Part One.

COSMIC INFLUENCES.

Chapter I.

INTRODUCTION.

Now-a-days every farmer and gardener should once again learn something about cosmic influences. If we go back in history, we find that there was a real knowledge about the relationship between cosmos and earth. In this book we want to deal primarily with agriculture, so we must limit ourselves to mentioning only a few of these interesting facts. We need go no further back than the time of Pliny (23 A.D.). In his "History of Nature" we read about the influence of the moon on the growth of plants. Many instructions are given about the gathering of plants, and about pruning or cutting trees, according to the phases of the moon. If it was desirable that the plants should continue to grow, then cutting and pruning should be carried out during the full moon. If, on the contrary, it was not desirable that the plants should go on growing, these operations should be carried out during the new moon.

If you wanted to sell fruits, then it was better to gather them during full moon because they would be full of juice and good to look at. If you wanted to preserve the fruits for some time, then it was better to harvest them during the new moon, because they would not rot and would dry more easily. Harvesting of all kinds of vegetables had therefore to be done during the new moon, also the collecting of fallen leaves.

Manure had to be stirred during the waning moon, and it was best to manure the fields at new moon or half moon to avoid the growth of weeds.

During full moon it was good to cover the roots of the trees.

In damp places it was better to sow during new moon and the following 4 days. From new moon until half moon, the moon was supposed to encourage fruitfulness, in the second period, half moon to full moon, the moon was supposed to give warmth.

In the 18th book of his History of Nature Pliny says, that in bygone times people lived crudely and without any science". " But, we will see, that their sense to observe such things was not less keen than our present calculations. They were afraid of three periods of the year where their fruits were concerned, and therefore they created three holidays and festivals: the rust-feast, the feast of the blossoms, and the wine-feast".

"The rust-feast was created by Numa (about 703 B.C.). Now we have it on the 7th day of the Kalends of May (25th April) because it is about that time that the rust may attack plants. According to Varro, this is the time, when the sun stands in the 10th degree of Taurus. But the real reason is, that 21 days after the Spring equinox, the dog-star, a very violent star, descends. And before this, the small dog-star has to descend".

"The feast of the blossoms has been fixed for the fourth day of the Kalends of the same month (237 B.C.) according to the prophecies of the Sibyl, so that everything may blossom successfully. According to Varro, on this day the sun is in the 14th degree of Taurus. If there happens to be a full moon during these few days, all the fruits and everything that blossoms will be damaged".

"The first feast of the wine (during which it was customary to make offerings of the new wine to Jupiter) was fixed for the 23rd of April; testing the new wine has nothing to do with the fruits and also nothing to do with the wine plants and oil trees, because the fructification of those begins when the Plejades are rising, that is the 10th of May. That is another date covering about four days, during which period they do not like to get dew, because they are afraid of the descending cold constellation of Arcturus, and in no way should there be the interference of the full moon. These are the times when sterility may be caused through the heavens.

Pliny also states, that during the Summer the new moons are harmless, and during the Winter the full moons, with the exception of two days; further that one has only to be afraid of the very short summer nights, but not of the days.

So we find that during the time of Pliny there was quite a detailed "science" of the effects of certain constellations and of the influence of the different phases of the moon on plant growth. And Pliny looks back to past centuries where people had "no science" as yet, but nevertheless knew about the influence of the cosmos on earthly processes.

But not only plant growth was influenced by the moon. Pliny also speaks about the influence of the moon upon animals.

He tells us that the ants rest during the new moon and are very busy during full moon, even at night. "Oysters and other similar creatures grow during full moon and slacken growth during new moon".

"If it is desirable to castrate bulls or other animals, it should be done during the waning moon".

Even the human being is subject to certain phenomena which are connected with the moon. Female menstruation has always been held to be related to the moon. We even find conception and birth similarly related. We count the period of pregnancy by lunar periods. It was thought that the waxing moon facilitated the process of birth, whereas the waning moon made it more difficult.

Pliny also writes about the influence of the moon on weather conditions. If it rises very bright and clear, it means good weather; if it rises with a red glow, it means a storm; if it rises darkened, it means rain.

Or let us read Virgil. In his poem about Agriculture we get a marvellous description of the cultivation of the land, of fruit trees, the raising of cattle and each single work is closely connected with occurrences in the heavens. Sun and Moon, Saturn, Jupiter, Mars, Venus and Mercury have to be observed by the husbandman, as well as all the constellations. Certain seeds have to be sown when the" glittering Taurus opens the year with his golden horns". If the farmer wants to grow wheat, then he must wait until the Pleiades hide themselves in the morning (i.e. between 20th October and 8th November); if he wants to grow beans or lentils, he must wait for the descent of Boötes, etc.

Then came the epoch, when modern natural science developed, and nobody believed any longer that the stars, far away from the earth, could have any influence upon earthly affairs.

It is interesting to read in this connection the publications of the famous German scientists Professor Schleiden and Professor Fechner. Fechner was still convinced of the influence of the moon on weather conditions. He calculated from careful statistics that there is more rain during full moon than during new moon periods. He found the proportion as 107: 100. Professor Schleiden was very annoyed by the views of his colleague and he published a work in which he started by quoting Pliny, as I have done. He then passed to the Middle Ages, where people thought remedies would be effective if they were applied according to the phases of the moon. Finally he dealt with his colleague Fechner. Fechner, a young student, had written a humorous pamphlet: Does the moon contain Iodine? In this pamphlet he ridiculed the idea that certain remedies, immediately after they were discovered, had great powers attributed to them. Sometimes they came to be regarded as universal remedies, able to cure nearly every kind of disease. But slowly they became antiquated and, by inference, weaker and weaker. Their radius of action became smaller and smaller, and very often they finished up like old, childish people, thrust into a corner. Schleiden points out that this is also the fate of the moon. The good man has grown old and weak, and only a few people, who have grown old and weak with him, cherish his memory like that of an old family doctor. "What can he do?" asks Professor Schleiden. An old, burnt out globe of dead matter slowly turns round the earth. Its average distance is about 52,000 miles, its whole orbit only about 326,000 miles; and to complete its circuit this lazy body takes 27 days and nearly 8 hours, whereas our earth covers 14,000 miles in a single hour. Its whole surface accounts to 690,330 square miles, about as much in area as the land in the southern hemisphere of the earth, or about 1/10th of its water area. Its plane makes an angle of only 5 degrees with the earth. From time to time it turns its back to the sun and since it gets its light from the sun, it is then completely dark".

Then Schleiden complains that the moon is also a weakling as far as "light" is concerned. It reflects no more light from the sun, than a small white cloud, and disappears completely in day time.

The warmth which may come from the moon is so insignificant therefore, that for a long time one did not even believe in its existence. It was necessary to construct a very fine apparatus (Melloni) to be able to measure it.

Even its force of gravitation is very weak. And from this weakling people dare to expect considerable effects on the earth

Schleiden does not even believe that the moon has any influence upon the tides.

It is really extremely interesting to study this controversy in the 18th century. No virtue whatsoever was left to the moon.

Schleiden asserts that "in the 16th and 17th centuries science has abolished astrological superstitions. For natural science the moon has become merely one of the heavenly bodies. As for its activities we can only admit forces like gravitation, light and heat, and we should not dream about further things of which we know nothing. We must confess, like astronomers and true scientists of the last hundred years, that we are fully entitled to push the old, weak and powerless moon from his throne of earthly power.— "

That is the period in which it was not "scientific" to speak of an influence of the moon, or of any other heavenly bodies, on the earth. They were much too far away.

Today it begins to be different again. We are beginning to talk about "cosmic waves", radiations as direct or indirect emanations of the stars. This is perfectly scientific. These emanations come from every part of the cosmos they penetrate everything; they influence our life as well as producing physical phenomena. The moon is coming into its own again.

We know that lunar radiations are responsible for interference with transmission from wireless stations. There are maxima and minima of intensity in the reception of electro-magnetic waves which correspond to the phases of the moon.

There is a very interesting book by an engineer George Lakhovsky.[1] He is a Russian, who later became French. The book was originally written in French and later translated into German, also Italian and Spanish, and very recently, into English. The German translation was published in Munich 1932. In the eighth chapter of this book, Lakhovsky deals with the influence of sunspots and cosmic radiations on life and health. He points out, that the sun not only sends us light and warmth and emanates ultra-violet rays, but also gives off electric and magnetic waves, especially during the eruptive periods of the protuberances or sunspots. Under the guidance of Deslanders, the director of the Observatory of Meudon, astro-physicists have made investigations into the correlations of the intensity of sunspots with certain accompanying phenomena. They have observed that inundations, terrestrial cataclysms, tidal waves, and especially earthquakes seem to be associated with sunspots.

We see that occurrences on the sun are reflected on earth. And if we ask why, then the scientist answers: there is interference with the normal field of cosmic waves by solar waves emanating from the sunspots.

Lakhovsky also mentions the connection between the sun and meteorological phenomena. Already in 1651 an Italian scientist Riccioli, mentioned this fact; then in 1801 Herschel[2] confirmed the observation, and in 1887 the astrophysicist Baxenbell was able to show how the average temperature on earth was connected with the number of sunspots.

It is interesting to know that the periodicity of the sun, about 11½ years, is again influenced by other cosmic waves so that we get an interfering period of about 33 to 35 years. This period has been found out by Bruckner through the observation of rainfalls. Observations made in Madras, Washington and 100 other stations have shown that, outside the tropics, solar radiation causes two alternating periods of rain and drought in the course of about 35 years.

A similar periodicity has been observed in the drift of icebergs and the variation of level in lakes.

Sir William Herschel also pointed out that a scarcity of vegetation appeared whenever the sun was seen to be free from spots. In 1901 Moreux observed, that wheat production in France and in the whole world followed roughly the variations in intensity of the sun's radiation.

Dr. W. J. Stein, editor of the periodical The Present Age, published in a special number (June-July, 1937), an extremely interesting and important work on "The Earth as a basis for World Economy". Chapter VII deals with "the Solar and planetary Influences on Weather and Climate as the Foundation of Harvest and Prices".

"It has been discovered that the sunspot maxima and minima are related to the cyclones and the quantity of rainfall, not, however, unconditionally, but according to the geographical position of the point of observation. As regards the summer monsoons in India, it has been ascertained that during the maxima years of sunspots the rainfall is higher than in the minimum years. The winter rainfall in northern India follows the opposite course". (A. Hill "Variation of Rainfall in Northern India", Indian Met. Memoirs, vol. 1 No. 6,878.)

The fact of the connection being thus established, we must note that the character of the relationship depends upon geographical and seasonal modifications, For instance it has been found

[1] George Lakhovsky: Das Geheimnis des Lebens, C. H. Beck'sche Verlagsbuchhandlung München, 1932.

[2] On the 14th of March, 1781, Herschel discovered in the constellation of "Gemini" the Planet Uranus. He proposed for the new planet the name "Georgius Sidus" because King George III of England supported his astronomical observations.

that in the central parts of North America and along the coast of Labrador a temperature prevails in years of extensive sunspots, which is lower by several degrees, whilst on the other side of the Atlantic from the Bay of Biscay to Spitzbergen exactly the opposite happens. The minimum epochs of the sunspots produce cold years and the maxima epochs warm ones[3]. It is most instructive to see that one and the same cosmic event can produce such different effects in various parts of the world. This would seem to be the rule.

North Japan has a good rice crop if August is warm. A warm August in Japan may, however, depend on the rising of the air-pressure in the south east coast of Canada in April[4].

There is a strange interdependence of conditions at various points on the earth. We are only beginning to reach an understanding of this fact. The greater the difference between the temperature of the Atlantic Ocean current on its surface and its temperature at a depth of 200 metres, the better will be the harvest in Norway: even the German wheat and rye crops are influenced by this factor[5].

A small percentage of ice around Iceland in the Spring corresponds to favourable conditions for corncrops in Western Europe and North Germany[6].

We see that sunspots or changes in the circulation of the oceans have, like other cosmic events, very different effects on different parts of the earth. If we could understand them in their totality, they would reveal themselves as organic dependencies in a living being.

This variation of the sunspots is by no means a primary phenomenon. A number of scientists have shown that the phenomena of sunspots are related to the planets.

The investigations carried out by the scientists Kr. Birkeland[7], E. W. Brown[8],

A. Schuster[9], Franz, J. Goeschel[10], Elsworth Huntingdon[11], Vladimir B. Schostakowitsch[12] and Inigo Jones[13] have made it clear, that the period of sunspots is no more than a combination of planetary periods. The planets therefore are working behind all the phenomena which are ascribed to the sunspots. Partly directly, partly by way of the sun, the planets modify the course of events. As the sun radiates into space against gravity and the planetary forces come into operation wherever such radiations against gravity take place, so the radiations of the sun must needs succumb to the influence of the planets. With regard to direct planetary influences, only Venus has been so far observed. Henry Ludwell Moore[14], indicates the connection between the rhythm

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3 L. Meeking, Annalen der Hydrographie 1918, p.1.
F. Baur, Mitteilungen der Wetter und Sonnenwarte St. Blasien, Heft 2, 1922.

4 T. Okada, ref. p. [652] Hans Suering, Lehrbuch der Meteorologie.

5 Alexander Supan and Erich Obst: Grundzüge der physischen Erdkunde vol. 1, p. 332, Berlin, Leipzig 1927.

6 Mainardus: Schwankungen der nordatlantischen Zirkulation und ihre Folgen. Annalen der Hydrographie 1904, p. 353.

7 Kr. Birkeland, "Recherches sur les taches du Soleil et leur engine", Skriften udvigne af Videnskabssels Kabet I, Christiania 1879

8 E. W. Brown, "A possible explanation of the Sunspot Period", Monthly Notices, Royal Astron. Society, vol. lx No. 10, 1900 pp. 599-606.

9 A. Schuster, "The influence of the planets on the formation of Sunspots", Proceedings Royal Society London, vol. lxxxv, 1911, pp. 3 09-323, deals with Mercury, Venus, Mars, Jupiter, Saturn.

10 Franz J. Goeschel, Planetare Einflüsse auf die Sonne, Salzburg 1912.

11 Elsworth Huntingdon, Earth and Sun; Weather and Sunspots, Newhaven 1923, p. 212.

12 Vladimir B. Schostakowitsch, Sonnenflecken und Planetenstand Meteorologische Zeitschrift, Berlin 1928, vol. x.

13 Inigo Jones in Nature, July 31, 1932, dealing with Jupiter, Saturn, Uranus, Neptune.

14 Henry Ludwell Moore, Economic Cycles, their law and causes, 1914.
Generating Economic Cycles, New York 1923.

of the sunspots and the rhythms of Venus. Every eight years the rays of Venus are particularly bright.

She does not, as one might expect, show the whole disc, but only a sickle with a faintly luminous shadow. She is however especially close to the earth in this constellation. Five weeks before her lower conjunction Venus can be seen thus and she shines with exceptional brilliance if she is at the same time in close proximity to the earth. The diameter of Venus is then 40 inches and the size of the luminous part 10 inches, so that less than a quarter is shining. In this position she sends more light to the earth owing to its nearer proximity, than when radiating with her full disc[15].

All these cosmic and meteorological rhythms have at any rate been studied from an economical aspect, and extensive literature on the subject is available. The already mentioned observations of Sir William Herschel were made after he had read the fundamental work of Adam Smith and his observations on prices. It struck Herschel, that these periods, taken purely economically coincided with those of the sunspots. As the realization of the relationship first came to an astronomer and not to an economist, this fundamental discovery was ignored. The astronomers regarded Herschel's excursions into the economic field with disfavour, considering them to be quite out of place. The unfortunate position between the scientific disciplines, as in so many cases, once again stood in the path of progress. One cannot help smiling when one reads the polemics against Herschel in the Berlin Astronomical Year book, and than his cool reply a year later (1806-1807). There is a decided advantage in setting polemic differences in a yearly periodical. It leaves time to develop sufficient phlegm!

The following reflections would seem to contradict Herschel, but Herman Fritz has refuted these statements and recent research corroborates Herschel on all points.[16]

Henry Arctowsky's[17] investigations are of special importance because the fact dawned upon him that the temperature system of the earth is an organic unit, in which each part is connected with every other part. Sir William Beveridge[18] and Westerguard have investigated the problem economically from many different aspects.

Eduard Brückner[19] shows the influence of the fluctuations in the climate on the crops and corn prices. His work on this subject provides the best introduction to meteorological problems and it is satisfactory to observe the versatility of his descriptions.

That the influence of the sunspots is indeed a remarkable one is shown by the research work of the zoologists.[20]

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15 George Chambers, a Handbook of descriptive and practical Astronomy, Oxford, 1889.

16 Hermann Fritz, Die Beziehungen der Sonnenflecken zu den magnetischen und meteorologischen Erscheinungen der Erde, Haarlem 1878. Naturkundelige Verhandelingen van de Hollandische Matschappij der Wetenschappen, vol. iii, Derde Versameling.

17 Henry Arctowsky, Studies on Climate and Crops, New York 1910-12.

18 Sir William Beveridge, "Weather and Harvest Cycles", Journal of the Royal Economic Society, June 1920, March 1920 and December 1921.

19 Eduard Brückner, Klimaschwankungen, Wien, 1890.

20 H. Simroth, "Der Einfluss der letzten Sonnenfleckenperiode auf die Tierwelt", Kosmos 9, 1908. A. W. Anthony: "Periodical emigrations of Mammals", Journ. Mammal, vol. iv, p. 60. R. E. de Lary, Arrival of Birds in Relation to Sunspots, 1923. C. Elton, "Periodical Fluctuations in the number of animals", British Journal of Experimental Biology, vol. ii, No. 1, October 1924, Edinburgh University.

Vladimir P. Schostakowitsch in his excellent hook on periodical fluctuations in the phenomena of nature (1931) with references to further literature, has dealt with their influences on economic life in a most thorough fashion.

And again I return to Lakhovsky's book chapter VIII in which he states, that it has been officially confirmed that the great famines in India occur every 11th year; that means again a sunspot rhythm.

A comparison between the statistics of the observatory Meudon with the statistics of wine production in Bourgogne and Beaujolais showed that the remark-ably good wine years corresponded with the years of sunspot activity. With regard to wine he has noted that the remarkable years of 1847 and 1915 corresponded exactly with the maximum activity of the sunspots, according to the documentation established by the Chambers of Commerce of Bordeaux and Burgundy.

For the red wines of Bordeaux the results are the following: –

Maximum of Sunspots	1848	remarkable wine	1847 and 1848
,, ,, ,,	1858	,, ,,	1857 ,, 1858
,, ,, ,,	1869	,, ,,	1869 ,, 1870
Period 1880-1889		Phylloxera	
Maximum of Sunspots	1893	fairly good years of 1890-1899	
,, ,, ,,	1906	good years of 1906-1907	

Mention must also be made of the famous wine of 1811 as the "wine of the comet" whose excellent quality may be attributed to this comet's radiation.

Lakhovsky has also the conviction that the interference caused through sunspots, may produce if not disease, at least fatigue and slight disturbances in the state of health of people.

As to the moon, Lakhovsky reports on some interesting experiments he has carried out. It is possible to sterilize water and other liquids through direct contact with metallic conductors. He found that the sterilizing effect of the metal was different according to the phases of the moon. The metal used was silver. In April 1929 (full moon) 26 hours were necessary to sterilize the water the following month, again during full moon, 40 hours; on the 18th June, the experiments being carried out 4 days before the full moon (full moon on the 22nd June) the contact with silver even produced the opposite effect; instead of sterilizing the water, the bacterial growth was enhanced. During the waning moon the water was sterilized in from 6 to 7 hours. These experiments have been carried out in two different laboratories in the "Salpetrière" and "l'Institut Pasteur".

These experiments are extremely interesting. Lakhovsky uses as contact metal "Silver". That means he uses a metal which is especially apt to be influenced through the moon. In the year 1929 when Lakhovsky made these experiments I published the book "Das Silber und der Mond" (Silver and the Moon), experiments carried out in the Biological Institute at the Goetheanum in Stuttgart, Germany.

In this publication I tried to show by means of experiments made with filter paper, that a solution of silver salt produces different effects if used during full moon or new moon.

Slowly the ring will be closed. Ancient wisdom of centuries long gone by and modern natural science will be able to meet. There is one "special" metal, "belonging" to each planet. It is affected, if the planet undergoes certain changes. In old traditions, iron is the metal of Mars and gold the metal of the Sun and lead the metal of Saturn, etc., and this can now be proved to be true with the help of scientific experiments.[21] This matter will be dealt with in the book "The Seven Planets and the Seven Metals", an attempt to unite Astronomy, Chemistry and Physiology. But it is necessary to mention here, that the moon not only influences plant growth, certain processes in the animal kingdom, and also sometimes the human being, it is also related to the metal silver.

Moon and water are a unity. Wherever there is water, there is also the activity of the moon. And again we need to take the word water in a wider sense. We do not mean only rainwater, or distilled water, we mean it as a representative of the liquid state. The moon rhythm is embodied in the water itself. The tides are not there because the moon always attracts water. Once the moon was united with the earth; that is an acknowledged fact. At that time our solid earth had not yet been formed. We must picture everything as being in a more or less liquid condition. After the exit of the moon, the earth became solid, but all the remaining "water" still behaves like the moon. The moon itself has solidified, but it moves according to the same rhythms as the liquids move on earth.

In the same year 1929[21] we also published a series of experiments, carried out during some years, connected with the influence of the moon on plant growth. These experiments have been carried out incessantly, therefore we have to-day extensive material at our disposal.

Professor d'Arsonval writes in his preface to Lakhovsky's book "The Secret of Life" "… that space is full of forces which are unknown to us and that living beings emit radiations or effluvia of which we are not aware, but whose significance has attracted the attention of certain observers, are facts that I have long since accepted. Anything is possible. But one must not accept anything except that which can be proved experimentally. The ideas of an insane person differ from the conception of a genius mainly because experiment invalidates the former and confirms the latter".

Well – it can be proved experimentally that the moon influences the growth of plants. This will be shown in the following chapter.

[21] L. Kolisko: Sternenwirken in Erdenstoffen.
I. 1927 (English translation) Workings of the Stars in earthly substances.
II. The Solar Eclipse of June, 1927.
III. 1929 Silver and the Moon.
IV. 1932, Jupiter and Tin.
V. 1936, The total solar eclipse of June, 1936.

Chapter II

MOON AND PLANT-GROWTH

A detailed publication which I can only summarise here, on plant growth, appeared in English in 1936[1]. Experiments have been carried out for 15 years, partly in the laboratory, partly in the open.

Experiments carried out in the laboratory

Carefully selected grains of wheat (8 different species) oats, and barley, were inserted in glass dishes containing garden soil. The soil used for these experiments carefully was prepared and did not contain any artificial manure. After a fortnight the plants were measured. Normally two leaves develop so the measurement was taken of the first leaf, the second leaf, the internode and the roots. Provided the grains had been carefully selected, there were no great differences between the 30 plants growing in each glass dish. For each species of grain two glass dishes were used and each contained 30 grains. The first experiment started at full moon and ended at new moon; the second experiment started at the waning quarter and ended at the waxing quarter; the third experiment started at new moon and ended at full moon; the fourth experiment started at the waxing quarter and ended at the waning quarter; thus it continued for many years. Each week one experiment ended, and the next began. The result obtained is highly interesting. I have never been able to publish all the experiments which were carried out in this connection and this time I have again to limit myself, and can only mention briefly what has been done.

At the end of a year a graph could be drawn showing the average length of the first leaf, the second leaf, the internode and the roots of the wheat grown during the various phases of the moon. Such a graph shows in the first part increasing, and in the second part decreasing growth. The maximum growth is always reached during the waxing moon-period, from new moon to full moon. That seems to be a law. It repeats itself year after year. The month may vary, sometimes the maximum of the year is reached at the end of June, sometimes in July or even the beginning of August. Fig. 1 shows an example of this type of graph.

Whoever is interested in this subject finds a detailed account in the book mentioned before. Beyond any doubt these experiments prove that the moon influences plant growth.

Experiments carried out every day

For some years grains of wheat were inserted in glass dishes (as described before) every day; that meant 365 experiments a year. Each day one experiment had to be measured, and a new one started.

One series of experiments was carried out in the laboratory in a room with windows facing south; another series in a room with windows facing west; one series of experiments in a glass house.

These experiments showed very clearly which were the most favourable days during the year. The best results, the biggest plants, we found nearly always two days before full moon, sometimes three or four days before full moon.

[1] L. Kolisko: The Moon and the Growth of Plants, 1936.

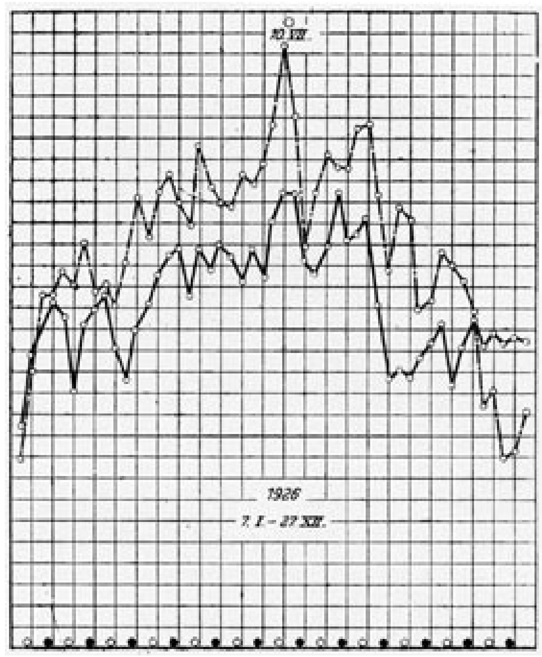


Fig 1. Graph representing the average growth of wheat during the various phases of the moon in 1926.

Experiments carried out in the open

These experiments started in 1926 with maize. The seeds were sown 2 days before full moon, according to a suggestion of Rudolf Steiner; and the experiment was repeated a fortnight later, 2 days before new moon. The seeds sown 2 days before full moon sprouted very quickly, and strong, healthy plants developed.

The seeds sown 2 days before new moon needed longer to sprout and developed very poorly.

To ascertain this effect, similar experiments were carried out, year after year, with a great variety of plants, and we always got the same result.

One objection could be raised: if the first experiment starts two days before full moon, and the second two days before new moon, the second experiment will always be a fortnight younger. **Is not the difference in growth only due to the difference in time?** This objection is easy to overrule. We must say that the difference is much greater than can be accounted for by a fortnight's difference. Furthermore we always get many more flowers; or later on, a much bigger crop from all the vegetables sown two days before full moon.

But we can also make an experiment which excludes any mistake entirely. We plant at three successive phases of the moon. The first experiment starts 2 days before the full moon; the second a fortnight later (2 days before new moon) and the third experiment again a fortnight later (2 days before the next full moon). If the difference in growth is only due to the difference in time, then the third experiment – being the youngest – should have the smallest plants; and the first one the largest plants. But this never happens. The first and the third experiments are much better than the second between them. Fig. 2 demonstrates one such experiment with carrots.

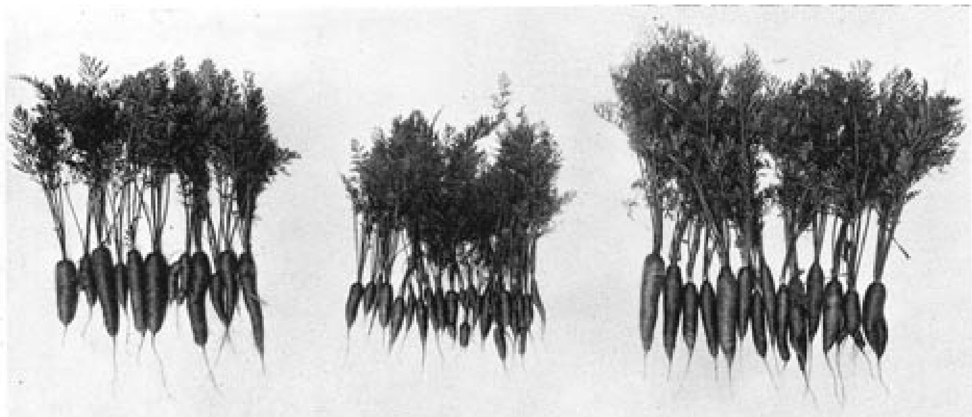


Fig. 2 Carrots grown two days before full moon, two days before new moon and again, a fortnight later, two days before full moon,

Experiments with Tomatoes

Tomato seeds respond strongly to the moon. We experimented for many years, and always with the same rather starting effect. Every year four series (spread over two months) were sown in the frame, two days before full moon, and two days before new moon respectively. They were pricked out and transplanted into the open. In the frame it was observed, that those seedlings which had been sown two days before full moon appeared much more vigorously and formed complete rows; while those sown two days before new moon were much weaker, and some did not germinate at all. The result became even more evident, when four series were sown over a period of two months. The second full moon was a fortnight younger than the first new moon and nevertheless the plants were finer and stronger. The pricking out and transplanting, if possible, was done in the corresponding phases of the moon.

In the open the difference between the new moon and the full moon tomatoes was easily seen; the latter showed a deeper green foliage, and gave better yields by at least 60 per cent.

Very often we noticed that, in autumn, the new moon plants had already yellow foliage, while the full moon series still showed a fresh, vivid green.

From a qualitative standpoint the full moon tomatoes had more juicy fruits.

Report on Tomato Experiments carried out 1934

We had 5 series of experiments sown in the frame:-

first series	two	days	before	full moon	
second	,,	,,	,,	,,	new moon
third	,,	,,	,,	,,	full moon (next month)
fourth	,,	,,	,,	,,	new moon,,,,
fifth	,,	,,	,,	,,	full moon again a month later.

The fifth series was therefore the youngest. Fig. 3 and 4 show the average result.

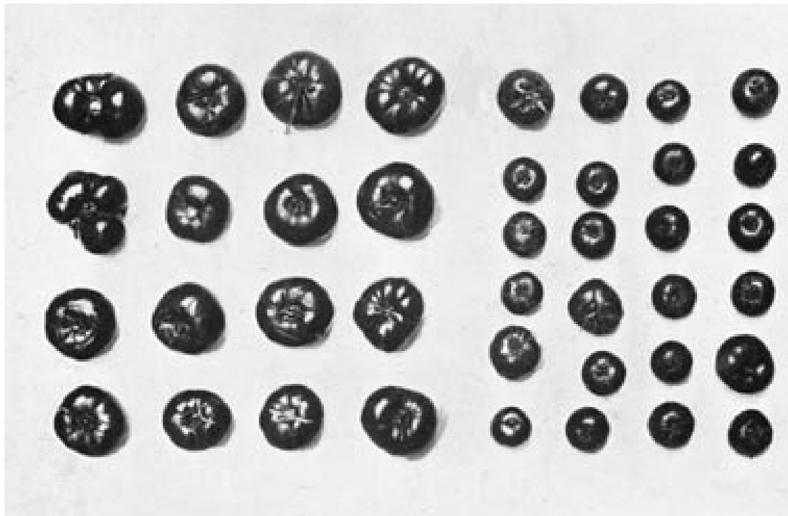


Fig. 3. First and second series.

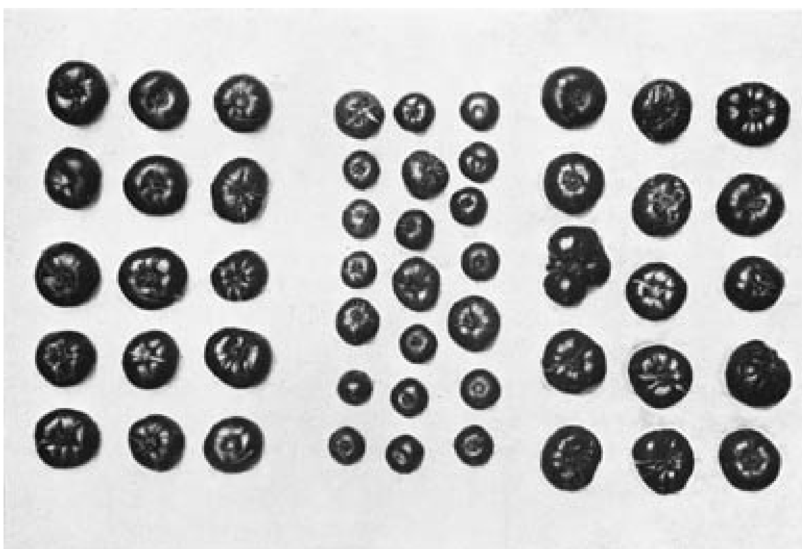


Fig. 4. Third, fourth, fifth series.

The three full moon series were very prominent compared with the new moon series. The yield of each series was carefully noted and the proportional value worked out as follows

Series	I	II	III	IV	V
	2.9	1.4	2.6	1.2	2.5

It is interesting to observe how the quantities among the full moon series decrease from 2.9 to 2.6 to 2.5. The smallest yield was obtained from the youngest series. Also the yield in the new moon series decreased correspondingly from 1.4 to 1.2. We omitted to sow a third series for the new moon because we considered the season too far advanced.

In the year 1934 the full moon tomatoes yielded an increase by more than 100%. The weight of a single tomato sown two days before full moon was between 280 and 350 grams (9-12 oz.); of a single tomato sown two days before new moon 120-180 grams (4-6 oz.).

Considering the experiments of many years we can recommend with good conscience that tomatoes should be sown two days before full moon.

As a general rule we observe that the seeds sown two days before full moon push through the soil very quickly in a few days time. Seeds sown two days before new moon take a much longer time. In most cases we find that those seeds **wait in the soil for the next waxing moon.** But even if they wait until the next full moon to germinate, they do not benefit from the full moon so much, as the seeds which have been sown right from the beginning at the right time. The time which they spend waiting beneath the soil, somehow weakens their life-force.

The experiment with maize has been repeated by a farmer in East Africa (Kenya) and he sent the following report: "During the maize crops I have found the fact spontaneously proved that Maize planted with the waxing moon yielded 30-40% more, than the one planted in the waning moon. Also here the differences between one or two days before full moon, and one to three days before new moon are greatest".

How can we explain the fact, that by sowing two days before the new moon we get just the opposite effect to that obtained by sowing two days before full moon?

At full moon the forces of the moon are just beginning to decrease. Two days before the moon is full, we are in a stream of energy striving towards the maximum strength. It is therefore necessary to sow two or three days before the moon is full if we want to benefit from all the moon can allow to stream into the life-forces of plants.

On the other hand if we want to get the strongest effect of the new moon forces, it would be wrong to sow exactly at new moon, because then the moon forces are just beginning to increase. The stream of decreasing moon forces is used, if we sow two or three days before the new moon.

There is an old peasant saying: all crops ripening above the soil should be sown during the waxing moon and all crops ripening beneath the soil should be sown during the waning moon. We tried to find out whether this rule is true. We made many experiments with beetroots, carrots, kohlrabi, radishes, etc., sown two days before full moon, and two days before new moon. The result was that we got bigger and more carrots, beetroots, kohlrabi and radishes from the full moon crop.

Now we come to another interesting fact. Certainly we would be wrong if we only take into consideration the **quantity** and do not also study the **quality** of our various experimental crops. Let us take, for example, one of the full moon carrots, and one of the new moon carrots; cut them with a knife and watch the surface. The full moon carrot becomes watery immediately after cutting; the new moon carrot remains dry. Now, if you taste, you will find a rather sweet, mild flavour in the full moon carrot, and a more bitter and sharp taste in the new moon carrot. Looking carefully at the skin of the carrot, you notice that the full moon carrots have a smooth surface; the new moon carrots are often wrinkled and shrunken. This is a sign, that the one is fully penetrated by the watery element, and that the other is more dry; this is connected with the difference in taste.

A similar effect will be found in cutting radishes, kohlrabi and beetroots.

It seems to be a natural law that full moon forces bring more of the watery element into the fruits. Once we have understood these laws, we shall be able to master them.

There are two possibilities of error. If we sow two days before full moon and there has been too much rain before and after sowing, the fruits may become too watery and easily get putrid. On the other hand, if we get too much of the new moon forces into the germinating plants, the other extreme is likely to happen: the fruits become too dry. For instance sowing kohlrabi two days before new moon, results in getting a certain percentage of woody plants; this never happens if sowing takes place two days before full moon.

The moon quarters have an intermediate position, as can be seen from many experiments.

When we have an exact **science** of this relationship between the moon and all that is watery on earth, it will be possible to sow plants every year in such a way that the most favourable results can be obtained.

It is quite obvious that cucumbers, vegetable marrows and similar vegetables respond enormously to the influence of the waxing moon. Also, experiments carried out on a larger scale by some farmers proved an increased crop of 25% for **wheat, barley, oats** and other cereals if planted two days before full moon, in comparison with those planted two days before new moon.

Peas and **beans** also produce up to 80% larger crops if sown two days before full moon. Fig. 5 demonstrates the different growth of peas sown two days before new moon, (right side); and a fortnight later, two days before full moon (left side).

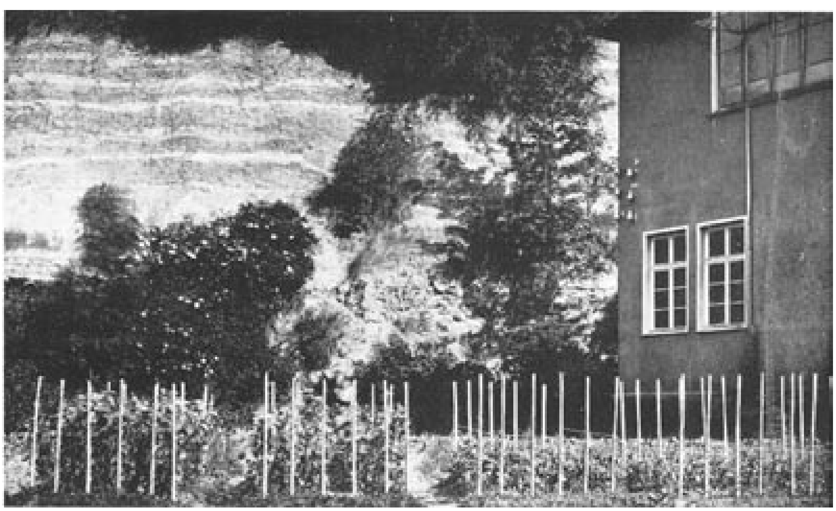


Fig. 5. Experiment with Peas

two days before full moon *two days before new moon.*

The new moon series has been planted earlier, still the photograph indicates that the plants are scarcely half as big as the younger full moon series. Later on, the pods turned yellow sooner and the peas began to shrink in the new moon series.

We have mentioned already the experiment of a farmer in Kenya with Maize. Another friend staying for some time in South America, stated, that there also the native population knew about the importance of the lunar influence. They sow their seeds three days before full moon, and transplant three days after new moon. They also observe the tides. They never cut a tree during the flood, or else the tree would "bleed", and be damaged. They find out the tides by cutting into a banana leaf. If the juice begins to flow out of the leaf, then it is the time of the flood.

During my travel in India I tried to find out as much as I could about old customs, or still practised customs connected with the moon. Wherever I asked, people began to tell about the new moon, never about the full moon. There are many rules about the new moon. The new moon day is even an official holiday. Nobody would undertake a journey or do business when the moon is new. One does not even call a doctor, because the cure could not be successful if the doctor starts the treatment on a new moon day. There is one special new moon in the year, when no child may be born. Should this happen, everybody is convinced that the child will have a bad character and may become a thief or even worse. It is interesting then to find out that there is also a special month during which no marriage can take place; and if this rule is observed, then there is no possibility that a child will be born at that unlucky new moon.

During a visit to a hospital in Madras I had an interesting talk with the English doctors residing there. I told them about my experiments concerning the influence of the moon and asked if they were able to tell me something about the native customs there. At first they did not remember anything, but later they told me the following story: A woman patient was completely cured, and the time was fixed for the husband to come and fetch her. The husband came, but he declared he would not take his wife home that day. She could only leave the hospital the next day. Why? It was new moon day, and if the wife left the hospital when the moon was new, she would fall ill again.

Furthermore the doctors told me, that the Indians believe, that, if, during the critical stage of an illness, a new moon day occurs, then the patient will inevitably die. And, strange to say, the doctors added, that this really had happened several times.

In Travancore (southern India) I once asked an Indian who began to speak about the new moon, why I never heard anything about the full moon. He smiled and said: "You see, the full moon is always good, we need not speak about it. But you must be careful about the new moon".

Of course the modern, educated Indian, who is very proud of his English degree, does not like to speak any more about the influences of the moon. Western Science has taught him that these old traditions are not true, not scientific. I shall never forget an interview I had with an Indian professor at Madras University. I gave several lectures about the "Influence of the Moon on Plant Growth" in Madras; and, talking with this professor, I felt that he grew more and more uneasy. "Your experiments are really very interesting, and, of course, I believe you are right; but you see, I find them dangerous".

That was the first time I had ever heard that my experiments were "dangerous". Why? Because the Indians are just beginning to learn to forget their old traditions. They want to be scientific!

And if it is true, that the moon has an influence on plant growth, then people will say: "then all our other traditions are also true". And that is not possible. There are so many things which cannot be true.

It is precisely one of the tasks of a true scientist to find out what is true, and when he has found it, to say so, even if it does not please people…

In the annals of the Royal Botanical Garden, Perandenia, Ceylon X 1907 there is a report by A. S. Smith about the influence of the phases of the moon on the cutting of bamboo; and a similar article from E. P. Stebbing an Indian Forester, 1906. We are told that in India, Ceylon, Colombo, it is known that the phases of the moon influence the **quality** of the wood. Trees cut during full moon are full of sap and this means that the wood is easily attacked by insects and worms not so the wood of trees cut during new moon. This phenomenon we find mentioned in Pliny. He speaks about **oak trees.** They should be cut during a new moon.

In **Brazil** the negroes only cut trees during new moon if the wood is needed for building purposes. There was a custom of marking the wood with a **"moonstamp"** to testify that it had been cut during the right phase of the moon.

In Europe also people familiar with the properties of wood, know when trees should be cut. Years ago a professor of the Technical High School in Stuttgart (Württemberg) came to see me in the Biological Institute at the Goetheanum, and asked me some questions. He had heard that I was studying the influence of the moon on plant growth and had published a book on this subject. Now it often happened to the professor, when he needed wood, that the forester said: "It is not possible to cut the trees now. The wood cutters would not do it, because we have not the right moon". Then I explained why the wood cutters were right. During the full moon the tree is full of growing energy – sap – and it is almost impossible to get the wood dry if the wood is cut during this period, and the wood cannot be used for working purposes; it is not even of much use for fuel. But when trees are cut during the waning moon, then the wood gets dry easily and can be used for furniture-making and other purposes. Only people living in towns, far away from nature and plant life, who treat such laws as superstitious nonsense, think it is possible to fell trees at any time of the year.

The well-known scientist Professor Karutz sent me the following notes on his observations about the influence of the moon in the tropics:

"The influence of the moon on trees is so enormous, that in the trade with wood, the buyer always makes a condition, that the trees are cut during the waning moon. If the trees are cut during the waxing moon, they are quickly attacked by worms and the wood is spoilt".

"Fish caught during full moon get putrid exceedingly quickly. Fish bought in the morning at the market can perhaps still be cooked at noon, but cannot be kept until evening; it would have fallen to pieces by about 7 o'clock in the evening. Sometimes it is not even possible to eat the fish at noon. It gets too soft".

"About 8-10 days after full moon we observe that the full moon has caused the sap to flow into the plants; they develop quickly growing new shoots. This happens, according to the kind of plant, every 4th, 8th, or 12th week".

"We also noticed here (about 11 degrees from the equator) that we could stay in our boats on the water during moon light only on two evenings. After this time the influence of the moon on the water was so great, that the water moved violently, and we did not find it pleasant to stay in the boats. If the moon (after full moon) rises later than 9 o'clock in the evening, a more or less strong wind moves the water, and the movement only dies down again after the moon has risen for some time above the horizon".

"People who fall asleep in their chairs during the full moon wake up with swollen faces".

"Sick people feel their condition much worse during the full moon. These are very strange occurrences which we can observe in the tropics".

"I have also been told that on old bills for Bordeaux wine a note used to be printed saying that the barrels had to be filled according to the phases of the moon if one wanted to keep the wine in a good condition".

Chapter III.

EXPERIMENTS WITH WHEAT FROM 1 TO 16 METRES BELOW THE SURFACE OF THE SOIL, TO DETERMINE THE INFLUENCE OF THE MOON.

Perhaps it may seem strange to the reader, that an attempt should be made to look for the influence of the moon even below the surface of the soil. But this problem as to what happens deeper down in the soil, does arise, if one has studied the influence of the moon for years with various objects, both in laboratory tests and in the open. Are those influences traceable also beneath the surface of the soil to the same extent? Are they weaker, or perhaps do not exist at all? Is there a limit to be found?

For some other experimental purposes our assistant, Mr. W. Kaiser, dug a hole about 7 metres deep. Some years later a still deeper hole was dug out (16 metres). It was about 1 1/2 metres square and one person could just descend – not very comfortably – on a vertical ladder. The natural underground conditions had to be kept undisturbed as much as possible. That meant that light and air had to be excluded as perfectly as possible. At each second metre, the hole was closed again by a wooden cover, while, the surface of the hole was of course kept permanently closed, being bolted by strong wooden bars.

To make quite sure that no influence of light and air could enter, another smaller channel was dug each metre down, parallel to the surface. To make this quite clear: one deep hole was dug vertically, descending 16 metres. At a distance of every metre, horizontal channels were cut in. The distance between the last two channels was 1.5 metres; that means we had 15 channels distributed over 16 metres. These horizontal channels were again bolted with wood against the vertical channel. On opening the first cover for only a few moments, light and air could enter. Descending, we always immediately shut the first cover, and stood on a wooden board offering just enough space to open the horizontal channel into which the various experiments were placed. Standing on the ladder, the floor of the first two metres could be lifted. We descended, shut the cover, and so on, until we reached the eighth sub-division, 16 metres below the surface of the soil.

Each horizontal channel contained a thermometer to record the temperature, and a hygrometer to show the humidity.

These experiments were very difficult to carry out. The arrangement was rather primitive; there was no security against accidents; no fresh air was available during the whole time we had to work below the surface of the soil. In the beginning it took about 3/4 of an hour to complete the descent and ascent. It was interesting to watch the psychological and physiological effect caused by this experiment. Mr. Kaiser used to describe the effect the digging had on him physiologically in a very drastic way. The deeper down he went, the more conscious he became not only of his physical body, but of all the liquids moving inside. Then head-aches started, terrific head-aches which lasted for many hours. When he had finished the hole, he told me quite frankly: "Of my own free will I will not enter that hole again. I will go only if I must".

Now it was my task to go down with the experiments. Each week one set of plants went down and another set had to be measured, according to the phases of the moon. For some time experiments dealing with the study of the forces of crystallisation were carried out every day. The first experience I had was quite strange. When I descended I found the atmosphere damp, and there was a rather mouldy smell; some little creatures, earthworms and centipedes dropped on my head. Suddenly I began to yawn. That was most astonishing. Normally I never yawn, not even after working through several nights! The deeper I went, the more I had to yawn. Then I became aware of my head. I cannot say that my head ached; perhaps I describe my feelings best by saying, I felt that I had a head. I experienced no difficulties with breathing. When I came out again to the surface, I felt a little giddy, there was a strange heaviness in my head and oh! I was tired, tired to death. That is not pleasant, if you have to experience it every day. I remained tired the whole day, and only slowly did my head become clear.

Then there came the day, when I thought I heard water running. Quite distinctly, close to me, I was sure there was running water. I heard the little noises of dropping and trickling water. It took me some time to find out that it was the fluids in my own body.

Another time I heard a distinct knocking, and wondered where the knocking came from. It could not possibly be somebody outside who was calling me. Of course not; it was my own heart!

The difference of the seasons is felt very strongly underneath the soil. There are always changes in the atmosphere. For instance in summer-time on descending you feel it is beautifully cool underneath the surface. In Winter time the opposite happens, it is much warmer than outside. Sometimes I had difficulties with breathing, and one day I simply could not go on. Having reached the bottom of the hole, I felt exhausted and still could not make up my mind to ascend; so I finished the work at 16 metres and 14 ½ metres. Slowly climbing up, I thought that having succeeded with the work at 16 metres if should be easier to work at 12 and 13 metres. But it became worse and I wondered if it would be any use ringing the little bell which would announce that I did not feel well. Soon I abandoned that thought. The laboratory was far from the hole and the nearby school was often ringing bells; so by the time my friends might find out that it was I who was calling for help, it would be much too late. Then I rushed up the ladder as quickly as I could, and sat panting outside the hole. Ten minutes later I descended again; still I could not go on working. Tired and with an aching head, which seemed to be quite a separate living being, I went home.

The experiments had to be carried out. I began to think that perhaps it was not really as bad as all that beneath the soil; that I was exhausted after having undergone this procedure for many months. So I tried, for the first time, to send somebody else down: a perfectly healthy young girl, a student, who had asked me again and again to let her try. She went down and I remained to look after her. Feeling responsible, I climbed down also and asked if she still felt well. For the first eight metres she called back that everything was all right. At ten metres I heard her breathing heavily, but she was still assuring me it was all right. At 12 metres she began to gasp, and I recalled her immediately. So that was that. Even somebody fresh and healthy could not succeed.

Then, my assistant, Mr. Kaiser, had to complete the experiment. But he also complained later on of feeling very poorly. Something must have been wrong on that special day. I had to find out the reason. The calendar told me it was the 24th of December, 1931, one day before full moon, nothing else. The next day I went down again to make crystallisations and changed the plants. The same thing happened-only I had made up my mind to go through with it; and, in any case, during the Christmas holidays, I had to work alone. Day after day I had the same experiences-until January the 7th. Quite suddenly the hole was in normal condition again.

I am glad that I went through all these experiences without using artificial breathing apparatus, or any other help, because only thus is it possible to get the complete picture, in uniting the objective and subjective phenomena. These experiments were carried out for nearly five years without any interruption.

Of course, plants which are growing underneath the surface of the soil, show certain phenomena corresponding to dark-room experiments. The leaves are yellow instead of green; the first leaf develops much longer than the second. The second leaf just pushed through, and it was not worth while to take the measurement. We recorded only the length of the first leaf and the length of the roots

As mentioned before, the seeds have to be selected very carefully to obtain reliable results. The seeds were inserted in glass dishes in garden soil (the same we used for all our laboratory experiments) containing no artificial fertilizers.

The actual figures for one such experiment are:–

Metres	Temp.	Metres	Temp.	Metres	Temp.	Metres	Temp.	Metres	Temp.
1	3 ° C	2	12 °C	3	12.5 °C	4	13 °C	5	13.5 °C
Leaf	Root	Leaf	Root	Leaf	Root	Leaf	Root	Leaf	Root
2.0	6.5	12.5	14.2	15.3	15.2	19.0	17.2	17.0	15.0
2.0	5.5	13.0	17.0	15.0	14.5	20.0	15.8	18.2	16.0
2.7	6.76	12.6	13.0	15.6	17.0	22.0	15.2	18.5	15.0
2.0	6.4	12.5	11.4	16.0	15.0	21.0	15.0	20.0	17.0
2.0	4.0	11.6	14.6	15.0	12.5	18.0	15.0	21.0	16.8
1.5	5.0	11.3	13.0	13.8	14.8	19.4	14.3	18.8	15.5
1.6	6.0	11.8	14.0	14.8	14.0	22.0	17.0	21.0	17.0
2.0	4.0	13.0	13.5	16.0	17.0	22.0	16.8	18.0	14.6
2.0	6.5	11.0	13.0	15.5	15.5	20.0	17.0	18.0	15.6
2.5	6.5	12.8	14.0	16.0	16.7	21.0	17.5	18.0	14.0
1.6	5.5	13.0	14.0	14.0	14.8	19.0	15.0	18.0	14.5
2.0	7.0	12.8	14.0	16.2	16.3	20.0	16.5	18.0	16.8
2.5	4.0	11.4	13.0	16.5	15.5	21.0	16.0	17.6	17.0
2.0	5.4	11.8	15.0	16.0	17.0	20.0	15.2	18.8	16.0
2.0	4.0	12.8	14.0	15.8	16.5	22.0	17.0	19.0	17.6
2.0	5.6	11.5	13.5	15.0	15.5	19.2	16.5	21.0	16.8
2.5	4.8	12.0	14.6	13.8	12.0	21.0	17.4	21.0	17.2
1.9	5.0	11.6	13.8	15.5	14.7	21.5	16.7	20.0	16.8
2.2	6.0	10.5	14.0	15.0	15.4	18.6	15.0	19.0	14.5
2.0	5.4	11.0	13.2	15.2	15.8	20.0	15.9	22.0	14.8
41.0	109.8	240.5	276.8	306.0	305.7	406.7	322.5	382.9	318.5
Average		Average		Average		Average		Average	
2.05	**5.49**	**12.0**	**13.8**	**15 30**	**15.28**	**20.3**	**16.1**	**19.1**	**15.9**

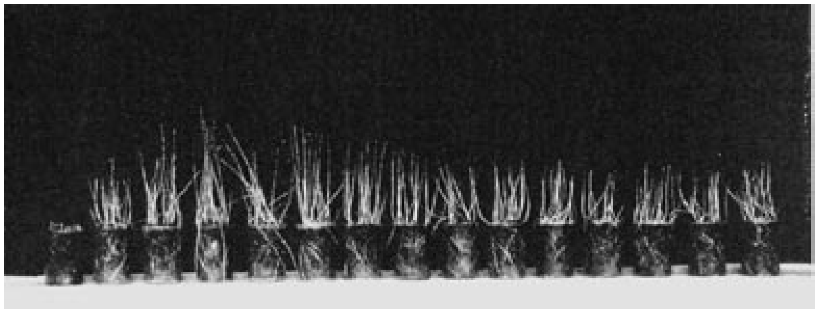
Metres	Temp.	Metres	Temp.	Metres	Temp.	Metres	Temp.	Metres	Temp.
6	13 °C	7	13.5 °C	8	13.5 °C	9	12.5 °C	10	12.5 °C
Leaf	Root	Leaf	Root	Leaf	Root	Leaf	Roots	Leaf	Roots
15.8	14.2	15.8	17.5	13.6	14.0	11.5	12.0	12.0	13.8
17.0	14.2	14.0	15.0	14.5	14.0	12.8	12.0	10.0	10.0
15.7	14.0	16.0	18.0	12.8	15.8	11.6	12.5	13.0	13.0
16.3	17.5	14.8	16.2	12.5	16.0	12.0	15.0	12.0	11.0
16.2	17.5	13.8	15.0	13.0	15.0	12.6	14.6	12.5	12.0
17.0	16.5	14.2	13.6	14.3	15.0	11.6	13.5	10.6	10.0
16.3	15.0	16.8	15.7	12.5	13.5	12.8	12.6	10.8	11.0
17.2	16.8	16.5	16.2	12.0	14.3	13.8	15.2	11.0	11.2
16.0	16.8	15.5	14.6	13.0	15.6	12.6	12.8	11.0	12.0
15.0	14.8	14.8	16.2	12.0	14.8	13.0	15.8	13.0	13.2
15.5	15.0	15.6	13.0	13.5	14.0	12.6	13.3	11.0	12.8
16.0	17.0	16.0	15.8	14.8	16.0	11.3	13.5	12.0	13.5
16.2	16.0	14.0	16.0	12.8	12.0	11.0	14.5	11.6	12.5
17.5	14.6	16.0	14.8	12.0	12.0	13.2	14.0	12.1	12.8
15.8	17.0	15.0	16.6	12.0	12.0	12.6	14.8	10.0	11.5
17.6	16.8	13.8	13.5	12.8	16.0	11.8	12.8	13.0	12.0
16.8	17.5	13.8	14.0	13.6	12.0	12.3	15.3	12.6	14.2
16.0	14.5	16.0	15.0	12.0	12.0	12.2	14.0	11.0	10.8
16.6	16.0	14.8	17.0	12.0	11.0	12.6	13.8	10.6	12.2
15.8	16.8	14.8	14.5	14.0	16.5	12.4	14.6	11.0	14.3
326.3	318.5	302.0	308.2	259.7	281.5	246.3	276.6	230.8	243.8
Average		Average		Average		Average		Average	
16.3	**15.9**	**15.1**	**15.4**	**12.9**	**14.1**	**12.3**	**13.8**	**11.5**	**12.2**

Metres	Temp.	Metres	Temp.	Metres	Temp.	Metres	Temp.	Metres	Temp.
11	12.0 °C	12	12.5 °C	13	12.0 °C	14 1/2	12.0°C	16	12.0 °C
Leaf	Roots	Leaf	Roots	Leaf	Roots	Leaf	Roots	Leaf	Roots
11.7	14.0	9.5	13.2	10.3	14.2	9.5	11.0	11.5	13.0
12.0	11.5	10.0	10.0	11.0	13.3	10.3	12.0	10.8	12.2
10.0	11.5	9.8	10.0	10.8	12.0	11.0	12.6	11.3	13.2
10.7	14.0	11.7	12.5	10.0	10.0	11.0	13.0	11.0	11.5
10.7	11.8	9.6	12.5	12.2	12.5	10.0	11.2	11.0	13.0
11.2	13.8	10.2	12.5	12.0	13.0	9.0	10.2	11.0	11.3
11.3	13.3	11.0	12.0	11.5	11.5	10.2	13.0	9.6	10.5
10.8	10.0	9.8	12.6	9.3	12.0	9.2	10.3	9.8	11.8
11.5	13.0	11.0	11.2	9.2	11.5	11.3	10.8	10.8	12.5
12.0	13.8	11.6	13.0	10.2	12.5	9.2	12.5	10.6	11.5
13.0	14.2	10.2	13.0	10.0	13.0	10.6	12.8	12.0	12.8
12.0	14.3	9.8	11.0	10.2	12.5	9.8	10.0	12.5	11.3
11.3	11.3	11.6	13.5	10.6	13.5	10.8	12.2	9.6	12.5
10.0	10.0	10.0	14.0	10.0	10.0	10.0	11.5	10.7	12.0
10.0	11.5	11.3	15.8	9.0	11.3	10.0	12.8	9.8	11.3
11.0	13.8	11.6	12.5	10.3	12.5	10.0	12.8	9.2	12.0
11.0	13.0	11.0	10.2	11.2	12.5	9.8	13.2	10.8	11.2
12.5	11.8	9.0	11.6	11.3	12.8	9.5	11.0	9.3	10.0
12.0	12.5	11.7	12.0	12.0	12.2	9.5	10.2	11.2	11.7
11.0	12.8	11.0	14.0	10.4	12.3	10.0	12.4	1.1.4	11.2
225.7	251.9	211.4	247.1	211.5	245 .1	200.7	235.5	213.9	236.5
Average		Average		Average		Average		Average	
11.3	**12.6**	**10.6**	**12.4**	**10 6**	**12.3**	10.0	11.8	10.7	11.8

Following we reproduce a photograph of this experiment together with the respective figures.

The 23rd December, 1932:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14 ½	16
Temp.:	3°	12°	12 .5°	13°	13 .5°	13°	13 .5°	13 .5°	12.5°	12.5°	12°	12.5°	12°	12°	12°
Leaf:	2.05	12.0	15.3	20.3	19.1	16.3	15.1	12.9	12.3	11.5	11.3	10.6	10.6	10.0	10.7 cm
Roots:	5.49	13.8	15.2	16.1	15.7	15.9	15.4	14.1	13.8	12.2	12.6	12.5	12.3	11.8	11.8 cm



Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

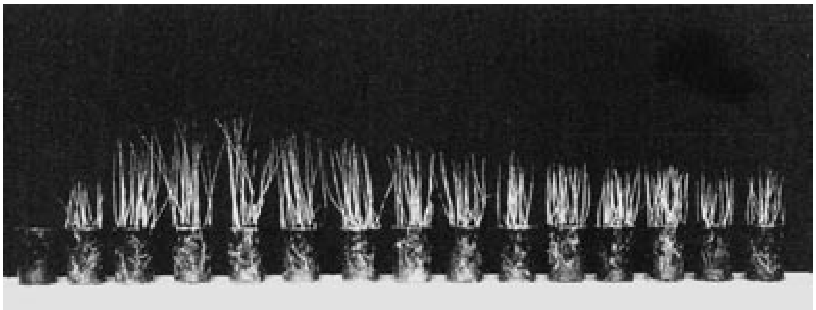
Fig.;. 6. – Wheat grown beneath the surface of the soil.

The figures for each glass dish show convincingly that the seeds have been selected in such a way that the individual differences are negligible. The average obtained for each pot is reliable.

Looking at the photograph we notice that the first metre with 3 ° C produced only tiny plants, scarcely visible; the next metre has considerably increased the temperature and growth. Again we are astonished that the small difference of half a degree at the third metre enhances the plant growth so much. Again with half a degree more at the 4th metre, the plants are still bigger. Again half a degree more in the fifth metre and the plants become smaller. The 6th metre has 13 degrees; the warmth corresponds with the 4th metre, but here we get 20.3 cm. and there only 16.3 cm. Therefore we cannot explain the difference in growth by the differences in temperature. That is the first thing one finds out in looking at this experiment. Of course it is justifiable to say that the first metre, with only 3 degrees of warmth, offered too unfavourable conditions for the seeds, so here the difference is due to the temperature. We may also explain the increased growth which follows, with the difference from 3 to 12 degrees; only further on we cannot use this explanation.

We try another week. The 3rd January, 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14 ½	16
Temp.:	6°	12°	12 .5°	13°	13°	13°	13°	12.5°	12.5°	12.5°	12°	12.5°	12°	12°	12°
Leaf:	1.0	10.0	15.5	18.2	19.2	18.1	15.8	14.3	12.9	12.4	11.4	10.9	11.3	10.9	10.4
Roots:	4.2	12.6	15.0	16.1	16.6	14.6	14.0	12.9	13.5	12.6	12.5	11.5	12.4	12.2	10.9



Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

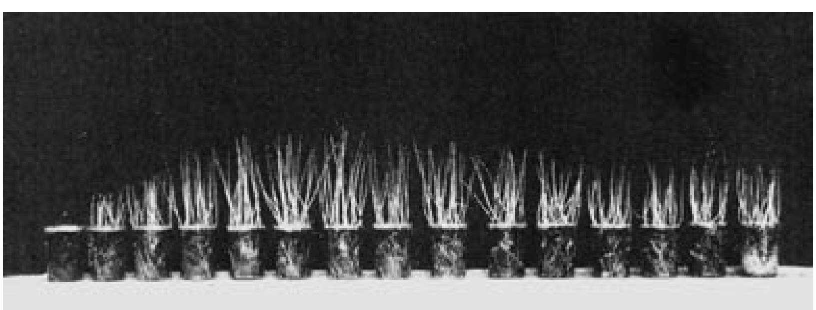
Fig. 7. – Wheat grown beneath the surface of the soil.

The photograph looks similar. The plants increase in growth until the fifth metre, but the temperature increases only up to the 4th metre; then it remains steady until the 7th metre, but the plants may either increase or decrease.

The same phenomenon we find between the 8th and 12th metre. The temperature remains steady at 12.5° but growth varies. Again between the 13th and 16th metre, the temperature remains steady at 12° but growth is decreasing.

The 16th of February 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	5°	10°	11°	12.5°	13°	13°	13°	13°	13°	13°	12.5°	12.5°	12°	12°	12°
Leaf:	0.6	6.9	10.0	15.4	16.4	16.7	17.0	15.9	15.7	14.7	13.2	13.2	12.3	12	12
Roots:	6.5	9.2	12.3	15.3	14.9	14.8	15.6	15.3	15.9	15.1	13.5	13.8	12.5	13.5	12.6



Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

Fig. 8. – Wheat growing below the surface of the soil.

The temperature increases until the 5th metre; the plants increase in growth until the 7th metre. From the 5th to the 10th metre the temperature remains steady, but the plants vary in growth.

The 24th of April, 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	8.5°	11°	11°	11.5°	11.5°	12.5°	12.5°	13°	12°	13°	13°	12°	12.5°	12°	12°
Leaf:	7.0	8.0	9.3	12	12.3	13.9	15	15.5	16	15	15.6	13.6	14.2	13.2	13.6
Roots:	9.8	11	12.6	14.2	15	18.7	17.3	17.9	18.2	18.2	16.6	16.6	16.9	16.2	15.2

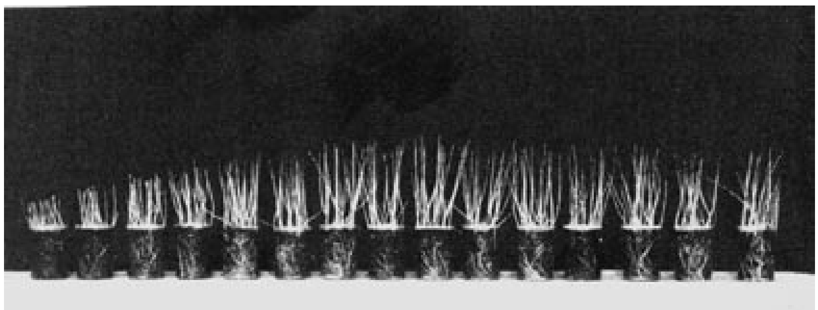


Fig. 9. – Wheat grown beneath the surface of the soil.

The plants increase steadily until the 9th metre. The temperature is the same at 2 and 3 metres deep; at 4 and 5 metres; at 6 and 7 metres; it reaches the maximum at 8 metres; it decreases at 9 metres, where the plants reach the maximum; increases again at 10 metres, remains at 11, decreases at 12, increases at 13 and decreases again at 14½, remains at 16 metres.

The 8th of June 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	12.5°	13°	12°	12°	12°	12.5°	12.5°	12.5°	12.5°	12.5°	13°	12.5°	12.5°	12°	12°
Leaf:	10.5	10	10.1	10	10.5	10.3	10.3	11.9	11	11.3	11.1	11.3	10.7	10.1	10.5
Roots:	12.9	12.5	12.1	11.7	12.3	11.7	11.1	13.9	13.6	13.2	12.9	13.1	13.7	12.4	12.3

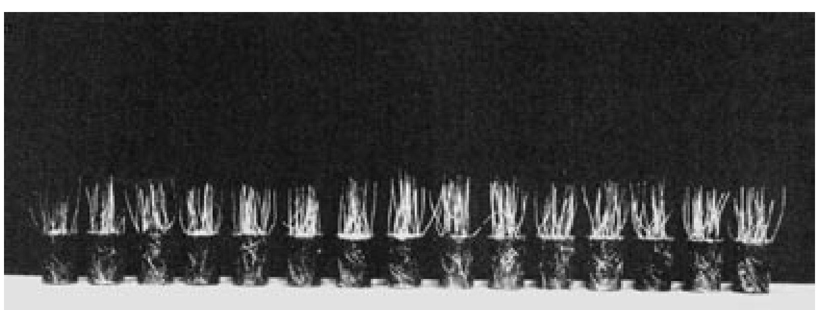
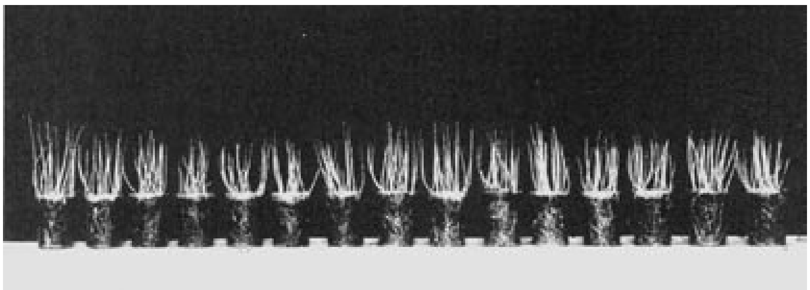


Fig. 10. – Wheat grown beneath the surface of the soil.

This is a very interesting experiment. Nearly all the plants have the same height.

The following week, June 14th shows an other interesting phenomenon:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	13°	12°	12°	12°	13.5°	12.5°	12.5°	13°	13.2°	13°	12.5°	12.5°	12°	12°	12°
Leaf:	14.8	11.7	11.7	11.3	10.9	11.8	12.4	13.1	12.6	12.2	12	11.7	12.1	11	11.8
Roots:	16.7	14	14.7	12.6	12.9	13.1	14.2	14.3	14.1	14.5	13.3	13.4	13	12.9	12.9



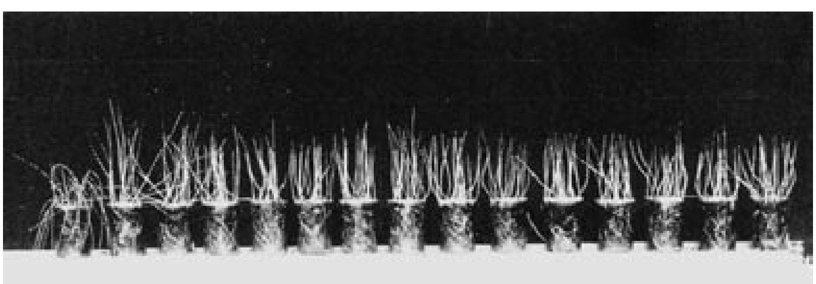
Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

Fig. 11. – Wheat grown beneath the surface of the soil.

The plants decrease at first and then increase again. The temperature decreases from the first to the second metre; then remains steady until the 4th metre; increases again and reaches the maximum at 5 metres; decreases at the 6th metre, remains steady at the 7th; increases at the 8th and 9th; decreases at the 10th and 11th; remains at the 12th and decreases once more at the 13th; then remains steady to the end.

A month later, on the 14th July, 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	10°	14.5°	14.5°	15°	14°	13.5°	13.5°	13°	13°	12.9°	13°	12.8°	12.5°	12.4°	12°
Leaf:	21.4	19.4	17	13.8	13.2	12.2	13.8	14.5	14.4	13.6	12.8	13.8	13.1	12.7	12.7
Roots:	15	15.9	15	13.8	14.2	14.9	14.5	15.4	.15.1	14	14.3	13.6	14.4	13.2	13.4



Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

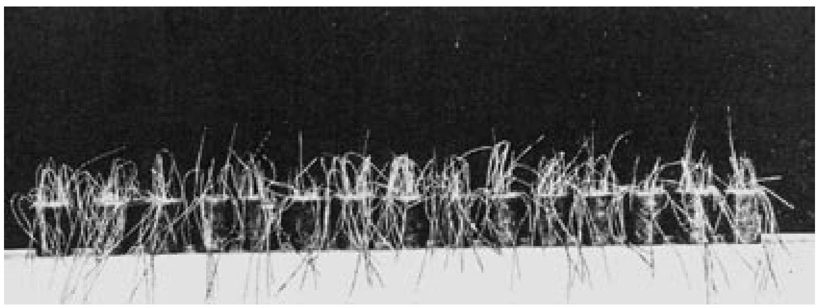
Fig. 12. – Wheat grown beneath the surface of the soil.

We find the first pot has developed such long leaves that they cannot stand upright, they droop. Of course this is due to the fact, that plants lacking sunlight are very much weakened. In the second pot they stand upright, the leaves are smaller. Then we find decreasing growth until the 6th pot. The 7th and 8th increase again; and again the growth decreases.

The temperature however is **lowest** where the plants are **biggest.** The first metre registers only 10 °C, the second and third 14½ degrees. The maximum temperature is reached with 15 degrees at the 4th metre.

Again a month later, on the 13th of August, 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	12°	16°	15.5°	15°	14°	13.5°	13.3°	13°	12.5°	12.5°	12.5°	12.5°	12.5°	12.4°	12°
Leaf:	28.6	29.2	29.4	29.9	25.8	24.8	25.6	25.3	24.8	23.8	23.6	23.7	24.3	23.0	21.9
Roots:	15.9	16	16.9	17.5	16.0	14.6	16.9	16.8	19.6	17.3	17.7	17.0	16.9	16.5	14.5



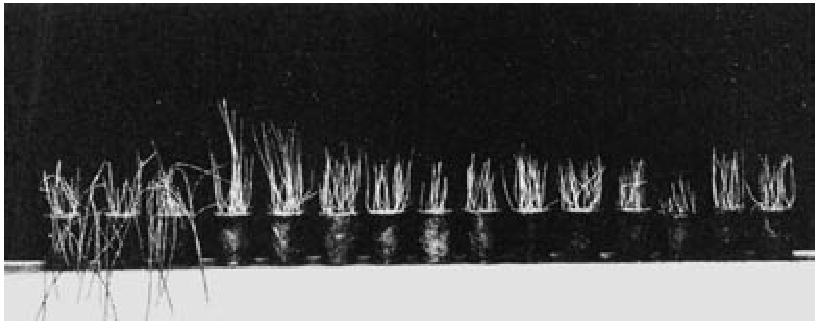
Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14½ 16

Fig. 13. – Wheat grown beneath the surface of the soil.

All the plants have drooping leaves. The temperature 1 metre below the surface of the soil is only 12 degrees, still the plants reach a length of 28. cm. The second metre has the maximum temperature of 16 degrees; but the maximum growth is readied at 4 metres.

September 11th, 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	16°	17°	16°	14.5°	14°	13.2°	13°	13°	13°	12.5°	12.5°	12.5°	12°	12°	12°
Leaf:	28.8	28.4	27.3	20.1	17.7	12.0	10.9	5.8	7.7	11.9	10.7	9.2	5.8	10.1	10.9
Roots:	16.9	17.7	13.9	14.5	14.6	11.7	12.2	7.1	9.3	11.5	10.4	10.4	6.8	10.8	10.9



Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

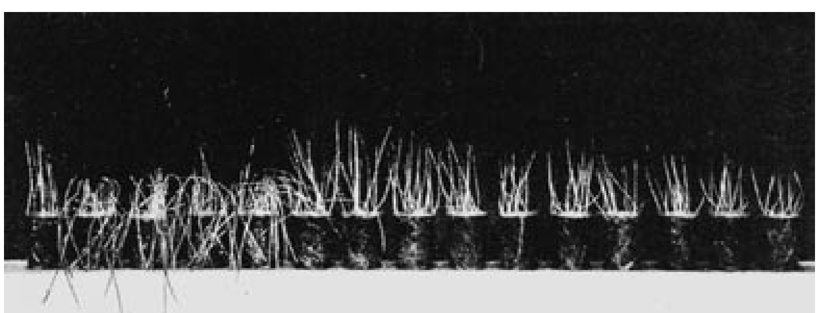
Fig. 14. – Wheat grown beneath the surface of the soil.

Only the first three pots show the phenomenon of drooping leaves. The temperature at the first metre has considerably increased to 16 degrees; and the second keeps the maximum temperature with 17 degrees. Maximum growth is reached at the first metre with 28.8 cm. Then the plants rapidly decrease in length.

If we compare for instance, the growth of the 8th metre with that of the previous month – we have in both experiments the same temperature of 13 degrees – but in August the plants readied a length of 25.3 cm and in September only 5.8 cm.

October 3rd, 1933:

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	16°	17°	16°	14.5°	13°	13°	13°	12.8°	12.8°	12.8°	12.5°	12.5°	12.5°	12.2°	12°
Leaf:	27.7	26.6	28.3	23.6	20.7	16.1	15.1	13.4	12.6	13.2	10.7	13.3	11.8	12.4	11.0
Roots:	16.1	16.6	18.0	14.7	15.0	13.7	13.7	12.4	11.5	13.8	12.5	14.2	13.2	14.9	13.3



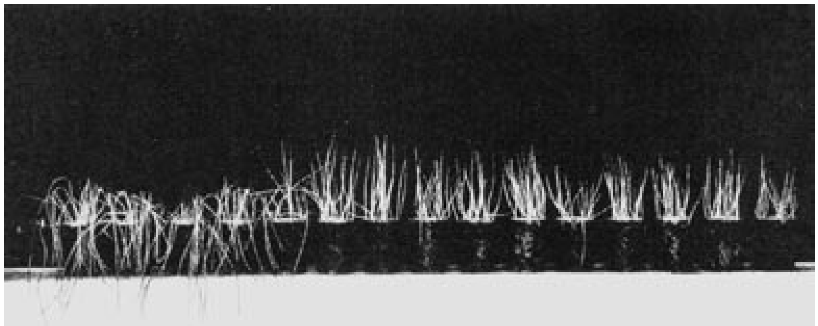
Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

Fig. 15. – Wheat grown beneath the surface of the soil.

The first 5 pots have drooping leaves. Maximum growth is reached at the third metre with 28.3 cm; the maximum temperature at the second metre with 17 degrees. Then the temperature slowly decreases, and also the plants decrease in growth.

November 10th, 1933

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	16°	15.5°	14°	13°	12.5°	12.5°	12.5°	12.5°	13°	12.8°	12.9°	13°	12.5°	12°	12°
Leaf:	17.0	25.0	25.2	24.0	22.5	17.2	15.3	13.5	12.8	10.9	12.0	11.2	10.3	11.0	10.0
Roots:	14.0	17.0	16.5	16.7	16.0	14.8	13.0	11.4	14.3	13.0	13.0	12.7	12.0	12.0	12.0



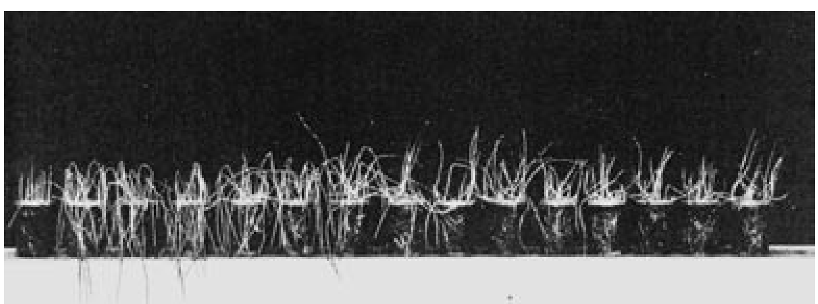
Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

Fig. 16. – Wheat grown beneath the surface of the soil.

The first plants stand upright; the following 4 pots show the phenomenon of drooping leaves. Then again the plants stand upright, but are slowly decreasing. The maximum temperature at the first metre is 16 degrees; the maximum growth at the third metre with only 14 degrees.

December 17th, 1933

Metres:	1	2	3	4	5	6	7	8	9	10	11	12	13	14½	16
Temp.:	5°	10°	13°	14°	14°	14°	14°	13°	14°	14°	14°	14°	13°	13°	13°
Leaf:	6.6	23.5	22.5	26.9	23.3	23.8	20.4	17.8	15.6	16.0	13.0	12.6	13.0	14.5	13.3
Roots:	10.2	12.0	17.4	18.2	16.6	16.1	16.7	16.0	16.1	13.7	12.2	13.2	13.5	13.7	12.8



Metre 1 2 3 4 5 6 7 8 9 10 11 12 13 14 ½ 16

Fig. 17. – Wheat grown beneath the surface of the soil.

1 metre deep the leaves are rather small. At the 2nd, 3rd, 4th, 5th, 6th and 7th metres we find drooping leaves, and then gradually growth decreases again. The maximum is reached at 4 metres.

The temperature is only 5 degrees at the first metre and readies the maximum with 14 degrees at the 4th metre; then remains steady until the 7th metre. It decreases at the 8th and rises again to 14 degrees up to the 12th metre; then decreases to 13 degrees until the 16th metre.

We notice that the warmth slowly penetrates into the soil. We have an outside temperature far below zero; one metre beneath the surface of the soil 5 degrees of warmth; then 10 degrees, then 13; and then for some metres the highest temperature of 14 degrees.

The warmth of the summer sun slowly enters the soil and the plants may benefit within the soil from last summer's sun. That is a very important fact.

I would like very much to publish the photographs of all the experiments, but I have to limit myself to these few, and can only hope that it will be possible to include all the graphs.

We will study at first the graph of the temperature, 1931*, 1 metre below the surface of the soil. The graph begins with the third of January and ends with the end of December. It is a harmonious-looking graph, with the minimum between February and March (3 degrees) and the maximum in August.

The following year, 1932, looks similar but it has an individual character compared with 1931. The minimum is at the end of February, the maximum August-September. Immediately afterwards follows a heavy drop and then it rises again nearly to the maximum.

The year 1933 shows a few strange phenomena. The minimum is reached early in January; then it keeps on a level the whole of February and half March, before starting to rise ultimately. Then a sudden drop occurs at the end of June; the temperature remains very low during the whole month of July and part of August. The maximum is reached at the end of October and beginning of November; and in December we have again a very sudden drop.

The year 1934 shows a very steady climbing up to the maximum and gradually drops. The maximum is reached at the end of July and the beginning of August and occurs again in the middle of September.

But looking on all the four graphs again and again, one feels strongly that they should be divided differently. The year 1931 does not really end with the end of December, it ends later – at the end of February. That seems also to be the right beginning for 1932.

The end of 1932 is about the beginning of March, 1933. The end of 1933 is about the beginning of March, 1934. This would be the right division of the graphs.

The same impression is there in studying the temperature during these 4 years, 2, 3, 4, and 5 metres below the surface†. The deeper we go beneath the surface of the soil, the more flat the graph becomes. The differences in temperatures arc very slight. The more interesting it is to see that each year has its own specific character. The year 1932, for instance, shows very distinctive changes between the 10th and 16th metres.

Supplement 3 represents the average growth obtained for the wheat plants in the years 1931, 1932, 1933, 1934, one metre below the surface[2]. Above the middle line we have the graph for the leaf, and below the graph for the roots. We may just imagine the grain is lying on the middle line, and the plant is growing the leaf upwards, and the roots towards the soil. It is clearly seen that the same phenomenon which we noticed in studying the graph for the temperature, occurs also for the plants themselves. It does not seem reasonable to start the year at the beginning of January and finish it at the end of December. The graph looks too long at the left hand side and

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* See supplement 1

too short at the right. If we try to subdivide the graph in a natural way, without taking any notice of the time, we find that we have to subdivide at the beginning of March – or more accurately – about the 20th of March, when the sun is entering the Spring constellation. **This is the true beginning of the year.**

For instance if we look at the graph for 2 metres below the surface of the soil, 1934, there is no sense in it, if we stop the graph at the end of December. We must continue 10 more weeks; then the graph seems to be complete; but that also means the middle of March.

This is one remarkable result of these experiments: **we can establish quite objectively the true beginning of the year: the natural year.** It is connected with the sun.

May I remind the reader at this point, that the year did not always begin with the month of January? The Romans, for instance had a year of only 10 months, beginning in March. Of course this year was too short, and then they added two more months. The second month was April, the third May, the fourth June, the fifth was originally called Quintilis (the fifth). In the year 44 B.C. the name was changed to Julius (July) because the birthday of the Emperor Julius, the founder of the Roman Empire fell on the 12th of the month. The following month was called at the beginning "Sextilis"; that is the "sixth"; and, later on, was named after a great Roman Emperor-Augustus Caesar – the month of August. Our present-day names for the months, September, October, November and December, still mean the 7th, 8th, 9th and 10th months of the year. The month of January and February were added later.

So the study of our graphs representing the growth of plants at various depths in the soil, results in the discovery that, for nature, the year obviously does not begin on the 1st of January, but at about the Spring equinox.

What about the moon? Can we also find in our graphs laws connected with the rhythms of the moon? At one metre deep, the maximum is reached during the full moon period in the years 1931, 1932, 1933 and 1934. The result is therefore identical with all our other experiments carried out in the laboratory

For the sake of comparison we give the graphs for these four years.

[2] See supplement 1 and 2 charts for the temperature.

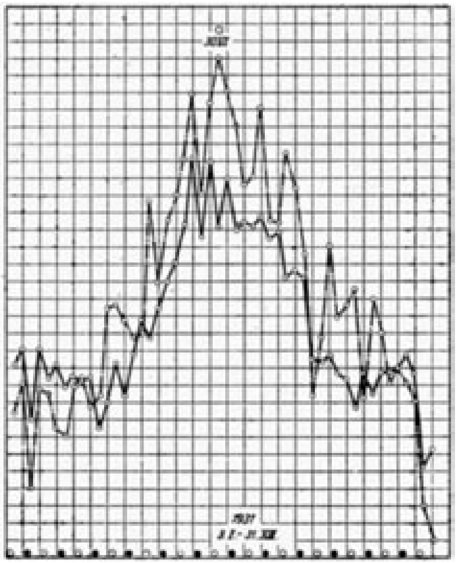

Fig. 18 – Graph representing the average growth of wheat during the various phases of the moon in 1931.

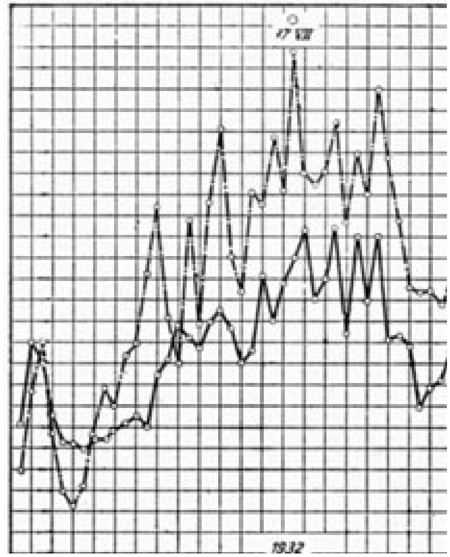

Fig. 19 – Graph representing the average growth of wheat during the various phases of the moon in 1932.

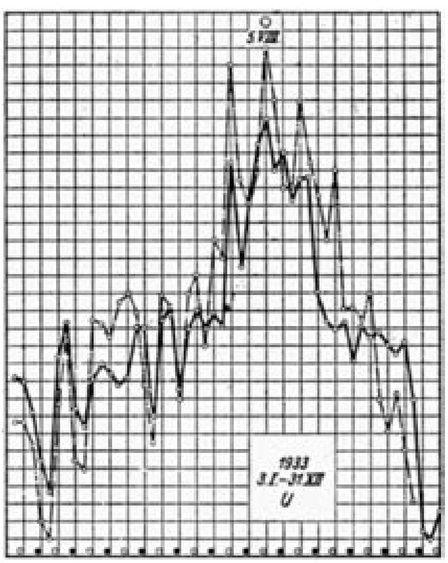

Fig. 20 – Graph representing the average growth of wheat during the various phases of the moon in 1933.

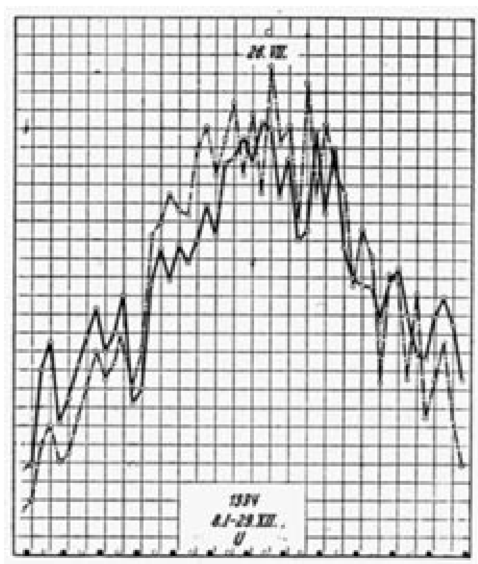

Fig. 21 – Graph representing the average growth of wheat during the various phases of the moon in 1934.

2 metres deep: 1931 and 1932, reach the maximum growth during the full moon period. 1933 produces two maxima, the first is reached by plants having grown from waning quarter to waxing quarter; the second is reached during the new moon period. In the year 1934 the maximum is again readied during the new moon period.

3 metres deep:* 1931 and 1932 the maximum is in the full moon period. In 1933 the maximum is during the new moon period. In 1934 the maximum is reached by plants growing from waning quarter until waxing quarter.

4 **metres deep:*** The year 1931 has its maximum at a new moon period. The year 1932 has its maximum at a waxing quarter; the year 1933 has the maximum waxing quarter to waning quarter. The year 1934 has the maximum again at a full moon.

5 metres deep:† The year 1931 has the maximum at the new moon period;

so has the year 1932. In the year 1933 we find 4 points to take into consideration. The first two are reached during waning to waxing quarter respectively and the second two during the new moon periods. The year 1934 reaches the maximum growth during the full moon period.

6 metres deep:† 1931 has one maximum very early in the year during the full moon period, the second maximum during waning to waxing quarter, the third at the new moon period. In 1932 we find an early maximum during the full moon period, and a late maximum during the new moon period. In 1933 there are two maxima and both are during new moon periods. The year 1934 has one maximum during the full moon period.

7 **metres deep:‡** The year 1931 has an early maximum during the full moon period and a later maximum during the new moon period. The year 1932 shows the same phenomena. In 1933 the maximum is during new moon period. It is rather difficult to decide for the year 1934; the graph is very unquiet. We may say that there is an early maximum during full moon; later on a second maximum during waning to waxing quarter; and still later a third one in the full moon period.

8 metres deep:‡ In 1931 an early maximum is reached during a full moon period and a later maximum during a new moon period. In 1932 the first maximum is reached during full moon the second during new moon. In 1933 we find two maxima during the new moon periods. In 1934 the most prominent points are kept by waxing and waning quarters.

9 metres deep:§ In 1931 we find an early maximum during the full moon period, and a later maximum during the new moon period. In 1932 the first maximum occurs during waning to waxing quarter, the second at a full moon and the third at a new moon period. In 1933 the maximum is during the new moon period. In 1934 the first maximum is reached during full moon.

10 metres deep:§ In 1931 the maximum is readied during- full moon. In 1932 the maximum is during full moon period. In 1933 the maximum is reached during waning to waxing quarter. In 1934 there is one early maximum during the full moon period.

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* Supplement 4.

† Supplement 5.

‡ Supplement 6.

§ Supplement 7.

11 metres deep:** In 1931 we find an early maximum during full moon. In 1932 one early maximum during- the full moon period and a later maximum during the new moon period. In 1933 the maximum occurs during new moon period, and in 1934 there are two maxima; the first early during the full moon period, the second during new moon.

12 metres deep:** In 1931 there is one early maximum during the full moon period. In 1932 there is one early full moon maximum. In 1933 the maximum occurs during new moon, and in 1934 two maxima appear; the first one early during full moon the second during new moon.

13 metres deep:†† In 1931 there is one early maximum during full moon. In 1932 one maximum occurs during the full moon. In 1933 one maximum appears during waxing to waning quarter. In 1934 the maximum is reached during waning to waxing quarter.

14½ metres deep:†† The year 1931 cannot be decided upon, because there are many weeks when plants did not germinate at all. In 1932 the maximum is during full moon period. In 1933 the maximum is during a new moon period. In 1934 the maximum occurred during a new moon period.

16 metres deep:‡‡ In 1931 the maxima appear during the full moon periods. In 1932 the maximum is during full moon. In 1933 the maximum is during the new moon. In 1934 we find an early maximum during waning to waxing quarter, the second during waxing to waning quarter

The result of this analysis will be explained in detail in the following chapter.

** Supplement 8.

†† Supplement 9.

‡‡ Supplement 10.

Chapter IV.
THE CONVENTIONAL YEAR and the NATURAL YEAR

POSITIVE AND NEGATIVE NEW MOON.
POSITIVE AND NEGATIVE FULL MOON.

It is quite fascinating to study the results of these experiments. We come to the conclusion, that we have to introduce some new terms. For instance we have to discriminate between the **Conventional Year** and the **Natural Year.**

The conventional year begins on the first of January, and ends on the 31st of December. Of course in these charts the beginning accords with the phases of the moon; therefore our year begins, maybe, on the 3rd or 4th of January, and ends perhaps on the 27th of December, but on the whole the conventional dates are adhered to. But a study of the charts induces us to make a different beginning. The natural year starts when the vegetation begins, and ends when we notice the decline of the forces of vegetation. These two different years, the conventional and the natural, are indicated in the charts either through straight or interrupted lines. The interrupted lines enclose the "natural year". We get a real picture of **increasing plant growth, maximum growth,** and **decreasing growth.** The natural year always includes these **three facts.** However, if we look at the conventional year, we find, penetrating most deeply into the earth, that sometimes the whole year consists only of the rising section, and reaches the maximum very late; and just at the moment when it begins to decline, the next conventional year commences. Therefore the next year has an extremely long decreasing section, and almost no rising vegetation. That seems completely wrong. On the left hand side, there is definitely a big "tail" belonging to the previous year and on the right hand side the corresponding section is missing.

The following 4 graphs should make this perfectly clear. Fig, 22 represents the growth of wheat plants 2 metres below the surface, in the year 1932. We take at first the "conventional year", starting on January 7th and ending on December 27th according to the phases of the moon. This graph shows the phenomenon mentioned before, that on the left hand side a piece seems too long, and on the right hand side, the graph seems incomplete.

Fig. 23 represents the plant growth 2 metres below the surface in the year 1932, beginning on the 21st of March and ending therefore on the 18th March, 1933: the **natural year.**

We get the same phenomenon if we try the third metre. Fig. 24 represents the result obtained for the "conventional" year, and Fig. 25 the result obtained for the "natural" year.

The "natural" year is the **real** year for the vegetation. Everyone who is sufficiently interested to study the charts (supplement 2-10) will come to the same conclusion.

We expect that some readers will object that the introduction of the "natural year" makes things still more complicated. It cannot be helped. Nature is complicated, and our task is to try and understand these marvellous hidden rhythms.

Fig. 22 – Wheat plants growing two metres below the surface of the soil. "Conventional Year"

Fig. 23 – Plant growth two metres below the surface. "Natural Year"

Fig. 24 – Plant growth three metres below the surface. "Conventional Year"

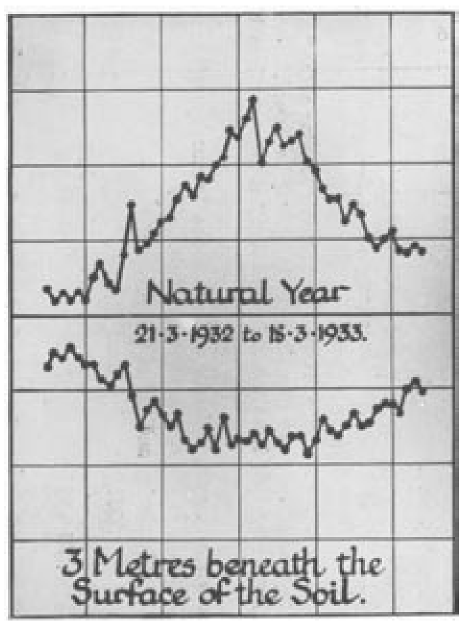


Fig. 25 – Plant growth three metres below the surface. "Natural Year"

We enumerate here the beginning and end of the "natural year" according to the plant growth in the different depths of the soil:

Beginning and end of the "natural year"

Metres	1931/32	1932/33	1933/34	1934/35
1	11.3 - 7.3	14.3 - 3.3	10.3 - 28.2	8.3 - 4.3
2	25.3 - 21.3	29.2 - 18.3	25.3 - 8.3	15.3 - 10.4
3	23.4 - 5.4	13.4 - 18.3	25.3 - 13.4	21.4 - 10.4
4	31.5 - 5.5	12.5 - 24.5	1.6 - 21.4	28.4 - 9.6
5	8.6 - 5.5	12.5 - 30.5	7.6 - 21.4	28.4 - 9.6
6	8.7 - 20.5	4.6 - 24.5	1.6 - 13.5	21.5 - 9.6
7	8.7 - 4.6	11.6 - 24.5	1.6 - 13.5	21.5 - 9.6
8	8.7 - 4.6	11.6 - 24.5	1.6 - 13.5	21.5 - 9.6
9	15.7 - 4.6	11.6 - 1.6	8.6 - 20.6	27.6 - 9.6
10	8.7 - 4.6	11.6 - 24.5	1.6 - 20.6	27.6 - 9.6
11	8.6 - 4.6	11.6 - 24.5	1.6 - 20.6	27.6 - 9.6
12	8.6 - 4.6	11.6 - 24.5	1.6 - 20.6	27.6 - 9.6
13	8.6 - 4.6	11.6 - 24.5	1.6 - 4.6	27.6 - 9.6
14½	1.6 - 27.5	4.6 - 24.5	1.6 - 4.6	12.6 - 9.6
16	8.6 - 5.5	13.5 - 24.5	1.6 - 12.5	20.5 - 9.6

This chart reveals to us the interesting fact, that the deeper down we go into the earth, the later the year begins. At first the beginning happens in the month of March, then in April, then in May, then in June, and it may even happen in July.

Spring begins later. This may seem strange. If the year begins later, then also the maximum growth must vary. Therefore these phenomena must be studied as well.

Positive and Negative New Moon or Full Moon:

We may also discover, that each year seems to have a certain point which it aims to reach (we find this indicated in each chart of plant growth in the various depths below the surface of the soil). For some charts we must say the climax is reached with the **maximum growth;** others are definitely **circling round the minimum.**

This fact asks for the introduction of another expression. For instance: we may find the maximum growth is expressed in one chart during the new moon period, another graph circles round the minimum, and also falls at a new moon period. **These two new moons have a different Quality.** The simplest way of discriminating between these two different kinds of new moons seems to be the introduction of the term; positive and negative new moon. To help readers in the study of these experiments, a few statistics follow which show these different qualities of the new moon as negative new moon; –● and the one representing a maximum growth around which the whole chart circles, as positive new moon.

MAXIMUM GROWTH ACCORDING TO THE CONVENTIONAL YEAR.

Metres.	1931	1932
1	28.8 ○	14.9 ○
2	28.8 ○	14.9 ○
3	26.9 ○	14.10 ○
4	2.4 ○ & 10.11 ●	5.11 ☽
5	2.4 ○ & 10.11 ●	18.6 ○ & 28.11 ●
6	2.4 ○ & 10.11 ●	18.6 ○ & 28.11 ●
7	2.4 ○ & 10.11 ●	18.6 ○ & 28.11 ●
8	2.4 ○ & 10.11 ●	18.6 ○ & 28.11 ●
9	2.4 ○ & 10.11 ●	14.4 ☽ & 18.6 ○ & 28.11 ●
10	2.4 ○	18.6 ○
11	2.4 ○	18.6 ○ & 28.11 ●
12	2.4 ○	18.6 ○
13	2.4 ○	18.6 ○
14½	2.4 ○	18.6 ○
16	2.4 ○ & 28.8 ○	18.6 ○

Metres.	1933	1934
1	4.9 ○	26.7 ○
2	28.8 ☽ & 19.10 ●	8.10 ●
3	21.8 ●	14.11 ☽
4	13.8 ☾	22.10 ○
5	13.8 ☾ & 17.12 ●	22.10 ○
6	21.8 ● & 17.12 ●	22.10 ○
7	21.8 ●	28.4 ○ & 20.12 ○
8	21.8 ● & 17.12 ●	29.11 ☾
9	21.8 ●	28.4 ○
10	28.8 ☽	28.4 ○
11	21.8 ●	28.4 ○ & 9.9 ●
12	21.8 ●	28.4 ○ & 9.9 ●
13	13.8 ☽	16.9 ☽
14½	21.8 ●	9.9 ●
16	21.8 ●	21.5 ☽ & 16.9 ☽

MAXIMUM GROWTH ACCORDING TO THE NATURAL YEAR.

Metres.	1931/32	1932/33
1	28.8 ○	14.9 ○
2	28.8 ○	14.9 ○
3	26.9 ○	14.10 ○
4	10.11 ●	5.11 ☽
5.	10.11 ●	18.6 ○ & 28.11 ●
6	10.11 ●	18.6 ○ & 28.11 ●
7	10.11 ●	18.6 ○ & 17.4 (33) ☾
8	10.11 ●	18.6 ○ & 28.11 ●
9	10.11 ● & 9.12 –● & 14.4 ☽	18.6 ○ & 28.11 ● & 17.4 ☾
10	9.12 –●	18.6 ○ & 12.12 –○
11	9.12 –●	18.6 ○ & 28.11 ● & 17.4 (33) ☾
12	9.12 –●	18.6 ○ & 17.4 (33) ☾
13	9.12 –●	18.6 ○ & 17.4 ☾
14½	9.12 –●	18.6 ○ & 12.12 –○
16	9.12 –●	18.6 ○ & 26.1 (33) –●

Metres.	1933/34	1934/35
1	4.9 ○	26.7 ○
2	28.8 ☽ & 19.10 ●	8.10 ●
3	21.8 ●	14.11 ☽
4	13.8 ☾ & 31-12 –○	22.10 ○
5	13.8 ☾ & 28.8 ☽ & 19-10 ● & 17.12 ○	22.10 ○
6	21.8 ● & 17.12 ●	22.10 ○ & 26.2 (35) ☾
7	21.8 ● & 28.4 (34) ○	26.2 (35) ☾
8	21.8 ●	26.2 (35) ☾
9	21.8 ● & 28.4 ○	26.2 (35) ☾
10	28.8 ● & 28.4 ○	19.1 –○ & 15.5 (35) ○
11	21.8 ● & 28.4 ○	9.9 ● & 26.2 (35) ☾
12	21.8 ● & 31.12 –○ & 28-4 ○	9.9 ● & 26.2 (35) ☾
13	13.8 ☾ & 31.12 –○	16.9 ☽ & 26.2 (35) ☾
14½	21.8 ● & 31.12 –○	9.9 ●
16	21.8 ● & 31.12 –○	16.9 ☽ & 26.2 (35) ☾

These statistics show that the maximum growth happens at first between August and September; then in October and November. In 1933 we find it in December, or it moves even to the following year. So we might say, the Spring begins in June/July, the maximum growth November/December. In 1934/35 the "Natural Year" points to February as having the maximum growth. **On the surface of the earth it is midwinter, and at 6, 7, 8, 9, 10 metres below the surface it is summer-time.**

Again, strange to say, this summer beneath the surface of the soil, **is not indicated by a higher temperature.** We do not find such great warmth as the summer brings on the surface of the earth. Still the plant-growth says: it is summer, the maximum is reached. We cannot say that this maximum is due to warmth. It must be an influence of the sun, not connected with warmth. We see the maximum growth gradually retiring to greater depths. In the first metres we observe even a rise in temperature during winter time. We see that the warmth is slowly entering the soil. But later it is no longer the warmth; the temperature remains steady, yet the plants indicate a difference in their growing capacity.

Now we need to study the influence of the moon. In the experiments carried out in the laboratory for many years the fact could be ascertained that the maximum growth is reached every year during the full moon period. This periodicity is still found **one** metre deep below the surface of the earth, during the years 1931, 1932, 1933, 1934.

At two metres deep only 1931 and 1932 show the maximum growth during full moon periods. In 1933 and 1934 the maximum is reached during new moon periods or waxing quarters. The same happens at 3 metres deep.

From the 5th to the 16th metres there is one smaller maximum on the 2nd of April (**the Easter Full Moon**), and a second maximum in November falling on a new moon period in 1931.

In 1932, one maximum is kept through from the 3rd to the 16th metre on the 18th June, again a full moon period. The second maximum also occurs in November (similar to 1931) on a new moon period.

The year 1933 seems especially favourable for the new moon periods in the month of August; and the year 1934 has more inclination towards the full moon periods, in October, November, December.

Each year has a certain dominating lunar period, but it is no longer only the full moon periodicity which we have learned to know in all the experiments above the surface of the soil. Decidedly an influence of the moon is to be found. Perhaps one could say, the influence of the moon gets weaker the deeper one goes down, but it is still there.

The forces of vegetation on the whole diminish from the 1st to the 16th metre.

Maximum Growth:

Metres	1931	1932	1933	1934
1	32.5 cm.	31.0 cm.	33.0 cm.	40.0 cm.
2	27.0 "	30.0 "	31.5 "	40.5 "
3	23.3 "	28.0 "	32.0 "	40.0 "
4	21.0 "	28.5 "	30.0 "	40.0 "
5	20.5 "	20.5 "	25.5 "	38.5 "
6	17.0 "	18.5 "	25.5 "	37.0 "
7	17.5 "	15.5 "	29.0 "	33.0 "
8	16.5 "	17.5 "	26.5 "	27.5 "
9	15.0 "	16.5 "	28.5 "	29.0 "
10	15.5 "	19.0 "	25.0 "	24.0 "
11	14.0 "	19.5 "	25.5 "	21.0 "
12	14.5 "	18.0 "	24.0 "	19.0 "
13	16.0 "	20.0 "	25.0 "	18.0 "
14½		19.0 "	25.0 "	19.0 "
16	15.0 "	18.5 "	25.0 "	17.0 "

We notice 1931	a drop from	32.5 cm.	to	15.0
1932	" "	31.0 "		18.5
1933	" "	33.0 "		25.0
1934	" "	40.5 "		17.0

These experiments beneath the surface of the soil are extremely interesting. I wish they could be continued for many more years, then many interesting laws about plant growth and the universe would be discovered. They are not easy, because the natural conditions have to be kept intact as much as possible. That means that no air from above the soil must enter. No ventilation, no artificial breathing apparatus must be used, or else many interesting phenomena will not be perceived.

Chapter V.
THE FORCES OF CRYSTALLISATION IN NATURE.

Something about crystallisation above and below the surface of the soil.

The study of plant growth as described above, was accompanied by a study of the forces of crystallisation. Unfortunately it will not be possible to give a full account of these experiments here.

Of course much is known about crystallisation nowadays; still experiments above and below the surface of the soil, in order to study the influence of the different seasons, of the different depths, have – so far as I know – not yet been carried out. I began to study crystallisation in 1920, so I may look back over 20 years experience. A great variety of salts has been studied – salts which crystallise very quickly like sodium sulphate, and salts which need a long time to crystallise, like copper chloride.

Difference between day and night.

For those readers who are not well acquainted with this subject, a few introductory remarks will be of assistance.

What does “crystallise” mean? We find the word “crystallos” used in ancient times for what we call a “crystal” and for what we call “ice”. If we think about this fact, it is very good to combine the thought of crystallisation with the formation of ice. Here we see, in nature, the transformation of something liquid into the solid state. This transformation can take place, so that big masses of ice in rocklike formations appear; or the very subtle ice flowers, which decorate the windows in winter time. Quickly they appear and as quickly they disappear again. A good position for observing ice flowers is in a railway coach near the engine in winter time. The train stops; the hot vapour of the engine passes the windows; the train begins to move, cold air passes and immediately flowers begin to spread all over the window panes. Beautiful fernlike or palm-leaf-like formations are quickly drawn. At the next station, when again the hot vapour from the engine passes over the windows, the ice-flowers disappear as quickly as they were formed.

To crystallise means that “out of a liquid something solidifies”. The Primary Phenomenon of crystallisation is represented in ice, where water itself solidifies.

If water crystallises we find another remarkable thing. It is a law in nature, that warmth expands matter, and cold contracts it. If a piece of metal is heated, and measurements are taken before and after, we find an increase in volume; if the metal is cooled down again, it has contracted. If water becomes solid, it makes the opposite movement; water expands in freezing. This is very well known because in winter-time bottles containing liquids may burst if the liquid turns into ice.

In order to study this process of crystallisation, some salt may be dissolved in water. This process of dissolving also interferes with the temperature. Let us take some salt which dissolves very quickly, and in a large quantity. Feeling the water before and afterwards reveals that the temperature goes down considerably. The process of dissolving needs warmth, so the liquid cools down. Common use is made of this law. In winter-time, to get rid of ice, salt is sprinkled on it, and after a short time, the ice dissolves. The salt is stronger than the ice. The salt wants to dissolve itself, and in doing so reduces the ice to water. The temperature can be many degrees below zero, still the water remains liquid because of its salt content. This can quite easily be demonstrated by dissolving sodium nitrate in water. The temperature may go down to -14 °C. Now we take a test tube; fill it with fresh water, and dip it in the water containing sodium nitrate; immediately the water in the test tube turns into ice.

The process of crystallisation is connected with changes in temperature. If out of a liquid something solid is deposited, something has also happened to the temperature. Therefore in studying crystallisation, all the changes in temperature have to be watched carefully.

A certain amount of salt may be dissolved* in cold water. If the water is heated, more salt can be dissolved[1] until the point is reached where the water cannot go on dissolving it. If still more salt is added it falls down as a deposit. The solution is then said to be saturated. This saturated salt solution is poured into shallow glass dishes. The solution cools. The salt cannot stay dissolved, because there is no longer the necessary warmth; and we can watch how crystallisation begins. If the salt solution cools **slowly**, the process of crystallisation is also slow, the tiny crystal begins to grow, and develops slowly into a bigger one.

If the salt solution is cooled **quickly**, the salt falls out quickly. We cannot watch the slow formation of a big crystal; we see a great many tiny crystals pouring down to the bottom of the glass dish in powder form.

The first factor we have to observe is **temperature;** the second is **time.** The third is **concentration:** how much salt has been dissolved in a certain amount of liquid.

One more factor we soon learn to observe, namely: the surroundings. Suppose the experiment is made with sodium sulphate, there is a hot saturated solution. The glass dish is carefully filled. The room is rather cool, so the crystallisation ought to start soon. You sit very quietly before the glass dish and wait. You wait a quarter of an hour, half an hour, nothing has happened; one hour goes by; nothing has happened. At last you lose your patience and get up, moving the chair. In that moment in a fraction of a second your salt solution turns into solid matter. What has happened? You kept perfectly quiet for an hour. The solution cooled slowly, undisturbed and reached the state of “undercooling”. Just because it was so perfectly quiet in the room, the salt remained dissolved even at much too low a temperature. You pushed back the chair, the immense tension which was in the saturated salt solution is broken, and the liquid turns into salt. There is no time for forming a beautiful crystal, not even time to form the hundred thousand tiny ones. If you are lucky you may find in your glass dish one beautiful starlike formation. Fig. 26 and 27 represent this phenomenon of slow and quick crystallisation. The forms we obtain in such experiments remind us very much of the way ice flowers form in winter time.

* (with some exceptions).

Fig. 26. – Slow Crystallisation of Sodium Sulphate.

Fig. 37. – Quick Crystallisation of Sodium Sulphate.

In my previous publications about crystallisation* I made a distinction between the "Form of Crystallisation" and the "Force of Crystallisation" The "form" appears during a more or less slow process. The "form" of the single crystal shows to which crystallographic system it belongs; if it is a hexagonal, rhombic or monocline etc. crystal. But behind the appearance of the specific form, there is the "force" which brings about every kind of crystallisation. One watches the action of this "force" which shoots through the solution as the arrow flies from the bow, if such a sudden formation occurs. Looking at the single crystal one may be able to say immediately what substance has been used. Looking at a quick crystallisation one is often unable to say which salt has been used. It may be sodium sulphate; it could equally well be acetate of lead.

We were very interested in the question whether there is **any difference between an experiment carried out during day time or during night time.** We studied this problem from various angles, also with the help of crystallisation. One possibility would be to repeat the experiments under exactly the same conditions during the day and during the corresponding hour in the night. The **concentration** of the solution; the **temperature** in the room; and of course also the **humidity** of the air must all be the same. All these conditions can be carefully arranged. The day experiment is begun at noon exactly; note is taken of the temperature and humidity; the beginning of the crystallisation is watched; the first tiny crystal forms after 15 minutes. The time when the crystallisation begins varies, of course, according to the salt, and according to the temperature and humidity in the room. The experiment is repeated at midnight, under exactly the same conditions. Nothing is changed except that the first experiment lasted from noon until midnight, and the other one started at midnight and ended at noon the next day. Then we compare: (1) the **size** of the crystals, whether both are alike, or whether one experiment has produced larger or smaller crystals than the other. (2) we may compare the **time** when the process of crystallisa-

* Mitteilungen des Biologischen Instituts am Goetheanum No. 1, 2, 3, 4, (Records of the Biological Institute at the Goetheanum in Stuttgart, Württemberg), 1935.

tion started; and finally (3) we may compare the **weight.** How much of the salt contained in the solution has solidified?

Such experiments have been carried out for many years each noon and each midnight with different salts: sulphate of iron, alum, sulphate of copper, and nitrate of lead. There is a difference between the crystallisation carried out during the night or during the day. Summarising the result briefly we may say: **during night the beginning of crystallisation is quickened and the amount of salt which crystallises is increased.**

Of course we cannot limit ourselves to the study of noon and midnight changes. One experiment may be started at 6 o'clock in the morning, and the other at the corresponding hour at night. But here a new problem has to be faced. What is the corresponding hour to 6 o'clock in the morning? Is it 6 o'clock in the evening? This question does not arise if one chooses noon and midnight. It is obvious that these two hours correspond. They are fixed by the sun. Either the sun has reached its highest point above the horizon, or the lowest beneath the horizon. Suppose we make our experiment in summer. The sun rises at 4 o'clock and sets at 8 o'clock. If we start the experiment at 6 in the morning, the sun has risen two hours before; and in the evening the sun has not yet set. It is two hours before sunset. Are these really the corresponding times? In the morning the sun has been 2 hours above the horizon, in the evening the sun is still 2 hours above the horizon.

Suppose we make the experiment in winter. The sun rises at 8 o'clock and sets at 4 o'clock. That means our experiment starts 2 hours before sunrise and two hours after sunset.

Let us try 10 o'clock in the morning and 10 o'clock in the evening. In summer it may mean 6 hours after sunrise and 2 hours after sunset. In winter it may mean 2 hours after sunrise and 6 hours after sunset. Is it reasonable to compare these experiments? Have we really the corresponding hours during the night? No. We cannot look at the clock and compare 10 with 10, or 3 with 3; they mean something different in the course of the year. We must look to the cosmos, to the position of the sun. Night begins when the sun sets; and day starts when the sun rises. We must compare the position of the sun below and above the horizon. When the sun is three hours above the horizon, the corresponding time will be, when the sun is 3 hours below the horizon. In Summer our clock will show that it is 7 in the morning and 23 in the evening. Or 8 in the morning (4 hours after sunrise) corresponds with midnight (4 hours after sunset). If we start to count from sunrise to sunset, we suddenly find that 8 o'clock in the morning has to be compared with midnight. Noon in summer means 8 hours after sunrise, and has its counterpart 8 hours after sunset; there we arrive again at sunrise. So we see it is not easy to find the real, corresponding hour. During the equinox when day and night are equal, there is no difficulty. Sunrise and sunset correspond; midnight and noon; 3 hours after sunrise (9 o'clock) correspond to 3 hours after sunset (9 o'clock) 4 hours after sunrise (10 o'clock) correspond to 4 hours after sunset (22 o'clock) and so on. But in summer we have 16 day hours to 8 night hours; and in winter we have 16 night hours to compare with 8 day hours.

The only solution to this problem is to have both in summer and winter, 12 hours of daytime, and 12 hours of night time. The old Chaldeans had this time measure. They divided the time between sunset and sunrise into 12 parts and the time between sunrise and sunset again into 12. Using this method we keep the 24 hours for the day – only the **hours have a different length. In summer we have long day-hours and short night hours, in winter we have short day hours and long night hours.**

This is again a very **natural** thing to do. Do we not feel in winter that the night is endlessly long; the hours drag so slowly? And how quickly the day goes by! We can never finish all we have to do! In Summer, how soon the night is over; the hours run away so fast. We must learn a very important thing – to recognize the **quality of each hour.**

Let us take the sunrise again at 4 in the morning, and the sunset at 8 in the evening; that makes 16 hours, each having 60 minutes, or **12 hours each having 80 minutes.** The night has 8 hours, each with 60 minutes, or **12 hours, each having only 40 minutes.** In winter the opposite takes place, the night hours have 80 minutes and the day hours only 40.

The study of plant growth has forced us to introduce the "natural year"; the study of crystallisation, the necessity to find the real, corresponding hour during the night, forces us to **create the introduction of the "natural hour".**

It is not comfortable; you cannot experiment automatically each day at the same hour; you have to reckon out every day the exact time according to the real sunrise and sunset. During the equinox we have day and night at equal length, also each hour has the same length of 60 minutes; but the length of the hour varies according to the length of the day, and the length of the day varies according to the position of the sun to the earth.

The following sketches illustrate what is meant by the "natural hour". The first sketch (Fig. 28) shows the picture we get during the equinox; each hour has the same length of 60 minutes; day and night have the same length of 12 hours.

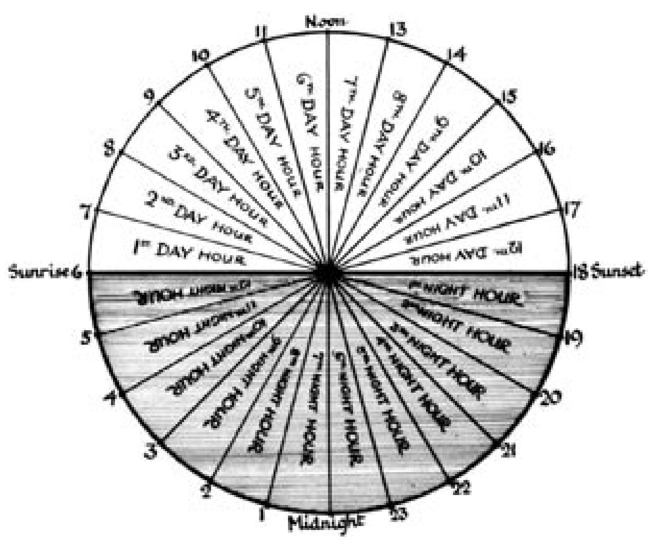


Fig. 28.

The second sketch (Fig. 29) illustrates what happens in summer, if we try to oppose the first hour of the day with the first hour of the night; 8 hours are left over during day time. We have no night hours to oppose.

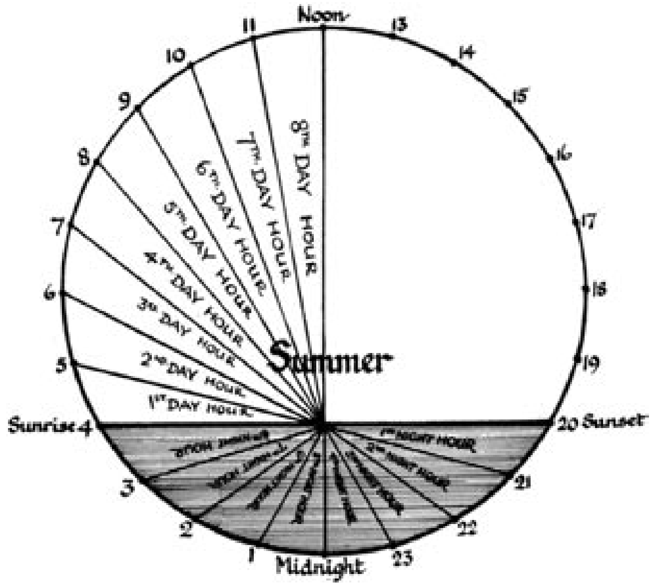


Fig. 29

The third sketch (Fig. 30) illustrates what would happen in winter. 8 hours during the night are too much.

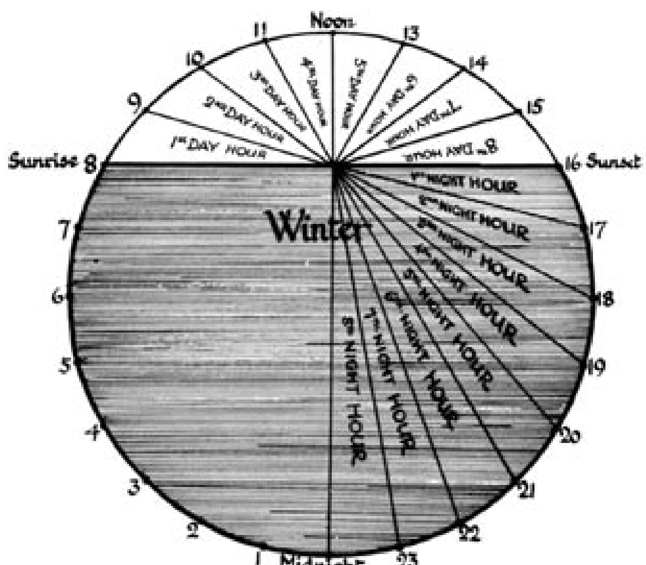


Fig. 30.

The fourth sketch (Fig. 31) illustrates the longer hours in summer-time during the day and the shorter hours during the night; but we get 12 hours for the day and 12 for the night. The first hour during the day lasts from 4 to 5.20 and the first hour during the night lasts from 20 to 20.40.

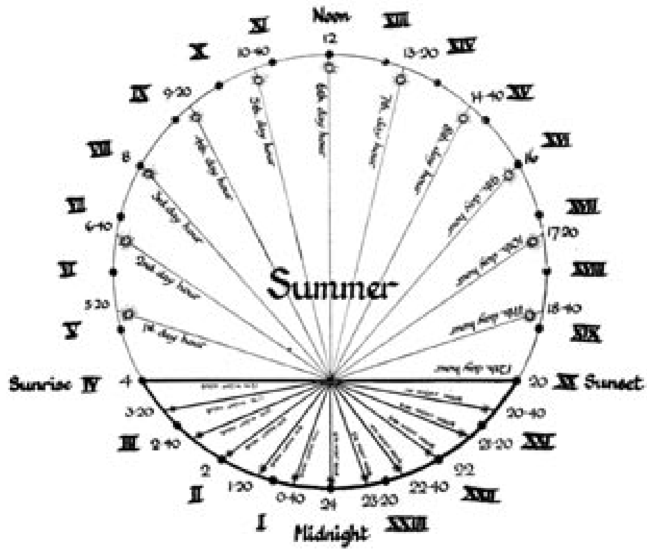


Fig. 31.

The fifth sketch (Fig. 32) illustrates, during winter, the short day hours and the long night hours. The first day hour lasts from 8 to 8.40 and corresponds to the first night hour which lasts from 16 to 17.20.

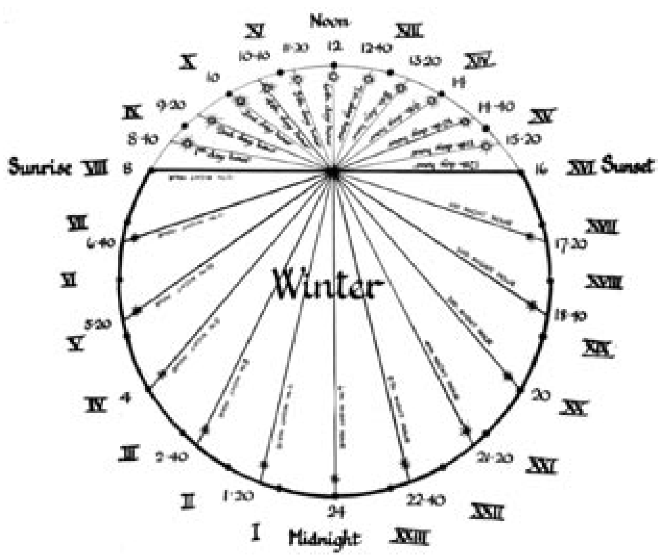


Fig. 32.

Of course these sketches change again and again according to the changes in sunrise and sunset. But that also means the real times may be compared in an exact experiment, if we want to study the changes which happen, hour after hour, according to summer and winter, spring and autumn.

These experiments have been carried out for years, to compare the crystallisation of at least four different metal salts during day time and at the corresponding hour during the night, with the help of the "natural hour" system. If one does this for years, it is astonishing what a new sensitiveness for "time" one acquires. One begins to be aware of the different quality each hour has during day or night in summer or in winter.

Another way to study crystallisation is to go on incessantly each hour, every day and night, and then to compare the results of the "conventional hours" with the result of the "natural hours".

All these experiments have been carried out. The results are, as I summarised briefly before: during the night crystallisation begins more quickly, and the weight is greater. It is impossible to go into details here.

Still these experiments are not quite satisfying. One part of the experiment is **artificial.** Can we really say that we study the influence of day and night and the different seasons, if we establish an artificial temperature and humidity? The natural difference of day and night consists also in a change of temperature and humidity, and the difference of Summer and Winter necessarily has these small daily differences in a much higher degree. If **we want to follow up the steps nature performs, we cannot create artificial conditions in the laboratory.**

How can we find the difference between crystallisation in Winter and Summer, if we make them in a room which is kept, Summer and Winter, at the same temperature? We create an artificial summer during winter and we find that we have some more experiments to carry out. The one part has to be done in the laboratory the other part in the open. One series of experiments stood every day in summer and winter outside the laboratory on the windowsill, and another one on the surface of the soil in the garden in a quiet spot.

In a cold winter it happens that not only salt crystals are formed, but the rest of the solution is also frozen. There is one exception: Sulphate of iron, sulphate of copper and alum may freeze, but even during very cold winters, nitrate of lead did not freeze. These experiments in the open, may be compared with all the others carried out under artificial conditions in the laboratory.

Again we may doubt whether we are getting the right result, considering how much crystallisation is influenced by changes in temperature, if we submit our experiments to such big changes and even to the chance of freezing. The conditions are "natural" but we know everything that can be said against them. Where can we find "**natural conditions**", which are stable summer and winter, the whole year round, so that we can say the changes are not due partly to the influence of temperature?

Beneath the surface of the soil! If we look at our temperature chart some metres below the surface of the soil, we find nearly no change in temperature summer and winter, or only a very slight one. It is quiet; it is always dark; we have the same humidity, and only natural conditions.

For one year every day crystallisation was started at the same time inside the laboratory, outside the window, on the surface of the soil, and 1-16 metres deep, below the surface.

Each day fresh solutions had to be prepared, containing always the same concentration of sulphate of iron, sulphate of copper, alum, and nitrate of lead. These solutions were put in thermos flasks and poured into the glass dishes with a measuring glass, so that always the same amount of solution was used. Of course this had to be done below the surface of the soil, on the spot where the crystallisation had to take place. The next day one series of glass dishes containing the finished crystallisation came up and the fresh experiments started. The finished crystallisations came into the laboratory, the remaining liquid was put away, the crystals carefully lifted out of the glass dish, put on filter paper to dry, then each experiment was weighed.

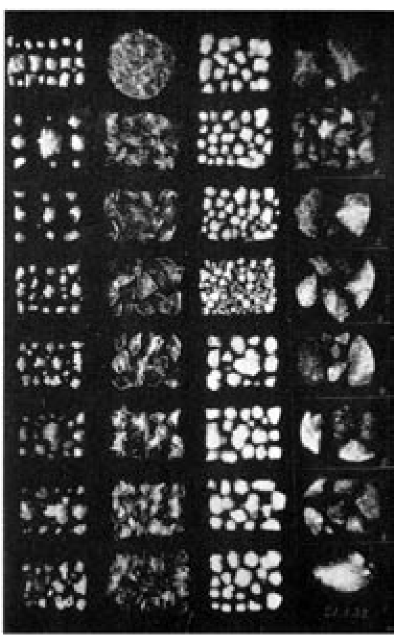
60 glass dishes were placed below the surface.
 4 on the surface of the soil. 4 outside the window.
 4 in the laboratory.
———————————
72 crystallisations each day.

After the weight had been recorded, the crystals were laid out on black paper and photographed.

In following years the experiments were carried out on alternative days.

Meanwhile other experiments were made, dealing with crystallisation with chloride of quicksilver and many other salts. Only the 4 above mentioned salts were used uninterruptedly.

As already mentioned it is impossible to give a full account here of these numerous experiments (72 x 365 = 26,280 a year). It is only possible to give a few examples and then to summarise the result. Figs. 33 A and B represent the photograph of one such experiment in January, 1932.



0 m.
1 m.
2 m.
3 m.
4 m.
5 m.
6 m.
7 m.

Fig. 33 A

8 m.
9 m.
10 m.
11 m.
12 m.
13 m.
14½ m.
16 m.

Fig. 33 B

Crystallisation carried out January 21st, 1932 with Nitrate of Lead, Sulphate of Copper, Alum and Sulphate of Iron

It is seen that the crystals in the first column vary in size, and apparently also in quantity, according to the different depths of the soil. Each square contains the crystals of one experiment; the first square on the top left side represents nitrate of lead at the surface of the soil; underneath, nitrate of lead crystallised one metre below the surface of the soil, underneath again, crystallised 2 metres below the surface and so on. In the second column we find the crystals of copper sulphate; in the third, crystals of alum; and in the fourth, the crystals of iron sulphate. The actual figures of the actual quantities are:

	Lead nitrate	Copper sulphate	Alum	Iron sulphate
Grams	6.3 = Surface	6.1 = Surface	7.8= Surface	6.5 = Surface
„	7.9 = 1 m.	6.7 = 1 m.	5.3 = 1 m.	7.9 = 1 m
„	5.8 = 2 m.	5.0 = 2 m.	5.2 = 2 m.	5.8 = 2 m.
„	4.3 = 3 m.	6.2 = 3 m.	4.8 = 3 m.	7.3 = 3 m.
„	4.2 = 4 m.	4.4 = 4 m.	5.2 = 4 m.	7.2 = 4 m.
„	5.0 = 5 m.	4.7 = 5 m.	7.5 = 5 m.	6.5 = 5 m.
„	5.5 = 6 m.	5.5 = 6 m.	6.1 = 6 m.	7.5 = 6 m.
„	4.2 = 7 m.	5.2 = 7 m.	7.2 7 m.	5.5 = 7 m.
„	4.8 = 8 m.	4.8 = 8 m.	6.2 = 8 m.	4.8 = 8 m.
„	4.3 = 9 m.	4.8 = 9 m.	6.2 = 9 m.	7.3 = 9 m.
„	4.2 = 10 m.	6.2 = 10 m.	8.0 = 10 m.	6.2 = 10 m.
„	4.0 = 11 m.	3.1 = 11 m.	5.1 = 11 m.	7.8 = 11 m.
„	3.9 = 12 m.	4.9 = 12 m.	5.8 = 12 m.	7.6 = 12 m.
„	4.3 = 13 m.	4.5 = 13 m.	4.7 = 13 m.	6.3 = 13 m.
„	6.0 = 14½ m.	5.2 = 14½ m.	7.4 = 14½ m.	7.4 = 14½ m.
„	6.4 = 16 m.	5.5 = 16 m.	9.0 = 16 m.	6.4 = 16 m

Another experiment about a month later is represented in Fig. 34 A and B.

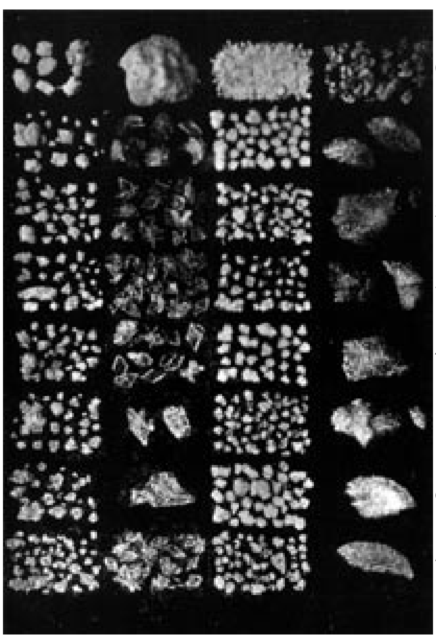


Fig. 34 A

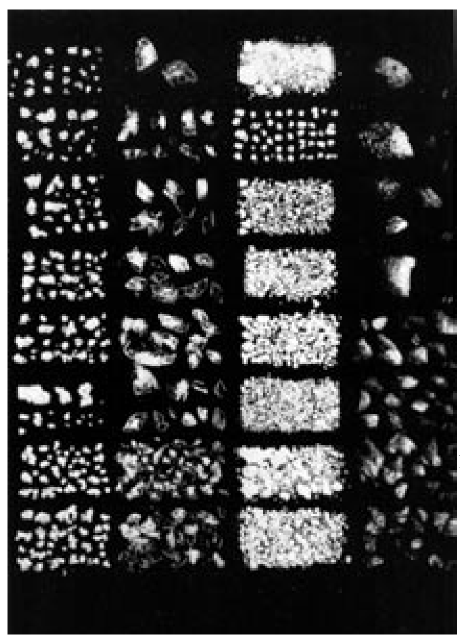


Fig. 34 B

Crystallisation carried out February 13th, 1932

If we compare these two months as represented by these two photographs, we notice that a greater amount of nitrate of lead has crystallised on the surface of the soil in February, than in January; the same has happened with sulphate of copper. We can even notice that the copper has frozen, forming nearly one solid block. The single crystals disappear in that formless cluster. Alum is more pulverised; and with regard to the iron sulphate we are not even able to spread out the full amount of crystallised salt in the tiny square allotted to each salt.

Copper sulphate has partly formed beautiful, clear crystals.
Alum varies between more or less pulverised crystallisations, according to the various depths.
Sulphate of iron forms huge clusters of beautiful crystals, then decreases; and between 12 to 16 metres the crystals become considerably smaller. The amount of salt crystallised, expressed in grams, is the following:

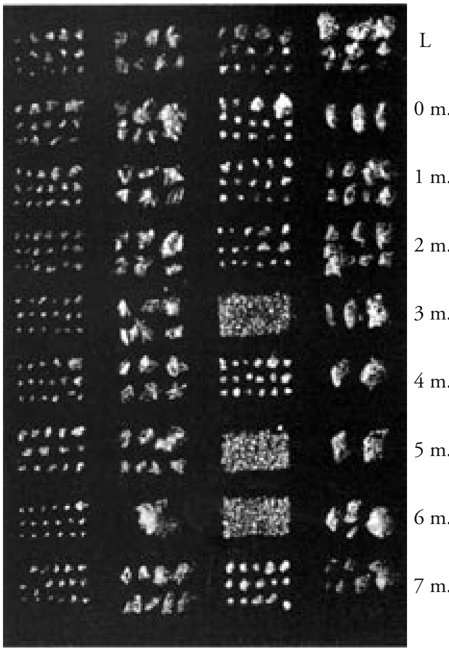
	Lead nitrate	Copper sulphate	Alum	Iron sulphate
Grams	12.4 = Surface	10.5 = Surface	8.5 = Surface	14.7 = Surface
„	7.9 = 1 m.	6.2 = 1 m.	8.5 = 1 m.	7.9 = 1 m.
„	8.4 = 2 m	5.7 = 2 m.	6.8 = 2 m.	8.2 = 2 m.
„	7.2 = 3 m.	6.2 = 3 m.	5.0 = 3 m.	7.7 = 3 m.
„	6.5 = 4 m.	4.6 = 4 m.	7.1 = 4 m.	6.3 = 4 m.
„	7.2 = 5 m.	4.2 = 5 m.	6.5 = 5 m.	6.3 = 5 m.
„	5.6 = 6 m.	3.3 = 6 m.	7.5 = 6 m.	5.8 = 6 m.
„	4.4 = 7 m.	5.4 = 7 m.	7.2 = 7 m.	5.1 = 7 m.
„	3.6 = 8 m.	3.6 = 8 m.	5.6 = 8 m.	4.1 = 8 m.
„	5.2 = 9 m.	4.1 = 9 m.	5.0 = 9 m.	6.1 = 9 m.
„	5.1 = 10 m.	5.0 = 10 m.	6.7 = 10 m.	6.4 = 10 m.
„	3.8 = 11 m.	5.5 = 11 m.	3.5 = 11 m.	5.1 = 11 m.
„	4.6 = 12 m.	6.8 = 12 m.	4.6 = 12 m.	9.4 = 12 m.
„	3.8 = 13 m.	5.9 = 13 m.	4.1 = 13 m.	10.5 = 13 m.
„	6.2 = 14½ m.	6.9 = 14½ m.	5.9 = 14½ m.	13.5 = 14½ m.
„	7.5 = 16 m.	7.2 = 16 m.	6.2 = 16 m.	12.2 = 16 m.

Now we return to the photograph and find the interesting fact that **quality** and **quantity do not coincide.** The beautifully shaped, and clear, transparent crystals of copper sulphate 6 metres below the surface of the soil, represent only, 3 .3 grams of salt; whereas the less beautifully shaped tiny crystals at 14½ metres below the surface represent 6-9 grams of salt.

We find the same phenomenon in looking up the crystallisation of iron sulphate. The big crystal at 4 metres below the surface has a weight of 6.3 grams; and the smaller crystals at 14½ metres represent 13.5 grams. Beautifully shaped crystals are nearly always less heavy. We must say that beauty is a certain quality in crystallisation. We may perhaps prefer a beautifully shaped crystal to a less beautifully shaped one. Then we have less material. If we want the bigger quantity than we get less beauty.

Quality and quantity differ in every field of life. In plant life we find the difference expressed in a huge cabbage which looks marvellous – but if we look for the quality, it has not so much nutritive value as a smaller one. But we will refer to this in another chapter of this book.

Between January and February we note that the crystallisation increases in weight. I am sorry that I cannot include in this book more of this interesting material. I have to limit myself to only a few examples. Fig. 35 A and B represents the photograph of an experiment carried out in the month of July, and Fig. 36 A and B another one carried out in the month of August.



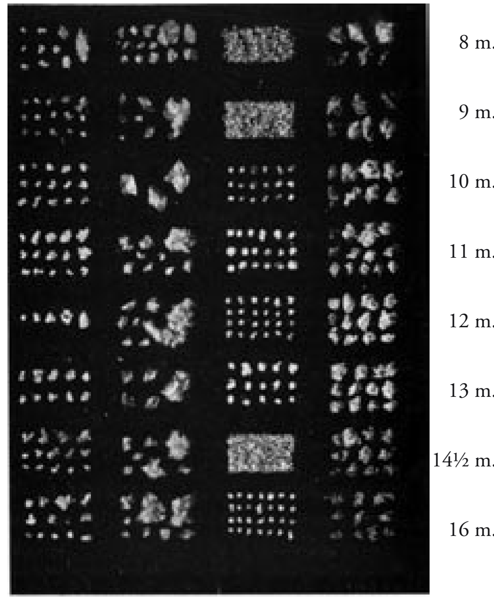
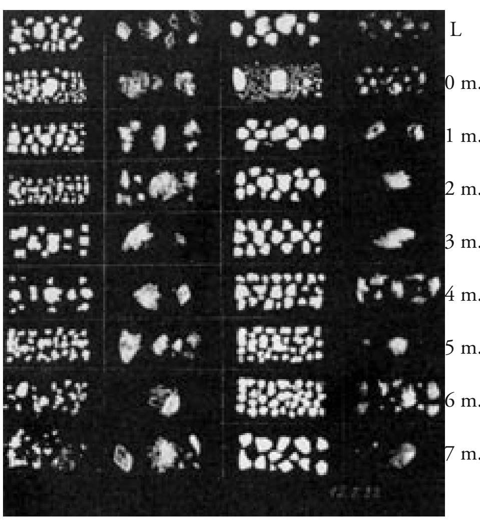


Fig. 35 A *Fig 35 B*

Crystallisation carried out during July 11th, 1932.



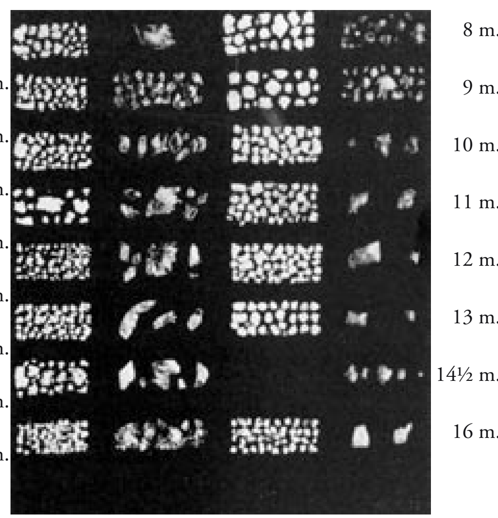


Fig. 36 A *Fig 36 B*

Crystallisation carried out during August 15th, 1932.

We see immediately that the quantity is considerably smaller in July and August than in January and February. The actual figures for the weight of these two experiments are given below:

	Lead nitrate	Copper sulphate	Alum	Iron sulphate
Grams	4.4 = Lab.	4.5 = Lab.	3.2 = Lab.	5.6 = Lab.
„	4.2 = Surface	4.2 = Surface	3.4 = Surface	4.6 = Surface
„	3.7 = 1 m.	4.3 = 1 m.	3.1 = 1 m.	6.3 = 1 m.
„	2.8 = 2 m.	4.1 = 2 m.	2.9 = 2 m.	5.2 = 2 m.
„	2.4 = 3 m.	4.6 = 3 m.	2.7 = 3 m.	4.1 = 3 m.
„	3.1 = 4 m.	3.9 = 4 m.	2.6 = 4 m.	4.2 = 4 m.
„	2.3 = 5 m.	3.4 = 5 m.	3.4 = 5 m.	4.9 = 5 m.
„	2.1 = 6 m.	3.2 = 6 m.	4.5 = 6 m.	4.0 = 6 m.
„	2.1 = 7 m.	4.1 = 7 m.	4.8 = 7 m.	3.2 = 7 m.
„	2.4 = 8 m.	3.8 = 8 m.	4.7 = 8 m.	5.1 = 8 m.
„	2.8 = 9 m.	3.4 = 9 m.	4.9 = 9 m.	6.1 = 9 m.
„	3.1 = 10 m.	3.7 = 10 m.	3.5 = 10 m.	5.4 = 10 m.
„	3.4 = 11 m.	3.3 = 11 m.	3.8 = 11 m.	5.8 = 11 m.
„	1.1 = 12 m.	4.1 = 12 m.	3.3 = 12 m.	5.7 = 12 m.
„	2.3 = 13 m.	2.9 = 13 m.	3.5 = 13 m.	5.3 = 13 m.
„	3.2 = 14½ m.	3.8 = 14½ m.	4.1 = 14½ m.	5.0 = 14½ m.
	3.2 = 16 m.	4.6 = 16 m.	4.3 = 16 m.	4.8 = 16 m.

Weight of the crystals on July 11th, 1932

	Lead nitrate	Copper sulphate	Alum	Iron sulphate
Grams	5.5 = Lab.	4.0 = Lab.	4.0 = Lab.	1.7 = Lab.
„	4.2 = Surface	3.8 = Surface	3.3 = Surface	1.0 = Surface
„	4.0 = 1 m.	2.5 = 1 m.	3.5 = 1 m.	1.4 = 1 m.
„	2.9 = 2 m.	3.3 = 2 m.	3.2 = 2 m.	2.3 = 2 m.
„	3.6 = 3 m.	3.3 = 3 m.	4.5 = 3 m.	2.2 = 3 m.
„	3.9 = 4 m.	3.2 = 4 m.	4.5 = 4 m.	2'5 = 4 m.
„	3.8 = 5 m.	3.4 = 5 m.	3.5 = .5 m.	2.0 = 5 m.
„	3.5 = 6 m.	2.6 = 6 m.	3.8 = 6 m.	3.0 = 6 m.
„	2.8 = 7 m.	3.8 = 7 m.	4.8 = 7 m.	3.2 = 7 m.
„	4.7 = 8 m.	2.3 = 8 m.	4.6 = 8 m.	2.7 = 8 m.
„	2.3 = 9 m.	3.0 = 9 m.	3.6 = 9 m.	2.1 = 9 m.
„	3.7 = 10 m.	2.5 = 10 m.	4.7 = 10 m.	1.7 = 10 m.
„	3.3 = 11 m.	2.5 = 11 m.	4.8 = 11 m.	1.9 = 11 m.
„	3.9 = 12 m.	3.7 = 12 m.	4.9 = 12 m.	2.5 = 12 m.
„	3.4 = 13 m.	3.3 = 13 m.	3.9 = 13 m.	1.7 = 13 m.
„	3.1 = 14½ m.	3.5 = 14½ m.	0.0 = 14½ m.	1.1 = 14½ m.
	4.2 = 16 m.	4.2 = 16 m.	3.4 = 16 m.	1.6 = 16 m.

Weight of the experiment carried out 15th August, 1932.

The comparison between the weight in the month of February and August proves that there is an immense difference between the forces of crystallisation in nature during Summer and Winter. For iron we get in February, 14½ metres below the surface, 15 grams; in August only 1 gram. Of course it would be impossible to pass such a judgment in looking only at the few examples which we are able to reproduce here. But in referring to the statistics of many years, we are able to say that there is a certain period during the course of the year in which the forces of crystallisation are stronger, and another period where these forces are less strong. A few charts follow here to elucidate this assertion:

Average weight during the 12 months 1930:

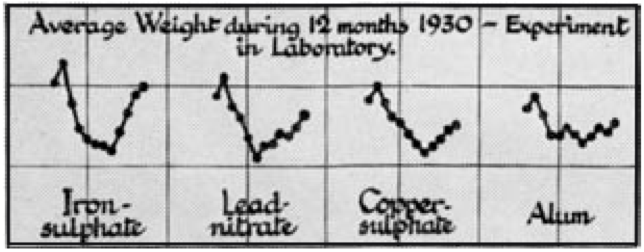


Fig 37. – Experiments carried out every day in the, laboratory.

The strongest effect is produced by the iron salt. Maximum weight in the month of February 13.0 grams, minimum weight between June and August = 2 grams.

Lead nitrate produced the greatest effect in the month of February with a maximum weight of 11 grams; minimum weight in the month of June = 1 gram.

Sulphate of Copper produced the greatest effect in the month of February with a maximum weight of 10 grams; minimum weight in the month of August with 1.5 grams.

Alum produced the greatest effect in the month of February with a maximum weight of 9 grams; minimum weight in the month of August with 3 grams.

Average weight during the 12 months 1930:

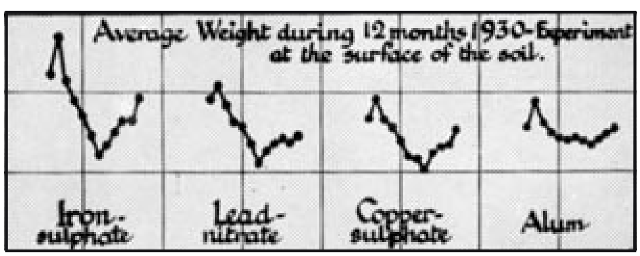


Fig. 38. – Experiment carried out on the surface of the soil.

Iron sulphate: maximum weight in the month of February with 17 grams; minimum weight in the month of July with 2 grams.

Lead nitrate: maximum weight in the month of February with 11 grams; minimum in the month of July with 1 gram.

Copper sulphate: maximum weight in the month of February with 9 grams; minimum weight in the month of August with 0-5 grams.

Alum: maximum weight in the month of February with 8 grams; minimum weight in the month of September with 3 grams.

Average weight during the 12 months of 1930:

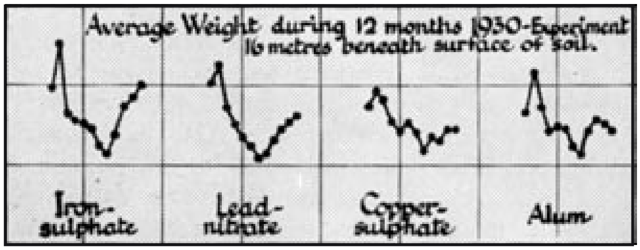


Fig. 39. – Experiments carried out 16 metres below the surface.

Iron sulphate: maximum weight during the month of February with 15 grams; minimum weight during the month of August with 2 grams.

Lead Nitrate: Maximum weight during the month of February with 13 grams; minimum weight during the month of July with 0.8 gram.

Copper sulphate: Maximum weight during the month of February with 10 grams; minimum weight during the month of August with 1.8 grams.

Alum: maximum weight during the month of February with 12 grams; minimum weight during the month of August with 1.5 grams.

If we compare the different years there are of course variations according to the particular character of the year. Sometimes the maximum weight reached for Iron sulphate is as much as 19 grams; sometimes the maximum is only 15 grams. The minimum may be as low as 0-5 grams; sometimes as high as 3 grams. But we always find that the **maximum of the crystallising forces is between January and February;** between June and August the crystals have scarcely any weight. They may look beautifully clear, the forms may be perfect; even lead, which is ordinarily more or less opaque, may become translucent, but there is no weight in the crystals; it is as if they are formed out of air.

Sometimes strange things happen. Why should we refrain from mentioning them? They were witnessed by my collaborators – but we were unable to take a photograph. Usually it is iron sulphate which may produce this strange phenomenon in Summer. There is no crystallisation at all – and yet you see the crystal. But it is only a shadow-crystal. We do not know if any body else has ever observed this phenomenon. If you take the glass dish very carefully from the place where it has been for 24 hours, some metres below the surface of the soil (sometimes it may even be very close to the surface), then you observe at the bottom of the glass dish a thin layer of sediment, and in this sediment the perfect shape of one or more rhombic crystals; only it is an **empty form outlined** in the sediment; the ghost of a crystal. We never succeeded in getting it unharmed into the laboratory. It is not possible to move the glass dish without shaking it, and the slightest movement that takes place in the liquid dissolves that shadow-crystal.

There is no other explanation to be found, than that the **forces which would have been able to form the crystal went through the solution, but the material was not ready to enter the form.**

On a higher level in nature you may observe a similar phenomenon, that a form may be built up, but **life** does not enter. In the mineral kingdom you may find the force working, but the material is not ready to use the form. This is a very strange but highly interesting phenomenon, which we sometimes find, and which enables us to look more closely into the inner being of nature, and fills our souls with reverence.

We must try to understand these two forces in nature: the force of crystallisation and the force of vegetation. Our experiments with wheat plants carried out for the purpose of studying the influence of the moon, show that maximum growth appears between June, July and August. That is just the period when the forces of crystallisation are at their minimum. When the plants are growing and growing, matter cannot contract and form heavy crystals.

We may compare the process of growth with the process of crystallisation by exchanging these words for two others: "**expansion**" and "**contraction**". These are similar polarities. Matter consolidates itself out of the liquid state; it falls out in large quantities and very quickly; it has not the time to form beautiful crystals which slowly ripen to their perfection, just during that time of the year – January to February – when the plants are resting, when the seeds are waiting in the soil for the Spring. When the forces of vegetation withdraw, then crystallisation is at its culminating point. Even the water is overpowered by its strength and turns into solid ice; ice flowers quickly form on the windows; snow stars fall from heaven and cover the soil with a white blanket; and underneath the seeds are waiting. The vegetation is at its lowest point. Is it not wonderful to understand how nature works with such immense wisdom; how the forces are distributed in the Universe?

Every farmer and gardener should understand these forces because he has to deal with nature for the welfare of mankind. He has to know the inner qualities of Summer and Winter; of Sun and Moon and Stars, and how they enter into plant life, changing the quantity and quality of his crops. A severe winter breaks up the soil differently from a mild one; and in a different strength the soil answers later on to the forces of vegetation. You cannot really grow food for mankind, if you only follow automatically the advice of the chemist, and sprinkle the soil with fertilizer. Never can any artificial fertilizer replace nature's work.

Chapter VI.
PLANETARY INFLUENCES UPON CRYSTALLISATION.

Here I can merely mention the fact that there is a possibility of studying the planetary influences upon crystallisation. A detailed account of this will follow in the book “The Seven Planets and the Seven Metals” which I hope to be able to publish one day. But having dealt with this great rhythm of Winter and Summer, the two streams of the forces of Vegetation and Crystallisation, I cannot omit to point out that the influences of the different planets are interwoven in this great yearly rhythm. If we carry out experiments with salt solutions like Lead nitrate, or Copper sulphate, or Iron sulphate, day after day for a year, we learn to know the **big rhythm of the Year.**

The experiments carried out **hour after hour day and night,** reveal the **smaller rhythm of day and night,** which is interwoven in the bigger one of Summer and Winter.

In this smaller rhythm of day and night, we find again interwoven the **interference of the planetary influences.** Here is just one example.

We take a certain concentration of Lead nitrate and, after our long experience, we know that this solution, containing so much lead salt, takes in the month of June, between 10 and 12 in the morning, about 12 to 13 minutes to start crystallisation. After two hours of crystallising we may expect a certain amount of crystallised salt. We know these figures exactly, because the same experiment has been carried out hour after hour during the whole month. We also know, with the same certainty, the figures and times we have to expect in the case of other metal salts used at the same time. Suppose there is a conjunction of the planet Saturn with the Moon at mid-day – then we have to expect an interference in the usual course of the crystallising process.

The experiments are carried out as usual every hour, but when the time of the conjunction draws near we add more control dishes, and repeat the experiments at intervals of \ hour; and in the last half hour before the conjunction a fresh experiment is started every 5 minutes. After the conjunction we still go on with the experiments every 5 minutes. Then ½ hour later we increase the interval again to ½ hour between each experiment, until we see that the normal conditions are restored.

The effects of a conjunction between Saturn and Moon are only to be found in the solution containing lead. Copper and Iron salts are not affected.

The conjunction nearly always delays the beginning of the crystallisation; sometimes it may even happen that no crystallisation at all takes place. The amount of salt which is deposited is greatly reduced.

It is not advisable for the study of planetary influences (conjunctions or oppositions) to prepare the solution in advance and then only pour it into the dishes for crystallising. It is important to dissolve the salt at the exact times and then put it into the glass dish for the crystallisation. A careful observation will show, that the salt also **takes a different length of time for the dissolving process during a conjunction or opposition.**

Chapter VII.
OTHER PLANETARY INFLUENCES ON PLANTS.

Having explained the influence of the moon on plant growth, the question arises: how about the other planets? That the sun affects plant life nobody doubts, but if we find that the moon enters into the germination and growth process of the plants, why should it not also be possible to find an influence proceeding from Venus, Mercury, Mars, Jupiter or Saturn?

Once there was an ancient knowledge of the connection between plants and stars. This knowledge we have lost. We have to confess this in all honesty: we do not know to-day how, or even whether, the stars have anything to do with the different plants. It does not even help us very much to look into old books, for what we read there we cannot understand. It does not fit in with our scientific world conception. I remember vividly having a long talk with an English scientist who came to see the Biological Institute, and to discuss my publication about the "Influence of the Moon on Plant Growth". "Your experiments are very convincing. But if the moon has that influence, what about the other planets? Do you know Culpeper's Herbal? There must be something in it, I am quite sure. But I cannot understand it".

"Culpeper's* **Complete Herbal**, consisting of a comprehensive description of nearly all British and foreign herbs, with their medicinal properties, and directions for compounding the medicines extracted from them" is a very interesting book. It is not even a very old book. Culpeper has a certain system in his descriptions of the single plants:

1. Description: of the plant
2. Place: where the plant grows
3. Time: when the plant flowers and ripens
4. Government and virtues: to which planet the plant belongs, and what its specific qualities are.

We read in this book for instance, that Aconite is under the government of Saturn; or "Angelica is an herb of the Sun in Leo, let it be gathered when he is there, the Moon, applying to his good aspect; let it be gathered either in his hour, or in the hour of Jupiter: let Sol be angular: observe the like in gathering the herbs of other planets and you may happen to do wonders".

Or: "Kidneywort (Cotyledon Umbilicus), Government and Virtues: Venus challenges the herb under Libra".

"Oak Tree: Government and Virtues: Jupiter owns the tree".

"Maple Tree: Government and Virtues: is under the Dominion of Jupiter".

Culpeper not only tells under which planet the plant is placed, but also says that the herbs should be gathered at a certain constellation. But he does not fully explain what has to be done. The last chapters of the herbal are dedicated to prescriptions for making syrups, etc. Chapter 1: Of Leaves of Herbs or Trees, tells us under point 5: "such as are astrologers (and indeed none else are fit to make physicians) such I advise; let the planet that governs the herb be angular, and the stronger the better, if they can in herbs of Saturn, let Saturn be in the Ascendant; in the herbs of Mars, let Mars be in Midheaven; for in those houses they delight; let the Moon apply to them by good aspect and let her not be in the houses of her enemies. If you cannot well stay till she applies

* Nicholas Culpeper, born 1616.

to them, let her apply to a planet of the same triplicity; if you cannot wait that time either let her be with a fixed star of their nature".

To understand the herbal of Culpeper we must not only understand Botany and Medicine, we must also have a knowledge of Astronomy and Astrology.

If we take instead of Culpeper's Herbal an up-to-date modern book about medicinal herbs, we will of course also find the description of the specific plants; then we arc told where the plants grow, and which is the best time to collect them. Sometimes we are told how these plants have been used in antiquity or in the Middle Ages, with historical notes reaching as far back as the 1st century B.C.

We may even be told about the different use in allopathic or homoeopathic medicine. But we are not told about the planetary forces which rule and govern the plants, or how the position of the planets must be considered for the purpose of gathering and drying them. Instead of this, something new is introduced in the modern herbals: the **science of Chemistry.** We are told the chemical constituents. Sometimes we get quite a long list of complicated names and formulae. It seems that Astronomy has been exchanged for Chemistry. But are we really the wiser for it?

An attempt to solve some of these problems:

It can be proved with many experiments, demonstrated in the previous chapters, that the moon influences plant growth. Nobody doubts the influence of the sun. Is there any possibility of proving that other planets also influence plant life?

We started experiments in this direction with the **Sunflower** (Helianthus annuus) 1928. Why is this flower called Sunflower? It was introduced probably from Mexico in about 1569, and Linnaeus formed the name from the Greek "helios" = Sun, and "anthos" = flower, comparing the huge yellow flowers and their radiating petals with the Sun. The flowers always turn their "heads" in the direction of the sun. So we are told; and it seems to be more or less an external point of view, it was the form of the flower, which made Linnaeus choose the name.

Rudolf **Steiner** mentioned in his lectures for farmers and gardeners how the cosmic forces of the sun are supported by the various planetary forces of Jupiter, Mars, Saturn, and that we may see some of these forces in the **colour** of flowers. For instance in the **red** rose, we see the forces of the planet **Mars:** in **blue** flowers the force of **Saturn;** and in **white** and **yellow** flowers the forces of the planet **Jupiter.** He even mentioned the sunflower, saying that the name is not quite correctly chosen. According to the colour this plant should be called a **Jupiter flower.**

These statements of Rudolf Steiner gave me a certain cue for the starting of my experiments. Of course I knew that these experiments would take years to produce any reliable result.

With the following simple account, we leave it to the reader to judge for himself the value of these experiments.

How may we discover if the sunflower is in connection with the planet Jupiter? Jupiter is the giant of our planetary system and is easily recognised by its quiet and brilliant white light which outshines all other planets. Its volume is about 1300 times that of the earth. From ancient times the planet Jupiter has been related to the metal **Tin.** Jupiter or Zeus, the God who hurls the lightning flashes and lets the thunder speak, was held to be the god of the greatest among the planets; the metal tin was also connected with him. In the Middle Ages without more ado, the name Jupiter was applied to tin, and his planetary sign given to the metal. This custom still obtained in much more recent times, but was supported only by tradition. It has already been mentioned in a previous chapter that experiments have been carried out for studying the planetary influences on metal salts. To-day we can prove with sufficient material that this influence exists. In 1932 we published a book "Jupiter and Tin" in which some of the material is reproduced. Tin and Jupiter are so to say, a unity. **Solutions of tin are susceptible to influences of the planet Jupiter.** If we take this as an established fact, we may proceed to the next step and ask the question: **has tin anything to do with the sunflower?** Can we establish perhaps a proof, that the sunflower has a certain inclination for tin?

With this question in our minds we started the first very simple experiment. The German biologist Professor Naegeli published in a scientific treatise about the olygodynamic effect of metals. That means metals are able to radiate certain forces in a liquid. A copper coin in a vessel containing water changes the quality of the water. Later on it was found out, that silver wire produced an effect harmful to bacteria, etc. Taking these well established scientific facts into consideration, I used specially made square dishes of various metals: lead, tin (pure Banka tin), iron, a thin sheet of pure gold, copper and silver. Quicksilver being in a liquid state had to be poured into a glass dish. The different metal dishes were filled with rain water (also poured on to the top of the quicksilver) and then seeds of the sunflower were inserted. The sunflower had been grown the previous year in our experimental garden. All the seeds used for this experiment were taken from the same sunflower. Each metal dish contained 20 seeds. They were all exposed to the same temperature and light. It was a very simple experiment, but had to be carried out very carefully. We watched the beginning of the germination to see in which metal dish the seeds would germinate first.

After	24	hours	germination	started	on the		Tin
,,	48	,,	,,	,,	,,		Quicksilver
,,	60	,,	,,	,,	,,		Iron
,,	68	,,	,,	,,	,,		Copper
,,	96	,,	,,	,,	,,		Gold
,,	80	,,	,,	,,	,,		Silver
,,	75	,,	,,	,,	,,		Lead

That was an interesting beginning, that the sunflower seeds selected the tin dish in preference to all the others. It was rather surprising that the second best was quicksilver.

The second step was to treat sunflower seeds with different solutions of tin and quicksilver salts. We combined the experiment with our studies on the effect of Smallest Entities (see Part II " The introduction of ' Smallest Entities ' into Agriculture ") and prepared the solutions from the first up to the 60th potency. The third substance we tried was chloride of gold, also first to the 60th potency; and there were 100 control seeds treated only with rain water.

We obtained the following result: The usual effect of potentising was observed: that the first potencies are smaller than the water control, then there is slowly increasing growth, and again decreasing growth. We reach the first minimum; then again growth increases to a maximum, and decreases to a second minimum, and so on. To be sure about our water control plants we begged permission to measure all the sunflowers growing in private gardens in the surroundings of the Biological Institute. The average growth we found in all the gardens was 2-65 m. Our own water control plants kept the same level. Maxima and Minima of the sunflowers growing under the influence of the potentised metal salt solutions differed enormously:

Water control plants average growth:	2.65 metres.
Minimum of the tin series:	1.38 metres
Maximum ,, ,, ,,	3.65 ,,
Minimum of the quicksilver series:	1.15 metres
Maximum ,, ,, ,,	3.56 ,,
Minimum of the gold series:	0.90 metres
Maximum ,, ,, ,,	2.90 ,,

If we look only at the length of the plants, we must say that the plants treated with quicksilver produced nearly the same effect as those treated with tin. But if we look from the figures to the real plant we get a different impression. There is a great difference between the sunflowers treated with tin or with quicksilver. The tin sunflowers looked healthy and strong; they had thick stems which possessed a certain amount of flexibility. You may bend the stem and the flower springs back. The quicksilver sunflowers however, reaching nearly the same height, had thin stems, looked rather poorly, and the stem was not flexible. If you tried to bend the stem, it broke like glass.

That specific change in the whole habit of the plant is to be seen from the first until the 60th potency!

The gold series produced on the whole, much smaller plants which looked very poorly.

We were quite satisfied with this experiment. It showed that sunflowers were favourably affected by a tin treatment. Of course this was not yet a sufficient proof to justify saying that the sunflower is influenced by the planet Jupiter. We are perfectly aware of this . Until now we can only state that we can prove with ample material that tin solutions are influenced by the planet Jupiter and sunflowers seem to select tin solutions, which influence their growth favourably.

The following year we decided to go on with these experiments, not only repeating the treatment with tin and quicksilver potencies, but also studying the influence of the other metal salt solutions, gold chloride, copper sulphate, iron sulphate, lead nitrate, and silver nitrate.

Each series was carried as far as the 60th potency and each potency was represented by 5 plants (= 300 sunflowers to each series). That makes, for the seven series, 2100 plants; and besides these there were also the water control plants. Of course we should like to give a detailed description of all these experiments and the highly interesting charts, showing the maxima and minima and how many flowers were borne by each stem, the diameter of the flowers, etc. We have to limit ourselves here, as we have for all the previously mentioned experiments. Every detail has been observed and duly noted. In summing up the result, we can only state the maximum growth for each series:

Maximum growth for the Water control plants:		2.75	metres
,, ,, ,, ,,	Silver nitrate series:	3.05	,,
,, ,, ,, ,,	Quicksilver chloride ,,	3.60	,,
,, ,, ,, ,,	Copper sulphate ,,	3.12	,,
,, ,, ,, ,,	Gold chloride ,,	2.85	,,
,, ,, ,, ,,	Iron sulphate ,,	3.22	,,
,, ,, ,, ,,	Tin chloride ,,	3.97	,,
,, ,, ,, ,,	Lead nitrate ,,	3.28	,,

Or we may arrange the figures differently, according to the decreasing or increasing growth, thus:

1.	Tin chloride	3.97 metres
2.	Quicksilver chloride	3.60 ,,
3.	Lead nitrate	3.28 ,,
4.	Iron sulphate	3.22 ,,
5.	Copper sulphate	3-12 ,,
6.	Silver nitrate	3-05 ,,
7.	Gold chloride	2-85 ,,

It really looks as if the sunflower has been wrongly named. Gold, as the earthly representative of the Sun, has the worst effect on this plant, and Tin, the representative of Jupiter, has the best.

The following year, we continued these experiments. Up to now we had tried to find out which metal salt influences the growth of the sunflower in the most favourable way. The answer was undoubtedly: **Tin.** We took another step forward on our long road and asked**: what happens if the sunflower seeds germinate during an opposition of the planet Jupiter with the Moon, or during a conjunction of the planet Jupiter with the Moon?**

Sunflower seeds were allowed to germinate during the opposition of Jupiter – Moon in rain water, and a series of 60 potencies with chloride of tin, was started at the same time. The next experiment was carried out during the conjunction of Jupiter and the Moon.

We obtained the following result:

Maximum growth during the	opposition-experiment	1.50 metres
	conjunction	2.50 ,,
Tin series during the	opposition	2.70 ,,
	conjunction	3.60 ,,

That seems to be a remarkable result, and it is worth while to follow this path further. It is a long way, and it will take many years, but at the end we shall be able to prove beyond doubt the connection of certain plants or plant families with specific constellations.

Similar experiments with Marigold (Calendula off.)

According to Dr. Steiner's assertion that the **colour** of the flower indicates certain planetary influences, the yellow sunflower is in reality a Jupiter flower; we chose another plant with yellow flowers in continuation of our studies. The Marigold is a well known plant which is found in nearly every garden. Culpeper describes it rather well: " The leaves are pretty thick and juicy, of a pale yellow-green colour, broader at the end than at that part next the stalk, somewhat clammy in handling; the stalks grow a foot or more high, beset with smaller leaves. The flowers grow singly at the end of the stalks, consisting of a border of gold yellow petals, set about the middle thrum, of a dark reddish fistular flosculi, of a strong somewhat resinous smell, standing in green scaly calyces. The seed is large and crooked, of a brownish colour. Government and virtues: the plant is hot and dry, therefore under the Sun".

We see that just the same happened to the marigold. It is placed under the sun, instead of under Jupiter in accordance with its colour. Our experiments were carried out exactly in the same way as for the sunflower, with all the different metal salts, and we obtained the **best result** with **tin chloride,** at the **conjunction** of **Jupiter and the Moon.**

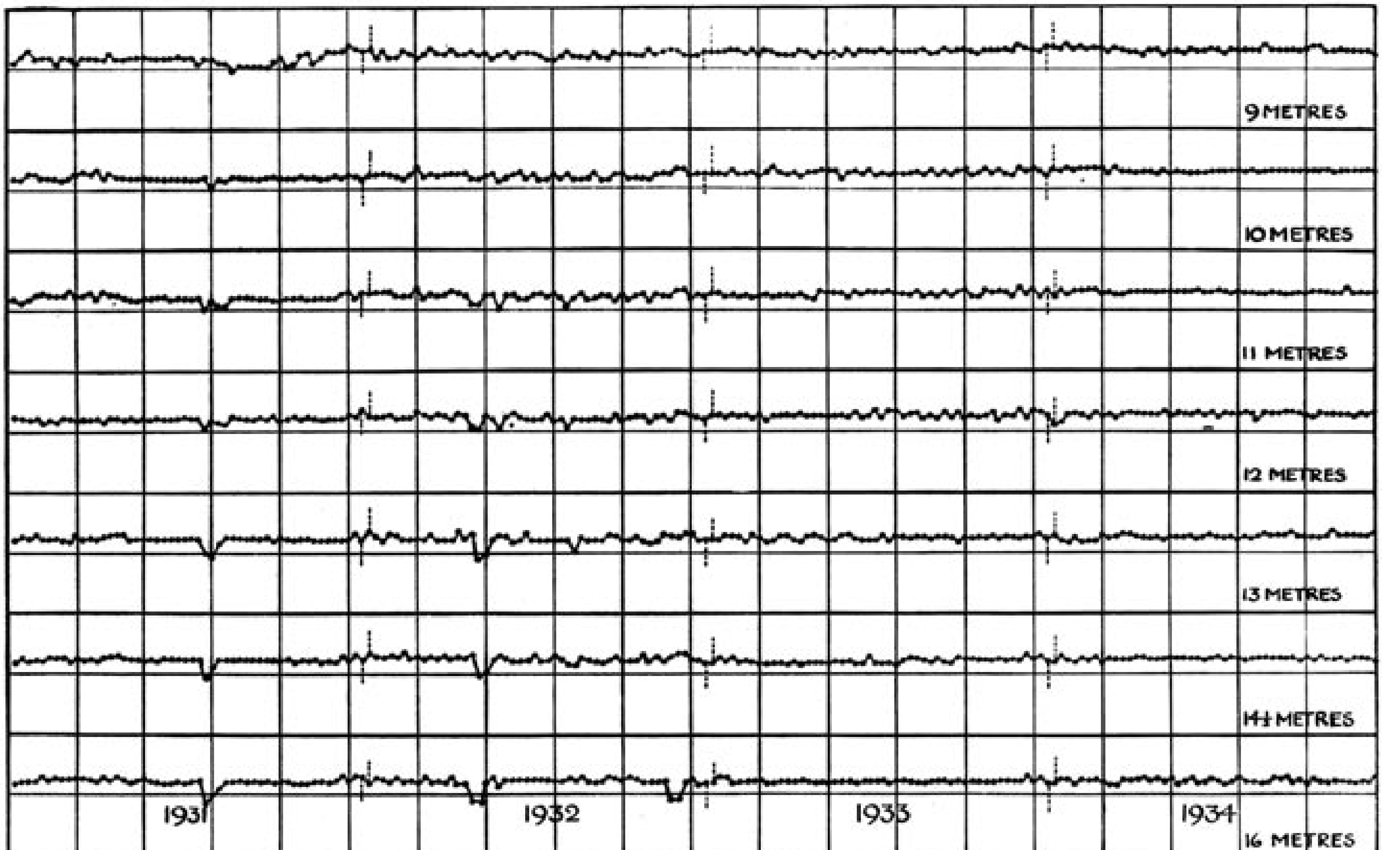
Experiments with Maple Seedlings.

Maple seedlings grow rather quickly, and, having a beautiful maple tree growing in the garden of the Biological Institute in Stuttgart, we took the opportunity of making experiments with these seedlings. Culpeper states, that the Maple Tree is under the dominion of Jupiter. "The decoction of the leaves or bark strengthens the liver". There is not only a relation between the planets and the metals; planets and plants; but also a relation between the planets and the different organs. Since the oldest times the Liver has been connected with the planet Jupiter, the Heart with the Sun (Gold); the Kidneys with the planet Venus; the Spleen with Saturn; etc. Culpeper says of the Maple tree, that "it is good to open obstructions of the Liver and Spleen and eases the pain which proceeds from thence".

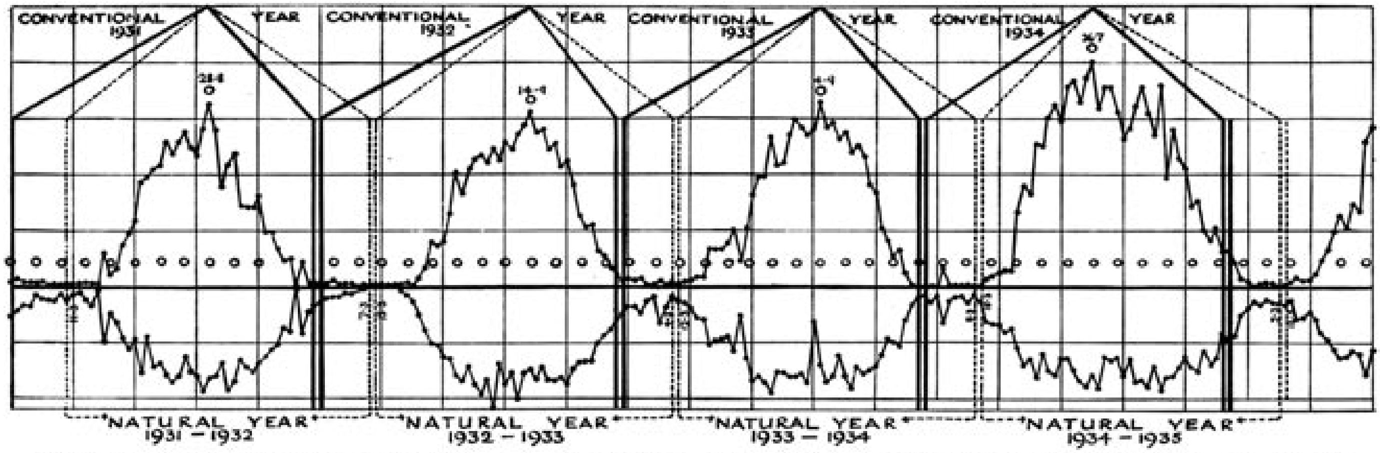
Here Culpeper's description is right. The maple tree is definitely under the government of Jupiter, as our experiments proved very successfully. Again it happened that Tin and Quicksilver produced a favourable effect on the seeds. But later on, in watching the development of the small trees, we found that treatment with tin chloride helped the plants to develop a beautifully shaped top and to grow healthy and strong. The quicksilver treated trees had the inclination to branch off again and again, to have a poorer foliage, of lighter green, and like the sunflowers, the thin stem broke easily when touched.

It would be good if more people would take an interest in such experiments. Many problems could be solved. If we knew the right times for planting trees, much money and labour could be saved.

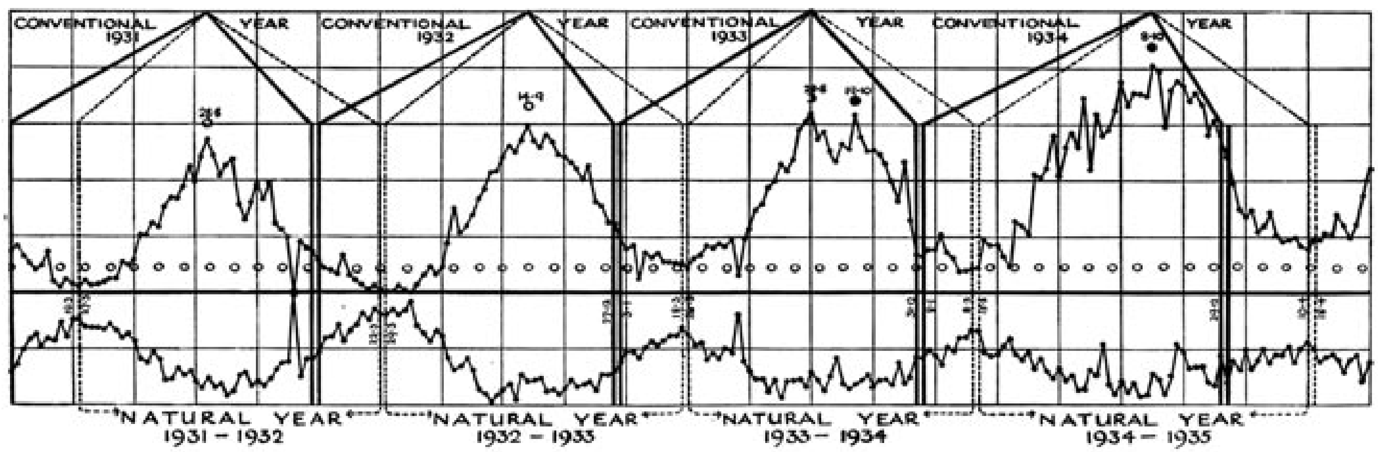

1 METRE
2 METRES
3 METRES
4 METRES
5 METRES
6 METRES
7 METRES
8 METRES
1931
1932
1933
1934



TEMPERATURE 1–16 METRES BENEATH THE SURFACE OF THE SOIL IN THE YEARS 1931, 1932, 1933 AND 1934



EXPERIMENTS WITH WHEAT: 1 METRE BENEATH THE SURFACE OF THE SOIL



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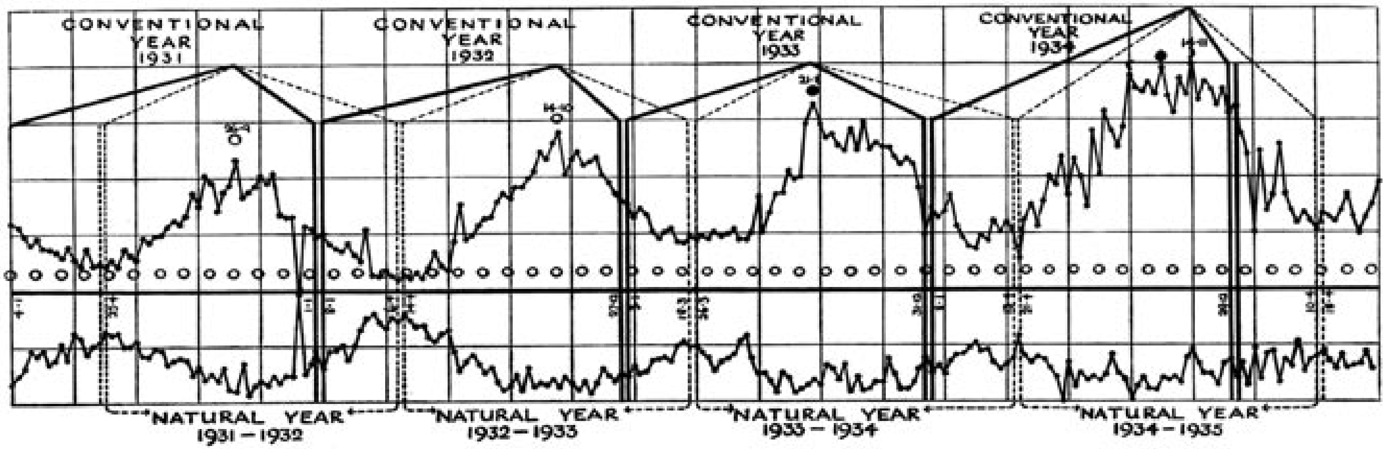
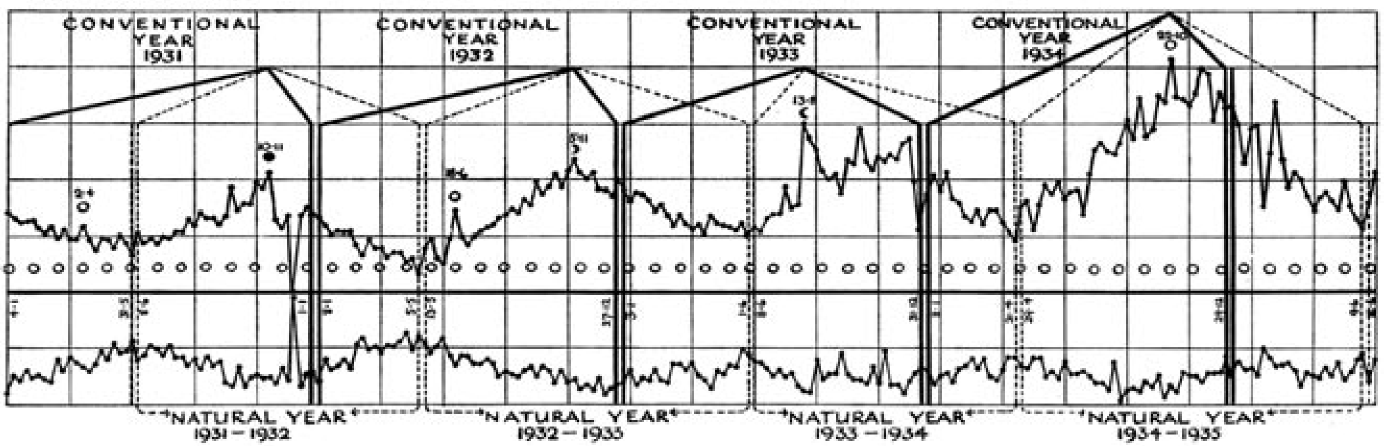
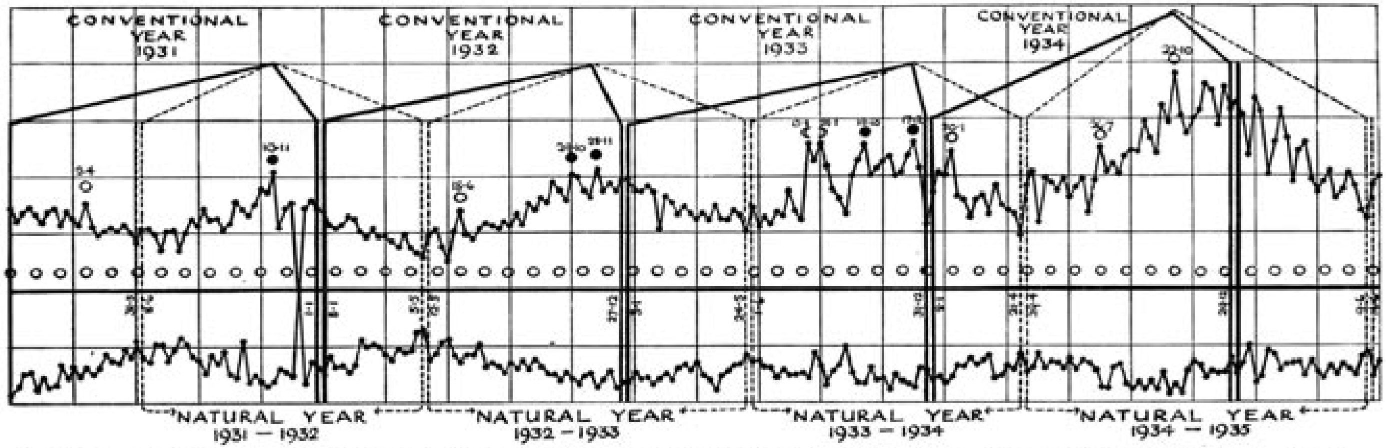


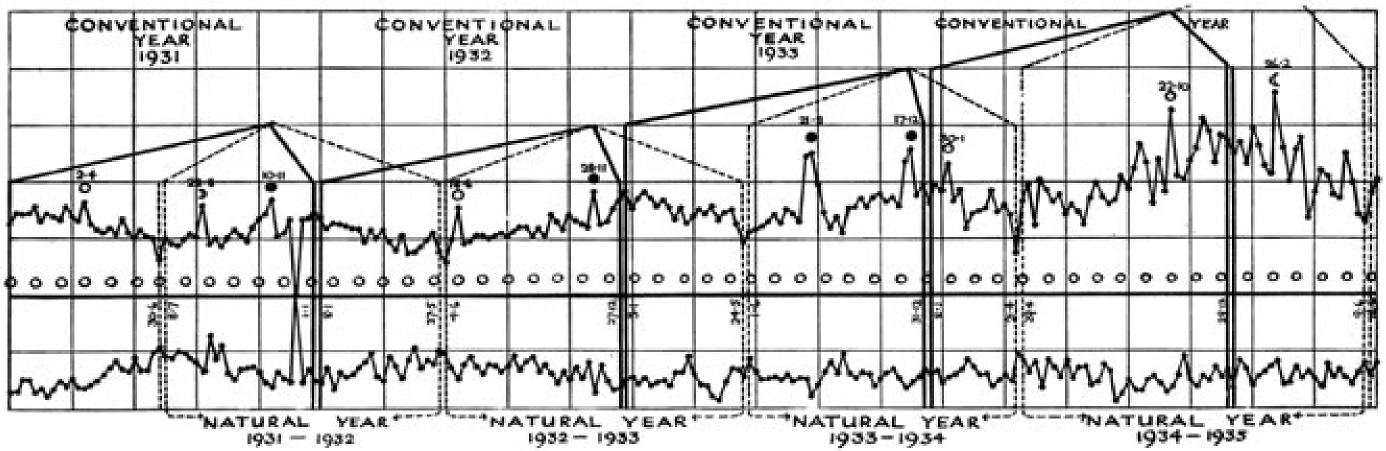
EXPERIMENTS WITH WHEAT: 3 METRES BENEATH THE SURFACE OF THE SOIL



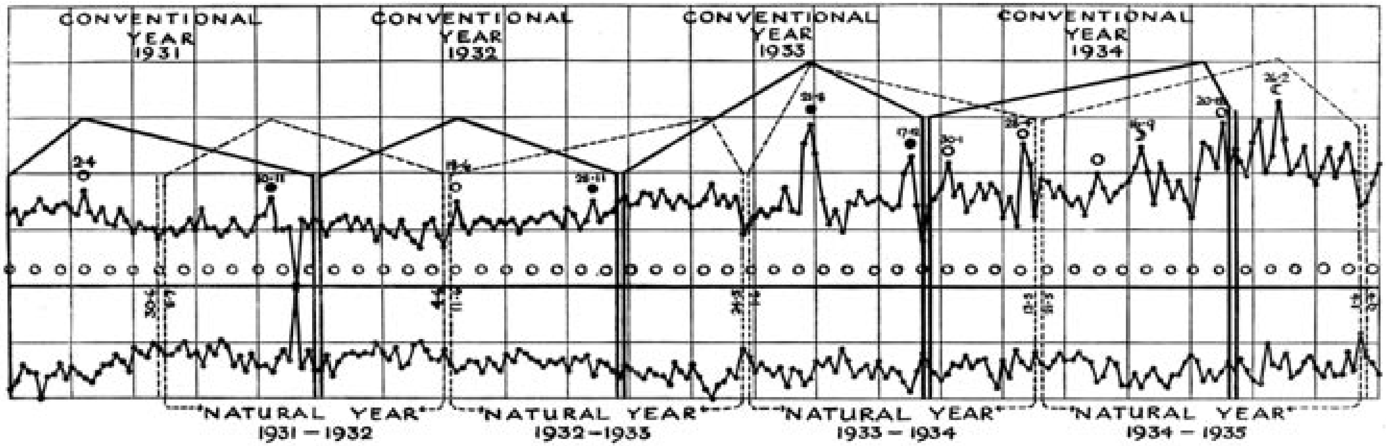
EXPERIMENTS WITH WHEAT: 4 METRES BENEATH THE SURFACE OF THE SOIL



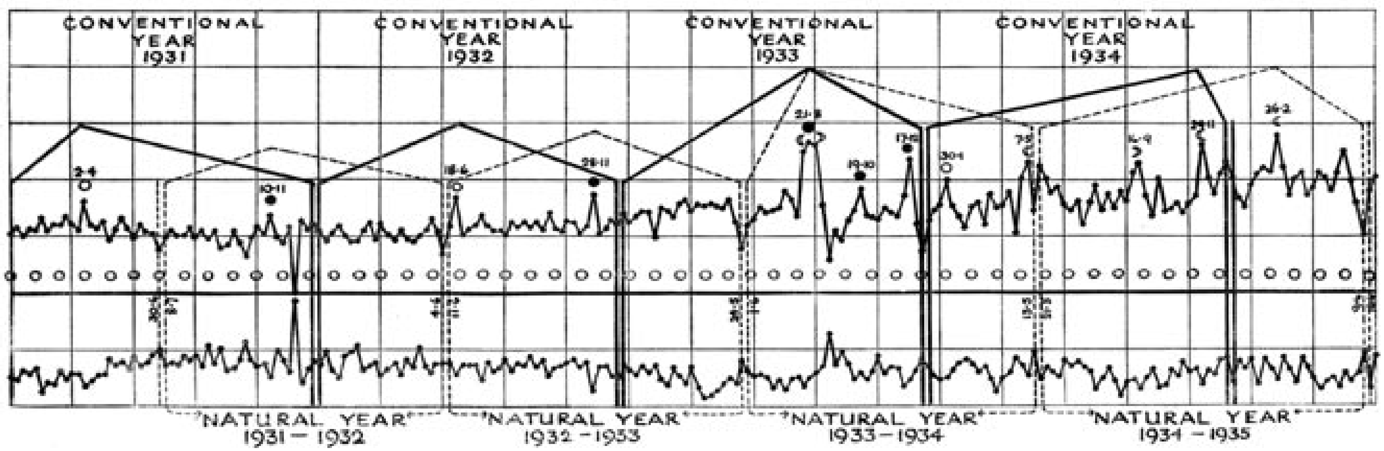
EXPERIMENTS WITH WHEAT : 5 METRES BENEATH THE SURFACE OF THE SOIL



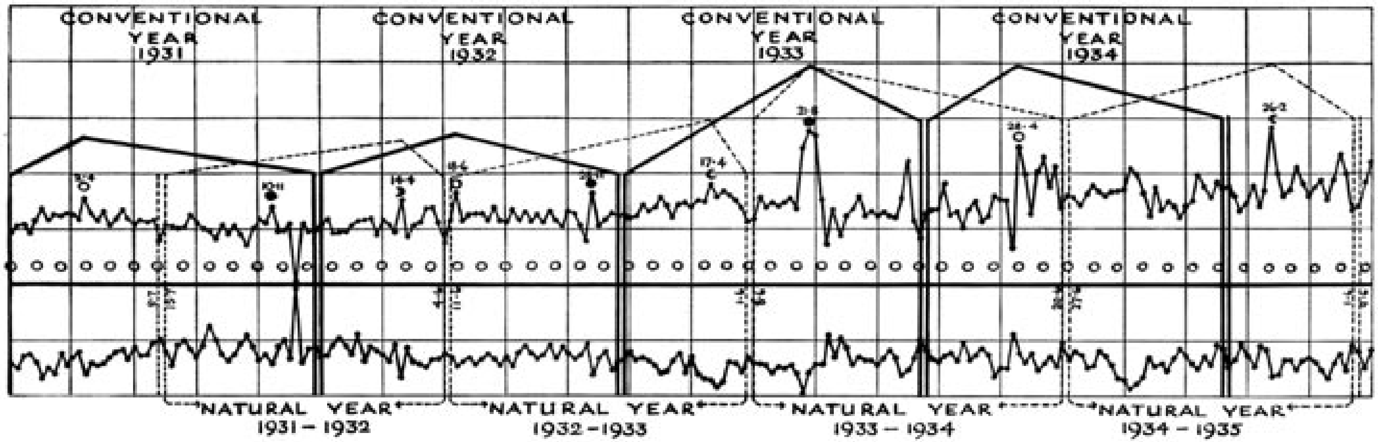
EXPERIMENTS WITH WHEAT : 6 METRES BENEATH THE SURFACE OF THE SOIL



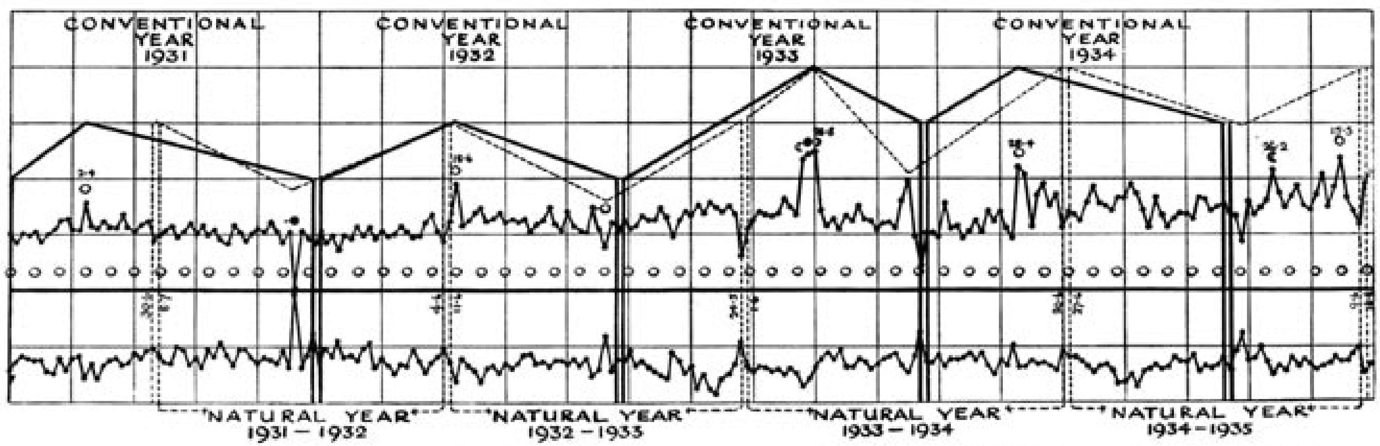
EXPERIMENTS WITH WHEAT: 7 METRES BENEATH THE SURFACE OF THE SOIL



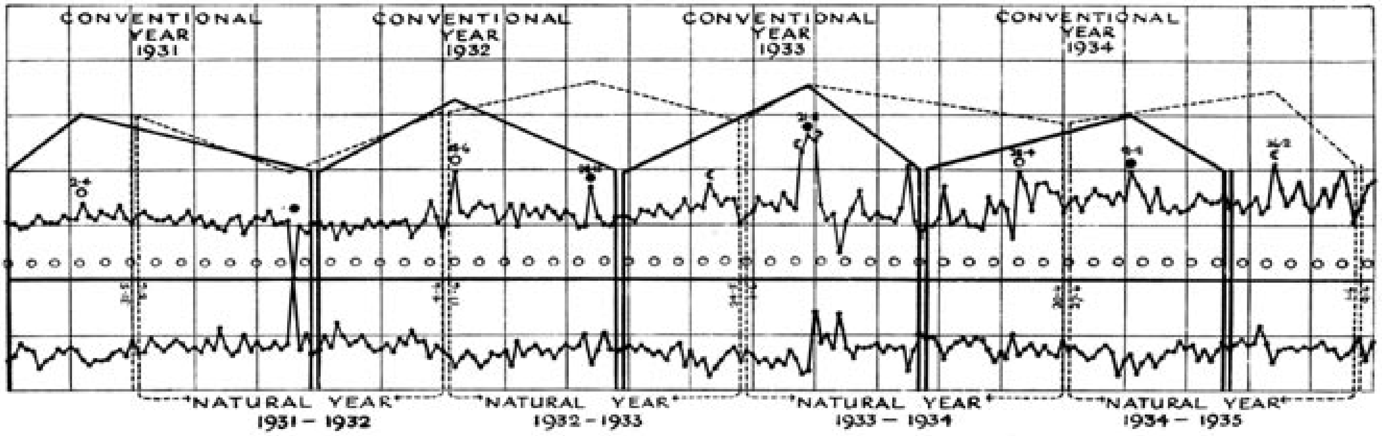
EXPERIMENTS WITH WHEAT: 8 METRES BENEATH THE SURFACE OF THE SOIL



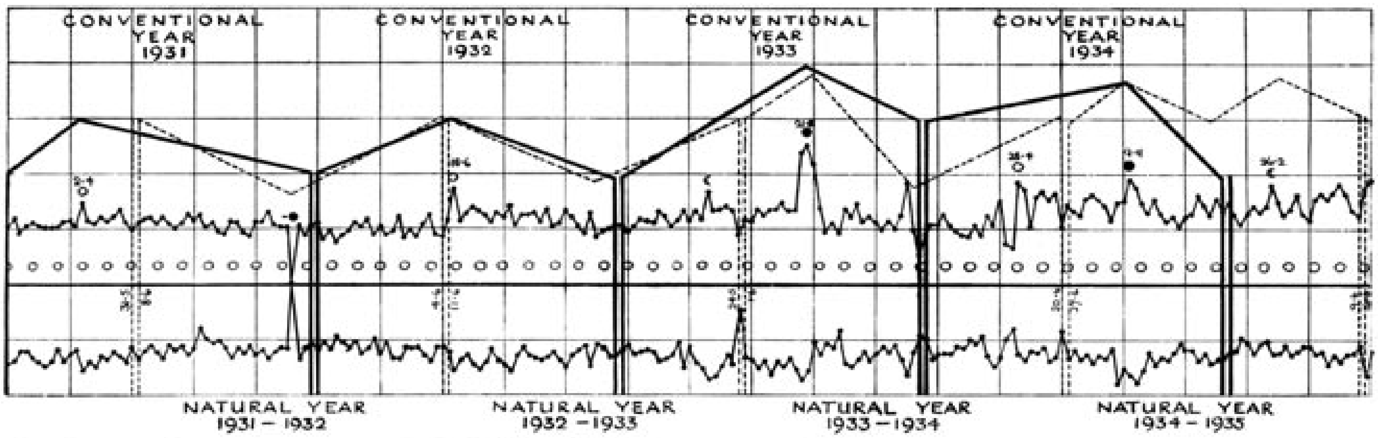
EXPERIMENTS WITH WHEAT : 9 METRES BENEATH THE SURFACE OF THE SOIL



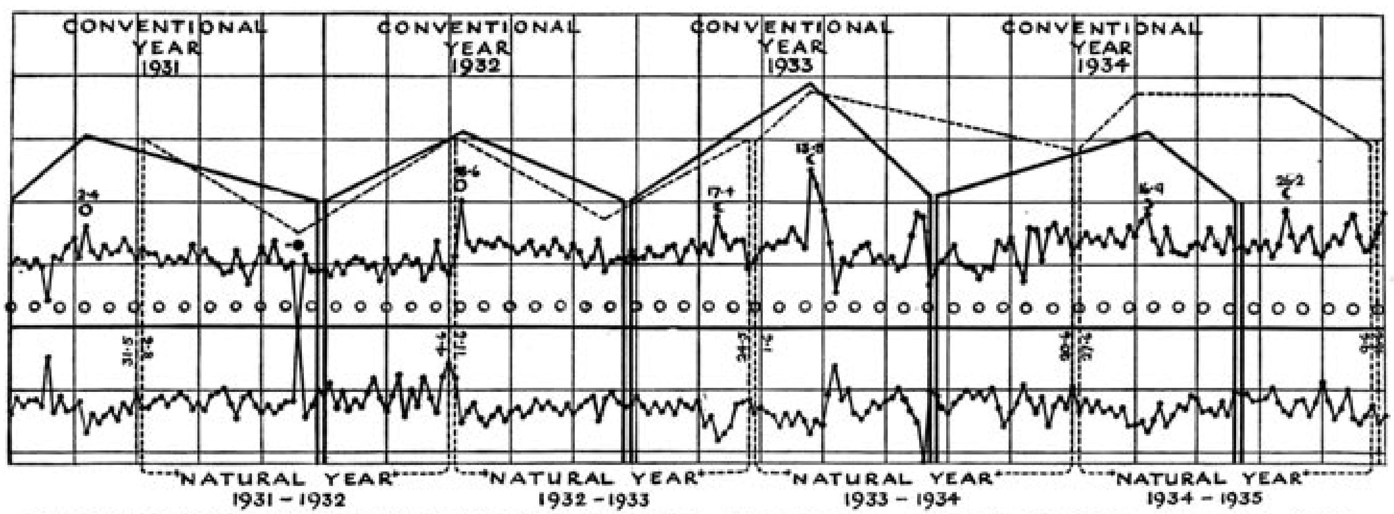
EXPERIMENTS WITH WHEAT : 10 METRES BENEATH THE SURFACE OF THE SOIL



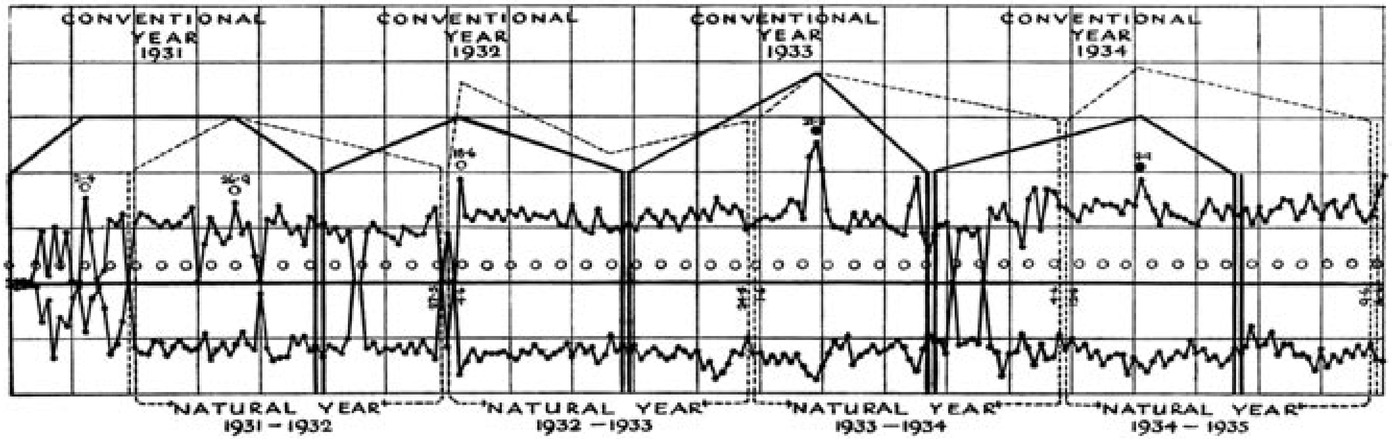
EXPERIMENTS WITH WHEAT: 11 METRES BENEATH THE SURFACE OF THE SOIL



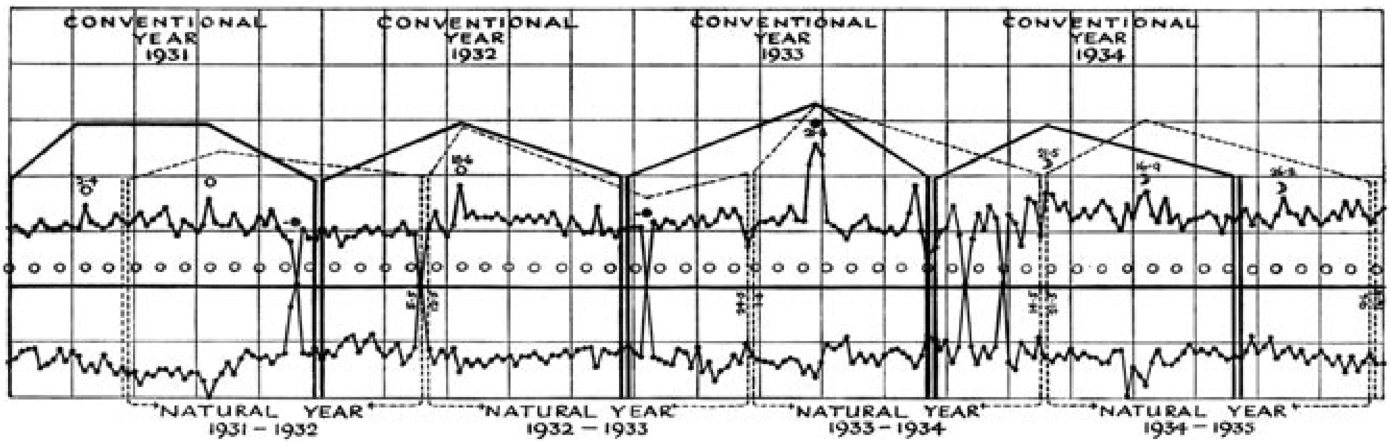
EXPERIMENTS WITH WHEAT: 12 METRES BENEATH THE SURFACE OF THE SOIL



EXPERIMENTS WITH WHEAT: 13 METRES BENEATH THE SURFACE OF THE SOIL



EXPERIMENTS WITH WHEAT: 14½ METRES BENEATH THE SURFACE OF THE SOIL



EXPERIMENTS WITH WHEAT: 16 METRES BENEATH THE SURFACE OF THE SOIL