GOALS OF QUALITY RESEARCH*

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The Problems of Pesticide Residues

The draft of the new decree[1] on maximum residue amounts contains ninety-two substances for which maximum amounts still have to be determined. This is mainly because there have been no methods of analysis for these substances until recently, and their low residual amounts could not be measured. When we think of all the scientists and bureaucrats who, over the past thirty years, have talked about the harmless and safe conditions surrounding residue analysis and freedom from residues, it is no small wonder that the public reacts emotionally where science and government bureaucracy is concerned. What else can a lay person do? Only recently a method of analysis for ninety-two substances has finally been made available on paper. But what is really going on in governmental offices? I went over the list of herbicides and found thirty-four which are not even listed in the new decree.

This year I had the opportunity to participate in talks at the Federal Ministry of Health,[2] which dealt with the subject of residues of veterinary drugs in foods of animal origin. A means of analyzing these residues has not yet been fully established, so there is no way for the meat to be checked during the prescribed "waiting period". Therefore, there are regulations which basically cannot be enforced in the foreseeable future. The list of substances used here is probably even longer than the one for pest control in plants. I would like to take this opportunity to state that very serious, very intense and quite controversial work is being done in scientific study groups to ensure the proper legislative and executive processes. This provides us with a ray of hope.

No food producer, however, can guarantee that the maximum residue amounts of hundreds of substances are not exceeded. He would have to ascertain the residue amounts by analyzing random samples. This is just not practical! We have consumer protection laws which are necessary but which cannot be implemented. In the long

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[1]A new law passed in Germany to establish maximum allowable residues for ninety-two active chemical ingredients in food crops.

[2]West Germany.

run, such an inability to implement laws can only make the reality of a "rights" state very questionable indeed.

We must take into account that chemical pest control for plants now advises against the use of some agents which it previously accepted and recommended. Since our society fought against these recognizable mistakes and such narrow-mindedness, something good came of this after all. However, is it not the task of those involved with agriculture (and, in particular, the science of agriculture) to think about this and to draw the consequences?

Now we are told not to eat the liver of the field hare, because it may have a high mercury content. Yet modern agricultural practices have, for decades, been feeding mercury to the hares through treated seeds and a variety of fungicides, despite the fact that even high school graduates know that mercury does not decompose and so its concentrations increase. Is it any wonder that the public has lost confidence in science and in government bureaucracy? This loss of confidence does great damage to society.

The real problem lies in the fact that modern agricultural practices, which I would describe as chemically-technically oriented, have fully integrated a large number of synthetic substances. All we can know about the effects of these substances, however, is how well the desired goal is met, and how much toxicity is found in laboratory animals.

As soon as a certain "threshold" is reached, any agricultural measure will lead to a reaction of the entire biological system. We are talking about fertilizers, pest control, growth regulators, soil conditioners, feed additives and veterinary drugs. Plant cultivation, animal breeding, machines and tools form part of an integrated whole; they support the system and its unimpaired progress along established lines. Thus, this system of cultivation itself brings about a tendency to increase the necessary use of chemical applications. The annual research expenditures are in the billions. Most of the chemical agents, however, only replace the natural processes.

The question must be asked as to whether we should have a change in direction. The goal of limiting the use of synthetic substances inevitably leads to an increase of scientific and practical interest in the natural processes and their management as a whole. Bio-dynamic work, as you know, involves such a change in direction.

The Position of Agriculture in Society

The quality of a product can be judged only when we look at its connection to the actual use of the product. Surprisingly, I missed the

fact that the biological system comprising "agriculture" within any given area has, within itself, a larger inter-relationship in which each product remains effective even after it has been sold. Each product leaves behind effects which influence the agricultural connection, be it the micro-organism population, the conditions of the root system, etc. There are many plants without soil, but there is no soil without plants. Plants create soil, and for this reason each growing plant influences the entire system and, hence, the possibility of the future improvement or decline of agriculture as a whole. The numerous small steps of decline may be characterized by an increase in the amount of chemical agents used. Although the application of these agents is supposed to compensate for the gradually incurred damages, however, their effects prevent a recognition of the direction the development is taking. It is the widespread, hidden illusion of the farmer who does his sowing in a well-maintained, plant-free field, that the soil is one system, the plant another, pest problems and pest control a third, and livestock yet another system. This farmer derives his knowledge from soil science, which utilizes the disciplines of chemistry and physics, and from theories of plant nutrition which arrive at basic concepts through hydroculture and tempered sand under laboratory conditions. Although many people take exception to what I have just said, it appears that, in the long run, most people do not think ecologically. In discussions of "integrated production", however, Bio-dynamics clearly emerges as the most consistently integrated system. Here is an example:

Over a period of four years, the arthropod fauna of a bio-dynamic fruit-growing farm was examined closely. In close vicinity an integrated orchard was examined also. The entire examined area is imbedded in a dispersed fruit-growing system, with old, tall, untended trunks which were, nevertheless, included in the study. A larger distance away an examination of two orchards, intensively worked, using orthodox methods, was conducted. The insect population of the bio-dynamically treated apple culture indicated a higher amount of individual species, frequently twice the amount found in the other systems. The useful fauna was particularly rich and there were species which ordinarily can be found only in warmer climates. The damage levels by sucking insects, as indicated by integrated pest control methods, were exceeded, though there was no recognizable damage. The population of the apple psylla *(Psylla mali)* during 1980 exceeded the damage level sixfold. Possible damage consists of atrophied shoots, leaves sticking together before they unfold, and black mildew, a sugar excretion from animals, covering the leaves on

top of the honeydew. None of these effects occurred, although there was a lot of honeydew and some isolated blight. (H. Jasser)

It is not only the control of harmful insect populations through useful insects which plays an important role here, but the condition of the plant as well. How else can we explain these phenomena?

Keeping Quality

The above results agree quite well with tests for keeping quality, or "freshness". Keeping quality is increased through fertilization with compost and enhanced as such fertilization increases. The same holds true for the bio-dynamic preparations, particularly when all are used together. Chemical fertilization, on the other hand, achieves the opposite results: keeping quality is harder to preserve, and it is diminished with the increase of chemical fertilization.

"Freshness" is not merely a pleasant, practical characteristic which may also involve methods of plant protection. It incorporates the quality of higher life *per se* — a quality which is difficult to understand. How can a plant build up negative entrophy and not collapse? Plants pile up substances that are energy-rich and decompose easily in their organism. There are decomposing bacteria, fungi, viruses, etc. present everywhere, yet the plant continues its building process. The activity of life turns the entropy theory upside-down. Does "freshness" characterize the degree to which a substance is enlivened? Although there are no simple, only differentiated, answers here, this is clearly an important area for further scientific study.

There is also the question of structure. Juices react like the untouched product. How does satisfactory or unsatisfactory preservation of freshness come about? The processes of plant growth must also be viewed from this aspect.

Characterization of Individual Properties

We need study groups, smaller study groups, in which quality criteria can be discussed thoroughly. I do not understand, for example, how the volume of bread and the raw protein of the grain can be used as quality criteria, or why "the bigger the better" should be the rule. Of course, we need bread that is easily edible and digestible. Beyond that, however, it is my opinion that greater bread volume may quickly become an absurdity, leaving little for people to sink their teeth into. It goes without saying that a late nitrogen fertilization increases the raw protein content of the grain. Thus, the criteria of bread volume and raw protein content appear to have been chosen to increase and

sanction nitrogen fertilization, pest control and plant cultivation in a onesided manner. I do not suggest bad intentions on anybody's part, but the relationship of cultivation methods with the end results is interesting, especially when we consider that the many agents added by the baker are also part of this system.

Every single desired quality, such as protein content, is of importance only in connection with all the other qualities of a product. When the quality is increased, through whatever means, it does not necessarily follow that the effect is also increased, since the appropriate relation to the other qualities is lost. Graphs of an evaluation of such increased quality will therefore show a decline after they peak; i.e., they maintain the character of optimum graphs. The good, at least according to the rule, lies between the extremes.

Furthermore, one cannot reinforce a single quality within the context of life without changing all other qualities, too. Not only the quantitative relationship of a property (e.g., that of a substance to the other substances, the later remaining unchanged) changes, but the entire system changes. With the increase in quantity the quality itself may change in as far as that is possible. With late nitrogen fertilization, the structural protein of the flour molecules is increased. This protein is different from the protein of the germ and also different from the protein of the aleuronic layer.

When the entire grain plant (i.e., a part of the agricultural context) is included in the quality judgment, then the high yields with the high protein content of the grains can, as a rule, be achieved only with the aid of fungicides. Even with limited nitrogen fertilization the vegetative parts of the plant already exceed the allowed optimum. Since an overfertilization with nitrogen can hardly be avoided, the plants become increasingly susceptible to fungal infections. Late nitrogen fertilization is an attempt to eliminate these side effects affecting the shaft and the leaves, and this method succeeds to some extent. However, the upper leaf blade, the top portion of the stem, and the vegetative parts of the grain ear are still affected. There is an increase in fungal infections of the upper vegetative plant organs when fertilization is intensified. The same holds true for infestation by aphids. At the time when late nitrogen fertilizer is applied, when blossoms begin to appear, these parts must have developed their full vegetative function and must maintain it. A large, varied spectrum according to varieties and location has to be expected, and is in fact already known to bear upon these conditions and reactions. If the quality of grain is to be judged with regard to its nitrogen fertilizer, it is not only the seeds which should be examined.

Limitations of Comparing Agricultural Systems

A few more words about the comparison of agricultural systems are in order. Neither chemically-technically oriented agriculture, nor alternative agriculture, nor the bio-dynamic system are systems which lend themselves to a clear description based upon their methods and means. In order to be able to compare systems one must decide on a specific, concrete system which can be defined in concrete terms, without generalizing. But even such a selected, concrete system, if it is reasonable, can never be a fixed system for any length of time, unlike, for example, the system which produces a car. For a specific type of car you can build an assembly plant in Europe, in Asia, or any place else in the world. That specific type of car will be built the same way, regardless of plant location. This cannot occur in living nature.

When certain measures are introduced into a location, then the location itself undergoes a change. The life processes of the soil in that location change in direction and intensity. Where the seeds are home-grown the plants change over the course of several generations. The animals' feed changes and they, in turn, change in behavior, needs and instincts. It is in the interest of the bio-dynamic method of agriculture to anticipate such changes, to be alert and to adapt one's methods according to one's experience. This is an integral part of the ideal system, which is an "individuality of a higher order" (Thienemann), differentiated into an abundance of species and individuals, and our cultivated plants and domestic animals are just a small part of it. Rudolf Steiner called it "an individuality that lives on in time."

Today's farmer has been brought up to believe that agriculture is a profession and that earning money is the purpose. Income, expenditures and working hours fill his consciousness. The use of synthetic agents directed at increases in production and profitable management is the direct extension of the economically-oriented agricultural system. A real change in the farmer's thought pattern regarding the ecological context is not necessary and, as a rule, comes about only when damages force him to think again. But initially even more treatments and measures are found along established lines. This is not true for everyone, and it is not always the rule — there are exceptions. It does, however, apply to the development of the entire chemically-technically oriented system of agriculture today.

When comparing systems, what should be compared? Any agricultural system must be adapted to the goal one wishes to pursue. In the end, each detail undergoes changes. Another plant variety may have to be chosen, for example. Then what shall be compared?

A lot of insights may be gained through such a comparison of

systems. These insights can be quite helpful. It is impossible, however, to determine causal relationships which are known to those who run a biological system. The question of which system is going to be used in a certain case is decided, on the one hand, by one's willingness to embrace new thoughts regarding the context of life and one's readiness to accept the consequences. On the other hand, much depends on the evaluation of the specific location, since no location is equal to another.

The understandable desire to compare systems is frequently based upon the hope that one can learn from the results. Plausible as that may be, it is, however, based on the thought that the agricultural production system is no different from a technical, mechanical system. This error, in my opinion, should be overcome primarily through thought processes and not through experiments.

The Significance of the Exact Experiment

The most important point of quality research is the establishment of a connection between certain qualities and the measures and conditions which brought them about. To that end, individual factors within an existing system, or within a system created in an experimental model field, must be gradually increased and then compared. The results of such an experiment may be limited but clear, and they may be applied to various conditions and implemented on a practical scale.

Human Needs

In the end, quality research must, of course, meet the criteria created by human needs. Human health, however, depends to a high degree on long-term effects. The time between the beginning and the actual onset of most common illnesses today — illnesses such as gout, rheumatism, heart disease, circulatory ailments, cancer, diabetes, etc. — is about twenty years. Nutrition is an important lifelong factor affecting our health. Experiments cannot yet prove this directly. Animal experiments are an important step on the way. When, after a few weeks of experimental feed, decisive differences can be observed (as, for example, in the reproductive organs, as shown in the experiments conducted by Aehnelt and Hahn), then an important statement is being made. Naturally the question of transferring the results from animal to man must be resolved.

It is essential to follow and understand the entire process of

producing quality in agriculture and also the effect of this quality on the human organism.

In addition we must also look at the decisive effect production has on the location on a long-term basis. Only when we look at both of these aspects together will we be able to make a value judgment. Under limited conditions, judgment may be passed even beforehand — the reader may verify this for himself — as long as the criteria are clearly indicated.

Basic Questions of Natural Science

In the area of quality research, natural science oversteps its intention of remaining objective. In the end, the value placed upon results is an important element of quality research. Quality research demands from natural science a thorough examination of its basic concepts.

If, for example, bio-dynamic preparations clearly influence not only compost decomposition but also the quality of plants, then should not a question be asked about the meaning of the effect of these preparations? It would be premature to expect cooperation in all quarters; however, the following should be pointed out:

Human consciousness is the realm in which all advances in knowledge — including the findings of natural science — occur. An understanding of natural science itself is not possible without including the consciousness of the scientist. Then, however, we are not dealing with natural science any more, since we do not focus our attention on nature but on the consciousness.

I have raised such issues in discussions now and then, but have been surrounded by a wall of silence. This is quite understandable, because our courses in natural science do not contain such thoughts. Starting with the first semester, the student is confronted with the existing approach to natural science without ever being asked to question this approach. Since the natural science teacher was in the same situation when he was a student, he also never questioned it. The educational system is a closed circle that, once entered, cannot be left. The experts are like moles digging ever deeper into the recesses of their specialized fields; while doing so, they develop excellent digging tools. The idea of possibly walking freely to a near mountain from which the surrounding area can be seen never enters their minds. This is left to the philosophers. They, however, do not speculate about the shaping of the world. And the results arrived at by philosophers have no bearing on natural science, because they are not taken note of.

Quality research must be an all-inclusive science because quality can be judged only from a concept of the whole. Is quality research not a reason to examine the question of scientific concept-formation? Is a broadening of scientific concepts necessary or perhaps even possible?

The quantity/quality concept, for example, is derived from Aristotelian categories. Aristotle, however, started out with the idea of *oysia,* which is translated as existence, being, essence, reality. What do these words mean?

Professor Buss, head of the Hessian Ministry of Environmental Protection, ascertained during the 1981 Conference on Alternative Agriculture, held by the European Council, that part of the chlorinated hydrocarbons found in our air do not originate from Europe but from India. Not only the agent but the entire agricultural system which relies on a myriad of such agents was created in Europe and from Europe reached the entire world. This small example represents the fact that we — i.e., the industrialized nations — in many ways find ourselves in the situation of the sorcerer's apprentice who cannot rid himself of the evil spirits he has called up. Can a solution be found which will not merely cure the symptoms, but also find the causes for these problems and remedy them?