
Modern crop protection: developments and perspectives

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Perspectives for rural areas in the European
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Perspectives for rural areas in the European community

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Summary

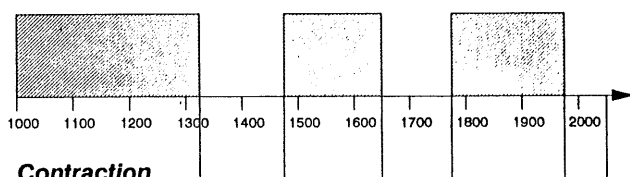
The Scientific Council for Government Policy applied land use evaluation methodology to study the effects of four alternative policy options in the EC. Each option had its own specific effects on possible future land use, especially with respect to the location of major agricultural activities. Three general effects were distinguished, valid for all four policy scenarios. These were a dramatic decrease in farmland needed, a very important decrease in the total volume (kilograms of active ingredient) of pesticides needed, and but little room for EC policy in view of the great technical developments pending.

1 Introduction

The Scientific Council for Government Policy (WRR), an advisory body to the Government of the Netherlands, published a report 'Ground for choices' (WRR 1992) in which some Europe-wide, long-term options for the use of rural areas were discussed. The choices to be made have an impact on crop protection activities in these rural areas.

This paper discusses some general results of the report on possible changes in land use in the EEC. The report foresees major changes in land use during the coming decades. Its aim was to produce some quantitative information on what the future may hold.

Expansion



Contraction

Figure 1. Fluctuations in the agricultural area of Europe. By courtesy of WRR.

Land use changes are of all ages. Under the influence of changes in demand, caused by demographic events, the cultivated area of Europe has shown considerable fluctuations (Figure 1). Historical records show periods of growth or expansion of the cultivated area and periods of decline or contraction. Traces of agricultural contraction can be seen on areal photographs where 'footprints' of lost villages from the Middle Ages are visible. During distinct periods large numbers of agricultural settlements were abandoned.

The idea that we may be facing a new period of contraction is therefore not exceptional.

2 Food security

At present the situation in EEC agriculture can be characterized as follows. (i) Productivity continues to rise thanks to advances in agronomic knowledge and - more importantly - by the built-in incentive to increase productivity. The use of inputs per unit of output decreases when higher yields per hectare are realized. So increasing the yields per hectare adds a bonus. (ii) In the Community this has led to a situation of self-sufficiency for most agricultural products. (iii) After self-sufficiency was reached, productivity continued to rise. This led to overproduction with major budgetary consequences. (iv) At the same time attention has grown for other goals than agricultural production. Environment, employment and farmers' income are nowadays tightly linked to developments in agriculture.

From this outline of the present situation we can already see some perspectives. The continuing rise in productivity means that food security within the Community can be guaranteed with only a relatively small number of farmers on a relatively small area. Much space and work force can be used for other aims, such as nature conservation and recreation.

Developments in productivity show a steady increase all over the world. In Figure 2 the increase in yield per hectare for wheat is indicated. Both the UK and the USA show an ongoing rise in productivity especially after World War II. Of course these developments will not go on for ever, although until now there hardly is a slowing-down. When and at which level the maximum will be reached is not very clear.

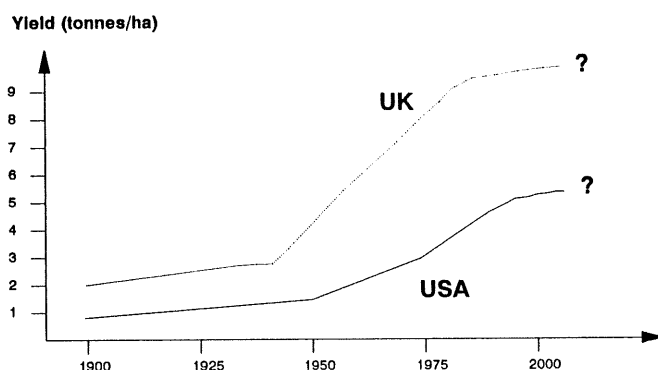


Figure 2. Increase in the productivity of wheat (kg ha^{-1}) in the United Kingdom and the U.S.A. By courtesy of WRR.

3 Limits to growth

The report aimed at defining the limitations to this growth in productivity. In the long run those limitations will define the possibilities of agriculture in the Community. The limitations are of three types.

Technical limitations. Every crop has a well defined yield maximum, given crop properties and climatic conditions. This tells how much useful product can be produced when plants grow under optimal conditions.

Demand limitations. Now that population growth in the EC has come to a stand-still, consumption will no longer rise and non-food uses of agricultural produce

appear to be limited.

Policy limitations. Policy objectives among which socio-economic goals, and aims in the field of nature conservation, recreation and the like, constrain agricultural production.

The report focuses on the effects of policy in relation to the technically possible productivity growth, which leads to the following approach. First we explore alternative policy choices, given the developments within the agricultural sector. Then we show the consequences of different policy goals for developments within agriculture. Finally, once the consequences are clear, we can evaluate instruments in order to define policy options.

The Council developed a computer model which calculates optimal land use in the community of the twelve member-states (the territory of the former German Democratic Republic has not been included). Inputs in the model are technical information about the possibilities of agricultural production, and policy views that indicate a desired priority between different goals and the levels to which these goals should be fulfilled. With these data the model creates different scenarios for land use. Policy-makers can now see how their priorities will affect land use and how the effects are distributed over the EC.

It must be clear that these scenarios show possible options under optimal conditions for agricultural production. We assume that farmers use the best technical

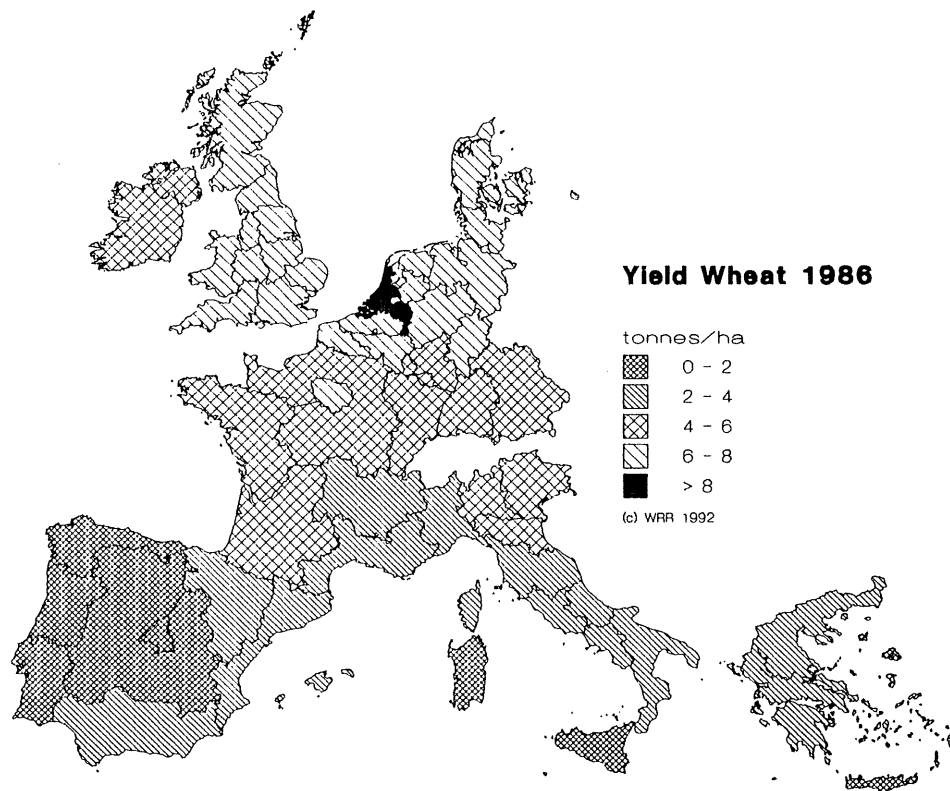


Figure 3. Actual wheat yields in the European Community, 1986, in tonnes ha⁻¹. By courtesy of WRR.

means and that farming activities are located where soil and climate conditions are optimal for a given crop. The scenarios show the extremes in the form of data (how many hectares and how many farmers are needed for production) and maps (where agricultural production will take place if one optimizes conditions).

This exercise has generated a lot of technical information. First we have carried out a land evaluation of the EC. Strangely enough such land evaluations have been performed for many developing countries, but they were hardly available for Europe. We used this land evaluation to assess where crops could be grown and what maximum crop yields are at a given location. To that end we discern between two situations (i) a maximum yield, using only the available water (rain-fed agriculture) which we call 'water limited yield' and (ii) a maximum yield when irrigation and/or drainage remove water limitations (called 'potential yield', because it shows the absolute maxima).

4 Wheat, an example

Let us take wheat as an example. Figure 3 shows the actual yield per hectare of wheat for regions within the EC. We can compare the actual productivity with the water-limited yield that the land evaluation shows. Figure 4 shows the maximum attainable yield per hectare within each region under optimal conditions, but with

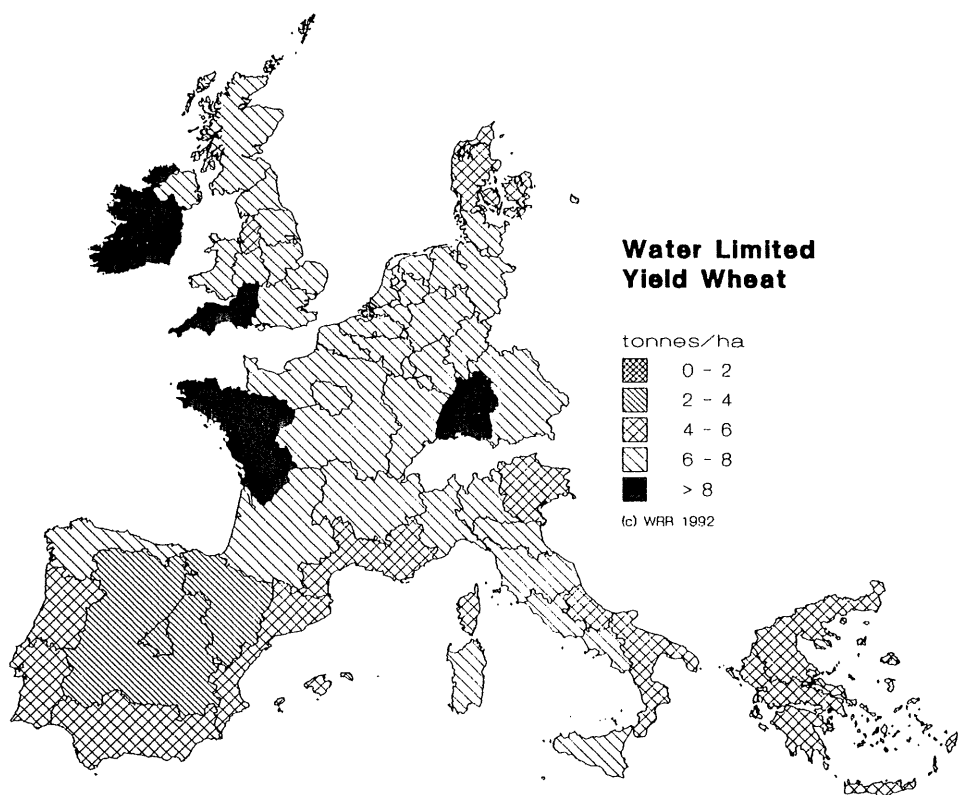


Figure 4. Potential wheat yields in the European Community under rainfed conditions (water limitation), other conditions being optimal, in tonnes ha⁻¹. By courtesy of WRR.

the water-supply limited to rainfall. The differences are clear. Looking at a map like this one, one must be aware that the results are averages. In fact, some parts of the regions indicated may not be suitable for wheat farming. The study used more detailed information.

If the water limitation is removed, Figure 5 shows the spectacular result. The assumption is here that in some regions extensive irrigation schemes will be introduced. Please note that this gain is an extreme, showing what is technically possible. No account is taken of the possibilities or impossibilities of irrigation in real life.

This land evaluation was performed not only for traditional agricultural products, but also for forestry. It turns out that areas favourable to forestry coincide with the higher yielding arable farmlands, even in the case of tree species of low nutritional demand. Another result of the study is a map that shows the preferred locations for nature conservation and development.

5 Scenarios

The technical information discussed above was used as an input for a number of scenarios. A scenario is the calculated result of a set of well defined policy objectives, used as inputs to the calculations by the model. The policy goals were mutually exclusive, so that each policy view results in a different scenario. The various scenarios also produce some results of general value.

All options imply a radically diminished use of land for agricultural purposes. At present the EC uses about 130 million (M) hectares as farmland. All scenarios show a spectacular decline to roughly 40 to 50 M hectares. Even if labour within agriculture is maximized, no more than 50 M hectares will be needed for production under optimal conditions.

Another result from the scenarios is that by using best technical means under optimal conditions only 2 to 5 M man years are needed for the total agricultural production, whereas at present about 10 M man years are involved in primary production.

A striking feature of all scenarios is the dramatic decrease in the use of pesticides. Under optimal conditions only 40 to 80 M kilograms of active ingredient are needed throughout the EC, whereas presently more than 400 M kilograms are used.

The maps resulting from the scenarios show the location of production given different policy views. One scenario is based on free market - free trade ideas. In this scenario costs of production are put as low as possible. Another scenario is based on reaching autarchy within the EC, with maximization of employment. The resulting maps show the locations of cereal production according to these alternative policy views. The volume of production is equal in the two scenarios, but the locations differ. In the second scenario the production is spread wider across the regions in order to satisfy the goal of regional employment. In the first scenario only the most efficient regions are used for production.

Other maps show the locations of grassland in the two scenarios. These maps must be interpreted together with the previous two. The location of grassland, combined with the location of cereals and with all other forms of land use, provides an optimal solution to the different policy views. It can be seen that grasslands in some areas near the Mediterranean are optimal in terms of minimizing production costs, an effect of the longer growing season in southern regions. The scenarios do not only generate information on important macro-policy indicators, but also on the

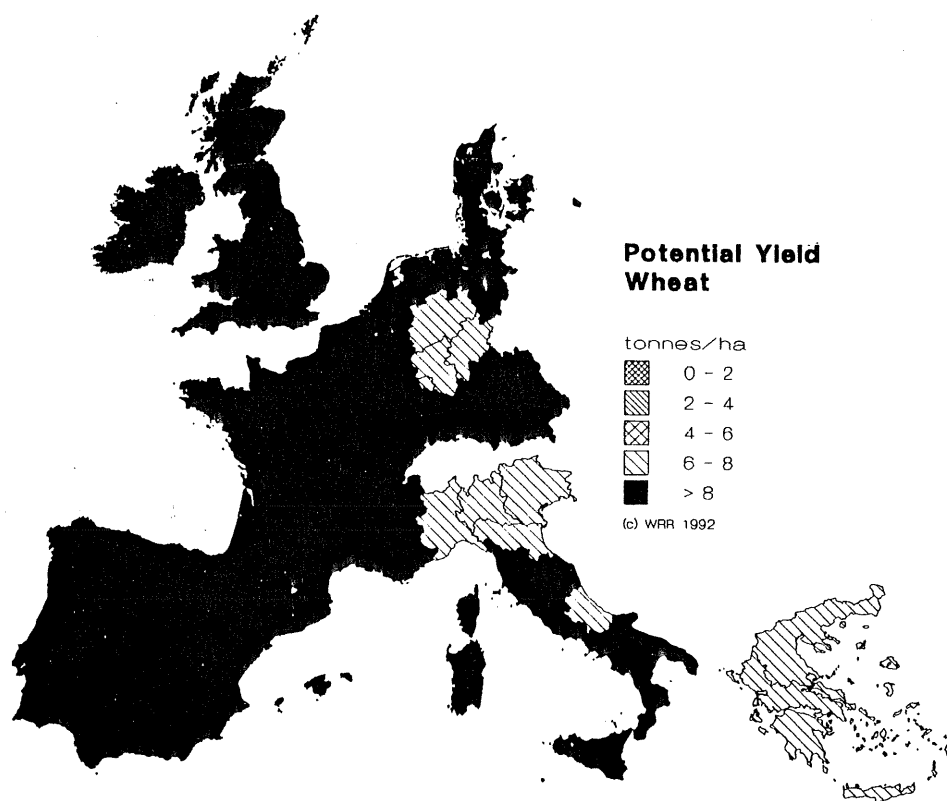


Figure 5. Potential wheat yields in the European Community under optimum conditions, after removal of the water limitation by irrigation where feasible, in tonnes ha⁻¹. By courtesy of WRR.

optimal allocation of land use.

6 Conclusions

The conclusions from our study can be summarized in three statements. (i) Major changes in land use are inevitable in all policy options. All scenarios point to a dramatic decrease in farmland. About one third of our present area under cultivation will be sufficient once productivity in the EC reaches the optimum. (ii). The differences between the scenario results indicate that there is room for policy, but the possibilities to mitigate effects are limited. Figure 6 shows that present land use of 130 M hectares will eventually come down to the range that was mentioned, be it that these figures are extremes. Technical development will bring about a maximum decrease of 90 M hectares. Through policy intervention it is possible to opt for either the lowest figure of 40 M hectares or the highest figure of 50 M hectares. So policy will have an effect, but compared to the decrease brought about by technical improvements this effect will be limited. Of course, as shown above, policy can have a major impact on the distribution of agricultural production locations over the member states. (iii) Finally, we can conclude that the Council's study will offer an effective tool for strategic policy choices.

7 References

WRR, 1992. Grond voor keuzen. Vier perspectieven voor de landelijke gebieden in de Europese Gemeenschap. Rapporten aan de Regering #42. SDU uitgeverij, Den Haag. 149 pp.