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Enhancement of Organic Carbon Formation in Pumice Sand with QBLOCK™. Second Part

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Abstract

Soil fertility is a challenge to overcome since the beginning of time. Soil fertility is one of the main constraints that limits agricultural food production by smallholder farmers and astronauts. The value of soil chemical measurements using as indicators Soil organic carbon (SOC), total nitrogen (N), phosphorus availability and pH are often-suggested chemical parameters.

Fertility problems cannot be treated in isolation and must include rotations, fallow practices, use of crop residues and use of nutrient inputs. Soil fertility is fundamental for food security. It is ultimately determined by the geology in the area, but also greatly affected by soil management and nutrient input.

Soon, it will be necessary to develop food sources for future astronauts living and operating deep space. It is fundamental to plant growth researchers working to unlock agricultural innovations that could help us understand how plants might overcome stressful conditions in food-scarce areas here on Earth and eventually apply it to complex conditions like lunar surface environment.

Keywords: astronauts, hydrogen, dissociation, fertility, moon, oxygen, soil, water

1. Introduction

Food security is a growing problem. Agriculture is at the center of the food, energy, and water node. It consumes 70% of the earth’s fresh water and consumes 30% of the world´s available energy. Seeds, agrochemicals and irrigation are getting more expensive every day. Fertilizers are bound to the price of oil; therefore, the cost of the synthetic fertilizers is well beyond the reach of many small farmers (Herrera, Esparz & Fabian, 2022).

Elevated oxygen levels in the soil are necessary for germination, perhaps more than Nitrogen, potassium, and phosphorous. Once we get understood that living things do not use glucose to combine with oxygen (combustion), it is realized that nature uses this toxic element (Oxygen), derived from the dissociation of water, in a very extensive and complex way at the same time. For example, the formation of clays, which is the result of millions of years of evolution during which all the processes that together give rise to and sustain what we call life were gradual and carefully concatenated.

And the basis is the same since the beginning of time and the constant presence of oxygen inside the subsoil. Since the production of oxygen requires living entities, the microorganisms that live in the subsoil and that obtain energy from the environment by dissociating the molecule from the water produce small but constant amounts of oxygen, hence the formation of clays is a slow process.

The amount of soil nutrients taken up by a crop can be derived from trials where nutrient additions are varied (Carsky, Asiedu & Cornet, 2010). The results of many trials are however difficult to interpret since numerous factors, often not reported in publications, impact tuber yields. These are weather conditions, cultivar, yam seed quality, seed weight, planting density, planting date, weeds, diseases and pests, and plot history (Rodriguez-Montero, Hilger & Leihner, 2001).

Some studies show positive impacts of Nitrogen, Phosphorous, and Potassium (K) inputs on tuber yields, while others do not show any impact of nutrient additions.

The Nitrogen, Phosphorous, Potassium (K) addition had increased the rate of soil organic matter mineralization. This phenomenon needs further investigation as it can have negative consequences on these soils, which have very low organic matter contents (Hgaza et al., 2011).

The phenomenon needs further investigation as it can have negative consequences on these soils, which have very low organic matter contents. Whether such an effect would also occur following organic fertilizer inputs should be assessed. Mineral fertilizer inputs have also been reported to increase tuber weight loss and rotting during storage and to negatively affect the organoleptic properties of tubers (Vernier, Dossou & Letourmy, 2000).

Soil fertility management has two requirements: establishing and maintaining the soil pH and essential plant nutrient elemental content within their desired ranges for that soil type and crop or cropping sequence, with its associated cultural management practices. It is obvious that none of the soil fertility management systems will meet all these requirements. The soils require development and implementation of special management approaches beyond appropriate fertilizer application, some of which have been developed to support food production on a continuous, sustainable basis (Iderawumi, 2022).

The production of fertilizers uses an old technique developed by Fritz Haber, at the beginning of the twentieth century, which is especially polluting. At first the soil seems to respond with greater production, but by not following the sequence of nature, the fertility of the clay progressively declines, which forces the use of an increasing amount of fertilizer and with fewer and fewer results since the natural biology of the soil progressively fades until, eventually, it disappears.

1.1 Fertility and Oxygen Levels in Subsoil

Our observation about the existence of other molecules in nature, in addition to chlorophyll, of dissociating the molecule from water using the energy of light, visible and invisible, transforming it into chemical energy that can be used by living beings, has led us to understand that the sequence of Nature, in the case of soil fertility, also starts with oxygen (Herrera, 2015).

Hence, this gaseous element is indispensable even for the very formation of clays; being responsible for the formation of tiny cavities within the clay, which with characteristics of the same and are an essential requirement for its fertility. And from then on, the other elements that the hatching of seeds and growth of plants require, such as nitrogen, phosphorus, potassium, calcium and others, begin to form.

But if we skip the natural sequence of the fertility of the land, for example, by applying nitrogen and phosphorus fertilizers; the rest of the sequence tends to be significantly impoverished, impoverishing in the end, the much-sought fertility of the same, since the fertilizers are make-ups that do not go to the bottom of the problem, this is: the decreasing levels of oxygen inside the subsoil.

For us, the fertility of agricultural soil starts with the right oxygen (and hydrogen) content of it. And we add hydrogen because it is a gaseous element that is obtained while the water molecule is dissociated inside eukaryotic or prokaryotic cell by several molecules characteristically derived from protoporphyrin IX, an organic molecule presents in all living things and melanin, which is a pigment also present in all living beings. (Figure 1, 2) And just as oxygen is needed to generate and maintain the tiny cavities that give fertile soil the spongy look and feel, hydrogen is needed to carry the energy that is released when the water molecule breaks. This molecular hydrogen carries the energy required for the formation of organic molecules in the subsoil, for example when combined with oxygen.

Figure 1. The coloration of the eggshell is given by the content of melanin molecules in it

1.2 The Unsuspected Intrinsic Property of Melanin to Dissociate the Water Molecule

Melanins are a broad class of aromatic macromolecules that are ubiquitous in nature (Figure 1, 2) but have proven quite difficult to characterize (Simon & Peles, 2010). Bottom-up studies (d'Ischia et al., 2020) aimed at revealing molecular structure indicate that unlike other biomacromolecules (e.g., proteins and nucleic acids), melanin does not have a common monomeric unit or linkage, and does not have a characteristic sequence, size, or architecture (linear vs. branched). In fact, there is still debate whether melanin is a high molecular weight polymer or an aggregate of lower molecular weight oligomers (Watt, Bothma & Meredith, 2009).

Melanins redox properties seem especially important to its biological or technological function. But due to the marked technical difficulties in studying melanin in the laboratory, it is not surprising that the discovery of the biochemical basis of such properties has arisen from the observation of melanin in one of its natural locations, and that is the human eye, and specifically the optic nerve and its surroundings (Figure 3)

the context could determine the action of melanins

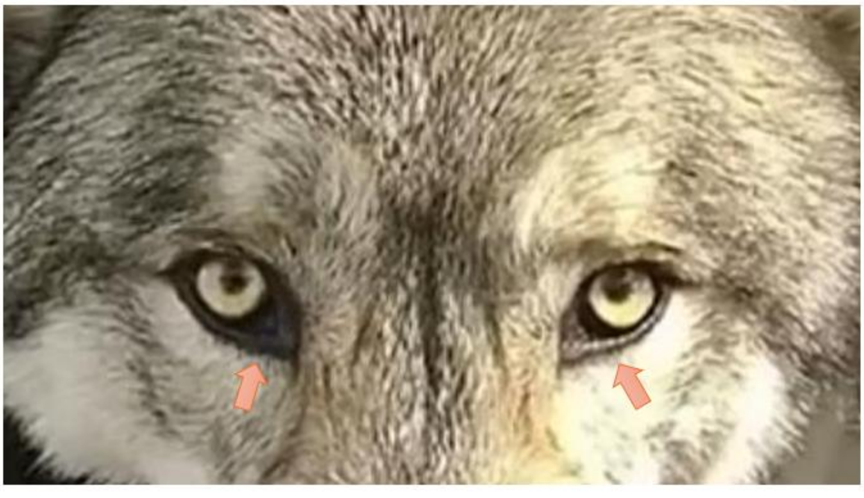

Figure 2. The melanin molecule widely diffused in living beings. In the photograph it can be seen in the fur, conjunctiva and palpebral edges (arrows) of the wolf

Figure 3. Photograph of the right eye, where the optic nerve can be seen, the blood vessels that enter and leave through it, on the left is the macula or spot in Latin, the arrow points to the melanin visible at the edge of the optic nerve

And it was during an observational study, which began in 1990 and ended in 2002, and included the ophthalmological records of 6000 patients, that we detected the unsuspected ability of melanin to transform the power of light into chemical energy, by dissociating the molecule from water, such as chlorophyll in plant leaves.

The reaction can be written as follows:

$$2H_2O_{(Liq)} \rightarrow 2H_{2(gas)} + O_{2(gas)} \rightarrow 2H_2O_{(liq)} + 4e^-$$

The first part of the reaction (blue) occurs strictly within melanin, is highly endergonic, and is possible only because the enormous amount of energy required to break the water molecule is harvested by melanin due to its still ununderstood ability to absorb wavelengths within the visible and invisible spectrum. and the process occurs within the range of nano (1 x 10^{-9} s) and pico (1 x 10^{-12} s) seconds.

Our observation has enormous implications in biology, because on the one hand, it teaches us that human cells and therefore eukaryotes and prokaryotes, can oxygenate themselves (Herrera & Arias, 2025), and on the other hand that the oxygen in our body comes from inside the cell and not from the atmosphere, as was mistakenly believed. So, just as the oxygen in the human body must come from the inside out, the oxygen required by agricultural soil must come from the bottom up, and not the other way around, as was mistakenly believed to date.

On the other hand, melanin is the most stable substance known, as it has been identified and found in good condition, in the ink sacs of fossilized squid that died 160 million years ago (Klug et al., 2021).

Let's not forget that the dissociation of water is a highly endergonic chemical process and requires so much energy that only the use of sunlight power can make it sustainable, and it happens in any living entity, as has been demonstrated by the eons of years of existence of life on planet earth. Meanwhile Hydrogen is the carrier par excellence of energy in the entire universe, especially at short distances, Oxygen is essential to combine and form parts of necessary molecules for the formation and replication of cells, such as peptides, proteins, lipids, carbohydrates, etc.

Hence, maintaining the dissociation of water inside the clay, as it has been since the beginning of time, is an essential photochemical reaction to induce, maintain or even increase the fertility of agricultural soils. Currently the intensive use of agrochemicals tends to impoverish this important and astonishing accurate process that gives rise to the sequence of life, since it has not changed since the beginning of time, tending to be biased relatively easily by the presence of contaminants both in the water, atmosphere, seeds, and in the soil itself.

That is why we should not be surprised that clay worldwide is progressively losing its food production capacity, since we are poisoning it with agrochemicals that do not follow or respect the natural sequence of events that give rise and maintenance of the soil fertility.

In this second part of our experiment, we are reasonably demonstrating that the generation of oxygen (and hydrogen) in continuous way by means of the replication of the dissociation of water molecules with our material (QBLOCK), ™ developed from the biology of the human eye, is capable of inducing fertility in soils considered infertile, such as pumice soil, of volcanic origin.

2. Material and Methods

In a previous article (Herrera, 2023), we described the preparation of the experiment; below we only replicate the photographs already published for the sake of brevity. (Figure 4-6)

Figure 4. In a relatively airtight plastic container, a 100-gram QBLOCK™ was placed in 400 ml of distilled water. (June 2022)

Before placing the stone and pumice soil, and after three weeks, the following variables were measured:

Table 1. Values of water variables, prior to the addition of soil and pumice stone, measured two weeks after placement of the QBLOCK™

Sample	pH	DO*	Brix degrees	Charge µs/seg**	Absorbance
Control	7.91	7.51	0.0	24.9	0.0
Target	9.0	7.36	0.0	1265.8	0.220

*DO: dissolved oxygen, ** µs/sec: micro-siemens by second.

The following figure (Figure 3) shows the initial aspect of the experiment.

Figure 5. The photograph shows the initial appearance of the plastic container, once the stone and pumice soil were added. Pumice stone tends to float when dissolved oxygen levels are elevated

At first no liquid water levels were left, only the pumice stone was completely moistened, but within 24 hours, the water had almost completely separated from the pumice stone and dust.

Subsequently, periodic photographs were taken to detect and, if necessary, demonstrate the appearance of organic carbon, which was the result we would expect given the constant dissociation of water by the QBLOCKs™. (Figure 6).

Figure 6) The appearance of the organic carbon on the outside (with greater sunlight) of the pumice stone 10 months after the experiment began is evident. The follow-up of the experiment has been mainly based on serial photographs, so as not to alter the variables with repeated sampling

At the time, the partial results of the experiment supported our proposal that by maintaining constant levels of oxygen and hydrogen, the other elements that form the basis of soil fertility, would somehow form.

On this occasion, we present photographs taken in January 2025, from the same experiment we started in June 2022. (Figures 7-16)

Figure 7. Organic charcoal has continued to evolve; it should be emphasized that from June 2022 to date (Jan 2025) we did not refill the water, as it had been preserved in suitable conditions for the visual and photographic control of the experiment

As expected, the changes were most noticeable on the side of the polyethylene container with the most exposure to natural light (Figure 7)

Figure 8. Photograph of the back of the polyethylene container containing water, stone and pumice soil, and the 100-gram QBLOCK (not visible)

The changes that can be seen in the less illuminated part are notoriously minor, but nevertheless present, exemplified by small green dots given by organic carbon formations. (Figure 8, 9)

Figure 9. On the opposite side, and in an area with the lowest natural lighting, the formation of small granules of organic carbon can also be seen (arrows)

The appearance of the water in the container is quite murky, but when it was uncovered for the first time after two and a half years to replenish water, the transparency of the water was surprising, especially in the central region. (Figure 10)

Figure 10. The murky appearance of the water from the outside, through the walls of the container, was so murky. But when it was uncovered for the first time after almost three years to replace the relatively small amount that had dropped in the water level, the transparency of the water contrasted markedly with its external appearance, as it was very clear, and the murky areas were mainly limited to the areas nearest to walls of the polyethylene container

The presence of organic charcoal, including algae-like formations, was limited to the interface between the liquid water and the pumice soil, and on the walls of the polyethylene container, especially the illuminated parts.

Figure 11. Appearance of the container uncovered, immediately after the water has been refilled

125 mL of distilled water was replenished. The interior appearance of the polyethylene container immediately after the water has been placed is shown in Figure 11. In the following figure (12), we show the inner part of the lid of the container, showing algae-like formations, attached to the inner face of the lid, located on the illuminated side of the container.

Figure 12. Interior appearance of the container lid, showing shapes adhered to the polyethylene, especially on the illuminated side. The rest of the surface is remarkably clean

To touch the experiment as little as possible, we added thermographic images of the illuminated side of the container (Figure 13 and 14) made in February 2025.

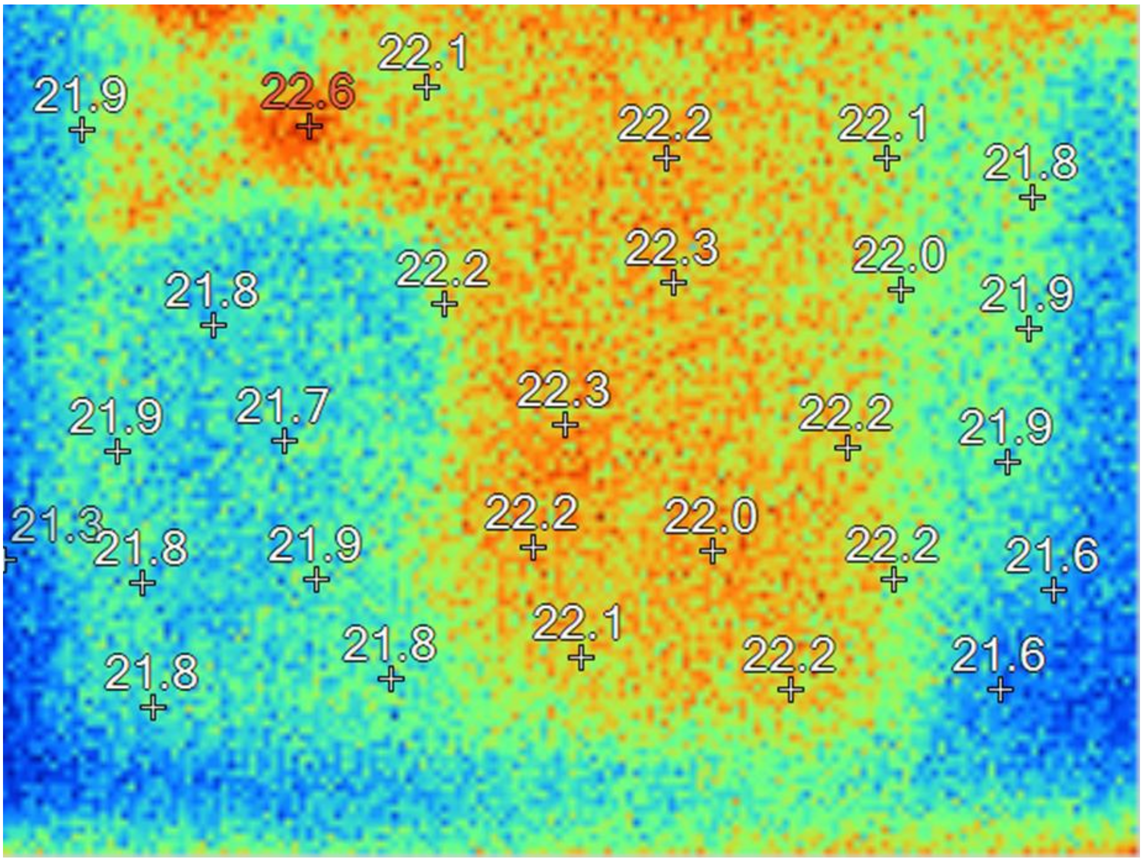

Figure 13. Thermographic images allow information to be obtained without altering experimental conditions. All measurements are in Celsius degrees

Figure 14 shows the image of the container from which the measurements were made.

Figure 14. Image from which the measurements were obtained

The experiments are being carried out with natural light, so the sunny part, with the greatest exposure to light, was where the formation of organic carbon compounds was detected more quickly. The following two figures (14 and 15) show the results of the thermographic study.

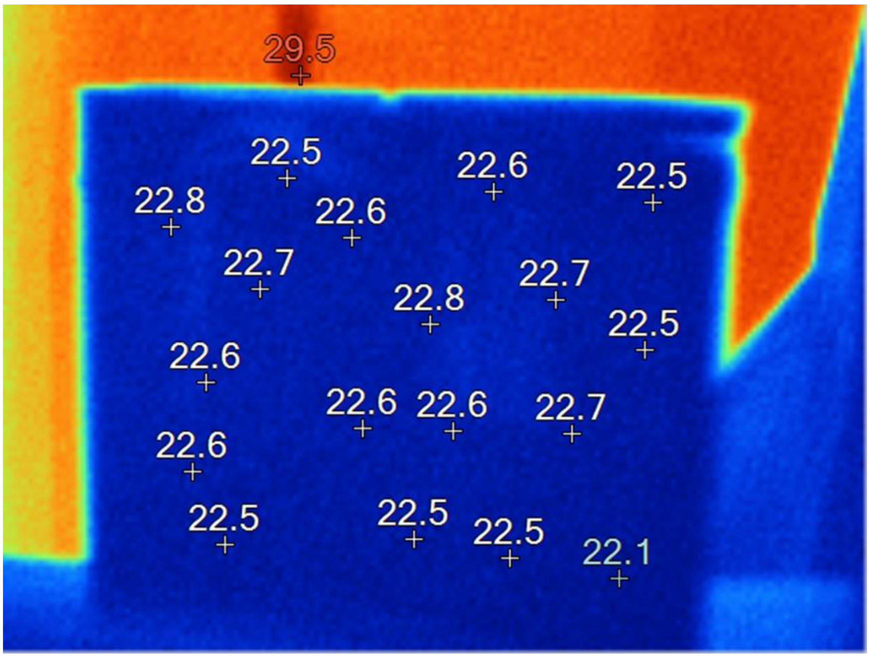

Figure 15. The back of the transparent polyethylene container, seen from its back. Measurements are in degrees Celsius (Celsius)

The photograph of the back of the clear plastic container containing the pumice stone, from which the measurements were made, is shown in the following photograph (Figure 15).

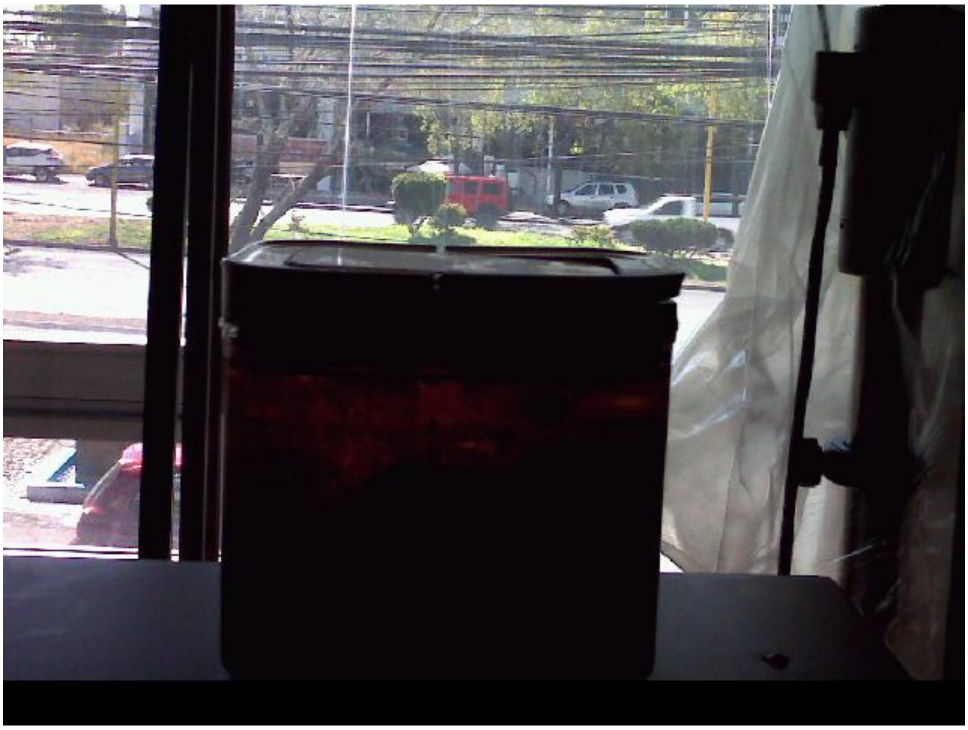

Figure 16. The photograph shows the back of the polyethylene container. The window to which the container is exposed can be seen

3. Conclusions

The experiments have yielded good results, perhaps better than expected. The control of these has been through serial, periodic images, which allow detecting and evaluating the rate of development of organic carbon formation, appropriately and touching it as little as possible.

The process we are describing is of course susceptible to improvement to obtain more, better results, and standardized results, practical enough so that, eventually, can be applied to produce food, both on Earth and in stellar space.

The results obtained to date allow us to reject the null hypothesis and support the alternative hypothesis in a firm way.

The following photographs show aspects of similar experiments carried out in parallel, but in different containers, time, and proportions.

Figure 17. Appearance of organic carbon formations within a cylindrical polyethylene container, containing water, QBLOCKS™ and Pumice soil

The results obtained in the original experiment and subsequent ones show that when the conditions are met, the event of the formation of organic carbon happens.

Figure 18. This other experiment, in earlier phases, shows similar stages to the other experiments. In this case, the formation of spaces inside the pumice stone is observed. Above the space formed, the formation of accumulations of organic carbon can be seen

Figure 19. It is usual for the formation of empty spaces to precede and accompany the formations of organic carbon, indicating the presence of gases

4. Comment

The importance of oxygen levels inside the subsoil had gone unnoticed, as it has not been given importance due to the data. However, our experiments show that it is the starting point for agricultural soil to fertilize itself, as it has been since the beginning of time. But it is necessary that oxygen and hydrogen be generated from the interior of the soil to a depth of about 50 cm, since atmospheric oxygen does not descend and penetrate through the agricultural soil, even if it was ploughed; but rather it tends to rise and ascend towards the atmosphere rather than penetrate towards the interior of the earth, given its very weak gravitational attraction exerted by the earth's mass.

Our experiments leave no doubt that the constant generation of oxygen and hydrogen that occurs inside the QBLOCK™, (figure 20), leads to the formation of organic carbon in significant quantities. And our method can be perfected by being capable of being used in the production and conservation of food on planet Earth, on the moon, or on the planet Mars.

In other experiments that we will report soon, we have found that elevated levels of hydrogen and oxygen, maintained constantly, contribute in surprising ways to not only maintaining but improving the nutritional content of naturally produced foods.

Figure 20. We interpret the continuous formation and hatching of organic carbon as irrefutable proof of the importance of the continuous presence of oxygen (and hydrogen) as a very first step for the formation of clays, followed by the appearance of carbon compounds and other characteristic elements necessary for the emergence of life

For oxygen (and hydrogen) to play their fundamental role in the sequence of fertility and therefore of life in the subsoil, it is necessary that the levels of both gases remain constant. And we achieved such constancy, in the case of this article, through QBLOCK, ™ a new material developed based on the biology of the human eye.

It should be noted that this material does not require electricity, nor does it require added chemicals to carry out its function. The average life of the material, once buried in the subsoil, is at least 25 years.

We believe it is important to communicate our results, given that food production and its conservation is urgent matter worldwide, and QBLOCK™ can mark a before and after.

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Authors contributions

All the authors contributed equally to the study.

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Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Conflict of interest: None

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data is available.

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