

Preface
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In 1922/23 Ernst Stegemann and a group of other farmers went to ask Rudolf Steiner's advice about the increasing degeneration they had noticed in seed-strains and in many cultivated plants. What can be done to check this decline and to improve the quality of seed and nutrition? That was their question.

They brought to his attention such salient facts as the following: Crops of lucerne used commonly to be grown in the same field for as many as thirty years on end. The thirty years dwindled to nine, then to seven. Then the day came when it was considered quite an achievement to keep this crop growing in the same spot for even four or five years. Farmers used to be able to seed new crops year after year from their own rye, wheat, oats and barley. Now they were finding that they had to resort to new strains of seed every few years. New strains were being produced in bewildering profusion, only to disappear from the scene again in short order.

A second group went to Dr. Steiner in concern at the increase in animal diseases, with problems of sterility and the widespread foot-and-mouth disease high on the list. Among those in this group were the veterinarian Dr. Joseph Werr, the physician Dr. Eugen Kolisko, and members of the staff of the newly established Weleda, the pharmaceutical manufacturing enterprise.

Count Carl von Keyserlingk brought problems from still another quarter. Then Dr. Wachsmuth and the present writer went to Dr. Steiner with questions dealing particularly with the etheric nature of plants, and with formative forces in general. In reply to a question about plant diseases, Dr. Steiner told the writer that plants themselves could never be diseased in a primary sense, *"since they are the products of a healthy etheric world."* They suffer rather from diseased conditions in their environment, especially in the soil; the causes of so-called plant diseases should be sought there. Ernst Stegemann was given special indications as to the point of view from which a farmer could approach his task, and was shown some first steps in the breeding of new plant types as a first impetus towards the subsequent establishment of the biological-dynamic movement.

In 1923 Rudolf Steiner described for the first time how to make the bio-dynamic compost preparations, simply giving the recipe without any sort of explanation — just *"do this and then that."* Dr. Wachsmuth and I then proceeded to make the first batch of preparation 500. This was then buried in the garden of the "Sonnenhof" in Arlesheim, Switzerland. The momentous day came in the early summer of 1924 when this first lot of 500 was dug up again in the presence of Dr. Steiner, Dr. Wegman, Dr. Wachsmuth, a few other co-workers and myself. It was a sunny afternoon. We began digging at the spot where memory, aided by a few landmarks, prompted us to search. We dug on and on. The reaper will understand that a good deal more sweating was done over the waste of Dr. Steiner's time than over the strenuousness of the labour. Finally he became impatient and turned to leave for a five o'clock appointment at his studio. The spade grated on the first cow horn in the very nick of time.

Dr. Steiner turned back, called for a pail of water, and proceeded to show us how to apportion the horn's contents to the water, and the correct way of stirring it. As the author's walking-stick was the only stirring implement at hand, it was pressed into service. Rudolf Steiner was particularly concerned with demonstrating the energetic stirring, the forming of a funnel or crater,

and the rapid changing of direction to make a whirlpool. Nothing was said about the possibility of stirring with the hand or with a birch-whisk. Brief directions followed as to how the preparation was to be sprayed when the stirring was finished. Dr. Steiner then indicated with a motion of his hand over the garden how large an area the available spray would cover. Such was the momentous occasion marking the birth-hour of a world-wide agricultural movement.

What impressed me at the time, and still gives one much to think about, was how these step-by-step developments illustrate Dr. Steiner's practical way of working. He never proceeded from preconceived abstract dogma, but always dealt with the concrete given facts of the situation. There was such germinal potency in his indications that a few sentences or a short paragraph often sufficed to create the foundation for a farmer's or scientist's whole life-work; the agricultural course is full of such instances. A study of his indications can therefore scarcely be thorough enough. One does not have to try to puzzle them out, but can simply follow them to the letter.

Dr. Steiner once said, with an understanding smile, in another, very grave situation, that there were two types of people engaged in anthroposophical work: the older ones, who understood everything, but did nothing with it, and the younger ones, who understood only partially or not at all, but immediately put suggestions into practice. We obviously trod the younger path in the agricultural movement, which did all its learning in the hard school of experience. Only now does the total picture of the new impulse given by Rudolf Steiner to agriculture stand clearly before us, even though we still have far to go to exhaust all its possibilities. Accomplishments to date are merely the first step. Every day brings new experience and opens new perspectives.

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Shortly before 1924, Count Keyserlingk set to work in deal earnest to persuade Dr. Steiner to give an agricultural course. As Dr. Steiner was already overwhelmed with work, tours and lectures, he put off his decision from week to week. The undaunted Count then dispatched his nephew to Dornach, with orders to camp on Dr. Steiner's doorstep and refuse to leave without a definite commitment for the course. This was finally given.

The agricultural course was held from June 7 to 16, 1924, in the hospitable home of Count and Countess Keyserlingk at Koberwitz, near Breslau. It was followed by further consultations and lectures in Breslau, among them the famous "Address to Youth." I myself had to forgo attendance at the course, as Dr. Steiner had asked me to stay at home to help take care of someone who was seriously ill. "*I'll write and tell you what goes on at the course,*" Dr. Steiner said by way of solace. He never did get round to writing, no doubt because of the heavy demands on him; this was understood and regretfully accepted. On his return to Dornach, however, there was an opportunity for discussing the general situation. When I asked him whether the new methods should be started on an experimental basis, he replied: "*The most important thing is to make the benefits of our agricultural preparations available to the largest possible areas over the entire earth, so that the earth may be healed and the nutritive quality of its produce improved in every respect. That should be our first objective. The experiments can come later.*" He obviously thought that the proposed methods should be applied at once.

This can be understood against the background of a conversation I had with Dr. Steiner *en route* from Stuttgart to Dornach shortly before the agricultural course was given. He had been speaking of the need for a deepening of esoteric life, and in this connection mentioned certain faults typically found in spiritual movements. I then asked, "*How can it happen that the spiritual*

impulse, and especially the inner schooling, for which you are constantly providing stimulus and guidance bear so little fruit? Why do the people concerned give so little evidence of spiritual experience, in spite of all their efforts? Why, worst of all, is the will for action, for the carrying out of these spiritual impulses, so weak?" I was particularly anxious to get an answer to the question as to how one could build a bridge to active participation and the carrying out of spiritual intentions without being pulled off the right path by personal ambition, illusions and petty jealousies; for, these were the negative qualities Rudolf Steiner had named as the main inner hindrances. Then came the thought-provoking and surprising answer: *"This is a problem of nutrition. Nutrition as it is to-day does not supply the strength necessary for manifesting the spirit in physical life. A bridge can no longer be built from thinking to will and action. Food plants no longer contain the forces people need for this."*

A nutritional problem which, if solved, would enable the spirit to become manifest and realise itself in human beings! With this as a background, one can understand why Dr. Steiner said that *"the benefits of the bio-dynamic compost preparations should be made available as quickly as possible to the largest possible areas of the entire earth, for the earth's healing."*

This puts the Koberwitz agricultural course in proper perspective as an introduction to understanding spiritual, cosmic forces and making them effective again in the plant world.

In discussing ways and means of propagating the methods, Dr. Steiner said also that the good effects of the preparations and of the whole method itself were *"for everybody, for all farmers"* — in other words, not intended to be the special privilege of a small, select group. This needs to be the more emphasised in view of the fact that admission to the course was limited to farmers, gardeners and scientists who had both practical experience and a spiritual scientific, anthroposophical background. The latter is essential to understanding and evaluating what Rudolf Steiner set forth, but the bio-dynamic method can be applied by any farmer. It is important to point this out, for later on many people came to believe that only anthroposophists can practise the bio-dynamic method. On the other hand, it is certainly true that a grasp of bio-dynamic practices gradually opens up a wholly new perspective on the world, and that the practitioner acquires and applies a kind of judgment in dealing with biological — *i.e.* living — processes and facts which is different from that of a more materialistic chemical farmer; he follows nature's dynamic play of forces with a greater degree of interest and awareness. But it is also true that there is a considerable difference between mere application of the method and creative participation in the work. From the first, actual practice has been closely bound up with the work of the spiritual centre of the movement, the Natural Science Section of the Goetheanum at Dornach. This was to be the source, the creative, fructifying spiritual element; while the practical workers brought back their results and their questions.

The name, *"Bio-Dynamic Agricultural Method,"* did not originate with Dr. Steiner, but with the experimental circle concerned with the practical application of the new direction of thought.

In the Agricultural Course, which was attended by some sixty persons, Rudolf Steiner set forth the basic new way of thinking about the relationship of earth and soil to the formative forces of the etheric, astral and ego activity of nature. He pointed out particularly how the health of soil, plants and animals depends upon bringing nature into connection again with the cosmic creative, shaping forces. The practical method he gave for treating soil, manure and compost, and especially for making the bio-dynamic compost preparations, was intended above all to serve the purpose of reanimating the natural forces which in nature and in modern agriculture were on the wane. *"This*

must be achieved in actual practice,” Rudolf Steiner told me. He showed how much it meant to him to have the School of Spiritual Science going hand in hand with real-life practicality when he spoke on another occasion of wanting to have teachers at the School alternate a few years of teaching (three years was the period mentioned) with a subsequent period of three years spent in work outside, so that by this alternation they would never get out of touch with the conditions and challenges of real life.

The circle of those who had been inspired by the agricultural course and were now working both practically and scientifically at this task kept on growing; one thinks at once of Guenther Wachsmuth, Count Keyserlingk, Ernst Stegemann, Erhard Bartsch, Franz Dreidax, Immanuel Vögele, M. K. Schwarz, Nikolaus Remer, Franz Rulni, Ernst Jakobi, Otto Eckstein, Hans Heinze, and of many others who came into the movement with the passing of time, including Dr. Werr, the first veterinarian. The bio-dynamic movement developed out of the co-operation of practical workers with the Natural Science Section of the Goetheanum. Before long it had spread to Austria, Switzerland, Italy, England, France, the north-European countries and the United States. To-day no part of the world is without active collaborators in this enterprise.

The bio-dynamic school of thought and a chemically-minded agricultural thinking confronted one another from opposite points of the compass at the time the agricultural course was held. The latter school is based essentially on the views of Justus von Liebig. It attributes the fact that plants take up substances from the soil solely to the so-called “*nutrient-need*” of the plant. The one-sided chemical fertiliser theory that thinks of plant needs in terms of nitrogen-phosphates-potassium-calcium, originated in this view, and the theory still dominates orthodox scientific agricultural thinking to-day. But it does Liebig an injustice. He himself expressed doubt as to whether the “N-P-K” theory should be applied to all soils. Deficiency symptoms were more apparent in soils poor in humus than in those amply supplied with it. The following quotation makes one suspect that Liebig was by no means the hardened materialist that his followers make him out to be. He wrote: “*Inorganic forces breed only inorganic substances. Through a higher force at work in living bodies, of which inorganic forces are merely the servants, substances come into being which are endowed with vital qualities and totally different from the crystal.*” And further: “*The cosmic conditions necessary for the existence of plants are the warmth and light of the sun.*” Rudolf Steiner gave the key to these “*higher forces at work in living bodies and to these cosmic conditions.*” He solved Liebig's problem by refusing to stop short at the purely material aspects of plant-life. He went on, with characteristic spiritual courage and a complete lack of bias, to take the next step.

And now an interesting situation developed. Devotees of the purely materialistic school of thought, who once felt impelled to reject the progressive thinking advanced by Rudolf Steiner, have been forced by facts brought to light during research into soil biology to go at least one step further. Facts recognised as early as 1924-34 in bio-dynamic circles — the significance of soil-life, the earth as a living organism, the role played by humus, the necessity of maintaining humus under all circumstances, and of building it up where it is lacking — all this has become common knowledge. Recognition of biological, organic laws has now been added to the earlier realisation of the undeniable dependence of plants upon soil nutrient-substances. It is not too much to say that the biological aspect of the bio-dynamic method is now generally accepted; the goal has perhaps even been overshot. But, important as are the biological factors governing plant inter-relationships, soil structure, biological pest-control, and the progress made in understanding the importance of humus, the whole question of energy sources and Formative forces — in other

words, cosmic aspects of plant-life — remains unanswered. The *biological* way of thinking has been adopted, but with a materialistic bias, whereas an understanding of the *dynamic* side, made possible by Rudolf Steiner's pioneering indications, is still largely absent.

Since 1924 numerous scientific publications that might be regarded as a first groping in this direction have appeared. We refer to studies of growth-regulating factors, the so-called growth-inducers, enzymes, hormones, vitamins, trace elements and bio-catalysts. But this groping remains in the material realm. Science has progressed to the point where material effects produced by dilutions as high as 1:1 million, or even 1:100 million, no longer belong to the realm of the fantastic and incredible. They do not meet with the unbelieving smile that greeted rules for applying the bio-dynamic compost preparations, for these—with dilutions ranging from 1:10 to 1:100 million — are quite conceivable at the present stage of scientific thinking. Exploration of the process of photo-synthesis — i.e. of the building of substance in the cells of living plants — has opened up problems of the influence of energy (of the sun, of light, of warmth and of the moon); in other words, problems of the transformation of cosmic sources of energy into chemical-material conditions and energies.

In this connection we quote from the book *Principles of Agriculture*, written in 1952 by W. R. Williams, Member of the Academy of Sciences, U.S.S.R.: *“The task of agriculture is to transform kinetic solar energy, the energy of light, into the potential energy stored in human food. The light of the sun is the basic raw material of agricultural industry.”* And further: *“Light and warmth are the essential conditions for plant life, and consequently also for agriculture. Light is the raw material from which agricultural products are made, and warmth is the force which drives the machinery — the green plant. The provision of both raw material and energy must be maintained. The dynamic energy of the sun's rays is transformed by green plants into potential energy in the material form of organic matter. Thus our first concrete task is the continuous creation of organic matter, storing up the potential energy of human life.”* And still further: *“We can divide the four fundamental factors into two groups, according to their source: light and heat are cosmic factors, water and plant food terrestrial factors. The former group originates in interplanetary space...”*

Or again: *“The cosmic factors — light and heat — act directly on the plant, whereas the terrestrial factors act only through an intermediary (substance).”*

We see that the author of this work rates knowledge of the interworking of cosmic and terrestrial factors as the first objective of agricultural science, while ranking organic substance (humus) second on the list of objectives of agricultural production. This is what was published in 1952. In 1924 Rudolf Steiner pointed out the necessity of consciously restoring cosmic forces to growth processes by both direct and indirect means, thereby freeing the present conception of plant nature from a material, purely terrestrial isolation; only through such restoration would it be possible to re-energise those healthful and constructive forces capable of halting degeneration. He said to me, *“Spiritual scientific knowledge must have found its way into practical life by the middle of the century if untold damage to the health of man and nature is to be avoided.”*

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Our research work began with the attempt to find reagents to the etheric forces and to discover ways of demonstrating their existence. Suggestions were given which could only later be brought to realisation in the writer's crystallisation method. Then it was our intention to proceed to expose the weak points in the materialistic conception and to refute its findings by means of its

own experimental methods. This meant applying exact analytical methods in experimentation with physical substances, and even developing them to a finer point. We proposed to work quantitatively as well as qualitatively. During my own years at the university, for example, it was my regular practice to lay my proposed course of studies for the new term before Rudolf Steiner for guidance in the choice of subjects. On one occasion he urged me to take simultaneously two — no, three — main subjects, chemistry, physics and botany, each requiring six hours a day. To the objection that there were not hours enough in the day for this, he replied simply, *“Oh, you’ll manage it somehow.”*

Again and again, he steered things in the direction of practical activity and laboratory work, away from the merely theoretical.

Suggestions of this kind were constantly in my mind during the decades of work which arose from them. They led me not only to work in laboratories, but also to apply the fundamentals of this new outlook to the management of agricultural projects, both in a bio-dynamic and in an economic sense. Dr. Steiner had insisted on my taking courses and attending lectures in political economy as well as in science, saying, *“One must work in a businesslike, profit-making way, or it won’t come off.”* Economics, commercial history, industrial science, even mass-psychology and other such subjects were proposed for study, and when the courses were completed, Dr. Steiner always wanted a report on them. On these occasions he not only showed astounding proficiency in the various special fields, but — what was more surprising — he seemed quite familiar with the methods and characteristics of the various professors. He would say, for example, *“Professor X is an extremely brilliant man, with wide-ranging ideas, but he is weak in detailed knowledge. Professor Z is a silver-tongued orator of real elegance. You needn’t believe everything he says, but you must get a thorough grasp of his method of presentation.”*

From these and many other suggestions it was clear what had to be done to promote the bio-dynamic method. There was the big group of practising farmers, whose task it was to carry out the method in their farming enterprises, to discover the most favourable use of the preparations, to determine what crop rotations build up rather than deplete humus, to develop the best methods of plant and animal breeding. It took years to translate the basic ideas into actual practice. All this had to be tried out in the hard school of experience, until the complete picture of a teachable and learnable method, which any farmer could profitably use, was finally evolved. Problems of soil treatment, crop rotation, manure and compost handling, time-considerations in the proper care and breeding of cattle, fruit-tree management and many other matters could be worked out only in practice through the years.

Then there was the problem of coming to grips with agricultural science. Laboratories and field experiments had to provide facts and observational material. I was now able to profit from the technical and quantitative-chemical education urged upon me by Dr. Steiner. This was the sphere in which the shortcomings and weaknesses of the chemical soil-and-nutrient theory showed up most clearly, and where to-day — after more than thirty years — one can see possibilities of building a bridge between recognition of the existence of cosmic forces and exact science.

The first possibility of breaking through the hardened layer of current orthodox opinion came through discoveries that cluster around the concept of the so-called trace elements. Dr. Steiner had pointed out as early as 1924 the existence of these finely dispersed material elements in the atmosphere and elsewhere, and had stressed the importance of their contribution to healthy plant development. But it still remained an open question whether they were absorbed from the soil by

roots or from the atmosphere by leaves and other plant organs. In the early thirties, spectrum analysis showed that almost all the trace elements are present in the atmosphere in a proportion of 10^{-6} to 10^{-9} . The fact that trace-elements can be absorbed from the air was established in experiments with *Tillandsia usneodis*. It is now common practice in California and Florida to supply zinc and other trace elements, not via the roots, but by spraying the foliage, since leaves absorb these trace elements even more efficiently.

It was found that one-sided mineral fertilising lowers the trace-element content of soil and plants, and — most significantly — that to supply trace-elements by no means assures their absorption by plants. The presence (or absence) of zinc in a dilution of 1:100 million decides absolutely whether an orange tree will bear healthy fruit. But in the period from 1924-1930 the bio-dynamic preparations were ridiculed “*because plants cannot possibly be influenced by high dilutions.*”

Zinc is singled out for mention here not only because treatment with very high dilutions of this trace element is especially essential for both the health and the yield of many plants, but also because it is an element particularly abundant in mushrooms. A comment by Rudolf Steiner indicates an interesting connection which can be fully understood only in the light of the most recent research. We read in the Agricultural Course: “... *Harmful parasites always consort with growths of the mushroom type, ... causing certain plant diseases and doing other still worse forms of damage. ... One should see to it that meadows are infested with fungi. Then one can have the interesting experience of finding that where there is even a small mushroom-infested meadow near a farm, the fungi, owing to their kinship with the bacteria and other parasites, keep them away from the farm. It is often possible, by infesting meadows in this way, to keep off all sorts of pests.*”

Organisms of the fungus type include the so-called *fungi imperfecti* and a botanical transition-form, the family of actinomycetes and streptomycetes, from which certain antibiotic drugs are derived. I have found that these organisms play a very special rôle in humus formation and decay, and that they are abundantly present in the bio-dynamic manure and compost preparations. The preparations also contain an abundance of many of the most important trace elements, such as molybdenum, cobalt, zinc, and others whose importance has been experimentally demonstrated.

Now a peculiar situation was found to exist in regard to soils. Analyses of available plant nutrients showed that the same soil tested quite differently at different seasons. Indeed, tests showed not only seasonal but even daily variations. The same soil sample often disclosed periodic variations greater than those found in tests of soils from adjoining fields, one of which was good, the other poor. Seasonal and daily variations are influenced, however, by the earth's relative position in the planetary System; they are, in other words, of cosmic origin. It has actually been found that the time of day or the season of the year influences the solubility and availability of nutrient substances. Numerous phenomena to be observed in the physiology of plants and animals (*e.g.* glandular secretions, hormones) are subject to such influences. The concentration of oxalic acid in bryophyllum leaves rises and falls with the time of day with almost clock-like regularity. Although in this and many other test cases the nutrients on which the plants were fed were identical, the increase or decrease in the plant's substantial content varied very markedly in response to varying light-rhythms and cycles. Joachim Schultz, a research worker at the Goetheanum whose life was most unfortunately cut short, had begun to test Dr. Steiner's important indication that light activity acts with growth-stimulating effect in the morning and late afternoon hours, while at noon and midnight its influence is growth-inhibiting.

When I inspected Schultz's experiments, I was struck by the fact that plants grown on the same nutrient solution had a wholly different substantial composition according to the light-rhythms operative. This was true of nitrogen, for example. Plants exposed to light during the morning and evening hours grew strongly under the favourable influence of nitrogen activity, whereas if exposed during the noon hours, they declined and showed deficiency symptoms. The way was thus opened for experimental demonstration of the fact that the so-called "cosmic" activity of light, of warmth, of sun forces especially, but of other light-sources also, prevails over the material processes. These cosmic forces regulate the course of material change. When and in what direction this takes place, and the extent to which the total growth and the form of the plant are influenced, all depend upon the cosmic constellation and the origin of the forces concerned. Recent research in the field of photosynthesis has produced findings which can hardly fall to open the eyes even of materialistic observers to such processes. Here, too, Rudolf Steiner is shown to have been a pioneer who paved the way for a new direction of research. It is impossible in an article of this length to report on all the phenomena that have already been noted, for they would more than fill a book. But it is no longer possible to dismiss the influence of cosmic forces as "mere superstition" when the physiological and biochemical inter-relationships of metabolic functions in soil-life, the rise and fall of sap in the plant, and especially processes in the root-sphere are taken into consideration.

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In an earlier view of nature, based partly on old mystery tradition and partly on instinctive clairvoyance — a view originating in the times of Aristotle and his pupil Theophrastus, and continuing on to the days of Albertus Magnus and the late mediaeval "*doctrine of signatures*" — it was recognised that relationships exist between certain cosmic constellations and the various plant species. These constellations are creative moments under whose influence species became differentiated and the various plant forms came into being. When one realises that cosmic rhythms have such a significant influence on the physiology of metabolism, of glandular functions, of the rise and fall of sap and of sap pressure (turgor), only a small step remains to be taken by conscious future research to the next realisation, which will achieve an experimental grasp of these creative constellations. Many of Rudolf Steiner's collaborators have already demonstrated the decisive effects of formative forces in such experiments as, the capillary tests on filter paper of L. Kolisko and the plant and crystallisation tests of Pfeiffer, Krüger, Bessenich, Selawry and others.

Rudolf Steiner's suggestions for plant breeding presented a special task. Research in this field was carried out by the author and other fellow-workers (Immanuel Vögele, Erika Riese, Martha Kuenzel and Martin Schmidt), either in collaboration or in independent work. Proceeding from the basic concept of creative cosmic constellations, one can assume that the original creative impetus in every species of sub-type slowly exhausts itself and ebbs away. The formative forces of this original impulse is passed on from plant to plant in hereditary descent by means of certain organs such as chromosomes. One-sided quantity-manuring gradually inhibits the activity of the primary forces, and results in a weakening of the plant. Seed quality degenerates. This was the initial problem laid before Rudolf Steiner, and the bio-dynamic movement came into being as an answer to it.

The task was to reunite the plant, viewed as a system of forces under the influence of cosmic activities, with nature as a whole. Rudolf Steiner pointed out that many plants which had been "*violated*," in the sense of having been estranged from their cosmic origin, were already so far gone in degeneration that by the end of the century their propagation would be unreliable. Wheat

and potatoes were among the plant types mentioned, but other such grains as oats, barley and lucerne belong to the same picture. Ways were sketched whereby new strains with strong seed-forces could be bred from “*unexhausted*” relatives of the cultivated plants. This work has begun to have success; the species of wheat have already been developed. Martin Schmidt carried on significant researches, not yet published, to determine the rhythm of seed placement in the ear, and to show in particular the difference between food plants and plants grown for seed. According to Rudolf Steiner, there is a basic difference between the two types, one of which is sown in autumn, nearer to the winter, and the other nearer to the summer. Biochemists will eventually be able to confirm these differences materially in the structure of protein substances, amino-acids, phosphorlipoids, enzyme-systems and so on by means of modern chromatographic methods.

The degeneration of wheat is already an established fact. Even where the soil is good, the protein content has declined; in the case of soft red wheat, protein content has sunk from 13% to 8% in some parts of the United States. Potato growers know how hard it is to produce healthy potatoes free from viruses and insects, not to mention the matter of flavour. Bio-dynamically grown wheat maintains its high protein level. Promising work in potato breeding was unfortunately interrupted by the last war and other disturbances.

Pests are one of the most interesting and instructive problems, looked at from the bio-dynamic viewpoint. When the biological balance is upset, degeneration follows; pests and diseases make their appearance. Nature herself liquidates weaklings. Pests are therefore to be regarded as nature's warning that the primary forces have been dissipated and the balance sinned against. According to official estimates, American agriculture pays a yearly bill of five thousand million dollars in crop losses for disregarding this warning, and another seven hundred and fifty million dollars on keeping down insect pests. People are beginning to realise that insect poisons fall short of solving the problem, especially since the destruction of some of the insects succeeds only in producing new, more resistant kinds. It has been established by the most advanced research (Albrecht of Missouri) that one-sided fertilising disturbs the protein-carbohydrates balance in plant cells, to the detriment of proteins and the layer of wax that coats plant leaves, and makes the plants “*tastier*” to insect depredators. It has been a bitter realisation that insect poisons merely “*preserve*” a part of moribund nature, but do not halt the general trend towards death. Experienced entomologists, who have witnessed the failure of chemical pest-control and the threats to health associated with it, are beginning to speak out and demand biological controls. But according to the findings of one of the American experimental stations, biological controls are feasible only when no poisons are used and an attempt is made to restore natural balance. In indications given in the Agriculture Course, Rudolf Steiner showed that health and resistance are functions of biological balance, coupled with cosmic factors. This is further evidence of how far in advance of its time was this spiritual-scientific, Goethean way of thought.

The author is thoroughly conscious of the fact that this exposition touches upon only a small part of the whole range of questions opened up by Rudolf Steiner's new agricultural method. He is also aware that other collaborators would have written quite differently, and about different aspects of the work. These pages should therefore be read in accordance with their intention: as the view from a single window in a house containing many rooms.