

# Alternatives of Agriculture to Meet the Growing Population's Food Requirements

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**ABSTRACT:** *This article explores the incorporation and eating of insects as a human meal called entomophagy. Insects are very useful, not only because of their ecological viewpoint, but also because they provide human consumption with a rich protein nutrition. The pharmacist beetle, silkworm, termite and hawkmoth are among of the species that may be eaten. Different plants in the environment, for example sweet potatoes, rice, soybeans and green vegetables do not offer a diet without certain vital elements that people need. These necessary elements are often supplied by animal foods, for example fish, eggs, chicken, meat, dairy products, etc. However, extracts from insects, which are simpler to manufacture compared with other methods, are the most practical means of obtaining these important nutrients. In addition, insects may fulfil other important biological functions. In the conclusion this article proposes remedies on worldly issues such as providing risky amino acids for people who mourn because of the shortage of more traditional animal proteins.*

**KEYWORDS:** *Beetle, Entomophagy, Insects, Interplanetary Agricultural, Nutrition.*

## 1. INTRODUCTION

It is referred to as entomophagy in the practical world, and it refers to the practice of eating insects to fulfil one's nutritional needs. For many years, humans have collected the larvae, pupae, eggs, and fully developed insects of specific species from appropriate habitats like forests to consume as a source of protein. These practices are quite common in various tropical countries that are suitable for a specific insect species and encourage them to grow to larger sizes; in addition, they are plentiful and relatively easy to produce on a yearly basis in those countries that are suitable for the specific insect species. Whenever insects are eaten as food, they provide a great amount of vitamins, lipids, proteins, and other important elements to the body[1].

There is compelling evidence in support of large-scale insect rearing for human consumption as food, since this technique of protein production causes less environmental harm than other methods of protein synthesis when compared to other methods of protein synthesis. For example, raising cattle for meat as well as destroying tropical rain forests are both very damaging activities. Upon comparing cattle with insect food sources, it was shown that cows are five times more capable of turning the food sources into edible meat. Furthermore, when both the rapid developing periods and the high reproduction rates of insects were taken into consideration, it was shown that the efficiency of food conversion among insects was 20 times greater than that of cattle[2].

While there are numerous advantages to mass harvesting insect species in order to meet the world's food demand, there are significant drawbacks, including a lack of fundamental knowledge about sustainable insect farming and the inability to determine which species are appropriate for harvesting as well as which species are commercially viable due to the existence of pre-existing markets. Regardless of these problems, there are certain insect farms in Thailand that specialize in the cultivation of red palm weevils and their enormous larvae, which are sold as food to the public.

Natural areas where insects can be harvested either in a sustainable manner or in large quantities artificially by controlling the environment in a nonthreatening manner can be considered as a better way to increase the preservation worth of natural areas where insects can be harvested either in a sustainable manner or in large quantities artificially by controlling the environment in a nonthreatening manner. Nonetheless, since there is no significant cultural or culinary history associated with the eating of insects in sophisticated western societies, entomophagy is expected to become fairly widespread in the near future. In many nations' subarctic regions, there is a shortage of plentiful and big insects that may be harvested and eaten on a regular basis, and as a result, development has not been seen in this region[3].

On the other hand, a large number of individuals living in western regions unwittingly consume insects or their components on a daily basis without having any knowledge of what they are doing. It has been estimated that the

typical American consumes approximately 2 pounds of dead insects and their components over a year's time period. These bacteria may be found in a variety of foods including vegetables, beer, pasta, rice, spinach, and broccoli. The Food and Drug Administration of the United States has approved the use of insect parts in certain food categories. For example, beer made mostly of hops may include aphids at concentrations of no more than 2,500 per ten grams of hops. For the most part, people in tropical areas of the Asian region raise insects for consumption as food. This is not because insects are environmentally friendly, inexpensive, or the most effective way to meet protein requirements; rather, it is because insects have a good taste and are consumed in large quantities, either prepared or raw, according to traditional recipes.

The provision of food for human habitation remains one of the most pressing issues in the engineering of space settlement. Unquestionably, in order to survive for an extended period of time on a spacecraft or on another planet, it is essential to maintain a farming system that produces food while also decomposing and recycling waste goods. Humans have traditionally eaten a variety of animals, and when they go to and live in space, they will be better able to deal with the environment because of this. As a result, varied, engaging, and high-quality food may be an important element in creating a comfortable atmosphere. There are many benefits to using insects as modules in a space-based agricultural system as opposed to the different groups of animals that might be used, especially in small systems, to supplement the food supply. The study of ancient excrement reveals that people have historically eaten insects, which is consistent with previous findings. As a result, this article suggests that entomophagy be studied in conjunction with space agriculture in order to support human life in a variety of space habitation configurations[4].

According to the system's perspective, the insects' role in interplanetary agriculture is to transform inedible or substandard biomass into superior-quality food for humans or fodder for livestock. In general, the cultivation of insects should not be included in astronomical or other capitals that are mostly comprised of plant culture. Therefore, insects must feed on plants or portions of plants that are not suitable for human consumption as a result of their evolution. For example, mulberry leaves are eaten by silkworm larvae, which are not suitable for human consumption since they contain tannins. While on the other side, insects are naturally talented in breaking down the indigestible vegetable components. It is appropriate if the materials are destroyed by insects, which may be a problem in space-based agricultural settings where insects are prevalent. For example, woody materials will isolate carbon, which will aid insects in speeding up the breakdown process by different soil organisms and fungi via partial digestion as well as mechanical activity, resulting in increased productivity. As a result, insects are in a position to make a significant contribution to the termination of material progressions. Larvae, bug pupae, and other farm animals such as cattle, chickens, and fish may all be consumed by other farm animals. The excrement of animals that have been grown in huge numbers, such as silkworms, may also be used in a variety of ways, including cultivating plankton or feeding fish in raw form. In general, by selecting and integrating appropriate insect species into an interplanetary agricultural system, the presence of materials loops in the system may be eliminated, and the consumption productivity of the incoming energy can be increased [5]. Figure 1 shows the consumption of insects as a food.



**Figure 1: The consumption of insects as a food.**

### *1.1 How can bug eating assist manage obesity?*

The intake of insects offers excellent food value, since most insects are rich in healthy fats, protein, iron and calcium, while the carbs are minimal. In actual fact, the author of the Food and Agriculture Organization (FAO) study argues that insect intake produces more nutrients than frequent meats, such as beef. For example, 100 grams of cricket have more calories, protein, fat and carbs than beef. Food and feed experts in the FAO study discover the low fat level of beetles that indicates further that entomophagy may be regarded an effective method to cope with obesity and associated illnesses. According to daily meal, a guy from an ordinary Western diet who switched to bugs owing to the erroneous getting of a bowl of crunchy crickets instead of peanuts found out later that insect intake in a meal helped him to lose weight [6].

### *1.2 Health advantages of bug eating:*

According to the report of the United Nations issued by the Food and Agriculture Organization in 2013, close to two billion people across the globe eat insects as part of their traditional diet. The most frequent insects include beetles and bees, wasps, caterpillars, locusts, ants, grasshopper and crickets. Above all, there are more than 1,900 bug species deemed edible. Entomophagy is regarded as widespread practice in many areas of the world including China, Asia, Africa, New Zealand, Australia, and some emerging Central and South American districts. In other parts of the West, on the other hand, it seems that bugs haven't pleased taste senses. According to a study report on insects as food, 72 percent of Americans are hesitant to eat insects as food. According to the FAO study, entomophagy has been seen by humans as extremely unpleasant and frequently links consumer insects with emerging behaviour in the main western areas. People in this group should learn about the potential health advantages of consuming insects that can alter their minds[7].

### *1.3 Animal resources to fulfil nutritional needs:*

The aim of a cross-planetary farming agreement must be based on the need of recycling the necessary resources for life-care, removing components which may cause damage to life and providing food. Therefore, oxygen must be supplied, while carbon dioxide must be removed from the gaseous stage and the synthesis of food may then start after all these stages. Furthermore, the water evaporated by plants must be condensed further into liquid form. The species chosen for the system must be picked based on their nutritional worth. As the volume and area of production access for agricultural goods are insufficient, in a given period of time the output per unit volume/area has to be considered so that food as well as oxygen may be produced at an acceptable rate [8].

Plant species soybean, rice, green/yellow vegetables and sweet potatoes are chosen to supply people with food-based fiber, metabolic power, vitamins, protein, and fat as well as trace components such as iron and calcium for an interplanetary system. The best combination of these four nutrients was evaluated: 100 g of soybean, 300 g of green/yellow vegetable 300 g of rice and 200 g of sweet potatoes per day per individual. The criteria utilized to choose the aforementioned combination were:

- I. Total use of energy.
- II. Score of amino acid.
- III. The amount of each nutrient is sufficient.
- IV. The lipid, protein and carbohydrate energy ratio.

Despite all these combinations of plant products, it does not fully satisfy the individual nutritional needs, thus the amount of salt and fat are very little, and it appears that the presence of amino acid is also not balanced. This is a reciprocal characteristic of herbal diets. For the purpose of overcoming these scarcities, mineral sodium may also address many additional problems by supplying animal protein in insect form.

### *1.4 How might entomophagy assist to fulfil the food needs of a growing population?*

The FAO proposes that entomophagy may help resolve the food crisis, which is expected to occur under the growing population scenario. According to the study released by the World Bank, by the end of 2050 the world's population is projected to increase by almost nine billion, which implies that around 50 per cent more food is need to feed two billion more people. Climate change is predicted to occur which may decrease agricultural production yields beyond 25%, therefore there is a vital need to identify unconventional means of meeting the extra food demand [9].

The FAO study recommends that its current food sustainability initiatives include entomophagy as a feasible alternative. Furthermore, it points out that the basic aim is to promote food and nutrition safety and to provide policy makers and consumers with more environmentally friendly food recommendations, which also clarify the significance of ecologically sustainable food arrangements. The use of insects as food is appropriately classified as an environmentally-friendly food scenario and must also be seen as a key option for both food supplements and staples and for their important part in common sustainable diets.

### *1.5 Space Agriculture Insect Species:*

About 70% of all animal species on Earth are insects and, in a composite fashion, play a key part in the recycling of components in the land dwelling biosphere. A broad range of insects, for example, is acceptable as food, equal to the diversity of the normal environment. In nature, insects may be equivalent to the commonly consumed lobster, shrimp and crab, and the texture and flavor of meat produced from insects are similar.

The vast diversity of insects produces with plants and numerous interspecies linkages between plants and insects in their co-evolution may be readily discovered. Consequently, in many instances, the leaves of a certain plant are exclusively eaten by a specific kind of insect, which can adapt and manage the defenses of the plant. In order to provide floral nectar, a certain flower will thus rely on a particular insect for cross-pollination. Given these environmental characteristics, the policy of an interplanetary agricultural system would rely largely on the natural partnerships between components to enable the efficient development of food groups and the end of the loop of recycling[10].

We must thus have a better understanding of the web interaction between species for the ecological engineering unit. For interplanetary agriculture, various insect species such as the hawkmoth, the silkworm, the termite and the pharmacy beetle are investigated. In the midst of numerous benefits, these insects cannot compete with people because of the food resources; on the other hand, they convert waste or inedible biomass into edible food for human use.

## **2. DISCUSSION**

One would not survive on consumption of bugs alone in a survival scenario, despite the fact that certain websites claims that this is possible under some situations. Insects, on the other hand, are often regarded as an important component of nature that helps to keep humans alive. Bugs have a high nutritional content, with a high concentration of vitamins and proteins, as well as varying quantities of fat and other fat-soluble nutrients. Before eating insects, it is important to be aware of a few facts. Avoid insects that are brightly colored, especially those that are yellow, red, and orange in hue, such as ladybugs, which are known to attract attention. Insects with brilliant colors on their bodies are said to be nature's method of communicating to humans that these specific kind of insects are very hazardous to eat. As a result, rather of choosing brightly colored insects, go for ones that are harder to see, such as green, black, and brown. It is for this reason that they are undetectable. Due to the fact that they are sought after by humans as well as other animals, they are in high demand. Likewise, keep away from insects that emit foul smells, which are often indicative of the presence of poisons inside the insects.

Stink bugs, on the other hand, are a notable exception, since they are often consumed raw in certain areas of Mexico as well as other parts of the world. It has been noted to have a pronounced anise flavor, with a cinnamon flavor emerging later in the process. When it comes to eating bugs, the first and most important guideline is to boil them as soon as you capture them. Insects are employed to shield vile parasites, germs, and a variety of other cruel creatures from harm. The majority of these parasites and bacteria are destroyed when food is cooked at the proper temperature. People also benefit from cooking since it allows them to prevent the possibility of ingesting pests via their usual meals. The nutritional value of the insects was assessed in order to determine whether or not they might serve as a viable replacement to the insects' flesh in a commercially viable manner. Despite the fact that it has a very high protein content when compared to other mulberry leaf plants, there is a substantial improvement in the case of protein passing through the insect. As a result, an increase in protein content is seen, which is accompanied with an increase in the amount of many hazardous amino acids. Silkworm pupae contain fat in concentrations that are eight times greater than those found in mulberry leaves. Furthermore, it exhibits an animal-like structure as well.

The model diet utilized in this study includes 50 grams of silkworm or a variety of insects in addition to the primary composition of plants such as sweet potato, rice, soybean, and leafy green vegetables. It is estimated that mulberry farming would need an area of land equivalent to 64 meters square each person in order to fulfil the demands of providing this massive quantity of silkworm every day. For the cultivation of the four most important plant species, a 200-meter square per person is required.

Despite the fact that insects do not have a complete complement of nutrients that may be obtained from bird egg or insect meat, they can nevertheless offer a significant portion of the nutrients that are needed. It is possible to meet all of the remaining nutritional needs via a variety of different methods. The materials produced from chicken are used to correct deficiencies in vitamin B12, cholesterol, and vitamin D that occur in the standard dietary intake. The inclusion of the Japanese mushroom helps to compensate for vitamin D deficiency caused by a lack of sunlight. If the food is powdered and finely chopped before being subjected to Ultraviolet (UV) radiation in order to stimulate the transformation of the antecedent component into vitamin D, the amount of vitamin D in the diet may be decreased. The many additional nutrients may be used as supplements to the pills or as food additives in conjunction with the tablets.

The hardness of different species is a critical element in determining which ones should be used in the interplanetary agricultural system. The various types of fish species may be taken into consideration when deciding which ones to use in an interplanetary agricultural system. In many locations, fish are raised in rice paddies, where the loach fish is regarded to be the most frequent species that can be found naturally in this environment. It has been discovered that this specific type of fish is unaffected by unfavorable weather circumstances such as partial aeration of the paddy and low water quality. After ingesting oxygen via their digestive tube, they may expel it through their anus, which they use to disperse the excess oxygen. A significant concentration of nutrients may be found in it. There are certain additional chemicals that continue to be examined for the purpose of calculating the nutritional content of food; nevertheless, they are determined to be insignificant and not detrimental to the concept of an interplanetary agricultural system.

### 3. CONCLUSION

It is believed that entomophagy is a potential way of meeting the dietary needs of humans on various planets. In an interplanetary agricultural system, insects are capable of recycling items and processing trash; moreover, they not only serve as food and feed, but they also aid in the pollination of plant species. It has been discovered that a prototype diet consisting of sweet potato, rice, soybeans, green vegetables, loach fish, and silkworm pupa may provide all of the nutritional needs of a human being completely. Because they can perform a wide range of tasks while without interfering with the development of plants, the integration of insects as components of an interplanetary agricultural system may improve its effectiveness. Additionally, the creation of a prototype for an interplanetary agricultural system must provide insight towards improving the management of the Earth's biosphere and sanctioning the system for long-term sustainability. At the conclusion of the paper, we conclude that Entomophagy is regarded to be a potential important concept in mitigating the global food crisis.

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