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Possible Economic Recovery Factors and Prospects for European Agriculture

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Introduction

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.

Historical records show periods of growth or expansion of the cultivated area and periods of decline or contraction. At the end of the middle ages contraction of agricultural area took place in Europe as a result of the reduction of the number of inhabitants - due to a pestpandemic - with circa 30%. Then agricultural area increased again and another period of contraction started at the end of the seventeenth century, due to increased production and trade.

The idea that we may be facing a new period of contraction is therefore not exceptional. This may become clear in the following in which I will describe a study on possible developments of rural areas in the European Community.

At present the situation in EEC agriculture can be characterized as follows:

a. Productivity continues to rise thanks to advancements 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.

b. In the Community this has led to a situation of self-sufficiency for most agricultural products.

c. After self-sufficiency had been reached, productivity growth continued to rise. This has led to overproduction with major budgetary consequences.

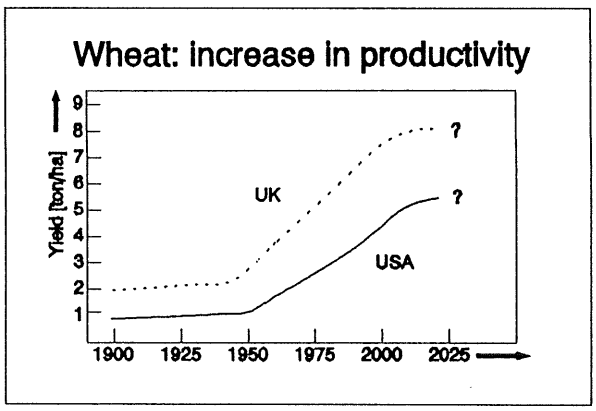
d. At the same time attention has grown for other goals than agricultural production. Environment, nature conservation, employment and farmers income are nowadays tightly linked to developments in agriculture.

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, like nature conservation and recreation.
To investigate what options there are and how various policy objectives can be achieved, the Netherlands Scientific Council for Government Policy performed a study on possible land use in the future. The results of this study will be presented in this paper.

Productivity rise

Developments in productivity show a steady increase all over the world. In this graph the increase in yield per hectare for wheat is shown. Both the UK and the USA show an ongoing rise in productivity especially after World War II.

On a larger time scale the wheat yields per hectare in Western Europe are shown from 1200 until 2000. It is clear from this graph that yield increase was very slow during the period 1200-1900 but rose in the



present century from 18 kg wheat per hectare per year to more than 80 kg wheat per hectare per year. This is a phenomenon that is found in all countries, indepently of the political system, all over the world. The time of discontinuity in the increase varies according to development level.
Of course these developments will not go on for ever, although until now there has been no slowing-down. When and at which level the maximum will be reached depends on the biophysical possibilities and the objectives for environmental policy etc.
These possibilities and the need for further readjustment of the Common Agricultural Policy form the background of this study.

Objectives of the study

The aims of the study are consequently the definition of the limitations to the growth in productivity. In the end those limitations will define the possibilities of agriculture in the Community.
The limitations are of three types:
Firstly *technical limitations*: there is a well-defined yield maximum for each crop, given crop properties and climatic conditions. This tells you how much useful product can be produced when plants grow under optimal conditions.
Secondly *demand limitations*: now that population growth in the EEC has come to a standstill, consumption will no longer rise and non-food uses of agricultural produce appear to be limited in the short run, but may show possibilities in the long term.
Thirdly *limitations that stem from policy goals*: socio-economic goals, and aims in the field of nature conservation, recreation and the like.

Approach used in the study

In the study we focussed on the effects of policy in relation to the technically possible productivity growth.
This led to the following approach.
Firstly alternative policy choices were explored given the developments within the agricultural sector.
Then the consequences of different policy goals for developments within agriculture could be shown.
And finally, once the consequences were clear, instruments could be evaluated in order to define policy options.

General Optimal Allocation of land use (GOAL)

For the study a computer model was developed which calculates **optimal** land use in the Community of the twelve Member States (the territory of the former GDR was not included).

Inputs in the model are:

Technical information about the possibilities of agricultural production.

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 can create different scenarios for land use. Policymakers can thus see how their priorities will affect land use and how the effects are distributed over the EEC.

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

Results

There are two types of results: firstly technical information that was used in the model studies. This information has a value in its own and can be tested and verified. Secondly, model results which show the outcomes of the various scenarios.

The study generated a lot of technical information. Firstly a detailed land evaluation of the EEC. Strangely enough such land evaluations have been performed for a lot of developing countries, but are hardly available for Europe.

This land evaluation was used to assess where crops could be grown and what crop yields are possible at a given location.

To that end we discerned between two situations: a maximum yield, using only the available water (rain-fed agriculture), which we call 'water limited yield' and a potential yield when irrigation or drainage removes limitations (we call this 'potential yield').

Let us take wheat as an example.

On this map the actual yield of wheat is shown for regions within the EEC.

The colours show the actual yield *per hectare* within that region.

We can compare the actual productivity with the *water-limited* yield that the land evaluation shows. This map shows the maximum attainable yield per hectare within each region under optimal conditions, but with the water supply limited to rainfall. The differences are clear.

Looking at a map like this, one must be aware that the given results are averages: parts of the regions indicated are in fact not suitable for wheat farming. In our study we worked with this more detailed information. Verification of this detailed information took place in various Member States of the Community. In general, most estimates were considered conservative and not optimistic.

If the water limitation is removed, the result is very spectacular; 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.
We performed this land evaluation not only for traditional agricultural products, but also for forestry. It turned out that areas favourable to forestry coincide with the higher yielding arable farmlands, even in the case of low demanding tree species.

Another result of the study is a map that shows the preferred locations for nature conservation and development. This technical information, based on a set of criteria, was also used as an input for the scenarios. This so-called ecological mainstructure of Europe demonstrates where nature expansion should take place. Verification of the outcomes of this study was done by consulting the nature conservation services and ministries in various Member States.

Another source of technical information concerns the production techniques that were distinguished. Yield Oriented Agricultural (YOA) production techniques, Environment Oriented Agricultural (EOA) and Land use Oriented Agricultural (LOA) production techniques were distinguished. In all these production techniques the best technical means were used to reach

highest efficiency of inputs per unit of product or per unit of acreage. Techniques of very extensive forms of cereal cultivation or livestock farming were considered in LOA. The input-output tables of the various production techniques required a lot of detailed studies which were collected using literature, experiments, simulation studies and expert judgement.

Model results

The model was used to calculate scenarios on the basis of alternative policy views. Each policy view results in another scenario, but there also are some general results.

All options imply a radically diminished use of land for agricultural purposes. At present in the EEC about 130 mln. hectares are used as farmland. *All scenarios show a spectacular decline to roughly 40 to 80 mln. hectares.*
Even if one tries to maximize labour within agriculture, no more than 80 mln. hectares will be needed for production under optimal conditions. In this situation a great deal of agriculture makes use of very extensive production techniques. Two-thirds of the land in use will have extensive cereal production or livestock farming (yield levels circa 3500 kg of wheat per hectare). The other area will use production techniques with maximum efficiency in terms of nutrients per unit of product, etc.

Another result from the scenarios is that by using best technical means under optimal conditions *only 2 to 5 mln. manyears are needed for the total agricultural production.* At present about 10 mln. manyears are involved in the primary production. Another striking feature of all scenarios is the *dramatic decrease in the use of pesticides.* Under optimal conditions only 40 to 80 mln. kilograms active ingredients are needed throughout the EEC. Presently more than 400 mln. kilograms are used.

The reasons for this considerable deviation from the present situation are the use of good soils with high yields applying optimal agricultural production techniques and absence of wasting agricultural methods that have a tremendous overuse of plant nutrients and pesticides especially on agriculturally marginal soils.
The costs of agricultural activity show considerable differences between the

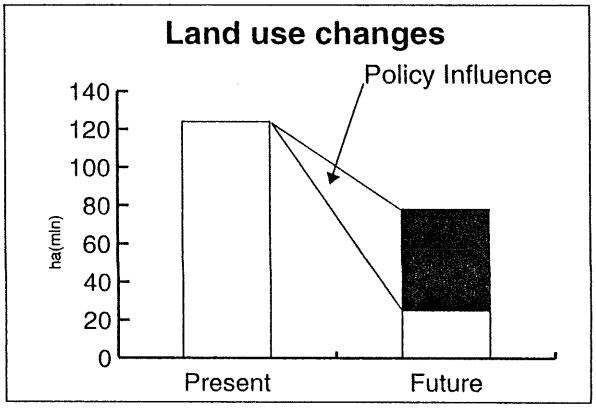
scenarios and with the present situation. The scenario in which economic objectives such as cost minimization and productivity maximization prevail is circa 30 billion ECU cheaper than the scenario in which regional development with more attention for maintaining employment in the marginal areas prevails.
The environmentally oriented scenario is less expensive and does not show as such a dramatic reallocation of land use as the other scenarios do.
The maps showing the distribution of land use illustrate this.

If we look at these maps, which result from the scenarios, we can see the production location given different policy views.
There are considerable differences and this is due to the relative weight of the various objectives and constraints. The distribution in the scenarios with emphasis on rural development shows considerable reduction of land use in the northwestern part of the EEC, and the environmentally oriented scenario shows the smallest changes in land use. The decrease in farm land will then be more equally distributed over the EEC and about 70% of the present cultivated land will still be in use.
In the scenarios where economic objectives prevail, many countries show a dramatic decrease in land use. Concentration of agriculture on the best agricultural land will then take place. Bankruptcy of many farmers may be the result in this scenario. In fact this scenario demonstrates the need for active government policy to support the agricultural sector, but in combination with the other scenarios it also shows that clear choices need to be made.

Conclusions
The conclusions from the study can be summarized in two statements.

I. As demonstrated, major changes in land use are inevitable in all policy options. All scenarios point to a *dramatic decrease in farmland.*
About one third to two thirds of our present area under cultivation will be sufficient once productivity in the EEC 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. This is illustrated by the following graph.



This graph shows that the present land use of 130 mln. 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 mln. hectares. Through policy intervention it is possible to opt for either the lowest figure of 40 mln. hectares or the highest figure of 80 mln. 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 in the distribution maps, policy can have a major impact on the distribution of agricultural production locations over the Member States.