

RESEARCH ON INTEGRATED AND ORGANIC FARMING

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As doubt about the perspectives of current agriculture is growing, interest in alternative systems of production is increasing. As a result, many new research activities have been started. Currently, most initiatives are taken in the field of plant production.

Objectives and significance of integrated and organic farming

The intensification of agriculture, based mainly on the increasing inputs of fertilizers and pesticides, is considered as the major cause of the crisis. On the one hand, it is causing pollution of the environment, flattening of landscapes, and declining of flora and fauna. On the other hand, it leads to the increasing agricultural surpluses, which are forcing policy-makers to switch from a protective to a more market-oriented agricultural policy. Consequently, farmers all over the world have to face the snowball effect of the falling prices, decreasing incomes, and threatening unemployment. Integrated farming seems to be the only realistic strategy to control the still aggravating crisis, since it takes into account both ecological and socio-economical considerations. Briefly, its objectives at a farm level are as follows:

1. A shift in emphasis from greater production to cost reduction and improvement of the quality of both products and production ways, through substituting expensive and polluting inputs, especially fertilizers and pesticides, by both agricultural and ecological knowledge, (brain) labor, and non-chemical husbandry techniques.
2. Encouragement and conservation of flora and fauna in and around the fields to stabilize the agro-ecosystem as a major preventive measure against outbreaks of pests, weeds, and diseases.

As main social effects of this integrated farming strategy, the following can be expected:

- a. Less pressure on profits of the agricultural holdings at increasing cost of production means and decreasing prices of products.
- b. Less pollution of the environment.
- c. More safety for the public health.

Biological or organic farming may be considered as the most radical approach of these integrated objectives. On the long term it may also appear the most successful approach, provided with necessary technical and economic improvements produced.

Farming methods and techniques

Crop rotation

Appropriate crop rotation can be very effective to control pests, diseases, and weeds; and maintain soil fertility. In conventional agriculture, the chances for a good rotation have been strongly reduced. For this reason, the integrated system had the same crop rotation as the conventional system. The choice of crop for the variable year/field depended on the market situation. A longer rotation would have offered a better barrier against soil borne pests and diseases, but it would also have been less profitable than the current 4-year rotation. In contrast, the mixed character of the organic system offers excellent opportunities for a diversified and sound rotation. Perennial pastures with grass and clover suppress weeds, restore the soil structure, and increase the organic matter and nitrogen content of the soil. Moreover, a high proportion of grassland in the rotation reduces the cropping frequencies of the marketable crops such as potatoes and cereals. As a result, the pressure of the soil borne pests and diseases is kept to a minimum.

Fertilization

As usual in arable farming, the conventional farm fertilization was mainly of a mineral nature. Organic manure, preferably solid chicken manure was applied to supply organic matter. On the integrated farm, fertilization was mainly organic and mineral fertilizers were only used in a complementary way. In this, system crops were moderately supplied with N in order to avoid abundant leaf development and, as a result, high disease susceptibility.

In conventional agriculture, green manure was applied to improve soil structure. On the integrated and organic farms, green manure crops were also grown to fix the nitrate which had been left behind by the main crop or which had mineralized after harvest. Thus, green manure crops served as a means to prevent nitrate leaching. On the organic farm, only organic manure from our own farm was used. Guatemala was the main source of N in the farm cycle. After being consumed as protein by the dairy cattle, N was collected in the loose-housing as stable manure. Together with the other nutrients, N was distributed over the various crops, as required. Because products were sold, soil reserves of P and K were gradually depleted. This was compensated for by purchasing straw and roughage, and some concentrates.

Crop protection

In conventional agriculture, crop protection was chiefly of a chemical nature. Whereas integrated farm, pesticides were only used as a last resort. Chemicals that are known to be highly toxic, persistent or mobile were avoided. Weeds, diseases, and pests were controlled mainly by means of resistant varieties, lowering of the N-dressing, mechanical weed control, use of appropriate sowing times, and sowing distances, etc. On the organic farm, ample rotation was indispensable for the prevention of weeds, pests, and diseases because chemical control was prohibited. In both experimental systems, some loss in yield caused by weeds, pests, and diseases was accepted.

Results of farming and research

Economics and environment represent the two main criteria for the social acceptability of the three production systems. The inputs of fertilizers and pesticides were important indicators of the environmental impact. Compared to the inputs on the conventional farm, total inputs of K and N were less and the total input of P was the same. On the organic farm, a very large quantity of K was brought into circulation by fodder crops and cows. However, P and N fertilization was by far the lowest here. N-availability was clearly the main limiting factor for production on the organic farm, as it appeared from the yield's comparison between experimental plots in the pastures with and without clovers. From the results, it has been concluded that biological N-fixation was the main source of N-input in the organic system. On the organic farm, relatively little nitrate was leached, which appeared from analysis of the average drain water contents. Nitrate leaching on the integrated farm remained equal to the conventional farm, notwithstanding it's principally an organic form of N-supply. Apparently, the resulting higher degree of N-mineralization after the harvest was recovered successfully by green manure crops. In fact, the drain water of the organic farm was so clean that it could also meet the requirements of the European Community-guidelines for the maximum admissible nitrate content of drinking water (5,6mg NO₃-N/l = 25mg NO₃/l).

Experimental introduction of integrated agriculture

From the experimental results, the conclusion may be drawn that drastic reduction of the usage of fertilizers and pesticides by means of integrated farm management is attractive from an environmental point of view. The resulting cost reductions may also offer sufficient compensation for lower yields and may even bring a higher profit. As increasing costs of production and especially decreasing prices of agricultural products put profits under pressure, it becomes attractive to convert to integrated management. Considering the saturation of markets and the growing amount of restrictions through environmental legislation, research on integrated farming should be extended, through experimental introduction of the system into practice. Undoubtedly this will also lead to the improvement and broadening of the current integrated cropping programs, promoted by the great variety of practices in attitude and skill of farmers, nature and size of holdings, soil types, crop rotations etc.

Perspectives on organic farming

The net output of the organic mixed farm has increased steadily since 1985. Consequently, an acceptable income can be expected in the next few years. This can be achieved on the condition that higher price level is obtained for the organic products, compared to the conventional market which makes up for the higher investments in capital and labor. This need with high premiums however, appears to be too high, a threshold for the majority of the farmers and consumers up till now. This does not mean that organic farming is doomed to play

a marginal role. In areas with sensitive ecological characteristics and also in water collection areas, organic farming may play an important role because of its minimal introduction of nutrients and its rejection of chemical pest control. Therefore, organic farming in these areas deserves financial support from the public funds. Finally, an increasing demand for organic products is occurring on the European market, inspired by the growing concerns for man and his environment and for the well-being of animals. Sooner or later this may lead to a breakthrough of organic farming into conventional practices of farm production, trade, and consumption.