COMMENTARY

Organic farming *vis-à-vis* modern agriculture

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Before the 19th century, most food in the world was organically produced using organic manure and human and animal power (horses in the US and oxen in Asia)[1]. The agricultural revolution began in England in the early 19th century, when Jethro Tull invented a horse-drawn hoe and a seed drill. By middle of the 19th century, manufacture of superphosphate fertilizer was started in England. The first tractor with an internal combustion engine was developed[2] in the US in 1910. Near about the same period, the German chemist Fritz Haber developed the process of ammonia synthesis, which led to the manufacture of nitrogen fertilizer in Europe and the US[3]. Fertilizer N was needed in large amounts to benefit from the discovery of high-yielding hybrid corn (maize). Insecticidal property of DDT was discovered in 1939 by P. Muller in Switzerland and was followed by the discovery of BHC in France and UK[4]. Nitrophenols were the first group of selective herbicides developed in 1933 and were followed by the development[5] of 2,4-D and MCPA in 1940s. Thus, by the middle of the 20th century, most of the components of modern agriculture, i.e. tractors and associated farm machines, fertilizer and agrochemicals were in use on agricultural farms in the developed world.

Modern agriculture has been of great help in alleviating hunger from the world, because the world population more than doubled itself during the last half of the 20th century; it increased[6] from 2.5 billion in AD 1950 to 6 billion in 2000. It is predicted that the world population will again double itself by the end of the 21st century and will touch the 12 billion mark. Most of this increase in population has been, and will be, in the developing countries in Asia, Africa and South America. Modern agriculture with all its components has thus to stay to ward off hunger from developing countries. India's own achievements in agricultural production after the Green Revolution in the mid-1960s, has been exemplary and mainly due to increased use of the components of modern agriculture, namely fertilizer, pesticides and farm machinery. Food-grain production in India more than doubled itself during the post-Green Revolution period with virtually no increase in net cultivated area; it increased from 95 million tonnes in 1967–68 to 209 million tonnes in 1999–2000 (140 ± 1 million ha)[7]. Nevertheless, overuse of pesticides, specially in vegetables and fruits, resulted in residues above safety levels[8,9], and this brought to attention the ill-effects of modern agriculture; even drinking water was not spared[10]. Soon the ill effects of overuse of fertilizer nitrogen were recognized in Europe, USA and even in India. These were nitrate enrichment of groundwaters; river waters and estuaries and release of ammonia and nitrous oxide to the atmosphere; the former added to the problem of acid rain, while the latter led to the reduction of ozone layer[11–13]. These ill-effects of modern agriculture forced people, specially in countries with high-income economies (European countries, USA, Canada, Australia, etc.) to demand food grown without fertilizers and pesticides. This paved the way for organic farming.

The roots of organic farming can be traced to Europe back to the late early 20th century[14]. In 1927, a trademark 'Demeter' was introduced by the Austrian philosopher Rudolf Steiner for food produced in biodynamic farming systems. Hans Muller, working in Switzerland and later in Germany, founded a movement for agricultural reform centred around Christian concepts of land stewardship and preservation of family farms. Soil fertility was maintained through crop rotation and careful management and use of animal manures. In UK, Stapledon's work with alternate husbandry systems and Howard's work on the role of organic matter in soils and composting provided a powerful stimulus to Lady Eve Balfour, who in 1939, began the Haughly experiments (continued until 1969) to investigate the links between the way food is produced, food quality and human health. In USA, the Rodale family founded the Soil and Health Foundation in 1947, to study the production of healthy crops and livestock while maintaining healthy and fertile soils and to link the farm produce with human health and nutrition. The Japanese farmer and philosopher Masanobu Fukuoka practised and promoted natural farming throughout the world and has followers in India also. His book *One-Straw Revolution*[15] has been widely acclaimed. The formation of the International Federation of Organic Agriculture Movements (IFOAM) in 1972, gave an international framework for the discussion and codification of internationally recognized principles of organic farming.

A large number of terms are used as an alternative to organic farming. These are: biological, ecological, bio-dynamic, organic–biological and natural agriculture.

Organic farming requires certification by accredited agencies in India, like IFOAM, Tea Board, Coffee Board, Spices Board, Coconut Development Board and Directorate of Cashew and Cocoa. Agencies promoting organic farming in India are: National Steering Committee, Ministry of Commerce, Govt. of India and Agricultural and Processed Food Export Development Authority (APEDA). APEDA is the coordinating agency for organic food production and export under the brand name 'India Organic'. The steps involved in certification are: registration of the producers and processing industries, provision of basic information on the crop and farm, inspection and verification of the field and processing unit, inspection of production methods and practices by the inspector of the certifying agency. A transition period of 2–3 years is required during which no inorganic fertilizer and agrochemicals are used on the farm before which the produce can be marketed. Since crop yields during this transitory period are low, farmers intending to go for organic farming would suffer losses, unless some compensation is made for this. The cost of these products is further increased by the fact that the production in organic farming is generally 20–38% less[16] compared to that using modern agricultural practices. Furthermore, the current standard of organic farming is quite stringent in respect of organic manure used, animal feed/fodder used, minerals or soil amendments used, quality of surface irrigation and underground water and agricultural practices adopted at farms in the neighbourhood. In foreign countries, techniques such as Kirilian photography and microbiological and bio-chemical tests are employed[17] to check how organic foods are produced on the farm. Production of organic food therefore, requires considerable atten-

tion, care and skills and above all a good link with its market. Furthermore, organic manure is not abundantly available and on plant nutrient basis is more expensive than chemical fertilizers. What needs to be emphasized is that in the production and marketing of the organically produced agricultural products, the check is on the process of its production rather than on the product per se, although quality standards also have to be met. On the contrary, in the production and marketing of most industrial products, the check is on the quality of the product. This would explain why the check on organically produced food is so stringent.

In 1993, the Swiss Government decided to disburse payments based on organic farming. As a result, the main food distributors having 60% or more market shares in agricultural produce began intensive marketing programmes focused on more natural food. Organically produced agricultural products have received global attention in the last few years, specially due to their being a multi-billion trade. The global market for organically produced foods in 2003 is estimated at US$ 26 billion (Rs 11,700 crores)[18] and is estimated to increase to 102 billion US$ by 2020. According to a global survey conducted by Ockologie and Landbau (SOUL) (Formation of Ecology and Agriculture) of Germany, in 2003 organic farming was practised on only 5% of the world's cultivated area. Austria had the highest percentage (11.3) and India the least percentage (0.03) of cultivated area under organic farming[19].

Organic farming has received considerable attention in India and recently, the Govt of India constituted a Task Force on Organic Farming under the chairmanship of Kunwarji Bhai Yadav. In its report the committee emphasized on the need for consolidating information on organic farming and its benefits. One of the steering committees constituted by this Task Force under the Chairmanship of M. S. Swaminathan, Chairman, National Commission on Farmers, Govt of India, has suggested taking up organic farming as a challenging task and as a thrust area of the 10th Five Year Plan. The steering committee advocated to give boost to organic farming in the rainfed areas and in the northeastern states, where there is limited use of agricultural chemicals. Madhya Pradesh took early lead in this regard and Uttaranchal followed suit in declaring themselves as organic states. The National Academy of Agricultural Sciences organized a workshop on organic farming at New Delhi. Also, the M.S. Swaminathan Research Foundation, Chennai in collaboration with Ohio State University, USA had recently organized a Project Design Workshop on Sustainable Use of Natural Resources in India at New Delhi, with a full day session on organic farming. The major outcome of these two workshops was that organic farming was to be practised in niche areas on selected crops to be identified by the authorities and others having stakes in it.

Organic farming as in the modern context was practised in India only on 4800 ha in 2003 and the produce exported was valued at about 89 crores of rupees, which is only 0.8% of the current global market. Among the field crops, only Basmati rice, cotton and sesame were exported. Cotton and sesame are mostly grown under rainfed/dryland agriculture conditions, and it should not be difficult to grow these using organic manure. Cotton is the largest consumer of insecticides and real serious efforts will be needed to prevent their use to guarantee organically produced cotton by demarcating areas and restricting pest control to neem and other botanical insecticides and biopesticides. Basmati rice is grown in the north in the 'rice–wheat cropping system' belt, where large amounts of fertilizers are used. Here again, areas need to be demarcated. Reasonable price guarantee can do the trick since yield levels in organic manure fields are likely to be low. This area can also produce organically produced wheat, the market for which is likely to grow in future. Perennial plantation crops can be easily grown with organic manure; even today organic manure is used in large amounts in these crops. There has been a tendency to use chemical fertilizer in fruit orchards, which can be curbed. Vegetable crops are now grown using fertilizers and here areas have to be demarcated for organic vegetable production. Efforts are needed to prevent the use of pesticides on fruit and vegetable crops. However, in peri-urban agriculture, vegetables grown on sewage sludge are loaded with heavy metals (As, Cr, Cd and Pb)[20] and their continued intake could be a health hazard.

Continued use of organic manure on a farm improves its organic matter content, which supports the soil micro, meso and macro fauna and makes the soil a living body[21]. Organic matter improves soil structure and increases water-holding capacity, which is important under dry farming conditions. Continuous addition of organic manure assures a regular supply of micronutrients. Nevertheless, availability of macronutrients from organic manure is not as fast as from chemical fertilizers, because it depends upon the rate of their decomposition, which is controlled by their C : N ratio, and soil temperature and moisture[22]. Myths such as better taste, improved quality and higher nutritive value generally attached with organically produced foods have been argued[23] and found to lack a scientific basis[24]. Nevertheless, market for organically produced foods is on the increase.

India can greatly benefit from the export of organic foods, but needs to seriously devote attention to market intelligence regarding which products to grow, where to sell, distribution channels, competition, market access, etc. Pre-harvest prices should be announced, so that farmers do not suffer when the produce is ready. Contractual farming for select crops by commercial organizations could be another avenue.

Organic farming is a market demand-oriented, highly specialized small sector of Indian agriculture, which if well planned and executed can become an important foreign-exchange earner for the country and money-spinner for the farmers. However, to meet the ever-growing food-grain demands of the country, which is estimated[25] at 294 million tonnes per annum by 2020, the mainstream of Indian agriculture has to depend on modern agricultural inputs, such as chemical fertilizer and pesticides. Nevertheless, their restrained and efficient use is important. As regards plant nutrient needs in modern agriculture, integrated nutrient supply is the key for sustainable Indian agriculture[26].

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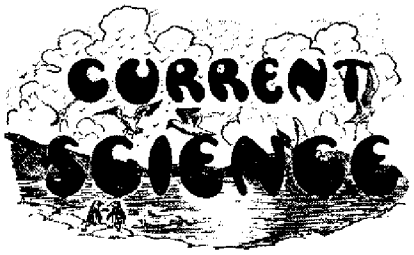
FROM THE ARCHIVES



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Scientific awakening

Professor A. V. Hill's dynamic visit to twelve Indian cities between mid-November, 1943, and early April, 1944, gave much comfort to the scientific community, and he now gladly testifies to the great goodwill universally manifested towards his mission. This lay in acquainting himself with the state of scientific and industrial research in this country, and thus equipping himself to advise the Secretary of State on the organization of scientific endeavour as a part of Indian post-war reconstruction; and on its co-ordination with similar activities in Britain. His report (Scientific Research in India. Professor A. V. Hill, Government of India Press, Simla, 1944, pp. 40) is rich in proposals directed towards development of Indian resources in men and material; its interest and importance are outstanding.

Immediately on his return, Prof. Hill procured an official invitation to a group of Indian scientists led by Sir Shanti Swarup Bhatnagar, Head of the Board of Scientific and Industrial Research, to visit British factories, laboratories and institutions concerned with linking scientific procedure to public needs. This embassy having later journeyed to the United States and Canada, returned to India in mid-February, and it is reasonable to hope that its members may come to be regarded as apostles of a new era; for their unique experience will authorise them to select and urge the adoption of such among Prof. Hill's proposals as they deem best applicable to Indian conditions.

Scientific awakening has come to other nations through the war, and India must not lag behind. Addressing the East-India Association in July 1944 on the results of his Indian mission Prof. Hill gave his emphatic summary in the words, 'Scientific Development or Disaster'. Faced with the standing threefold menace of ignorance, ill-health and malnutrition, India is threatened with the future calamity of a population overflowing the limits of her agricultural resources, because one immediate result of improved nutrition is reduced mortality. 'In quality and calories together India needs at once at least 50 per cent more food than she now has; give her that and her population will increase not by 15 per 1,000 per annum but by 20 or 25 – it is already 20 in the Punjab. Then in 30 years or so the food supply will have to be doubled again, to be three times what it is now'. A threefold increase in thirty years demands a stupendous national effort. New land must be brought into cultivation involving irrigation, and proper maintenance to avoid erosion. Roads, railways and bridges must be built, and transport multiplied. Wide improvement in the breeding of plants and animals must be effected, and insect-pests mercilessly combated. Soil chemistry must be studied and applied. Every known means for battling waste must be operated, so that all useful ingredients may return to the land. Afforestation must be stimulated, if only to avert the lamentable destruction of cowdung as fuel and redirect it to its proper destination, the soil.

There are many other matters discussed by Prof. Hill in his report, including Indian scientific societies and the various ways in which Government might assist and encourage them; for instance, by purchasing a certain mileage of air-travel for distribution among such bodies. His fruitful, sympathetic and stimulating visit followed by this wealth of practical proposals, will provide abundant material for reflection, discussion and construction during many years to come, the whole event being unique, in the scientific life of this country, In conclusion, it is worthwhile to quote a significant passage in Prof. Hill's preface to the report: 'I have assumed throughout that the scientific method, rightly and confidently used, will provide the framework within which national development will be planned by Indians for India. In their task they can be sure of the co-operation and goodwill of their scientific colleagues elsewhere. No other method can possibly succeed'.

M.O.F.