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More or Less About Algal Culture

MUCH HAS BEEN WRITTEN in recent months about algal culture, particularly regarding the production of the unicellar green algae, *Chlorella.* Many of the reports deal with *Chlorella* as a source of food while others discuss or recommend its use as a feed, fertilizer, or fuel. Admittedly algae could be used in all of the suggested fields. So could soybean meal.

Basic Research Justified

Providing food for an increasing world population demanding higher nutritional standards is an important problem. It justifies study and research as well as international cooperation. A basic cause of world discord is hunger. Anything we can do to stimulate and achieve increased food production in deficit areas will be a contribution to the realization of a permanent peace.

Why Algal Culture?

Research emphasis on algal culture stems from the fact that algae are very efficient users of solar energy and, therefore, highly efficient photosynthesizers. The growth of the plant in water takes place primarily through division of each cell into four, eight, or 16 new cells, each of which is capable of photosynthesis. Under favorable conditions a further division occurs every 12 hours. The growth of the culture requires a supply of carbon dioxide, inorganic nutrients, a relatively uniform temperature, and light. Large scale culture as well as continuous harvesting of *Chlorella* appears technically feasible. Under favorable conditions a production of 35.0 tons (dry basis) of *Chlorella* per year per acre of culture medium is a reasonable expectation. By way of comparison, the per-acre yield of soybeans is only 0.75 ton. The possibilities of producing large quantities of algae are therefore real.

According to R. W. Krauss, "many investigators have observed that the unicellular green algae can convert into chemical energy more of the radiant energy striking a unit area than higher plants. Although the efficiency of the photosynthetic mechanism is the same, the more rapid growth stems from the difference in organization of the morphology of the algae which enables it to take advantage of the environment. Not only is the rate of growth consequently the most rapid known, but the biochemical organization of the converted energy into protein and fats can be readily directed by manipulation of the medium. In brief, these organisms represent the best mechanism for conversion of solar energy available and their synthetic processes are the most pliable to human direction."

There Are Technical and Production Problems

It is appropriate to point out that the controlled culture of algae and particularly of *Chlorella* is not easy. As with all industrial microbiological processes, many precautions need to be taken to ensure a satisfactory yield and quality of product. When *Chlorella* is to be grown on a large scale in open ponds, the initial investment will be comparatively low, but vexatious operational difficulties are encountered:

1. Contamination of culture by protozoa and bacteria may make the harvest unsuitable for food or feed.
2. Harvesting of large-scale culture units containing 1% of algae, dry weight, is a costly procedure, particularly if a super centrifuge is used.
3. Algal cells when removed by centrifuge form a thick paste which contains about 75% water. In this condition the material spoils quickly. Freezing or spray drying facilities which would provide a solution to this problem are expensive.
4. Maintenance of the desired carbon dioxide concentrations in the culture media, although not difficult in a closed system, would constitute a major technical problem in open ponds or trenches.

Chlorella Not Yet A Cheap Commodity

On the basis of recent experimental projects it is estimated that closed system facilities for producing 50 tons (dry weight) of *Chlorella* per day (18,000 tons per year) would require a capital outlay of approximately $25 million. Assuming a 10-year write-off, there would be a charge of $140 per ton for amortization. Such a cost item would appear to condemn the scheme as impractical. Even a charge of $28 per ton (20% of estimate) would be a burden when competing with soybean meal at $65 or fish meal at $130 per ton. But, perhaps it is yet much too early to hazard a cost estimate.

Viewing Matters Objectively

From the FAO Second World Food Survey made in 1952, it is noted that the peoples of the Far East are particularly deficient in food supplies as measured against calorie requirements. These nations deserve our sympathy. Our feelings, however, should not lead us to believe that their situation is hopeless.

From the viewpoint of technology, the world can feed itself now, and in the century ahead, if it has the will to do so.

The major problem in organizing for food sufficiency in deficit areas is to catalyze an overwhelming desire in these less fortunate people for self-respect, self-help, and self-determination. To paraphrase an old adage, the task is not to make them drink but to create an overpowering thirst. Notable progress is now being made in some food deficient countries. Much more can and will be done.

In the meantime, our more fortunate nation can well afford to be generous with both material and technical assistance.

Need for Further Research

Notwithstanding our optimism regarding the ability of a technologically advanced civilization to provide the food it needs, we recognize the need for research on algae. It is necessary, however, to differentiate between recommending the immediate use of a new technique for producing organic matter and endorsing the need of further study of promising techniques. The pursuit of knowledge having possibilities of advantage to humanity is both a virtue and necessity.