"The Cosmic Philosophy"

Konstantin Tsiolkovsky

The Plant of the Future

Konstantin Tsiolkovsky

The Plant of the Future

(1929)

Preface

Why do I often not mention the sources and do not treat readers with the wisdom of encyclopedic dictionaries? Just because it will terribly increase the size of the work, confuse and tire the reader, force him to throw up the book. Time and forces are so limited! My goal is to give a lot in a small and accessible volume. I am burning with the desire to inspire all people with reasonable and invigorating thoughts. Moreover, I work independently and from zero; however, the basics are science-based, old and well-known. A lot of names, opinions and dates interfere with the main assimilation of the truth. It is up to specialists and historical sciences to give these dates, names and their contradictory opinions. I choose from all the material what I think is most likely. Of course, compilations require a different presentation. My works are not compilations.

Langley gave 30 large calories per minute for solar energy in the vacuum per square meter of a normally sunlit surface (at a distance of the Earth). Now some ones give 20 calories. Others gave 40 calories. Let's take the newest number – 20, which shows that the energy of the sun’s rays falling directly on a square meter of the surface can heat a liter or a kilogram of water at 20 degrees Celsius per minute. In a year we will get 10 million (m.n.) calories. Due to the spherical shape of the Earth (i.e. night and oblique rays), this number decreases of 4 times by an average, so that only 2.5 m.n. per square meter fall per year from the Sun.

A kilogram of flour or dry grain gives about 4000 calories. Consequently, the Sun should give (on average), with the ideal use (utilization) of its energy, 625 kg of flour per year, per 1 square meter of the planet's surface.

Let's take the grain harvest from the arpent* (hectare, or 100 ares. Each ar = 100 sq. m.) as 1 ton per year (we discard insignificant energy of straw and roots). Per square meter it will be 0.1 kg. This is 6250 times less than it should be.

* Russian measurements are meant here. Before the applying of metric system of measurments, arpent (dessiatin) in Russia was about 1.09 hectares. – translator's note.

What a sad use of solar energy! In fact, it is even smaller. Indeed, let's assume the Earth's population of 2 billion (m. r. d.). Let's assume, on average, 300 kilograms (kg) of flour per year for human sustenance, i.e. almost 2 pounds per day. This means that humanity downs 600 m. r. d. kilograms of flour. The surface of the Earth is more than 500 billion (b. l. n.) square meters. Each square meter – we have seen it – should give 625 kg of flour. So, all the solar energy received by the Earth should give 312,500 billion kg of flour. This is more than the actual 521000. Some of the plants are also used for feeding livestock, for fuel, etc. Therefore, even if we will increase the amount of extracted products by 10 times, the use will still be only one fifty thousandth of the solar energy. If at least 20% of solar energy were utilized, then even then the Earth could feed the population 100 thousand times more than today. It would only be unacceptably cramped.

There are very prolific and nutritious plants: some tropical root crops, also bananas, breadfruit trees, palm trees, fig trees and many others. Their utilization of sunlight is much greater. Let's consider a banana, which replaces good wheat bread. This plant can yield up to 400 tons of fruit alone (ton = 1000 kg, or 61 poods*) from an arpent (10000 sq. m.). From one sq. m. it happens to be 40 kg per year. The heating capacity of banana fruits is 4 times less than that of grain. Therefore, nutritionally, 40 kg of bananas correspond to ten (10) kg of flour. This is 62 times less than the ideal number (625). Utilization of radiant energy by banana will be 100 times greater than by wheat. The energy use of a banana will be figured out at 1.6%, and wheat at 0.016%. Roots, trunks and leaves further increase this utilization. However, laboratory experiments have not yet yielded more than 5%.

*Pood – old Russian weight measure, 16.38 kg. – translator's note.

About 80% (up to 45° latitude) of the entire land is in a warm climate. Therefore, when settling it and using the most prolific plants, it is already possible to feed the population 400 times more than the present. Indeed, there are 4 arpents of fertile soil per person in a warm climate. (Actually, 5-6 arpents, but part of the ground is still inarable.) A human can feed himself during the year with 1000 kg of bananas or similar fruits. The same is obtained from 100 sq. meters of soil, or from the 1 are. This means that 4 arpents (400 ares) can provide 400 times more food.

However, only 1-2% of solar energy is utilized, and if we accept the best conditions and wood energy, then no more than 5%. Let's analyze the possible causes of this offensive phenomenon. By finding the causes and eliminating them, we will get better results. These, in our opinion, are the main reasons.

1. Imperfection of plants.

Indeed, the individuality of the organism means a lot. So, cereals use 1/6000 of the share of solar energy, and a banana up to 1/60, i.e. 100 times more. This cannot be explained by a difference in the energy of the rays of a hot country and a moderate one only. The difference here is insignificant, but in recycling it is huge. Moreover, cereals even in hot countries give a little more (for example, twice, three times, due to several seeding-downs and harvests in one year). Some plants use solar energy even better than a banana. It is necessary to determine purposefully the percentage of utilization of solar energy by nutritious and industrial trees and to work out the best one by selection and cross-breeding. Experiments should be carried out mainly in tropical countries, since they own the largest part (80%) of the surface of the globe and future agriculture will take precedence here.

How much success and new results can be achieved in this regard can be seen, for example, from the history of Burbank's discoveries. This great man suffered great hardships at first, slept in a chicken coop and would have died of exhaustion without a kind woman who supported his strength with milk.

By crossing plants and selecting them, he received: a seedless plum, an edible cactus without thorns (we will talk about it later), a quince with pineapple flavor, a cross between blackberries and raspberries with fruits of 7-8 centimeters, a fragrant dahlia, a cross between a walnut, which at the age of 14 gave trees 24 meters high, with precious wood, potatoes, with 25% starch, a kind of tomato with potatoes on branches, a kind of potato with fruits above the soil surface, and much more other.

Other researchers also got wonderful results, although they did not match Burbank. Thus, in Europe, new wheat breeds have been created, growing in fields unsuitable for ordinary wheat, new more productive corn with various properties; new wheat yielding 4-5 tons of grain per tithe, also oats, barley and flax of good qualities and yields, the yield of maize has been increased by a ton per tithe. We have done much more. Everyone knows enough about artificially-bred sugar beetroot. Similar transformations are possible and well-known among the animal world.

2. A huge part of the solar energy is absorbed by the translucent atmosphere and its clouds.

This diminishes the effect of the sun by at least 4 times. In fact, it is much more. Many countries are constantly obscured by clouds and fogs and almost do not see bright light. Although the average cloud cover of the Earth is determined at 50%, but this is hardly true. Air nebulosity is a very common phenomenon. Although the sun is visible here, it’s not much use of it.

3. Extremely small amount of carbon dioxide in the air
(1: 3000, by volume).

Experiments show that the most favorable amount of carbon dioxide should be ten times more than the existing one (0.03%). It is different for different plants and has not yet been determined. The amount of carbon dioxide can be adjusted in closed rooms to plants, transparent from above. But it can, in general, be increased in the air through the burning of fossil coal, peat and oil, through the burning of limestones (cement business) and the destruction of wild forests, the wood of which takes a lot of carbonic acid from the air and represents dead capital. Cultivated plants, for this purpose, should have as few trunks, branches and leaves as possible. The fruits themselves should contain chlorophyll and work (chemically) instead of leaves.

However, the abundant future crops of fruit plants and humanity itself (with their bodies) will take away a lot of carbon dioxide from the air. But then there will be a lot of it, due to human efforts. A significant change in the composition of the atmosphere will be achievable only with an increase in the conscious population hundreds of times and the corresponding development of technology and industry. The bowels of the Earth continuously emit huge amounts of gases containing carbon, but at the same time it is absorbed by ocean shells (carbonic lime) and plants, oceans and land. Some of these plants do not decay (returning carbon dioxide to the atmosphere), but are carried away by the waters and buried in the ground and water in the form of coals, oil and peat. It is possible to weaken this sad phenomenon, but on the condition of a powerful development of intelligent life on Earth.

4. A lot of solar energy is wasted for harmful overheating of leaves, fruits, trunk, branches and exposed ground.

Truly, those leaves or fruits are ideal, which use all the energy of the rays falling on them for chemical work (the formation of sugars, starches, oils, fibers, etc.). Such ones are black not only for the eyes, but also for any photograph. Such plants will completely absorb the heat of equatorial countries, accumulating potential energy in their bodies. Were it not for the atmosphere, which inevitably absorbs the heat of the sun, then a polar climate would have formed among such plants and, of course, the plants would have died. Therefore, full (100%) use is unthinkable.

5. Due to overheating of the plant (most of all with thin leaves), it has to evaporate a lot of water, which is spent on solar energy.

So, when receiving one ton of grain, 260 tons of water is evaporated by the plant. The work used for this (heat of evaporation) is 35 times more than the reserved energy of the grain. This means that 35 times more is spent uselessly than is useful. Sunflower evaporates another 15 times more. Here evaporation takes 700 times more energy than chemical work (in fruits). In general, the usual harvest of our plants requires, for one kg of dry matter, 300 kg of water. Again, it appears that evaporation takes 48 times more than the useful work of the sun.

How to avoid it and is it possible to avoid it? If there is no evaporation, then there will be excessive heating of thin leaves and the death of cells. With a strong wind, there can be no harmful heating: the air cools the leaves and needles. But there are inevitable moments of calm air, which spoil the whole thing.

If the leaves are very thick or if they are replaced by massive fruits, then there can not be much heating even when calm. It is also weakened by the increased chemical work of chlorophyll in plants. Then these leaves or fruits replacing them can do without stomata and evaporation (like seaweed). They can be impervious to vapor and water.

Such plants already exist between the kinds of some cacti and other species. They were developed by a hot, arid desert with its burning, tireless sun and lack of moisture.

Such leaves, like all organic membranes, are not alien to diffusion: gases penetrate through them, but they almost do not lose water, i.e. they do not evaporate. Thus, the chemical processes in the leaf continue to take place.

Some of these plants are strikingly prolific. Thus, the Burbank's cactus yields 15,000 tons of matter per hectare per year with little irrigation (250 tons of fruit. Without irrigation – 9000 tons of substance). There will be 1.5 tons or 1500 kg of substance per square meter. This is 37 times more than a banana gives (counting only its fruits). We do not know what the heat-producing power of a cactus is, and therefore we cannot determine its use of solar energy. If its heating capacity is the same as carrots, i.e. half as much as a banana, then the use of cactus will be 18 times more than a banana. For the latter, we found 1.6%. So, for the artificially bred Burbank's cactus, in this case, we will get almost 29%. Even if we put the heating capacity of a cactus half as much as carrots, i.e. 258 calories (16 times less than flour), then utilization will be more than 14%. And this result is amazing. Indeed, due to the absorption of solar energy by the atmosphere and its clouds, the percentage of use cannot be more than 25%. We got 14% with the help of cactus. It turns out that the cactus gives 56% of the greatest possible.

However, there is almost no cloud cover in dry deserts, and therefore we will get not 56% of the possible, but about 25%. And that's not enough. This result should be encouraging to researchers looking for plants with a high percentage of utilization. This cactus (a hybrid of Prickly pear) was bred by the famous Burbank (Harwood and Timiryazev). Cactus fruits are edible and taste like oranges. There are 250 tons of them per hectare. The Burbank's cactus is unpretentious and can withstand dryness, cold and snow. He can turn the desert into fodder and fruit granaries.

6. Imperfection of soil and fertilizers.

The soil suitable for agriculture should contain per cubic meter at least a thousand billion solid particles or dust particles (1015), with a surface of 300 thousand sq. meters. The required average particle thickness will then be 0.01 mm. In the soil, in general, they are about 1.7 × 1018, i.e. 6000 times more than the minimum. This means that their diameter will be almost 4 times smaller, and the surface is the same number of times larger (1.2 square versts*) of the specified minimum (other experiments show that soil particles can be much larger up to several millimeters across).

*Verst – old Russian measure of distance, 1066.8 meters – translator's note.

In addition to fragmentation, plants need the presence of soil bacteria. Thus, ordinary soil, on average, contains about 1.6 × 1015 bacteria per cubic meter, i.e. there is one bacterium for every 1000 solid particles. Probably, every kind of plant is corresponded by its most useful bacteria and fungi. These are, for example, plants containing a lot of nitrogen in their fruits (peas, beans, French bean, etc.). In the absence of bacteria and infertility of the soil, it is sown with bacteria and it becomes fertile.

A certain composition of the soil is also necessary. It should contain 12-20 elements in suitable complex bodies. If there is no or little of certain substance, then the plant grows poorly or dies. This means that it is necessary to monitor the composition of the soil and supplement it as needed, or moderate it in case of an excess, which is also sometimes harmful, and even destructive.

The humidity of the ground is also needed. Its economical adjustment is best undertaken when each group of plants similar in some respects is isolated under a transparent cover (a special construction of greenhouse).

7. Unsuitable composition of the gaseous medium surrounding this group of plants. So, in general, we find in the air a harmful excess of oxygen and nitrogen, an unfavorable amount of water vapor and an extreme lack of carbon dioxide.

8. Temperature inappropriate for the plant and its changes. It interferes with the chemical process or slows it down.

9. Unproductive consumption of chemical energy of the plant for its warming (during cold weather).

10. Pests: microbes, fungi, insects, birds and other animals. These are cruel enemies, which, under ordinary conditions, are extremely difficult to fight. In the States of Nor. Amer. insects alone cause 150 rubles loss per person, and 600 rubles – per family. But what is the cost of struggle against them?

11. The presence of extraneous plants that take away food and light from cultivated ones. We mean weeds, unnecessary and unprofitable plants.

12. Dust covering the leaves and absorbing the solar energy fruitlessly.

13. Not the most favorable composition of rays falling on leaves and producing chemical work in plants.

The elimination of many of these imperfections is possible only when isolating similar plants in special rooms with a transparent cover, arranged in a special way for each group of plants. Here the temperature, the composition of the gaseous medium and the soil are regulated, all pests such as bacteria, fungi, insects and other animals are eliminated. Only what is useful for the main plants remains or is allowed, i.e. their beneficial cohabitation with other secondary organisms (symbiosis) is arranged. In a tropical climate or in hot dry deserts, isolation may well pay off even at the present time, since a tiny piece of land less than an are (100 sq. m.) is quite sufficient to feed 1 person and even gives an excess of fruits and other edible parts for sale. The arrangement of such cells depends partly on the kind of plants, climate, latitude of the place, soil and cannot be given here. The concept of that can be obtained from my work: “The Future of the Earth”.

***

Konstantin Tsiolkovsky named the aggregate of ideas, hypotheses, theses, which formed the core of his philosophical works, “The Cosmic Philosophy”. Its central element is a doctrine (worked out using scientific methods) regarding sense of life and its understanding in the process of implementing moral practice.

We can figure out how important these researches were for humankind from Tsiolkovsky's own assertion that creation of his rocket science theory was only a complementary result, an addition to his philosophic works.

The scientist wrote a great number of philosophical works, which are little-known to general reader because these works used to be suppressed for decades. These books are an attempt to break through the "plot of silence" over the philosophy created by the Russian space prophet, discoverer and solver of the problems, which beginning of a "space era" put before human civilization.

New way of thinking is impossible, without looking for sense of life in the unity of inhabited space.

Addressing his readers, K. Tsiolkovsky says:

> *“I will endeavor to recover what got lost by humankind in multitude of millenniums, to find the philosopher's stone it let drop.”*
>
> …
>
> *“Be attentive, strain every nerve to comprehend and understand the asserted.”*
>
> …
>
> *“For your tension, for your attention you will be rewarded – I will not say hundredfold, it is too little, but infinitely. There are no words for expression of this goodness you will get for your effort. There is no measure for this goodness. This measure is infinity.”*

“The Living Universe”
K.Tsiolkovsky, 1923.

Popular science publication

Konstantin Eduardovich Tsiolkovsky
(Russian: Константин Эдуардович Циолковский)

"The Cosmic Philosophy"

www.tsiolkovsky.org

Head of the Project	Mykola Krasnostup
Design, layout, makeup	Tetiana Kolpakova, Eugene Prodayko
Translation, proofreading	Pavel Volkov

Everybody is welcome to participate in the Project!

If you want to support this Project and can do something for it,
please email us: mykola.krasnostup@gmail.com