying organic fertilizers and mineral mixtures is the highest, amounting to 84 percent and 85 percent respectively. However, the quantities of mineral fertilizer applied per ha of sown area vary significantly between the different regions.

### **CHARACTERISTICS OF CROP PRODUCTION**

About 89 percent of agricultural businesses and 85 percent of private farms consider the high yield of crops to be an important factor determining profitability. High quality of produce was rated second; it was recognized as important by 58 percent of private farms and 69 percent of agricultural enterprises.

Among criteria ranking high in the choice of a production technology is the minimum application of agricultural chemicals, produce meeting consumers' requirements, the high quality of inputs and environmental considerations.

While both farmers and agricultural enterprises have the same choice of priorities in the choice of major production technologies, the issue of environmental safety appears to be of more concern for agricultural enterprises than for farmers. Environmentally friendly production seems to be more important for producers of Donetsk Oblast: 26 percent of respondents against 10 percent of respondents in the general sample.

Finally, an important indicator of the effective organization of the production process is the cost structure. Despite variations in the way production is organized by private farms compared with agricultural enterprises, the cost structure per unit of production is rather similar. Private farms and agricultural enterprises alike incur most of their costs in carrying out field work. The cost of field work per unit of output on private farms appears to be slightly higher than with agricultural enterprises. The private farmers are not so well endowed with means of production and lack economies of scale.

A separate cost category is expenditure on the purchase and application of mineral fertilizers. These costs are slightly lower in the case of private

farms, which correspond to lower rates of mineral fertilizer application per unit of area. Almost one fourth of the production costs (22 percent) are incurred by the purchase of seeds and sowing. On private farms this figure is a little higher, 23 percent of the overall production cost per unit of output. It is important to note that expenditure on crop insurance is not significant. It is particularly low in the case of private farmers. Agriculture insurance is poorly developed.

## Chapter 3

# Fertilizer sector

The level of the use of mineral fertilizers in agriculture in the country started to increase from the mid-1960s onwards. During the period from 1966 to 1970 an average of 1.4 million tonnes (or 46 kg/ha) of fertilizers were applied annually. In the second half of the 1980s this figure reached 4 to 4.7 million tonnes of fertilizers.

The increase in the application rates of mineral fertilizers influenced favorably the yields of agricultural crops. The yield of winter wheat increased from 2.3 tonnes/ha in 1969 to 3.7 tonnes/ha in 1987, the yield of maize increased from 3.0 tonnes/ha to 3.8 tonnes/ha (Figure 10), that of potato from 8.9 tonnes/ha to 12.6 tonnes/ha, during the same period.

After the collapse of the USSR, state financing was reduced at the time because of a general crisis in the Ukrainian economy. Private investment became the source of finance for fertilizer manufacturers. The exportation

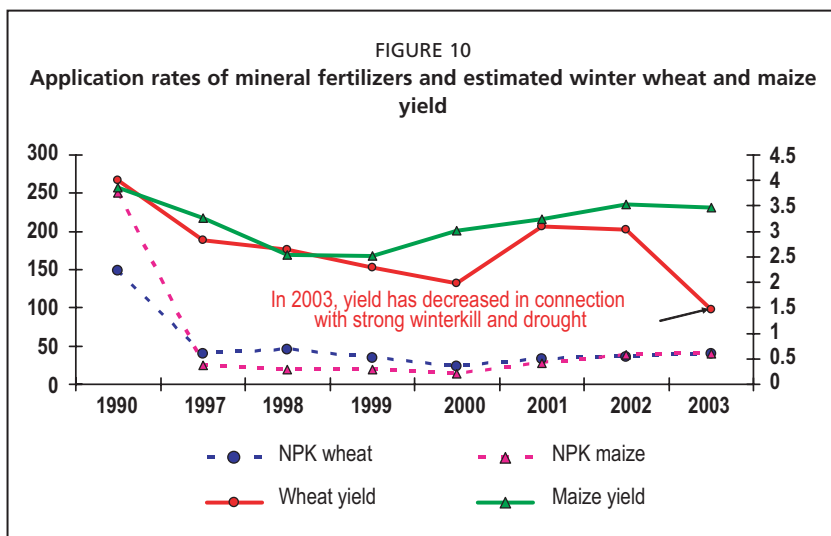


TABLE 9  
Yield of winter wheat in relation to the available phosphorus content of the soil

Soil	Content of available phosphate, mg/kg of soil					
	<50			50–100		
	<50	50–100	>100	<50	50–100	>100
	Yield without fertilizers (tonnes/ha)			Yield (tonnes/ha) with optimal doses of fertilizers (60–80 kg/ha)		
Haplic Chernozems	2.6–3.3	2.9–4.1	3.3–2.1	3.3–4.1	3.7–4.8	3.5–4.8
Calcic Chernozems	2.8	3.6	4.1	4.1	4.5	4.3

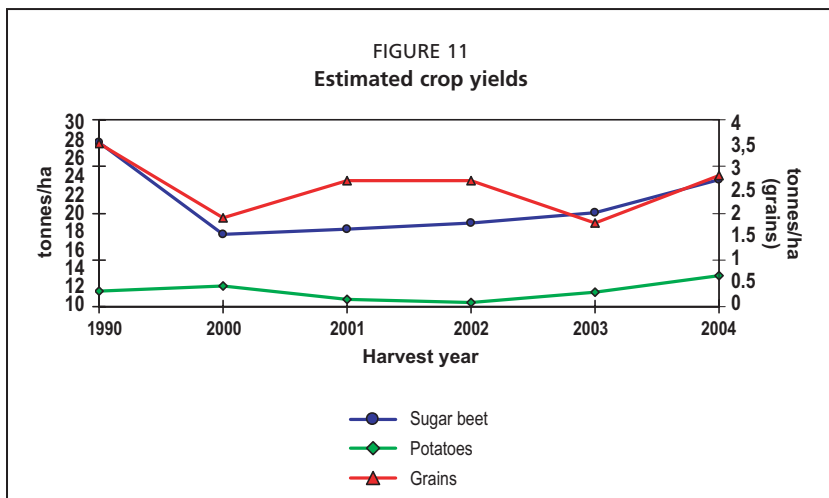
Source: Agrochemical service of Ukraine.

of fertilizers was the only means of covering the cost of reconstruction of the enterprises, due to the insolvency of the agro-industrial sector in Ukraine.

The findings of many research institutes and the agrochemical service of Ukraine testify to the role of mineral fertilizers in the increase of the soil fertility. The low level of soil saturation with available phosphorus is one of the negative factors influencing the yields of agricultural crops (Table 9). According to the results of the field experiments of the agrochemical service, depending on the soil, an application of 90 kg of phosphorus per ha increases the yields of winter wheat by 400 to 500 kg/ha, barley by 300 to 600 kg/ha, maize by 400 to 800 kg/ha, sunflower by 150 to 200 kg/ha, sugar beet by 300 to 800 kg/ha and potatoes by 150 to 250 kg/ha (Kucher and Korchinskaya, 2000).

The application of phosphate fertilizers increases the yields of almost all crops. Until 1990, with an adequate application of mineral fertilizers, grain crops yielded 3.5 tonnes/ha, sugar beet 28.0 tonnes/ha and potatoes 12.0 tonnes/ha. During subsequent years, the application of mineral fertilizers was reduced drastically (almost 7 to 10 times). Thus, in 2000 to 2004 (Figure 11), the yield of grain crops fell to 1.9–2.8 tonnes/ha and that of sugar beet to 18–23 tonnes/ha (SCS).

In recent years, the net phosphorus removal from Ukrainian soils has averaged 10 to 15 kg/ha annually. If no correction measures are taken, the available phosphorus accumulated in the soil will be exhausted as it is removed with harvested products. This will reduce soil fertility and crop production. It would also reduce quality with a negative impact on sales.



Potash deficiency leads to reduced growth and late ripening of many agricultural crops. Potash deficiency has a particularly negative impact on root and tuber crops, cabbage, fruit, ensilage crops and perennial herbs, as a result of their high uptake of potassium. One tonne of potato removes 8 kg of potassium, 5 kg of nitrogen and 2 kg of phosphorus from the soil. Rye, wheat, oats and barley are less sensitive to potash deficiency. Nevertheless, if there is a potassium deficit, they tiller badly and the leaves fade even with sufficient moisture in the soil.

According to the data of the agrochemical service, the application of one kg of potassium gives, depending on the soil, an additional yield of 3 to 5 kg/ha of winter wheat, 6 to 8 kg/ha of maize, 70 to 80 kg/ha of sugar beet, 50 to 80 kg/ha of potato and 4 to 11 kg/ha of sunflower. It should be mentioned that the potassium content of the soils of Ukraine is somewhat higher than that of phosphorus.

### **MINERAL FERTILIZERS, PRODUCTION AND MARKETING**

The most important products for the Ukrainian manufacturers of mineral fertilizers are the nitrogen products i.e. urea (46 percent N), AN (34.4 percent N), UAN (32 to 30 percent N) and AS (21 percent N). Urea is an important export commodity.

The Ukrainian companies have the capacity to produce about 4 million tonnes of nitrogenous fertilizers. There are 11 main producers ([www.agroperspectiva.com](http://www.agroperspectiva.com)).

There are eight manufacturers of phosphate fertilizers in Ukraine. The aggregate capacity of all these plants amounts to 1.4 million tonnes of  $P_2O_5$ , including 292 thousand tonnes of  $P_2O_5$  as liquid complex fertilizers, 690 thousand tonnes as ammonium phosphate and diammonophosphate, 280 thousand tonnes as superphosphate and 152 thousand tonnes as nitrophosphate. The highest production of phosphate fertilizers (including ground phosphate rock) was registered in 1987, with 1.7 million tonnes of mineral nutrients. This volume was the largest in Europe. At present, the utilization rate of the capacities of the phosphate fertilizer plants is below 20 percent. In 1998, three plants manufactured 92 percent of the total phosphate fertilizers produced in Ukraine.

At present, there are three main manufacturers of potash fertilizers. The total capacity of these manufacturers for the output of potash fertilizers amounts to 170 thousand tonnes of  $K_2O$ , including 62 thousand tonnes of potassium/magnesium fertilizers, kainite 100 thousand tonnes and potassium sulphate 9 thousand tonnes. The potassium/magnesium fertilizers and potassium sulphate are especially indicated for crops which are sensitive to chloride (potato, tobacco, buckwheat, grapes). The application of potassium and magnesium increases the yield of potato without reducing the starch content. Though kainite contains a small quantity of  $K_2O$  (10-12 percent), its effectiveness for sugar beet and maize is higher than that of potassium chloride. Today, only ten percent of the capacities of the potash plants are utilized.

## **IMPORTS AND EXPORTS**

The total value of fertilizer imported into Ukraine fell slightly from 528 thousand tonnes in 2002 to 509 thousand tonnes in 2003 (Table 10). The nitrogen containing fertilizers in Ukraine are imported predominantly from the Russian Federation; with a share of 96.2 percent of imports. The imports in 2002 and 2003 were as follows:

- Belarus and the Russian Federation are the main exporters of potassium to Ukraine. In 1999, 55 thousand tonnes of potassium fertilizers, accounting for 99 percent of the total imports of potash

fertilizers, were exported from these countries. These imports were mainly of potassium chloride, exported by Belarus and the Russian Federation, potassium sulphate (the Russian Federation) and abraum salt supplied by Belarus.

In fact, Ukraine has unexploited deposits of

potash ores of the sulphate type in the potassium basin of Prikarpatyya, located in the Lviv and Ivano-Frankivsk regions. These potash reserves amount to seven billion tonnes. The largest explored deposits are: Stebniske (1.2 billion tonnes), Markovo-Rosilnyanske (1 billion tonnes) and Borislavske (1 billion tonnes). Ukraine in fact has the raw materials for the development of a national potassium industry.

Also, Ukraine possesses important reserves of phosphorites in Volyn, Rivno, Ternopil, Khmelnytsk, Donetsk, Lugansk, Sumy and other regions. In the Rivno region alone, there are six areas with reserves of granular phosphorites located at a depth of 30 metres, which would permit open cast mining. Apatite is also available in Ukraine. If they were mined, the explored reserves of raw phosphate materials could provide almost 45 percent of the quantity required to feed the existing phosphate fertilizer capacities. The main disadvantage of Ukrainian rock phosphate is its low phosphorus content (5 to 7 percent on average). However, it is suitable for the production of ground phosphate rock (the cheapest fertilizer), which has the same efficiency as superphosphate provided it is used on acid soils. Over half of the Ukrainian soils are acid.

Ukraine exports large quantities of mineral fertilizers and the quantity exported increased between 1998 and 2002 (Table 11).

Fertilizer exports are dominated by nitrogenous fertilizers; for example in 2001 they accounted for 98 percent of total mineral fertilizer exports. According to the data of the SCS, Ukraine produced 2.1 million tonnes of nitrogenous fertilizers in 2001 and about 90 percent of the total domestic

TABLE 10  
Mineral fertilizer imports in 2002 and 2003  
(10 months)

Product	Quantity (‘000 tonnes of product)	
	2002	2003
Complex fertilizers	171	254
NPK complex fertilizers	58	69
Ammonium nitrate	40	98
Urea	1	-
Other	257	88
<b>Total</b>	<b>528</b>	<b>509</b>

Source: [www.agroperspectiva.com](http://www.agroperspectiva.com).

TABLE 11  
Major fertilizer exporting countries

Country	1998	1999	2000	2001	2002
	('000 tonnes of nutrients)				
Belarus	2 866	3 230	3 126	3 594	3 732
Canada	9 836	10 027	9 986	10 108	10 077
Germany	3 500	3 403	3 331	3 329	3 491
Israel	1 891	1 824	2 057	1 891	2 242
Netherlands	1 811	1 188	1 307	1 008	1 141
Russian Federation	7 686	8 505	9 619	9 455	9 938
Ukraine	1 328	1 664	1 899	1 742	1 941
USA	9 318	9 100	7 370	7 840	6 952

Source: FAOSTAT, 2004.

TABLE 12  
Exports of mineral fertilizers in 2002 and 2003 (10 months)

Fertilizer	Quantity ('000 tonnes of product)	
	2002	2003
Urea	2 472	2 812
AN	1 075	1 253
AS	260	356
UAN	44	143
<b>Total</b>	<b>3 851</b>	<b>4 564</b>

Source: www.agroperspectiva.com.

production of nitrogenous fertilizers is exported. The dependence of the domestic producers on the external market is monitored carefully. In view of the dependence on the export market, state support is indispensable for the domestic market. It is only the development of the domestic market that could change this situation.

In 2003, the exports of mineral fertilizers increased to over 4.5 million tonnes of product (Table 12).



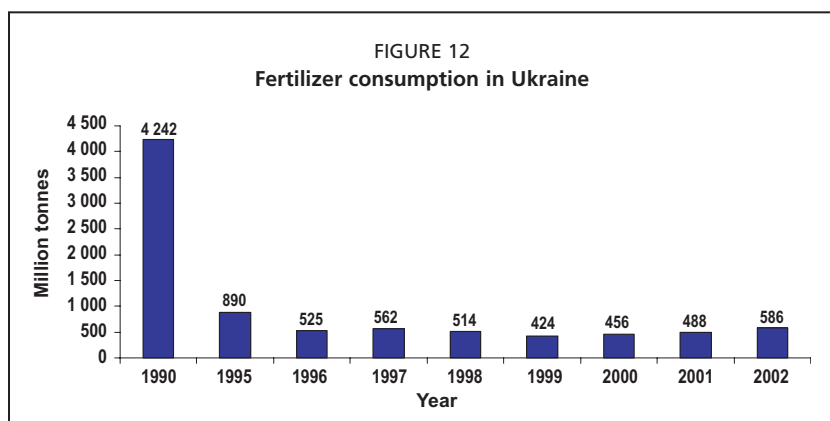
## Chapter 4

# Consumption of mineral and organic fertilizers

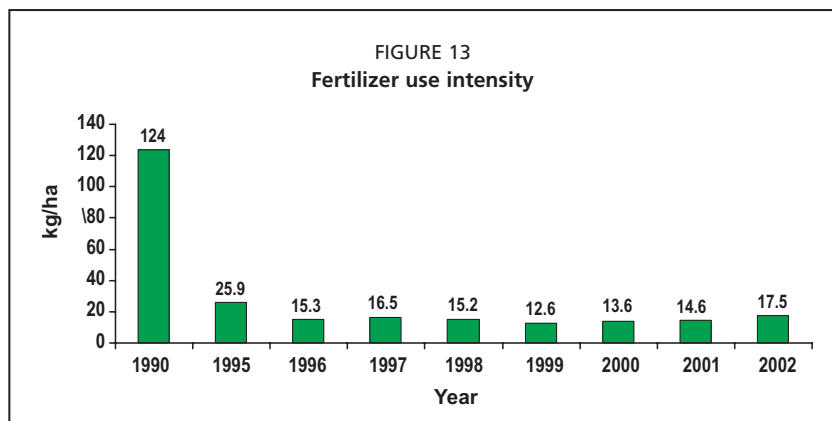
According to the official statistics, fertilizer consumption fell from 4.2 million tonnes of nutrients in 1990 (when admittedly fertilizer was excessively and wastefully applied) to 424 thousand tonnes in 1999. There is no shortage of mineral fertilizers in Ukraine and the fall is due to unfavourable economic conditions in agriculture.

In 2002, 456 thousand tonnes of mineral fertilizer nutrients were applied (Figure 12) or 14.6 kg/ha (Figure 13). This is 28 percent more than in 2000.

The present consumption level of mineral fertilizers is very low compared with 1990, particularly in the cases of potash and phosphate (Figure 14). In 2005, nitrogenous fertilizers accounted for 72 percent (in 2000, 80.1 percent) of total nutrient consumption, phosphorus and potash for 18 percent (13.5 percent) and 10 percent (6.4 percent) respectively (<http://nature.org.ua/nr98/ukrvers>).

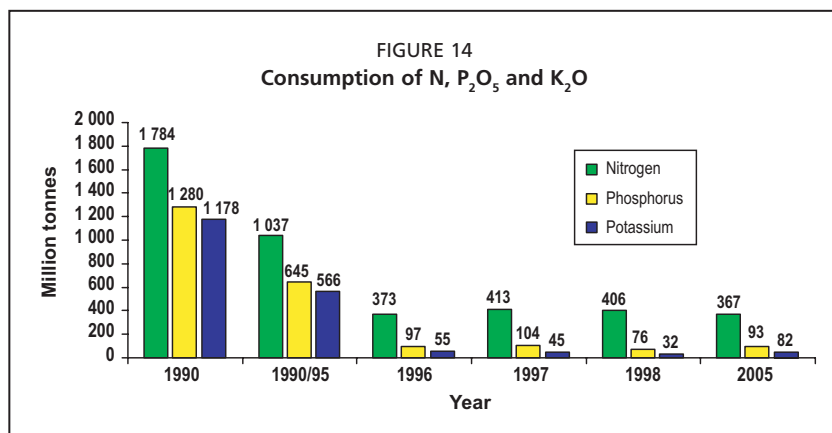


Source: SCS.



Source: SCS.

(Fertilizer consumption on arable + permanent cropland)



In 2004, mineral fertilizers were used on 45.5 percent of the total area under agricultural crops (6.4 million ha), while in 2000 less than a quarter of the sown area was fertilized. However, there were considerable variations between the oblasts (Table 13). For example, in the Poltava area only 29.1 percent of the sown area was fertilized, in Mykolaev the proportion was 26.7 percent, in Kirovograd 34.5 percent, in Kherson 32.4 percent, in Kharkiv 36.5 percent, in Chernigov 33.8 percent and in Zaporozhye 48.8