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Current State of Biological Husbandry in the World

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Abstract: The paper was aimed at considering experiences gained in the field of animal husbandry so far and at making recommendations for ensuring ecologically healthy and economically payable biological production.

Based upon the analysis of the current state of biological husbandry, it may be stated that only by means of improving the seeding surface structures, introducing legumes in crop rotation and applying organic fertilizers can nitrogen deficiency be reduced to a minimum. Nevertheless, organic farming (without chemical means) in agriculture is assumed to be possible only in the cases in which more significant improvement of the environmental factors is necessary, in the zones of natural source protection and on the plots intended for production of children and dietetic food.

In addition, it is necessary to determine the level of soil fertility at which biological husbandry may come into use, as well as the economic and energetic efficiency of its systems being recommended.

Key words: fertility, crop rotation, biological husbandry, seeding, soil.

Alternative husbandry systems are still only a small industry. They have been applied in Europe (France, Switzerland, Germany), the USA and Canada. Statistical data, however, point out the growing popularity of alternative agriculture. In the 1970s, the alternative production value increased six times and reached $\$ 6*10^9$. Switzerland has the highest percentage of such households; their number grew in the 1970s and reached 1,500. In Germany, over the period 1981-1986, the number of farms with ecologically healthy production increased 2.2 times and amounted to 1,562, whereas in 1988, it was 1,930. The investigations showed that in a great number of countries of Europe (Switzerland, Germany, Denmark, Sweden) and in the USA, many farm households have been making preparations for converting their operations to

alternative husbandry. In Switzerland and Germany, their number has reached 10% and 27%, respectively, of the number of farm households using non-ecological household running systems.

According to the estimation of American researchers, 44% of farmers think that it is necessary to apply technologies aimed at increasing soil fertility in a natural way, reducing the application of mineral fertilizers. They decided on this solution due to greater economic parameters obtained on alternative household as opposed to the traditional one. In Germany, for instance, in 1988, a farmer-ecologist gained, on the average, by 7.6 % greater income per 1 ha of soil than in traditional households.

The application of similar technologies does not mean the return to obsolete and low-productive husbandry methods. On the contrary, alternative systems consist in the working out and utilization of new technologies based on new scientific findings, but in accordance with the laws of nature.

It must be pointed out that such an approach is feasible only on the soils with high natural fertility potential or on artificially established plots initially fertilized intensively, with scientifically based crop rotation and husbandry practices and awareness that the crop rotation productivity growth is not a primary task.

A systematic highly professional mental and physical work is necessary in agriculture. Biological husbandry on less fertile soils with negative balance of nutrients is not promising. For instance, considerably large arable areas, particularly under grain crops, are practically not fertilized and the yield is obtained on the basis of natural soil fertility, that is with excessively negative balance of nutrients in the soil-plant system. The greater part of the soil is, now, characterized by moderate and low content of major biogenic elements. Stable yield cannot be obtained on the plots like these without the soil fertility increase. There is a lack of organic fertilizers, and their transport to long distances is economically and energetically unprofitable. The non-chernozem zone of Russia comprises a vast farming region with 32 million ha of arable land. Soils are mainly acid, with little humus - 80% of them containing 1-2% of humus and 15% - even less than 1%, while, for the purpose of obtaining stable and high yields in clay soils, it is desirable to have 2-2.5% of humus. Organic fertilizers are applied in a bit more than half the quantity necessary for non-deficit balance compensation, e. g. for humus in the soil.

Today, owing to the application of manure, compost and other organic fertilizers, 40% of nitrogen, 35% of phosphorous and 60% of potassium needs for the farming of the non-chernozem soil in Russia, are obtained (Mineev et al., 1993).

Greater productivity of arable land, particularly in this zone, is fully dependent on the significant increase in manure application, which can be achieved by increasing the number of heads of cattle and, consequently, the fodder crop base. The necessary quantity of high-quality fodder can be obtained only on highly productive agricultural soils, with substantial quantity of fertilizers used. Thus we return to the expanded spiral of the circulation of matter in agriculture, which can be achieved only through proper integrated application of organic and mineral fertilizers, to which there is no alternative.

That explains the small participation of farm households with established biological husbandry, irrespective of its ecological significance. A certain increase in the number of such households, in the past years, in fact, has a small effect on the feeding issue resolution. Thus, for instance, their share in the total number of farms is as follows: 1% in the USA, 0.8% in Switzerland, 0.2% in Germany and 0.3% in France (Prizukov, 1988).

Economically most justifiable and promising are the mixed-type households with crop and animal husbandry production. They do not require purchasing of organic fertilizers.

Furthermore, farmers are now faced with a great number of hard tasks brought about by the conversion to biological husbandry. One of the main tasks is the prevention of decreases in crop yields in alternative husbandry conditions, which gain lower yields than modern intensive technologies do. It has been observed that compensation of nutrients taken up with the yield, through the application of organic fertilizers, ploughing in of crop residues, from hard-soluble minerals and by biological nitrogen fixation, is insufficient.

The analysis of the current state of biological husbandry has shown that deficiency of biogenic elements is widespread. The organic fertilizer and crop residue mineralization, as well as biological fixation of atmospheric nitrogen do not eliminate nitrogen deficiency. Quite clearly, by means of improving seeding surface structures, introducing legumes in crop rotation and applying organic fertilizers, nitrogen deficiency can be reduced to a minimum or completely eliminated.

Phosphorous deficiency (15-20 kg/ha) is a burning current issue. Lack of natural sources of filling its reserves in soil can cause its excessive exhaustion in alternative farming. Potassium taken up with the yield can be compensated for by the application of manure, basalte of flour and other potassium sources.

Conversion to biological husbandry requires a systematic control of the change of soil fertility state and compensation of all macro- and microelements by introducing natural agrochemicals.

An important question concerning the pest and disease control remains to be resolved. It is necessary to determine the alternatives to pesticide application. Apart from the application of conventional ways of farming (crop rotation, reduced soil farming, resistant crop variety selection), it is necessary to develop new investigation trends.

Another question that needs to be dealt with is the question of quality production guarantee. It is necessary to take measures for the realization of high-quality production. Furthermore, there are, also, husbandry economic issues that must be resolved. How can we increase rentability of such households? As far as the transition to biological husbandry is concerned, a large number of issues demanding complex resolution have emerged.

In many European countries, the biological husbandry euphoria has been dying down due to the emergence of a great number of negative trends, mainly the considerable decrease in the crop rotation productivity.

As assigned by the FAO, investigations have been conducted, based on which it has been determined that, alternative husbandry has caused a decrease in yields of grain by 10-20%, and those of potato and sugar beet by 35% each

(Vereijken, 1986). Based upon more generalized data for Germany, the reduction was as follows: wheat by 20-30%, rye - 30%, oats - 20%, barley - 30%, potato - 55% (Blagovescenskaja, 1990).

At Iowa and California (USA) universities, the linear programming method has shown that during the transitional period from conventional (intensive) to alternative husbandry methods, wheat yield decreased by 40-44%, grain feed crop by 41-48%, soybean by 30-40% and cotton by 13-33% (Langley et al., 1983).

In the past four years, the Münster Agricultural Council (Germany) has, on farm households, conducted trials on a large number of winter wheat varieties in intensive and alternative husbandry conditions. On the "Bad Zalcuflen" farm, operating within the "Society for natural produce production" (ANOI), yield and quality of winter wheat grown by the application of the aforementioned technologies, have been compared. The alternative technology has completely (or almost completely) excluded the use of pesticides and growth regulators and reduced the application of nitrogen fertilizers to N_{130}. In each of the technological variants, three varieties have been used: Ares, Kraka and Okapi. Over the investigation years, and with all varieties (for four years on the average), the winter wheat yield, grown by the use of alternative technology, was by 30% lower on soils with high fertility level. On less fertile soils, more significant differences concerning the crop yield, depending on the technology used, may occur.

The results obtained during the trials in Rjuten and Rotcen (Germany) have shown that quality of the grain grown using alternative technology is different from that obtained by conventional technology. The raw protein content, for instance, was 10.5-11.1% vs. 14.5% in the wheat grain grown using intensive technology system.

Based upon long-term investigation on the possibility of agricultural management without any chemical means, the Agricultural Biologization Committee in Holland has concluded that a purely biological system (without any chemical means) is feasible only in the cases in which more significant improvement of the environmental factors is necessary Agricultural crop yield is much lower when using biological farming than when applying the intensive one (tab. 1).

Tab.1. Yield of crop using different husbandry systems, t/ha

Crop	Intensive farming	Biological Husbandry
Winter wheat, grain	7.7	5.0
Potato	55.5	24.6
Sugar beet (sugar yield)	10.3	7.9

Yield reduction during biological farm management is assessed to result from the exclusion of any factor of intensification from the cultivation system under unfavourable soil and weather conditions.

Apart from that, modern field crop varieties are highly demanding, as regards both fertilizers and pesticides to be used.

The excessive reduction of chemical means or their total elimination is recommended only in the zones of natural source protection and on the plots intended for the production of children and dietetic food. In other production conditions, chemicals cannot be excluded. Even with the increase of the grain (by 70%) and potato (by 100%) value, biological husbandry is economically unsuitable (Blagovescenskaja, 1989).

It is necessary to stress out that differences as regards the quality of products obtained by using different systems of alternative farming, have not been scientifically proven, yet. The obvious example is wheat. Apart from that, the application of high doses of organic fertilizers, manure, for instance, over 80 t/ha, with an aim to compensating nutrients taken up with the yield, can increase the accumulation of nitrates in soil and crops, particularly if they are grown for green fodder, silage and hay, as well as in potato and fodder fruits. In addition, if an imperfect technique is used for manure distribution, plots are formed in the field where fertilizer quantity can reach up to and even more than 150-200 t/ha. Clearly, that excludes the possibility of obtaining the ecologically healthy product.

Conclusion

Based upon the aforementioned, it can be concluded that there are various attitudes towards biological husbandry in the world. Scientists still have to examine a whole range of agrotechnical methods. It is necessary to determine the level of soil fertility at which biological husbandry may come into use, as well as the optimal share of legumes in crop rotation, finding a way to maintain the non-deficient balance of nutrients in the soil-plant system, and to pay more attention to the quality of products. The economic and energetic efficiency of the husbandry systems being recommended are necessary for a serious investigation. Without them, the question of the widespread use of biological husbandry cannot be dealt with.

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STANJE BIOLOŠKOG RATARENJA U SVETU

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Rezime

Rad ima za cilj da razmotri dosadašnja iskustva u oblasti biološkog ratarenja i predlaganje mera za realizaciju ekološki bezbedne i ekonomski opravdane biološke proizvodnje.

Na osnovu analize trenutnog stanja biološkog ratarenja u svetu može se tvrditi da je deficit azota moguće svesti na minimum poboljšanjem strukture setvenih površina uvođenjem leguminoza u plodored i primenom organskih đubriva. No, i pored toga, realizacija organskog ratsrenja (bez primene hemijskih sredstava) je moguće samo u slučaju ako se značajnije poboljšaju ekološki faktori životne sredine, zaštite prirodni izvori i zemljišne površine predviđene za proizvodnju dečije i dijetetske hrane.

Osim toga, neophodno je utvrditi nivo plodnosti zemljišta pri kojem je moguće realizovati biološko ratarenje, kao i ekonomsku i energetsku efikasnost preporučenih sistema ratarenja.