

ECONOMIC PLANT PRODUCTION ON AN ECOLOGICAL BASIS

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Introduction

The efficient use of the technical progress in plant production has led to an immense increase in yields per hectare and income over the last two decades. At the same time worldwide discussions about the ecological aspects of increasing fertilizer use is under way. Also other factors, especially the changed framework of economic conditions, have led to a more intensive discussion about the optimal use of fertilizer, not at least because of the increasing price of the cost of fertilizer.

Big attempts are being made worldwide to improve farm management methods for profitable crop production on ecological basis. We live in a time in which anxieties are being expressed more and more that economic growth cannot continue indefinitely. Criticism is being voiced about exaggerated materialism, an extreme exploitation of nature through a large-scale technology, as well as about science only being interested in measurable quantities. This concern is partly justifiable. It is true, that measurable damages can only be seen on a few locations. However, one must fear, that the number of affected farms and locations will increase if no changes in farm management are introduced. We are all obliged to look for solutions which will ease these conflicts. Some starting points for the field of farm management are presented in this contribution.

Framework for politicians and farmers

Agricultural policy and farm management

The structural change in agriculture will never come to a standstill. This process has some of its own sort of dynamic and will be influenced by the general ideas of the total population towards growth and development. This process will go ahead with or without state interference and the politicians can only influence this process in marginal limits. Nevertheless, the structural change, possibly at the lower pace, will always be necessary in order to accommodate new farmers and give less successful farmers a change to depart from agriculture. In a free economy a structural change is also necessary to allow new entrepreneurship to come alive. Limitations in agricultural and animal production. Therefore, economic growth and enlargement of agricultural enterprises will always take place through the enlargement of the acreage and through the use of new techniques to increase yields and cut costs.

But in the future, this development has to observe more and more the ecological needs of the country. At the same time also the process of specialization will go on,

especially, in times when product prices are decreasing and the cut of input costs becomes a big necessity for the survival of single enterprises and farms.

Under this theoretical framework it is noticeable and a proven fact that on good arable ground the high production level shows a very profitable use of nitrogen, other fertilizers, pesticides, herbicides and fungicides.

As a result of this, very high product price increases are needed in order to compensate for lower input, especially of nitrogen, fungicides and herbicides. On marginal arable ground, however, with a low profitability of fertilizer and fungicide inputs, a small increase in the price of these inputs leads to a rapid reduction in the use of these inputs. Increasing input prices also tend to reduce the overuse of inputs — the so-called risk proportion of the input — drastically. This is a proportion of input which is used to secure the highest possible yields per hectare under the various conditions from year to year. Lower real product prices and increasing input costs will reduce, especially this proportion of the input, dramatically. This decision of the farmer leads necessarily to greater variances in yields from year to year, but analytical results show that the average gross margin of a seven-year-period can be higher than with the highest possible fertilizer, fungicide- and herbicide inputs.

The negative influence of the restricted agricultural price policy towards the agricultural income and the limited possibility of cost reduction through single farm growth, lead to a necessity to watch the yield level per hectare very closely. At the same time the input costs must be controlled and at the same time the general market situation must be watched. Increasing supply with constant or only small increased demands makes it difficult for agricultural politicians to follow an active price policy. Therefore, higher yields tend to stabilise output prices or even lead to decreased output prices in real terms.

Quotas, limited market excess and other interfering instruments into the agricultural market, lead to a lower degree of specialization and limit the possibilities of agricultural restructuring.

An increased risk factor on the other side leads farmers to more sophisticated farming methods with a larger variety of crops and various sectors of animal production in order to minimize the risk.

In order to control the total amount of fertilizer and other agrochemicals in agriculture it is impossible to do this by any legislation. Economic incentives and disincentives have to be found. However, in the Federal Republic of Germany we have in certain regions certain

limitations for the use of fertilizer and especially for the use of slurry and other animal by-products. These areas are especially defined and are nature reserve, especially protected areas and water catchment areas.

Fortunately the Government is convinced that the price policy for inputs and outputs is a better contribution for a healthy environmental policy than a legislation with tight control which is in the last instance uncontrollable.

Goals of agricultural entrepreneurs

In a mainly materialistic orientated world the goal of achieving a maximum profit seems to be the ultimate. This goal is irrespectively of the political system. It occurs in capitalistic and in so-called socialistic systems. What we need in the long term is a good compromise between economic goals and our responsibility towards nature. On this road we will experience a competition between profit, prestige, leisure time, laziness and others on the one hand and solidarity towards society and nature on the other hand. In the different countries there will always be a mixture between these two extremes and over time there are changes inside of each society.

Especially in former times, over hundreds of years, the farmers showed an extremely high responsibility towards nature. Today, especially in Europe and the United States, younger farmers are increasingly on the same road again. An increase in profitability has not any longer for everybody the same high priority. Especially, when a certain secure income level has been achieved.

Other goals, especially the maintenance of the farming potential, the keeping up of a nice farmstead in a traditional area where the family farmed over generations, emotional values towards a special farm and others are of increasing value to a lot of farmers.

In contrary to this, especially with lower real product prices large numbers of farmers are forced to follow economic pressures in order to secure their existence. Under these conditions ecological goals will be put aside, at least for certain times. Under these conditions an ecologically orientated policy towards a healthier environment needs healthy economic conditions.

Meanwhile in farm management terms other things than profit can be measured. This was done in earlier times, especially with things like prestige, power, influence and growth, hunting amenities and others. Under the same conditions ecological goals can be prescribed and valued. The problem with these new items is that not all people are aware and attach the same value to certain ecological goals. In farm management today, the gross marginal calculation is one of the most used and at the same time the most useful method to calculate and judge the situation of a farm. Ecological values were very seldom measured with this method,

but everybody would agree that all activities to secure and maintain farming potential also have a high value.

Therefore, in future it is necessary to find and develop improved calculation methods which combine economic and ecological goals in one method. This is especially needed for long term calculations in order to value the influence of erosion, overgrazing and other problems. Ecological systems have to be very closely watched and to be maintained in order to avoid a disastrous destruction at a later time.

Better advisory services

The stronger observation of ecological goals besides economic goals creates the necessity for more differentiated advice given by commercial firms and the official advisory services, strongly orientated on the circumstances of the individual farm. Especially, the local circumstances and the individual character of the farmer must be taken into stronger consideration. Generalized advice is no longer possible. Specific information for each individual case has to be worked out. Especially in plant production two different ways can be observed:

- (a) The so-called 'intergrated plant production' is still favouring the economic goals. But at the same time more and more ecological aspects are observed.
- (b) The so-called 'alternative plant production' observes mainly ecological goals and the economic aspects are only considered in the second place.

Between these two extremes the current development of production methods and farm management techniques are developed in the Western world.

Stronger variation in the rotation

Two of the main characteristics of plant production are the proportion of the different crops in relation to the total acreage and the rotation. Economic aspects in the last two decades led to a closer rotation of crops and in the extremes to mono-cultures. Science and farm management must again discover the positive effect of the rotation and use its advantages more strongly. In the last two decades they were less and less observed, because:

- (i) costs for industrial inputs were relatively low, and
- (ii) knowledge about environment was not very well developed.

We must again learn to use the rotation in a total growing system in order to make the best use of the specific condition of a special environment and of the advantages and disadvantages between crops.

In this process also the plant breeding people must be stronger involved and mobilized. Especially crops with a

small and slow development in yields must be stronger observed in order to again widen the rotation. For example in the European rotation rye, oats and leguminosids must be intensively treated by the plant breeding section in order to make them competitive again and use their positive effects in the general rotation. This will be a long way and only small steps in this direction can be expected from year to year. Also the unconventional plants have to be looked after. They can widen the rotation and deliver a basis for industrial raw products.

A limitation in the success of any rotation is the management of the farmer. A widening in the number of crops grown on the farm puts another burden on his farm management capacities. He may not be able to grow all crops with the same success and also his marketing potential may be not good enough for all different products. Only very capable farmers will be able to manage a wide variety of crops in a wide rotation. Therefore, at the moment under profit maximization specialized farming may still have an advantage. But with the increasing observation of an ecological aspect this will change. At a first step in this direction small changes under ecological aspects without a decrease in profit are preferred to radical change which can only be successfully managed by a few farmers.

Farm management instruments

Results in practical farming in Europe have shown that a reduction in fertilizer and chemical input can only be managed by a few very successful farmers without loss in yield and profit. One of the most simple and nowadays very common method in order to save fertilizer input costs is the soil testing and the fertilizer calculation for the different crops at the different fields. This sort of information method has to be further developed and commonly used in a number of fields in agriculture, especially as far as chemical inputs are concerned.

In the Federal Republic of Germany we mainly concentrate on the following information systems:

- (a) Development of better techniques for the normal farmer to observe and describe the condition of soil, plant, weeds, insect infestation and others.
- (b) Development of planning methods to combine economical and ecological activities and goals in integrated plant production.
- (c) Development of methods to combine observed and measured data about the current situation and the planning for future activities for a better decision-making process.

Conclusions

Altogether, we have a number of methods available in order to combine ecological and economical goals. But unfortunately, constant changes have to be observed during the whole growing season. Quite a number of changes in farm management are necessary in order to reach a global concept which considers stronger than in the past the local aspect of the whole farming system. Today, it is not any more possible just to concentrate on technical aspects. One has to also consider new values and goals, especially towards a more ecological farming process. In the short term the agricultural framework doesn't allow and does also not foster a change towards an exclusively ecological agriculture. But ecological aspects are becoming of greater value. The ecological aspects will be enforced upon agriculture through society.

One of the future priorities of our work must therefore be the development and introduction of farm management systems which allow to consider and positively use ecological aspects of plant production. Economical and ecological values must be considered for good decision-making process. The existence of plant production of the future must observe monetary and ecological goals in a balanced way.

Summary

There are a number of methods available in order to combine ecological and economical goals. But, unfortunately, constant changes have to be observed during the whole growing season. Quite a number of changes in farm management are necessary in order to reach a global concept which considers stronger than in the past the ecological aspects of the whole farming system. Today it is not any more possible just to concentrate on technical and economic aspects. One has to also consider new values and goals, especially towards a more ecological farming process. In the short term the agricultural framework does not allow and does also not foster a change towards and exclusively ecological agriculture. But ecological aspects are becoming of greater value, because ecological aspects will be enforced upon agriculture through society.

One of the future priorities of our work must therefore be the development and introduction of farm management systems which allow the ecological aspects of plant production. Economical and ecological values must be considered for good decision-making process. The existence of plant production of the future must observe monetary and ecological goals in a balanced way.