RDHAN - APIGR
No. 1

ORGANIC FARMING

Proceedings of the
NATIONAL CONVENTION

19th to 21st March, 1984

held at
SEVAGRAM ASHRAM PRATISHTHAN
Sevagram, Wardha – 442102

A SAMVARDHAN – NAI TALIM PUBLICATION
Sevagram, Wardha – 442102 India.

Publishers

(1) NAI TALIM SAMITI
Sevagram Wardha.

(2) SAMVARDHAN – APIGR
D–1, Aurobindo Society,
Vastrapur Talavadi,
AHMEDABAD - 380015

Printed at:

Paramdham Mudranalaya Paunar
Wardha – 442111

★

CONTENTS

PREFACE

The Science and Technology which has become part of the daily life of people in the Western World, is now increasingly being superimposed on the Third World, in the name of development. The Third World is continuously deprived of options, except those that fall within the framework of Western Understanding and experience. While most of the Third world has achieved political independence, they stiil remain tied to the theories and prescriptions for development, doled out by the Western World. In the name of 'Progress', 'growth' & 'development' there has been a systematic assault on the knowledge resource and cultural base, traditions of the Third World people. The social and ecological fabric that sustained them, over centuries has been rent asunder. India has not been an exception to the rule.

Mega – developmental projects like the Green Revolution, the White Revolution, the Blue Revolution, Nuclear plants, Big Dams etc. have been significant contributors to this process, more than anything else. Despite the initial euphoria and optimism that surrounded the introduction of these mega-projects, the true nature and character of these projects have surfaced, in terms of its negative impact on various critical areas like genetic diversity, environment, human health, sustainability of resource use etc. etc. Sure, it did bring some benefits, to some sections of the population, but with each passing day the realisation of its potential for even swifter and more widespread destruction of man's social and ecological (or, should one say, survival) links are being established. Even as its credibility rapidly erodes, we are getting pushed in more and larger projects, of this nature,

It is with this perspective and understanding, that the Sevagram Ashram Pratisthan organised a meeting of concerned & like-minded people, in Sevagram, between 19-21 March, 1984. Within this overall changing scenario, the focus was on 'Organic Farming' and ts ramifications – taking food and agriculture, as the starting point for an exploration of the totality. It is the proceedings of this workshop that is reported herein.

One of the most important outcomes of this meeting, was that it set into motion the beginings of an organisation, now known as Samvardhan – Association for Propagation of Indigenous Genetic Resources (APIGR). Since I have had the good fortune to be associated with this process, and have seen the unfolding and sharing of common concerns take shape – I must congratulate the organisers for taking this initiative and starting the nucleus of a movement, in such a critical area of concern. On behalf of Samvardhan – APIGR, and the people of India, I express my deep sense of gratitude to the Sevagram Ashram Pratishthan, for this extremely well-timed initiative, on their part.

It is always difficult to express one's sense of gratitude adequately, to all the persons who have directly or indirectly, contributed to an initiative, such as this. There is probably no difficulty in identifying Mr. Kanakmal Gandhi of Sevagram Ashram Pratishthan, whose insights and foresight resulted in this meeting. But, he in turn, we are sure, would have many persons to thank for providing the mental stimulus, for the same.

To Ms. Priya Desingkar and Mr. Ashok Jhunjhunwala who patiently shifted through all the discussions to come out with a presentation of the proceedings, we remain extremely grateful, to Mr. Shailen Ghosh, whose – well-researched and studied ramblings in a major way, set the tone for the meeting, we remain indebted. And, finally for all their individual and collective contributions, we are thankful to all the participants present at the workshop.

This note would be incomplete, without acknowledging the support and hospitality of the Sevagram Ashram Pratishthan during the workshop – and Nai Talim Samiti for its financial assistance for printing of the proceedings of the workshop – and finally to all those, too numerous to mention, who have supported us, through this endeavour.

Korah Mathen
Secretary
Samvardhan-APIGR.

Keynote Address at the Inaugural Session of the Convention on Organic Farming at Sevagram on March 19, 1984.

S. N. Ghosh.

Friends,

We are holding this convention on organic farming at a place which is hallowed by the memory of Gandhiji. Many profound thoughts took their roots here and many far-reaching actions sprouted here. Let us hope and pray that this convention will usher in a mighty movement for organic farming and organic living and that it will crystalize certain ideas which will continue to feed and nurture the movement.

First, we have to understand why people have not been practising organic farming and why the Gandhians themselves have faltered in this. There is a debate in their minds. Many of them came to develop some misgivings that strict adherence to organic farming could be an impractical rigidity. We have to lay bare the roots of these misgivings.

Secondly, we have to give up the idea that chemicalisation of agriculture has not made much progress, that it has touched only the lands belonging to the upper 25 percent of our farming population and hence, the rest should be deemed as practicing organic farming. The rest may be non-chemical farming alright. But that is not organic farming if it is based on exhauston of the soil. In many of our Gandhian institutions, even in the rural areas, we find toilets with septic tanks. It is certainly not in confomity with the principle of organic farming. A great scientist said: "mankind may perhaps survive the atom bombs, but it would not survive flush toilets." Flush toilet breaks the biogeochemical cycle which supports life : It violates the natural

principle which enjoins that all those who take nutrients from the soil must return nutrients to the soil. If we are using flush toilets or even latrines with septic tanks, we are breaking this natural principle and the biogeochemical cycle. This is not working in organic relationship. It is also dissipation of the vital inputs for organic farming.

Then, there are many other related issues. During this introduction itself, I would like to deal with the interconnections between those questions and to visualize the fundamental concepts that underline organic farming.

Organic farming is very much native to this country. Whoever tries to write a history of organic farming will have to refer to India and China. The farmers of these two large countries are known as "farmers of forty centuries" and it is organic farming that sustained them. Therefore, it is not that some ideas about organic farming originated in the West and we are borrowing it. It is our own product, our contribution to the world.

The question is : why did it recede ? And why, despite its revival during the last one decade, has there been no upsurge in organic farming as yet? Answers to these questions will give clues to what exactly are necessary now.

Many people raise disputes about the nomenclature. Some say, "why talk of organic farming ? Call it Ecofarming". Some otheres prefer the term "biological farming." Yet others prefer "biodynamic farming", "macrobiotic agriculture," etc. It is not necessary to go into the niceties of these terms and the shades of differences between their emphasis. The basic point is that we need natural farming because it is farming based on natural principles which alone is sustainable. When farming encompasses all the wholesome natural principles, the total package of products is much more than the sum of yields which would be otherwise available. This is because there are symbiotic effects when these principles are allowed to be in operation together. In their joint harness they become more productive.

The next point to note is that there is a core of commonality between "eco-farming", "biodynamic farming"

etc. Their common seminal principle is that instead of trying to feed the plant directly, the objective should be to nourish the soil. The proponents of each of these natural forms of farming are convinced that bypassing the question of soil health is as foolish and counterproductive as the attempts of men who seek merely to "fertilise" sick women i. e. to make them produce babies. Both the baby and the mother die in such attempts.

Farming is not limited to cultivation of a few kinds of crops. It includes the farming of cereals of different varieties, genera and families; the farming of pulses, vegetables, oil seeds; farming of fruits, farming of livestock for milk and meat; and farming for fish, for poultry etc. etc.

Even this is not all. It represents a whole culture.

Organic farming means farming in the spirit of organic relationship. When you say this, it opens up a whole vista. In nature, organic relationship is a pervasive phenomenon. Everything is connected with everything else. Hence organic farming is not mere nonchemicalism in agriculture. To be able to sustain this "non-chemicalism", it has to get support from a host of other factors which are inseparably connected. Herein lies the essence of organicism.

Since organic farming means placing farming on integral relationship, we have to know the relationship between the soil, water and plants; between soil, soil microbes and waste products; between the vegetable kingdom and the animal kingdom, of which the apex animal is man; between agriculture and forestry; between soil, water and atmosphere etc. It is the totality of these relationships that is the bedrock of organic farming. However, the understanding of this totality of relationships in a general way is not sufficient for success in organic farming. Understanding the local specificity in respect of each aspect of these multiple relationships is also important. Much of this understanding is reflected in the traditional practices (folk practices) which developed over centuries. Practices which have been sought to be obliterated by the much vaunted "modernist" practices.

There are yet other questions. **Organic farming** is linked with the question of **organic living.** The ideal of organic living is very different from the kind of living being encouraged by the commercial civilization of today, where you find artificiality in everything – from conduct to food. Genuineness, simplicity, naturalness and harmonious relationship with the people around and with the plant and animal kingdoms will have to be restored. Things have been moving so fast in the direction of artificiality that today you cannot get even your basic necessity of life untainted. Take bread. What we get is, to borrow somebody's expression, "murdered bread deprived of the germ", farmers say it is tasteless. It is not merely so : it also lacks the nutritive values. Take rice. I have a bitter experience from my personal family circumstances. My niece bought a few acres of land in a new area, cultivated the land with chemical fertilisers and pesticides. The consumption of the pesticide-treated grains so affected her that she has been sick for the last fifteen years from stomach ailments. The basic purpose of cultivation gets defeated in such cases. Then, take eggs. You cannot see any more the yellow portion of the egg. The egg with the white "yolk" is certainly deficient in nutrition. This is the product of artificiality in poultry farming.

Then, take fish. For the last eight months I have been telling my family not to buy fish because the waters have been polluted and eating fish is no longer safe. There is yet another question regarding fish. Even those, who would like to eat fish risking safety, find that the quantity supply of canal fish or river fish is dwindling. The washings of chemical fertilisers and pesticides from the grain fields have decimated the aquatic populations in the canals and rivers. In the river, the industrial affluents are added to the washings (of chemicals) from the fields. Fish cannot grow in these conditions. Even then, the propaganda machinery of the Government of India says that there has been an increase of fish production. This is due mainly to the catch from the deep sea.

Many countries of the world have been indulging in over-exploitation of fish from the deep seas. We are trying to catch up with them. But, please remember, so far as the poor man is concerned, his mainstay for protein was the fish from the

canals and rivers, which he could catch with his own net. He does not own ponds. Nor can he afford to pay the market price. Government agencies are now saying that paddy and fish can be farmed together. But the problem is, when you use pesticides, fish cannot grow. And pesticides inevitably follow the chemical fertilisers.

Take pulses. Inspite of the Government's efforts at encouraging the production of pulses, there has been little success. Take it from me that however much it may try to increase pulse production, it will not succeed because all its efforts are in the context of chemicalising agriculture. Pulses are leguminous crops. Their increase depends upon the activity of the nitrogen-fixing bacteria in the root nodules. If fertiliser was used even during its preceding crop, the least harm that it did was to make the nitrogen fixing bacteria inert. After having made them inert, you cannot rejuvenate them at your sweet will during the phase of pulse production.

Take the case of milk. Milk production cannot increase without sound animal husbandry which, again, is impossible without the development of fodder. Now, let us see what is happening to fodder. Under the impact of "modern" agriculture, we are growing cereal crops of dwarf varieties which leave little straw for the cattle. In forestry also, we are planting such trees as cattle cannot browse. Thus in every way we are depriving cattle of their feed. Milk production can never increase under these conditions. Then, there is yet another problem to which our attention was drawn many years back by Dr. Albrecht of the Department of Soil Science, University of Mussourie (USA). He said that the cow is a natural biochemist. If you take a cow to luxuriant-looking grass, which is rich in nitrogen and in which the nutrients are not in balance, it will not touch the grass unless it is driven to starvation. All these questions point to the importance of fodder, its quantity as well as nutrient balance. Both are neglected in the so called "modern" agriculture.

The evil contribution of this "modern" agriculture does not end with the famine of milk or the poor quality of its scanty availability. The residues of pesticides in the fodder

build up DDT in whatever milk is available. The use of pesticides in crops has been affecting even the quality of mother's milk, the purest of the pure source of infant nutrition.

Take fruits. You cannot eat fruit without fear of consuming pesticides. In the case of grapes, there is a rule that these should not be plucked within ten days of the spray of pesticides. But hardly any seller observes the rule because if the waiting has to be that long, the grapes will be overripe and unsaleable by the time these reach the market. That the banana is ripened prematurely by carbide treatment is common knowledge. Green salad has always been known as health-giving food. Now, doctors are warning against the same green salad in the context of widespread use of chemical fertilisers and pesticides.

That the bees, nature's pollinating agents, have become rare as a result of widespread use of pesticides, is acknowledged by all. In tropical countries, the plants are pollinated more by insects than by the wind. Hence, if the bees and insects die, then the loss to the vegetable world becomes so heavy that no amount of fertiliser can compensate.

Whichever way you look, there is a threat to life from each direction. There is no salvation except by way of organic farming.

The "Chemicalised" agriculture, which is being encouraged by the Government today is the product of fragmented science. Since anything which lacks wholeness in its approach is really anti-science, it has no right to be called "scientific agriculture". Not only has it deprived us of quality but has also decreased our total food package and been ruining the very bases of production--namely the soil and water--apart from Polluting the air. The proponents of "modern" agriculture often claim that their technology has led to an increase in wheat yield and to a lesser extent, the rice yield. The questions to which they prefer to remain blind are : what was our objective ? Was it merely an increase in wheat yield and rice yield – or an increase in total packages ? If the "modern" agricultural technology has contributed -- as has been shown earlier -- to the decrease of pulses and oilseeds in the areas

relevant for comparison, if it has decimated fish population in canals and rivers and lowered the production of milk for the common people to increase the nation's dependence on commercial dairies and on imported powdered milk -- is this a gain or far greater loss ? Moreover, in any accounting regarding farming, it is obligatory to give comperative statements about the status of the soil and water. People must know.

a) What was the organic matter status of the soil in Punjab and Haryana 15 years back, in the interim period, and now;

b) How was the structure, tilth and water holding capacity of the soil, then and now;

c) What was the status of macro-and micro-nutrients, then and now;

d) What was the level of soil biological activity per centimetre, soil-type wise -- then and now;

e) what was the level of nitrate and phosphate in the ponds around and in the local groundwater, then and now.

If production-increases in certain crops have been achieved at the expense of these factors, then these increases are short-lived, "more flashes in the pan". I make bold to say, on the basis of accounts given by farmers, that deteriorations have taken place in these respects in all areas which have achieved, or are aspiring to, "green revolution".

All these point to the importance of preventing chemical-oriented farming which, in the name of increasing the yield of certain crops, disrupts the chain of production of all other crops and food items. It is only organic farming which holds the key to increase in total food package and better quality of food.

I have earlier mentioned why the chemical-induced increases in certain specific crops cannot last. I would now describe why the concentrated-energy-based agricultural technology itself cannot last long. Chemical fertiliser is, and has to be based on either coal or petroleum feedstock. Mostly

it is on petroleum. I come from the field of petroleum and am aware that the petroleum reserve on the world scale will not last for more than 50-60 years. Moreover, their price will keep on increasing. Since not many countries have oil, it is natural for the oil surplus countries to make hay while the sun shines- i. e. to get the maximum out of their exhaustible assets as long as these last. So chemical fertiliser is going to be increasingly costlier and unavailable.

"Modern" agricultural technology has been leading us to a grave disaster in yet another respect. May be, this is the worst disaster because it is irreparable and its effects are likely to burst upon us with greater suddenness. **This is the erosion of the genetic base of our crops** Where there had been earlier thousands of varieties of paddy and wheat, the "modern" agriculture has limited the cultivation to only a few high-yielding varieties. These high-yielding varieties (HYV) are so genetically controlled as to be responsive to only chemical fertilisers. Thousands of **deshi** (indigenous) varieties are thus being forced out of existence.

I had an opportunity to be present at the inaugural session of the recent International Congress of Genetics. There I witnessed a pathetic attempt at being in two stools. On the one hand the geneticists admit that because of encouragement to the high-yielding varieties, there is going to be a serious erosion of the genetic base of crops. At the same time they go on talking about the necessity of continuing to rely on these HYVs in farmers production programmes. This is a dangerous game. They indulge in this because they think they can preserve the gene pool in their "gene banks" and by the establishment of a few "biosphere reserves". Undoubtedly, both these measures are important. But these are no substitute for the large-scale cultivation of diverse varieties, by millions of farmers, in interspersed regions, in diverse surroundings.

Biosphere reserves are meant not only for the preservation of, as many varieties as possible in unhampered continuity in living conditions, but also for study of evolution of life. It is imperative to have these reserves. To be effective, each terrestrial (as distinct from the marine) "biosphere reserve" ought to be several hundred square kilometres in unbroken stretches.

The question is : how many "biosphere reserves" are you planning for? For a country of India's size and diversity, there ought to be several scores of such reserves. Will all these be there? This is most unlikely.

Let us, then, come to the question of gene banks. We grant that the scientists will take the trouble to collect, crop-wise, all the scores of thousands of forms of germplasms for storage, retrieve each form every three to four years for cultivation in tiny plots, and put the fresh seeds in storage. But, can all these steps be taken with such meticulousness by a few centralised agencies so as to supplant the efforts of millions of farmers? Will it be possible to keep all these in power-failure-proof condition? Even if all these could be achieved, which is unlikely, the larger question would still remain. The culture in miniscale plots could never give the scope, which widespread farming could, for the varieties' co-evolution with the surroundings. Rather, in such culturing, there is a danger of regression, under certain conditions. If there happens to be too much mixing of pollens of diverse forms of the same species, on account of their proximate culturing, it will lead to convergence, the negation of speciation, turning the wheel back from diversification. Cross-fertilisation is at its best where plants of many species, genera and families exist.

Supposing that it was possible to preserve gene pool satisfactorily by the measures suggested by the geneticists, there was still no justification for concentrating on those HYVs which are genetically so controlled as to be responsive to only chemical fertilisers and driving the other species out of living agriculture. Narrowing of diversities promotes pests. Since these HYVs have a demonic appetite for fertilisers, most of which have to escape to water and atmosphere for reasons which we shall explain later, these become the causes for atmospheric and water pollution. Besides, these deprive the soil of microbial activities. As against these genetically controlled HYVs, there are many naturally occuring high-yielding desi (Indigenous) varieties in different regions of the country which respond well to organic manure. Hybridisation with these breeds will create new forms and varieties which are preferable. (these may also mean upgradation of many varieties).

Selected varieties from among such hybrids may be more nutritive, palatable and non-polluting; and their cultivation will be within the reach of farmers of modest means. Even if this leads to medium-yielding varieties, that will be no cause for regret because the total package of foods – i. e. cereals, pulses, vegetables, fruits, milk and fish – will be larger and more nourishing.

Two very important facts need to be remembered in assessing the effects of pushing the variety-reducing agricultural technology in the tropical countries. First, more than three fourths of the crops now existing in the world originatted in the tropics. Secondly, in the so-called intensive agriculture, fresh genes will have to be implanted every 4-5 years : without this fresh implantation, the HYV will be prone to pests. The keeping quality of HYVs also is much less. HYVs kept for a few years fail to germinate and hence are not usable as seeds. Now, if you keep on narrowing your varietal base by driving all other varieties out of existence, where will you get the fresh genes from ? The gene for the dwarf Mexican wheat came from some wild species. There, too, a havoc has been, and is being, created by another facet of "modernism". With large-scale destruction of original forests, the wild species (i. e. the wild relatives of domesticated varieties), too, are disappearing. Hence it has come to be, destruction of genetic base both in agriculture aud forestry. When the countries in temperate climate had started reducing their genetic base, they depended upon the tropical countries – the countries of origin of most varieties – for the supply of fresh genes. Now, when the tropics are themselves being denuded, a collapse of world civilization stares us all in the face.

This deplorable erosion of gene pool is being created not merely in the world of vegetation. Gene erosion is being created in the animal world, too. In dairy farming, the concept of artificial insemination has been created. This is a cruel practice of depriving the cattle of their natural biological need. It can, in course of time, lead to infertility. Where artificial insemination has not gained currency, the practice of keeping only one bull to serve 18-20 cows for five years is in vogue. In this case, one bull becomes the progenitor of so many calves.

Thus, the genetic base of the cattle wealth, too, is being eroded. This genecide may prove to be the worst genecide in history. All this is being done in the name of scientific agriculture.

Now, I come to the question I had raised in the very beginning. Why did organic farming, which was so much in vogue in this country, recede here itself in this century? Was it due to any inherent short-comings or due to something else? According to my analysis the reasons were three.

First, chemicalised farming based on factory made chemicals had a romantic beginning. During the first world war when some German scientists developed a process of making ammonia by combining hydrogen and nitrogen gases under pressure and then converting this ammonia into nitric acid to meet their military needs, we were overwhelmed to see the wonderful effects of modern science. What thrilled us was the ability of this science to come to the rescue of the German state by enabling it to scorn the cessation of supply of sulphate from Chile. We were further dazzled when, after the war, the Germans – and following them, the Europeans – applied this ammonia to increase foodgrain yields. This chemical-oriented technology had the advantage of time and milieu. It developed at a time when nobody could even imagine that it could have any deletrious effect on soil, water or atmosphere or on the production of other items in the food package. It also grew in an environment where the deletrious effects show up much more slowly : the decomposition of soil organic matter in temperate climates, is far less than in tropical countries. So it was easy to fall a prey to its charm. Of all political leaders and social thinkers, possibly Mahatma Gandhi was the only one who remained free from this illusion.

Secondly, we in India easily come under a spell of foreign technology. This is because our elite developed an intellectual slavery which continues till today. Seeing the Europeans and North Americans well-fed, well-dressed and equipped with labour-saving gadgets, we, as a nation, developed an inferiority complex and became imitative in everything, including farming. The leaders who gave direction to the Indian State after Independence, were least informed about farming. Moreover, the fact that both Euro-Americans

and their rival, the Russians, accepted chemicalisation of farming, made it appear that this farming technology was so superior as to be beyond dispute.

Thirdly – and this is the most important – we had inherited organic farming as a tradition. Neither our farmers nor our elite were aware of the science on which it was based. So it was easy to discard it as we have discarded certain other traditions which appeared to us as mere prejudices. In this case, the lure of immediate economic gain made the discarding easier. In any case, when the state as a whole pushed hard the ideal of an industrial-commercial civilization – of course, with an admixture of "cooperative commonwealth" verbiage – organic farming was bound to recede because it was just not compatible with this drive towards commercialism. The plea of feeding an ever-increasing population was used to lull farmers into a false sense of security in chemical-oriented farming.

We would see a little later how organic farming becomes a near impossible pursuit when the nation's thrust of development is towards industrialism-cum-commercialism and why organic farming cannot succeed except under a national ideal of organic living. (I have used the word "industrialism" to mean a trend for "industry to feed industries to feed industries", losing sight of the basic objective of human welfare). A word is in order here about the character of modern science.

Modern science had its origin in Europe. It is based on the Baconian and Descartian philosophy which emerged in early seventeenth century. It was a reaction to the tradition of scholasticism and the Aristotlean philosophy. According to the latter, it was the whole which decided the parts. Naturally, the Aristotlean philosophy had been responsible for the neglect of any intensive study of the parts until the sixteenth century. Contrarily, modern science lays overriding emphasis on the study of components down to the minutest details. It neglects the study of the integrative processes in Nature, the overall functional ordering in Nature. Pre-modern western science and the modern western science (which has now gripped the world) are in two different poles. Neither was a holistic

science. But "modern" science is doing much harm to life. Its prescriptions in one field are causing destruction in all other fields and recoiling on its initial objective itself. Thus, it is a fragmented science and a destructive science.

In every field science is palming off such object defeating fragmentory solutions. Since our elite often refers to the USA and Japan, as if these are our models, it is necessary to cite two important facts. The USA has two billion acres of land and it is a little less than four hundred years since settled agriculture started in only some parts of the country; and it is even less than a century since it started "modern" agriculture. During this period, it has already finished off the production potential of a large portion of its land resources, despite its being in the temperate climate zone. To quote Vernon Gill Carker and Tom Dale, authors of "Topsoil and civilisation", "100 million acres of US farmland are already badly gullied. 50 million acres are eroding at a highly accelerated rate. Two-thirds of the nation's croplands are in destructive state. Two-thirds of pastures and ranges were thin, unproductive and subject to sheet erosion or wind erosion". "In the next 50-100 years, all the topsoil may easily be washed off and end up at the bottom of slopes, in streams or down rivers, filling up reservoirs and choking harbours with silt". Japan, which had once a rich tradition of organic farming, has, during the post-second-world-war years – i. e. since it embraced the so-called modern farming technology – been depleting its soil and polluting its waters. Japan has an advantage. It is surrounded by seas. The chemical washings from its fields – and factories get diluted in vast bodies of water. This has saved it to some extent.

One important thing which many scientists often underplay or do not realise is the basic difference between the temperate and the tropical climate conditions. It is necessary to understand this difference to know why the USA, Europe and Japan, which are all in temperate climates, have escaped rapid destruction despite chemicalised farming and why the destruction caused by this method of farming is far more rapid in the tropics. In temperate climates, the rainfall is evenly distributed throughout the year. There is neither torren-

tial downpour nor any long dry spell. As against this, in the humid tropical zones, there is torrential rainfall for three or four months, during which there is a heavy run-off of the topsoil unless there is protective forest cover. This is followed by a long dry spell, during which the soil is backed hard and much of it cracked. Hence when the rains come next, this cracked soil washes away at an even greater rate. On the other hand, in the dry tropics, the rainfall is scanty, the particles of scorched soil disintegrate rapidly and the bits are blown off by the wind. Thus, the prone-ness for soil erosion is much higher in both wet and dry tropics. Besides, high humidity and high temperature cause high bacterial activity in the wet tropics, leading to quick decomposition of soil organic matter and making the soil yet more prone to erosion unless there is continuing replenishment of organic matter. If nitrogenous fertiliser is applied under these conditions, it leads to further oxidation of soil organic matter.

In temperate climates, the soil remains moist throughout the year. Snowfall in winter conserves organic material underneath. The soft flow of molten snow in summer, too, is beneficial to soil : it does not scour. This is why the organic matter status of soils in temperate countries is very much higher. These have a larger cushion, with a high carbon-to-nitrogen ratio, and hence with a higher capacity for absorption of artificial nitrogen. This is the reason why both the eroding and the polluting effects of chemical fertilisers are much slower and much less visible in the temperate countries.

Since the differences between the temperate and the tropical countries are too obvious to be completely ignored, our agricultural science research bosses concede that there are certain differences. But in doing this they give certain twists so as to pipe our science to the tail of "modern" western science, oriented as it is to conquering Nature rather than understanding her ways. Let me give a simple example of this twist. This was, in fact, my first shocking experience with our agricultural science establishment. In 1972, I wrote in a journal, Oil Commentary, then edited by me, an article "Basic Error in Fertiliser Planning" and sent copies of

it to ministers, members of Planning Commissions and leading science policy makers, including the Director General of the Indian Council of Agricultural Research requesting comments. I received a rejoinder forwarded by Dr. M. S. Swaminathan, then Directar General of ICAR but written by one Dr. Amiba Singh, then an Assistant Director General of the said Council. The rejoinder started by abusing me and propounded a remarkable thesis, which can be summed up as follows. "In a tropical country, however much you may try, the organic matter status of the soil will not get built up beyond a certain level; and the organic matter status of the soil also cannot go below a certain level : therefore, all that you need to do is to make the soil yield what you want. It has to be fertilised by chemical fertilisers." Now, the first part of the thesis was no doubt correct : the organic matter status of the soil would not build up beyond a certain leval, for reasons explained earlier. But where from the Assistant Director General got the idea that the soil organic matter could not go **below** a certain level, we are unable to fathom. It is also noteworthy that instead of drawing the conclusion the tropical soil's tendency towards loss of organic matter needed to be countered by its continuing replenishment, the rejoinder ridiculed the emphasis on organic manuring.

Interestingly, some months later – after OPEC drastically raised the oil price – Dr. Singh sought to withdraw the rejoinder on the plea that the situation had changed. I had to point out that "the issues in the debate were not economic but scientific. If chemical fertiliser was essential for our soil there ought not to be any resiling from it despite the rise in oil price. On the other hand, if it was not suitable for our soil, it should not have been used even if it were available for a song".

I related the incident here not to belittle anybody but just to show how superficially the science issues are treated and how myopic most of our scientists' social perspectives are.

Let us leave for the time being such agricultural research scientists. There are many social workers who, while prefer-

ing organic manure, would still like to use some chemical fertiliser on the ground that "there is not enough organic manure" and that "there is, therefore, need for adding chemical fertiliser". This reminds me of the question Shri Mohan Dharia had put me many years back when he was Minister of State for Planning in the Government of India : "Is there sufficient organic material to produce the manure ? Shri Dharia had also suggested that there should be some comparative cost studies and cost-benefit analysis. The suggestion was ridiculous. That there could be absolutely no comparison between the cost of producing organic manure from natural material like human excreta, animal dung, plant wastes and that of producing chemical fertiliser through high-temperature, high-pressure operations. The transformation of these wastes into wealth was in any case an imperative because these wastes would otherwise be creating health problems requiring far larger investements in hospitals and in water and air purification. The minister's suggestion was a specimen of vacuous, pedautic phraseologies in high places to scare natural solutions. The answer is an emphatic yes. There is no very great difference, **in terms of weight,** between our food intake and our waste products. Therefore, if all of our own waste products - i. e. all the stools and urine - are mobilised, these should approximate to the food consumed by us (in terms of weight). If, in addition, the waste products of other animals, the fallen leaves from trees, the plant bodies of legume crops, vegetable refuse, the stubbles from fields, bushes and jungles, tank and canal silt, water hyacinth, husk unusable for fodder, bone meal of dead animals are collected, there would be more than enough organic material to produce the manure. Moreover, tnere is a limit beyond which even organic manure should not be applied. The application of too high doses of organic material may also lead by mineralisation, too much nitrogen being made available that the plant is forced to un-natural growth. About their nutrient content, let there be no doubt. Take the animal wastes first. No biological system can assimilate more than 40 per cent of the nutrients in the food : therefore, a minimum of 60 per cent of the nutrients of the original intake must be present in the

excreta. Generally, these contain 60-70 per cent. Then, the other organic material (vegetable refuse, hyacinth etc.) have rich manurial potential.

The real issue is not whether there is enough organic material to produce the needed quantity or quality of organic manure. The main problem is that we want to avoid the efforts necessary to collect the wastes and prefer the cosiness of a push-button system which factory production provides. Moreover, there is a belief that since the 'fertilising' impact of the chemicals is quicker, their addition will lead necessarily to instant incremental production. To those who subscribe to this belief, we would like to put a question: "Are you sure that this addition of chemical fertilisers will really mean **addition of nutrition ?**" In fact, there is a greater possibility of crop malnutrition.

It is known that nitrogenous fertiliser application usually leads not to better grains but to larger production of stem and leaves. This happens because Nature always seeks to maintain the ratio between total organic carbon and the total combined nitrogen constant in every part of her living empire. An increase in nitrogen, and the consequent lowering of the proportion of carbon sets in motion a process of restoration of the metabolic ratio by inducing more photosynthetic growth i. e. the growth of roots stem and leaves. In like manner an increase in the proportion of carbon by an abundance of straw and other cellulosic material will also be harmful. It will raise the carbon nitrogen ratio too high. Nature will lock up all the nitrogen in the soil and prevent its availability to the plant. Even if the fertiliser is administered on a genetically dwarf variety and after the tillering stage is over, it will merely increase the number of grains or enlarge the grain size at the cost of biosynthesis of nutritive elements. This means, its contents of starch, sugars, fats and oils will be more. Grains subjected to this kind of growth are marked by an imbalance in essential amino acids.

A. G. Norman of the University of Michigan had drawn our attention to this aspect in the early sixties. 'High yields are not synonymous with a high content of nutrient elements.... crops from well-fertilised plots may have a lower content of

some essential element (for health) than those from poorly yielding plots, the addition of a fertiliser may cause a reduce in the content of some of the other nutrient elements.' Refer to Herber, Lewis in "Our Synthetic Environment" Publisher : Knopf New york, 1962.

More recent researches by Dr. George Borgstrom, Professor of Food Science and Human Nutrition and Geography of the Michigan State University also support this view. A quarter of a century back, Dr. Wm. A. Albrecht, Chairman of the Deptt. of Soils, University of Missouri (USA) had also warned us against "believing that all the organic or in-organic nitrogen being sold were being converted into proteins". "Protein production" he said, "is a biosynthesis - a synthesis by life itself" requiring interaction of all the essential elements including trace elements. Even at that time (1958) he had pointed out that for the nutritive value of the crops and the health of the plants, we must first look to the soil - to the geological, the chemical, the biochemical and the biological performances by which the numerous streams of life take off from the soil and continue to flow through the many species of plants and animals." He even pointed to the crucial importance of calcium in growing protein-rich crops. Ironically, the practitioners of "modern" science tend to forget that the application of power-packed nitrogenous chemical fertiliser on the soil tend to acidify the soil and aggravates its need for liming.

Thus, there is no legitimate basis for welcoming the nutrition-deficient high-yielding varieties which merely push up the vegetative bulk and require quick release fertilisers therefore. Nor is there any justification for super charging chemical fertilisers on organic manure.

Quality preparation of organic manure involves blending optimally the carbon, nitrogen, phosphate rich materials, in which the trace elements are present in proportion and the crucial carbon-nitrogen ratio (C/N) is neither too high nor too low. This kind of preparation is within the competence of farmers, given certain guidelines. There should, therefore, be no question of adding some nitrogenous fertiliser and upsetting the nutrient balance. We refer specially to nitrogenous fertiliser because there is a craze for it on account of its being known as a stimu-

lator of growth and seed production and also because the potential for damage from its unbalanced use is much greater than from others.

In any case, the argument that "chemical fertiliser could be used as a supplement" is misleading. We have yet to see a mass action programme anywhere which, after beginning with "fertiliser as a mere supplement" did not end up as "fertiliser as the main constituent of nutrient package" in reality.

But we need to delve deeper to know why even some old Gandhian social workers plead for partial use of chemical fertilisers. In my view, this hesitancy to rely wholly on organic processes stems from two sources which are interlinked. One is a lack of awareness of the bounties offered by the nexus of symbiotic interrelationships in Nature. The other is an insufficient awareness of the perils which the efforts an artificial fertilisation invite by way of undermining soil fertility and all other bases of our existence.

Let us first take a look at the bounties in an undisrupted system. Not merely has Nature given plant leaves the scope for producing carbohydrates by capturing the carbon-dioxide from the atmosphere in the presence of sunlight and with the aid of moisture derived from the soil and for converting these carbohydrates later into sugars, starch, cellulose, lignin etc. She has also made ample provision for the supply of nitrogen through the root system in a variety of ways so that the essential elements of life could be breathed into these sugars, particularly for synthesis of proteins and nucleic acids. Rains wash down the nitrogen generated by thunder. Bacteria in the nodules of leguminous plants capture nitrogen from the atmosphere and fix it into the soil. So do some ferns, some forms of algae and some genera of freeliving bacteria (azotobacter, clostridium). Various genera have been endowed with this quality so that this operation could continue under differing conditions.

The benefits of legume crops are often underestimated by our "modern" scientists. It is being suggested that legumes do not leave enough nitrogen in the soil to promote the growth of successor crop. The question is : what is enough? A few days back, in a text book on biology meant for British school

students I was reading an estimate that "a good legume crop such as Clover can fix up to 90 kilos of nitrogen gas per acre in one season's growth". I would like to get estimates for our agroclimatic zones. In any case, considering the fact that crop rotations with legumes in between two other crops, sustained India's soil fertility over centuries, despite the decline of the practice of returning wastes to the soil, there is strong basis for the time-tested conclusion that legume's contribution to nitrogen fixation is considerable. Rotational cropping is only next to mixed husbandry in natural order.

There is yet another very interesting system of nitrogen supply in nature, which is universal in the forests and usual in the orchards and vegetable gardens. When the plant roots, growing in fertile soil, move downwards active root hairs' abundant fungal threads invade the root cells, only to be absorbed by the latter. These threads may contain as much as 10 percent organic nitrogen. Besides, their protein quality is well suited to digestion by root cells. This mode of plant nourishment by dense mate of nitrogen-rich fungi is called mycorrhizal association.

Probably the most important source of supply of nitrogen as also of other nutrients is the decomposition of animal and plant wastes. This is done by the decomposer bacteria and fungi.

From these it would be obvious that we can obtain from Nature much more of the beneficially utilisable nitrogen than we are getting now if only we know the pathways of its bounteous flows and cooperare with Neture in her systemic approach.

Nature adopts a somewhat different method in regard to the supply of phosphorous. This is because phosphorous is, unlike nitrogen, chemically highly reactive and it does not at all enter the atmosphere except as dust. Of course, the one method which is basic to all recycling is existent here too: it is the return of the plant and animal wastes to the soil. Animal eliminate excess organic phosphorous by excreting phosphorous salts in urine. There are also the phosphatizing bacteria to convert phosphorous in to the

stable forms of phosphate salts which remain bound with the soil.* At the beginning of the rains, the mineralisation of organic matter releases phosphates for uptake by the plants. If the phosphate level near the soil surface is low, but not too low, mycorrhizel roots may form to serve as efficient scavangers of phosphorous. The root-zone micro-organisms, too, may contain species such as phosphato-bacters which, by secreting phosphate enzymes, liberate phosphates locked up in the soil with compounds of very low solubility. These, too, prove that man has only to be an understanding partner and observe rules of the game.

For the supply of all other macro and micro-nutrients as also of vitamins and plant growth promoting substances, there are elaborate arrangements in natural soil system. The soil abounds in countless forms of micro-organisms-bacteria, fungi, viruses, protozoayeats, algae etc. - to perform different but interrelated functions. Each produces different kinds of enzymes by which all stand to benefit. This is a highly complex nexus of relationships and a symbiosis of a very high order. High productivity is attainable only if this nexus of relationships is understood and nurtured in creative partnership with nature.

A wonderful fertilising agent of Nature is the earthworm population which, Charles Darwin said, are the "builders of civilisation". Earthworms – which thrive in moist and warm surface soil ingest soil, mix it with secretions from their own guts, and leave a far richer soil cast. These worms concentrate in the cast most of the nitrogen and mineral constituents present in the plant debris, feces and cuticles of soil anthropods they ingest along with the soil. They are the principal agents for mixing the dead surface-litter more accessible to soil micro-organisms. They are the channelers and burrowers. By loosening the soils, they facilitate air inflow into the soil

---

* In the presence of abundant dissloved oxygen, phosphorous in water courses readily forms insoluble compounds which precipitate and thus gets removen from the general flow of nutrients. Thus it escapes too much dispersal and waits for a return to the terrestrial system.

By improving the soil structure, they improve the soil's capacity to hold moisture. In their death, too, the earthworms contribute handsomely. Their body tissues may contain up to 70 per cent protein. It is important to remember these facts about earthworms while we discuss organic farming versus chemical farming. Chemical farming tends to kiill the earthworms.

An extremely interesting process is observable in nature, which inspires reverence. In the ecosphere, just as there is a building up process working through the leaves (making carbohydrates, proteins and fats and thus building the structure of the plant), there is also a reverse process of breaking down of the soil organic matter into mineral matter. Organic matter is continually revertig to inorganic state to make mineral salts such as compounds of phosphorous, potassium, calcium, magnesium, sodium, iron, manganese, zinc, copper baron so that these could be available for absorption by the plant roots. **This breaking down process, apart from feeding the root hairs for the present, provides a reserve of mineral salts for the futures.** This explains why even in the subsoil regions which underlie the poorest of the poor surface soil, there is always a reserve of mineral chemical constituents, may be in tough combination with others, which can be solubilised by deep-rooting plants.

The mechanism with which Nature endows the plant roots to solubilise these mineral salts of the subsurface is also interesting. The respiration of the plant roots - which is like mild burning of sugar – releases carbondioxide from the root hair which dissolves in soil water to form carbonic acid, a mild solvent.

In order to make the essential trace elements available to all, including the shallow-rooting plants in an undisturbed eco-system, Nature has provided these elements in the upper soil layer itself. These mineral salts, needed in traces, come from the soil humus. They may also come as dissolutions out of, or as dispersions from, the surrounding rocks.

While we sing in praise of Nature's concern for sustenance of life, a question would be uppermost in the minds of the sceptics. Did not the very fact that man had to think of artificially reinforcing fertility show that natural processes had deteriorated or at least failed to deliver the goods? Yes, it is true that the soils have been losing in productivity. But why? It was because we snapped the nexus of relationships. First, the bond between agriculture and its foster mother, the forest, was snapped. Forest is a peculiar foster mother whose sustenance and protective care is needed in space-time continum. The biotic material from the forest must flow to agricultural fields continuously. The underground water storages, which were many times the volume of lakes, and were the assurance of inexpensive water supply for agriculture could be induced only by the tree roots. And the forests needed to be not only in the hills but also in each village to perform its multiple functions of protection and enrichment. All these avenues we have destroyed in the cause of setting up the trappings for an unsustainable civilisation. Secondly, we avoided the labour of returning wastes to the soil in a form which is beneficial to it. Thirdly, we became partial to certain crops disregarding the benefits of mixed husbandry and rotational cropping and, therefore, became crazy after certain nutrients at the expense of Nature's systemic functioning.

Sceptics might still persist. Once a sceptic had asked me: "If Nature is so beneficent, could it not be a little more generous in supplying nutrients particularly nitrogen, when this element alone constituted 78 per cent of the atmosphere?" The questioner was a technologist and was aware that nitrogen-bearing molecules such as proteins, nucleic acids enzymes, vitamins, hormones account for much of plant bodies' – and even more of animal bodies, - vital functions. That is why, his interest was focussed more on nitrogen. He was also trying to point to the fact that in the gaseous envelope surrounding the earth, nitrogen exists in a form which is not directly usable by the plants. The fact that atmospheric nitrogen is inert and does not enter into chemical reaction with any other element, except under great pressure appeared to the questioner to be an aspect of unkindness of Nature.

A question like this compels philosophical thinking about Nature's purpose concerning the behaviour of nitrogen, as also of other elements. A little introspection would show that if nitrogen had been easily reactive and if it had been more abundantly capturable, it would have poisoned the environment and dissipated the potential for life's existence. It would have created a profusion of nitrous oxides, the poisonous substance which even pierces the ozone layer. It could have produced many types of proteins that were toxic to living species. It could have also destroyed much of the non-living constituent of environment and thereby destroyed the very basis of interaction between the living and the non-living matter, i. e. the very condition for perpetuation of life on this planet.

It is to avoid such disasters that Nature had to adopt a double safeguard system. Nitrogen has first to enter this soil, whether by bacterial fixation from the atmosphere or through the decomposition of plant and animal wastes. It is only through the soil that it can enter the plant and animal bodies. Secondly even the release of nitrogen stored in the soil is not a one shot affair. It has to be in two stages -- first, in the form of nitrite and, then as nitrate ions, in which form it is usable by the plants. Plant root hairs can absorb only the minutest of the minute, invisible particle which is electrically charged, that is, charged with the energetics for passage into root cells. If Nature had ordained the release of nitrate in greater doses than were in accord with the proportion of sugars, enzymes etc. being released in the soil sap by other forces, it would not have been useful for plant nutrition. Rather it would have leached to groundwater levels and/or drined into surface waters causing there nitrate poisoning. It would have also forced the denitrifying bacteria to be more active to release soil nitrogen to the atmosphere. Denitrification i. e. return of nitrogen to the atmosphere is nature's step to maintain the cycle.

It is also significant "by far the slowest step in this nitrogen cycle is the release of nitrate from the humus". Let us ask ourselves : why did Nature make this the slowest step ? Evidently, this was Nature's way to ensure thrifty use of nitrogen so that little nitrate gets released to the water

from the soil. As a result, the nitrate content of natural surface water could be low, of an order of one part per million. Those who talk of forced fertilisation, of feeding the plant direct rather than through the soil and of speeding up plant uptake do not care for what happens to the plant cells or to the soil or to the nitrate or phosphate level of the groundwater or surface water. They completely miss the purpose of Neture's slowest step in releasing nitrate from the soil's store of nitrogen.

The solution is not forced feeding of the plants. The solution is to increase the store of natural soil nitrogen and to increase the efficiency of nitrate absorption by the roots. For both, it is the improvement of the humus status which is crucial. Contrarily, chemical fertiliser reduces this very humus. Thereby it perpetuates dependence on more and more chemicals. It is a choice between two roads. Because chemical fertiliser hits at the very core of natural processes, there is no scope of combining the natural and the artificial. It is like opting for smuggling operation. Once you make the choice, the inner logic keeps on working out till the journey's end.

Those who seek to conjugate farming with chemical farming are wasting their efforts in two ways - by engaging in a wholly unnecessary exercise and by trying to unite two entirely incompatible processes, which is impossible.

This is unnecessary because organic manure is not deficient in any nutrient : It is capable of supplying every nutrient to the extent that can be assimilated by the plants healthfully. Organic manure, being a complex mixture of hundreds of different organic compounds in various combinations of elements is a storehouse. It releases nutrients gradually so that all nutrients are supplied over a long time in right proportions. Its compounds are subject to minimal loss by leaching. The collcidal product of decomposing organic manure have a high "base exchange" capacity, which means the exchanged ions are not flushed out or wasted. Contact between plant root hairs and the organic manure particles ensures conservation. Thus, there is a built-in economy of supply and demand.

Besides, the organic manure affords a striking advantage. Although all its components start decomposing together, its constituents, on account of their differing hardiness and quanta, require, differing time-scales to decompose, and give rise to variable compositions of micro-organismic populations in succession. All the products of decomposition are available till the end and there is no shortage of any nutrient at any time. **Thus, there is a sequence and yet a continuity in this harmonic process of organic manure decomposition. And there can be no question of imparting greater sufficiency than the fullness that a well-prepared organic manure gives.**

The attempt to bring under a common harness the organic manure and the chemical fertiliser is like employing some disruptive elements along with a cooperatively functioning team, in wishful disregard of their antagonistic relations, with the result that the cooperative elements are prevented from doing their jobs. Here, too, Gresham's Law operates. Just as the bad coin drives out the good coin and the rogues in a team drive out the good people, the chemical elements force the naturally forming element to recede more and more into nothingness. We shall see a little later how the process works. It is not possible to integrate a disruptive approach and a building-up approach in one programme.

Nitrogenous chemical fertiliser works to force an unbalanced growth on the plants : it dilates the plant cells, affects flowering and thins the cell-walls, thus making the plant vulnerable to pests. It adversely affects the biodynamic quality of amino acids. (The proteins of chemically fed plants are of a poor quality because they lack the balance in essential amino acids.) It tends to acidify the soil and requires the use of lime (Calcium) to cure the acidity. It reduces the plants' power of transporting the photosynthesised carbohydrates from the leaves to the plant roots. Presence of considerable quantities of nitrogen in the soil makes the nitrogen fixing bacteria inert.

Talking of chemical fertilisers as a whole. their adverse effects are immense and in too many directions. These reduce soil organic matter; reduce soil porosity to impede oxygen flow; reduce the water-holding capacity of the soil; obstruct

naturel nitrogen fixation by soil bacteria as also the natural control mechanism; affect the soil flora and fauna; reduce the soil's resistance to extreme weather conditions [1]; deplete the trace elements essential for the healthy growth of plants, animals and microbes[2]; and poison the ground-water and surface water in the neighbourhood, to which the unabsorbed fertilisers drain[3]. Residues of pesticides, rhe invaribale companion of chemical fertilisers, persist in the soil, from three to fifteen years, depending on the type. Chlorinated hydrocarbons seriously impair fertility by affecting nitrigen-fixing and nitrifying bacteria. The residual effects of some herbicides inhibit nodulation of legume crops. In any case, the toxins of pesticides and herbicides are absorbed by plants and passed into the food chain.

Recently, the present writer had been to Chakdaha area in district Nadia of West Bengal, where the farmers had been using both organic manure and chemical fertilisers and also allowing the share of the latter to rise steadily. The farmers reported that the earthworms and the burrowing insect which they call "ghur-ghura" have become rare. They attribute this effect to the chemical fertilisers. Their experience would be an object lesson for all those who expect additive effect from chemical fertilisers. The need is to ponder over the basic question : Can such destruction of Nature's own fertilising agents be at all compensated ? To get an idea of the enormity of loss from such destruction by chemical agents, we need to know first the immensity of benefits which accrue from the earthworms and the burrowing insects. Sir Albert Howard of "Indore Compost" fame, used to quote the findings to the Connecticut Experimental Station : "The cast of earthworms

---

1. Humus keeps the soil cool in summer and warm in winter.
2. Nitrogen-fixing bacteria need the trace elements very much for their functioning.
3. Already due to the poisoning of water, the fish population in the canals and rivers has been decimated. The ill effect of nitrate poisoning on child health and cattle health has been reported from many places. In the years to come, the incidence will keep on increasing.

is five times richer in combined nitrogen, seven times richer in available phosphates, and eleven times richer in potash in the upper six inches of the soil." The loss of such potent contributors can never be compensated. When it is remembered that Nature's gift of earthworms is much more in the wet tropics than in the temperate regions, the loss to us as a result of imitation of the short-sighted Western practice of nature-conquering technology, would appear even more tragic. Experiences of farmers in the Chakdaha area - and in many other areas in this country - have shown that these natural fertilising agents cannot be saved by combining organic manure with chemical fertilisers.

The farmers of Chakdaha reported many other kinds of losses as having resulted from the accompanying use of chemical fertilisers and pesticides, such as the dwindling number of snakes and in consequence, the rising number of rats as a menace to foodgrains; and the near extinction of numerous species of fish in river Ganga which flows close by. Let us, however, restrict the present discussion to the loss of crop nutrition and the loss of the very base of production which result from the belief that the addition of chemical fertiliser to organic manure would lead to additive beneficial results.

For a proper understanding of exactly how the beneficial effects of organic fertilisers get reduced by the mixed application of organic manures and chemicals, it is necessary to know the interacting relations between the myriad forces involved - the behaviour of soil particles with their constituent elements, soil microflora and fauna, soil solution etc. - and the rhythm, sequence, symphony of natural systems. Instead of burdening the present article with these intricacies, let us briefly state here that the addition of chemical fertilisers detracts from the beneficial effects of organic manure, and causes harm, in the following ways :

a) Application of chemical fertiliser over and above organic manure is likely to produce an excess of nitrogen and even of phosphate. An excess of any element causes damage. In the case of nitrogen, we have earlier stated that its excess leads to dilation of cells, diminution of flowering, and

weakened resistance against diseases. Excess of phosphate, besides polluting water, does other kinds of damages. Thus, the addition of chemcial fertiliser is both a waste of resource and an invitation to injury. The injury is reflected in(i) lesser yield in the total food package from the overall husbanding of the given land[4]; and (ii) loss in nutritive quality.

b) Whereas organic manure consists of 30-40 elements of very minute strength, the chemical fertiliser contains only five or six selected elements in high concentrations, in the form of compounds. This results in an increase in the density of salt in the soil solutions, which means difficulty in water absorption by plants. This becomes more evident in Rabi (winter) crops. In kharif (i. e. rainy season) crops, the problem gets largely resolved by washout of salts. So, there has to be either wash-out i. e. wastage or the plants' difficulty in water absorption.

But there is an even more serious problem. Non tailored plants are not able to withstand frequent shocks through osmotic pressure variations[5] resulting from repeated fluctuations[6] in salt density in the solution ; only the

---

4. The chemical-dependent high-yielding varieties, while yielding larger quantities of certain selected crops, damage the potential for pulses, decimate fish population in the Paddy fields, canals and rivers, and also sicken the cattle by the residues of pesticides in the grass. Hence, in terms of the total food basket i. e. the sum of foodgrains, pulses, fish, milk etc. - the yield becomes lass.
5. Osmosis is the selective passage (through semi-impermeable membrane) of solvent, separate from the passage of the solute. This process is of utmost importance to the life of both plants and animals. Since a substance to pass from a solution in which the concentration is greater to the one in which ths concentration is less, a pressure has to build up on opposite sides of the membrane to keep the flows separate.
6. The phenomenon of repeated fluctuations occurs because chemical fertiliser has to be applied several times to a crop in split doses.

weeds are. Hence any use of chemical fertiliser prepares the ground for take-over by weeds. Of course, tailored plants like the "highyielding varieties" are designed to take these shocks. But there, too, Nature takes revenge by making these varieties pest-prone and obsolete every three to five years.

c) It disturbs the entire microflora and microfauna of the soil. It de-activates and even kills the nitrogen fixing bacteria and decimates all those bacteria which fix sulphur, iron, carbon, hydrogen etc. in their own bodies initially and contribute these elements to the soil organic matter while dying. When these bacteria are thrown into a disarray, the disease producing bacteria thrive on account of the disproportion of salts.

d) The use of chemical fertilisers, even in the presence of organic manure, upsets the sequence of decompositions, and hence both the successional order and the balance of micro–organismic populations. Different types of organisms are endowed with different functions and follow a line of succession relevant to the changing character of the substrata. In a natural system, there are many species of micro-organisms at any time. They assimilate carbon gradually. In their death they contribute to the organic matter to nourish the succeeding generations. But when the concentration of certain elements is selectively and artificially increased, it encourages excessive multiplication and overactivity of certain types of bacteria which are relevant to these salts. At the same time, it de-activitates and kills the more useful types of bacteria. Thus, two distinct developments take place. The latter (i. e. the more useful) types of bacteria die without doing their job and wirhout getting a chance to multiply. The former types decompose and deplete the organic matter too fast, preventing its longr-term function.

e) The use of chemical fertiliser, even with organic manure, affects both the physical and chemical structure of the soil. Apart from causing a loss of natural nutrients, it results in a loss of tilth and water holding capacity, which opens up a vast panorama of serious consequences. All the bene-

fits of aeration and moisture retention and hence all the biological processes which are based on soil water and soil air, tend to get reduced and ultimately evaporate. Along with these, the plants" strength to draw the nutrients diminishes. By shutting out the natural nitrogen, these processes keep on raising the need for chemicals and at the same time keep on decreasing the soil's capacity for their absorption. It is important to remember that organic manure can at best moderate the evil consequences for some time. It can neither prevent the consequences nor restrain these for long, just as good men forced into a company of evil and aggressive persons cannot act together for long.

f) The higher-than-normal concentration in the soil of the selected salts affects the balance in microelements which is extremely important for plant health. These compounds set off a chain of recombinations with other forms of salts. As a result, certain ions get themselves attached to soil particles by knocking off certain others. The knocked-off elements get leached out of the soil. This may mean toxicity caused by the excess of certain elements and shortages of certain other elements. Also, as a result of new combinations, certain elements become insoluble and unavailable to plants.

g) Whereas an organic mass generally maintains balance of trace elements, the addition of chemicals affects this balance. This is because many of these micro elements are sensitive to large changes in the concentration of cations[7]. For example, when ammonium ions are too high in relation to potassium, the plant tissues are likely to get killed. Excess of phosphate on calcareous soils may lead to zinc deficiency. Ammonium sulphate may leach out calcium. When calcium gets depleted, the species of legumes which are calcium-demanding will not grow. Use of ammonium sulphate increases magnesium availability and hence the possibility of magnesium toxicity on acidic soil. High sulphate availability may cause copper deficiency. Calcium can pick up phosphate from sodium and potassium and

7. Cations are positively charged particles.

immobilise it. If potassium sulphate and calcium nitrate happen to be added at about the same time, this will create calcium sulphate which is insoluble. Chemical compounds generally tend to make iron, manganese, boron insoluble.

h) There is the phenomenon of antagonism between salts. If we put phosphate and also iron or calcium, it will antagonise the absorption of phosphate with calcium/iron. The phenomenon of ionic competition for diffusion into plant body further complicates the situation. If sodium and calcium happen to be equivalent to potassium in concentration, the sodium/calcium will prevent the entry of potassium inio the plant body.

The importance of balance in trace elements is often overlooked though homage is paid to it in theory. These are "life chemicals" needed in small quantities. They are present in the soil in such small quantities that these are mentioned as parts per million and in some cases, even per billion. Yet, the deficiency or excess of any of these elements affects the growth and certainly the vitality of the plant. Discoloration and death of the growing plants are among the manifestations of micro-element deficiency. When there is a deficiency of several elements, even the quantity of yield may turn out to be quite low. This happens under a law of Nature which is called the Law of the Limiting Factcr. Even though the original formulator of this law, Liebig, had adumbrated it with reference to only the macro-elements and this had led to an overemphasis on the importance of nitrogen, phosphate and potassium (NPK), the law is valid with reference to micro-elements, too. According to this law, it is the nutrient which is most deficient that decides the level of nutrition. This phenomenon in farming can be explained by an analogy from transportation. The odd vehicle which adopts three tyres from a Rolls Royce and one tyre from Fiat is limited in its speed by the capacity of the Fiat tyre.

A peculiarity of the trace elements is that these are normally all very poisonous, if present in the soil in more than very minute quantities and in a form readily available to plants. Hence it is dangerous to administer these minerals/elements artificially. To the contrary, the organic manure, being a bulk

of organic substances, nearly always maintains a balance of these elements. It is well-nigh impossible to maintain a balance of micro-elements if chemical fertilisers are used.

In Nagarjun Sagar area in Andhra Pradesh, an excess of molybdenum was reported to be poisoning fhe plants. Widespread zinc deficiency is reported from Punjab and Haryana. The farmers in the latter states are now applying zinc in small dressings. But what will happen when several more elements will start showing pronounced imbalance ? Can this matter be left to the guessing game of humans ?

There is a kind of harmonious relationship between the soil, plant and the microbial population. Application of chemical fertiliser, even with organic manuring, means disturbance to rhe harmony. It is analogous to an effort at orchestration with provision for some overactive drums and some superfast tables.

The effect of applying chemical fertiliser, even with organic manure, can be gauged by linking up two palpable facts. Nowhere in the world does a farmer like to expose his field to chemical fertiliser alone. He uses some organic manure. This has not prevented thə ill effects. Between 1882 and 1952, the area of world desert rose from 1100 million hectares to 2600 million hectares. This expansion of desert was indeed attributable to deforestation and the pulverization of soil arising from the use of chemical fertilisers.

POSTSCRIPT

After the completion of the above write up, one major development occured in the Government policy and two esteemed commentators raised some queries. Far from pruning chemical fertiliser use, the Government has decided to raise the import of fertilisers. The justification which is being trotted out for this higher import is that the offtake was poor in recent years merely on account of the last three years of droughts in succession and that abundant rain this year would lead to a huge spurt in demand. What need to be pointed out are (i) that the trend of decline had set in even before the onset of the drought and (ii) that the threats of floods/ overflows of field boundaries, too, can be no less potent

inhibitors of fertiliser use than the droughts. Besides, the Government itself ought to have felt concerned about the harm to the soil and the higher incidence of pests caused by the chemical fertilisers, the cumulative effects of chemical fertilisers and pesticides on plant and animal nutrition, their adverse socio-economic and ecological effects in terms of high-cost agriculture, widening social disparity, release of nitrous oxides piercing the ozone layer, and decimation of the gene pool consequent on the drastic reduction in species diversity which chemical-dependent farming seeks to promote. Unfortunately, our Scientific Advisers to the Government are tending to behave more like technicians lacking holistic understanding or perspective.

Now to the queries. A prominent leader of voluntary work movement, famed for social experiments with inexpensive techniques accessible to common farmers, who found from experience that organic farming can yield bumper crops and is opposed to chemical use, asked : "would you not support the supply of zinc or boron where the soil has remained deficient in some trace elements despite the use of organic manures ? If there are deficiencies of other micro-elements – managanese, cobalt or copper – should we still desist from supplying these minerals ? Would that not be another kind of dogmatic rigidity ?"

Another commentator, a noted political economist, said: "The harmful effects of chemical fertilisers are generally acknowledged. But many people claim that if organic manures and chemical fertilisers are both used -- or if organo-mineral compounds are manufactured in the factory itself and then applied to the soil as composite products -- there could be bumper crops and yet no adverse effects on the soil. This claim is contrary to your statements. Why are there no controlled experiments to test your thesis and their claims ? Moreover, if some soils have become deficient in zinc and/or other micro-nutrients, why should we not apply the relevant mineral compounds to the soils in requisite quantities after testing the status of the soil in respect of each of these micro-nutrients?"

There are natural, organic methods of remedying the micro–nutrient deficiencies. Before we come to the remedies,

let us first try to see why and how these deficiencies occur. Prof. E. W. Russell in his classic work "Soil Conditions and Plant Growth" writes : "It is worthwhile stressing in this context the importance of a welldeveloped root system for maintaining an adequate supply of these elements to the crop. A crop whose root system is stunted, or shallow, or restricted in any way, is more likely to show a deficiency than the one with a well-developed root system."

We need to remember that the use of chemical fertilisers is often responsible for damaging the soil structure and for the formation of pans at shallow depths of the subsoil, which prevent the plants from striking deep roots.

About zinc deficiency, Russell says : "It is sometimes due to an unfavourable soil structure which restricts root development". "Compacting of soil can also induce zinc deficiency probably through its effect on restricting the root system." "Zinc deficiency may also sometimes be induced by high phosphate manuring of calcareous soils low in available zinc". Russell himself suggests the natural remedy for this deficiency. "It can be ameliorated by growing deep-rooting crops, such as lucerne, or allowing the indigenous weeds to grow and then discing them into the soil."

About boron deficiency, too, he says that it is cured when the plants develop a deeper and more extensive root system.

About the upsets in iron nutrition of plants, he says that this is a "phenomenon aggravated by poor aeration, by a high concentration of bicarbonate and a high level or available phosphates in the soil ;" and the foremost solution he suggested is "grassing the orchard down, and gangmowing fhe grass between the trees and leaving the mowings on the surface." "It can often be controlled by adding large quantities of organic manure, such as farmyard manure, to the soil, though care must be taken not to raise the bicarbonate ion concentration to too high a level as can happen if a heavy easily-decomposable green manure is ploughed in".

About copper, he says, "organic matter in the soil holds the copper very strongly and is a safeguard against copper deficiency."

All these point to the potency and primacy of an organic approach and the harm caused by the inorganics.

Now, it would be interesting to know why the emphasis is on growing deep-rooting plants or allowing weeds as a cure for mineral deficiencies.

Sir Albert Howard in his book "The Soil and Health : A Study of Organic Agriculture" explains it as follows. The topsoil is not the only source from which the plant draws its nourishment. The subsoil, i. e. the part of the soil derived from the decay of rocks in the geological process, is a depository of raw material. It always includes mineral elements -- potash, phosphate and many elements including the rarer ones. There is a power in the root of all plants, even the tiniest, of absorbing them from the soil solution. "But how the soil solution gets impregnated with these substitutes ? Mainly through the dissolving power of tha soil water, which contains carbon dioxide in solution and so acts as a weak solvent. It would appear that the roots of trees, which thrust down into the subsoil, draw on the dissolved wealth stored there and absorb this wealth into their structure. In tapping the lower levels of water present in the subsoil -- for trees are like great pumps drawing at a deep well -- they also tap the minerals dissolved therein." The "weak solvent" in the subsoil is the wonder of Nature's creation. It helps suction by plants and is also a measure for conservation. A "strong solvent" would have been a force for dissipation of ths subsoil mineral wealth.

It needs also to be noted that the plants hair roots are highly judicious absorbers of the minerals. In a natural state, they tend to draw only the requisite quantities of elements. Their power of discrimination, selectivity and accuracy as absorbers of the plants' requirements can never be taken over by humans. When man seeks to overwhelm this natural function of plant hair roots by causing forced penetration of certain elements into plant bodies, the system gets disrupted.

As for the commentator's suggestion for controlled experiments for testing the conflicting viewpoints, it is very welcome. The problem is that our ICAR is so convinced about the indispensability of chemicalisation that it does not regard such controlled experimentations as necessary, even though

it is the body whose responsibility it is to conduct such experiments and which has the resources for it.

As for the other suggestion for testing the soil's status in respect of each individual trace element and thereafter spraying the requisite quantities on the plant bodies or as dressings on the soils, let us refer to Russell again. He says : "The problem of assessing the trace element status of a soil from chemical analysis of the soil is very difficult. First of all, the uptake of a particular plant from a soil depends not only on the level of the active form of that element in the soil but also on the availability of many other elements, both major and trace, and both essential and non-essential for growth. Second, the level of that element needed for the effective functioning of the plant cells depends to some extent on the level of many other elements....."

"The assessment of trace element deficiencies from field trials (too) can be very difficult, particularly in soils in which several elements are deficient ; for supplying only some of the deficient elements may give either little or no improvement in crop growth, and not until all the elements have been given, will vigorous healthy growth take place.....

The division of trace elements into essential and non-essential is not absolute. Sometimes an element can be beneficial if another is in short supply.....

"Many elements will be toxic to plants if it is present in too high a level....."

The question is : what is too high a level ? The amount of requirement diverges very widely from elements to element. The uptake can vary from 0.001 Kg, per hectare in case of one element to 0.5 Kg. per hectare in case of another.

The best course, therefore, is to understand the ways of Nature, to co-operate with Nature, do organic farming and grow varieties of crops, by rotation and intercropping on the same soil. Some of these crops will have to be deep-rooting. These are the best ways of restoring the fertility of the soil. This does not mean that trace elements can never be applied. But when there are far more effective and less risky ways of tackling the problem. why should we prefer the un-natural method ? The ease of the "push button" system is vicious like the enchanting smile of the witch. ★ ★

Proceedings of the National Convention on 'Organic Farming' held at Sevagram Wardha, from 19 to 21 March, 1984.

The following is a brief report of the National Convention on 'Organic Farming' held at Sevagram Ashram Pratishthan, Wardha, during March 19 to March 21, 1984. They are based on extensive notes taken by Mr. Ashok Jhunjhunwala and Ms. Priya Deshingkar.

The Organic Farming Convention was sponsored by Sevagram Ashram Pratishthan, with the objective of bringing together associations, institutions and individuals who have been farming without using chemical fertilisers and pesticides etc. The convention attracted, many participants from all over the country. The list of such participants along with their contact addresses is given herewith as an annexture.

Inaugural Session:

This session was chaired by Dr. Vandana Shiva with Dr. Claude Alvares, Mr. Shailen Ghosh and Mr. Banwarilal Chowdhary providing the over-all dimensions of the issue and setting the tone of the proceedings.

Claude Alvares set the opening note by observing that the organic farming was not something foreign to our country but that it was part and parcel of the existing farming practices of this country. One of the great experimenters of organic farming, Albert Howard had developed the Indore Method of composting, after years of working in this country. Unless organic farming could be related to the indigenous agricultural system which still operated in major pockets in this country, it would tend to be a fad or fashion. He emphasized the fact that we had two distinct forms of knowledge that were being exploited in our country today. One was the indigenous, the other was knowledge that had been evolved in other environments. Such exotic knowledge could only be harmful to our interests. For example, in the area of improving our cattle stock, what cross-breeding with exotic strains, was doing actually outbreeding our indigenous genetic varieties.

Most of the traditional crop gene pools were being rapidly eliminated to create a situation that would be of benefit, purely to multi-national corporations (MNCS). Adopting organic agriculture, was one more strategy for countering imperialism; for keeping the World Bank and other international financial institutions at a safe distance.

Dr. Vandana Shiva in her intervention observed that the 'Loan culture' was completely destroying whatever was not finished by other means. She also expressed her doubts as to the suggestions made by Dr. Claude Alvares that one should let ICAR do whatever it wanted, while we carried on our efforts independently, because she felt that organic farming could not survive and produce best result in conjunction with farming using chemical inputs.

Mr. Shailen Ghosh in his detailed and exhaustive presentation made the significant point that all farming that was not chemical farming, need not automatically be organic farming. What was important to bear in mind was a total and complete organic re-cycling of all living mass and resources. Indigenous farming was also based to some degree on exhaustion of soil. Citing the example of flush toilet as a case in point, he stated that such contrivances caused major breaks in what was considered, hither-to, a natural chain in re-cycling. He felt that organic farming must be based on returning to the soil whatever was taken from it.

He observed that the use of fertilisers and pesticides had decimated fish populations, so that even suggestions made by Government for integrated farming of fish and rice were not possible. Chemical nitrogen also made nitrogen producing bacteria in leguminous crops inert. The aims of modern agriculture seemed to be merely to grow more wheat and rice, totally leaving out pulses. In the USA, millions of acres of land had been deprived of topsoil due to chemical farming. He observed that it was not true there was not enough organic matter available, as some critics say. Organic matter might not be available in push button form, like chemical fertiliser. It required a way of life. We were now recognising, belatedly, the importance of trace elements in the soil. These had been mined to exhaustion by chemical farming. Snakes, earthworms and insects, beneficial to farmers had also disappeared.

Shri Banwarilal Chowdhary brought into his observation the richness of his village experiences and his inferences thereof. His experience indicated that villages, even around 25 years back, had adequate quantities of milk and grains. The green revolution had certainly brought in increased yields but the villagers' hunger and poverty had increased considerably. With the green revolution and the increased yields, considerable quantities of milk and food grains etc. had to be pushed into the outside market place, in order to be able to purchase the costly chemical inputs and repay loans at inflated rates. Quoting the Sevagram (Wardha) experience, he mentioned that in those days they could obtain food and milk for around 300 people on 20 acres of land without any chemical fertilisers and pesticides etc. and still had a profit of Rs. 7000/- at the end of the year. Today, the yields were worth Rs. 2.5 lacs but the expenditure also had climbed to around Rs. 2.5 lacs. Apart from yields, the nutritional and health standards of the people had considerably deteriorated. Yields which went up considerably with the initial introduction of chemical farming, levelled off and finally stabilized despite large increases, in the use of chemical fertilisers and pesticides etc.

Far from being just an academic understanding, he stated that he already had seen farmers, who had experienced this phenomena, reverting back to organic farming. Although there was some loss of yields in the first year or two, it was largely compensated by the reduced cost of inputs. Yields started picking up, later on. Large quantities of organic manure were not important. Even homeopathic doses would do, along with the crop rotation, mixed cropping, traditional non-hybrid seeds etc. He concluded that in his opinion it was not by increasing the maximum yields of crop in any particular area that poverty and hunger could be eliminated, but by increasing the average yield of crops everywhere, and by enlarging the food basket.

The session was then open to the floor for comments, responses, experiences etc. Many participants contributed their observations to strengthen what was already stated. Among such responses,a remark by Shri Devendra Kumar was noteworthy. In his opinion, man's major mistake started when he began to plan for annual crops which demand too much of the

top soil; actually only trees could regenerate and keep it continuously healthy.

The session ended with a vote of thanks to the Chairperson, the speakers and the participants present.

Second Session :

The second session began with a description of Auroville's efforts in the direction of Organic Farming. Development began in 1968 on totally denuded land unfit for cultivation. In fact, in some places the subsoil had become exposed. Aurovilleans began by first taking care of the land before going into farming proper. Initial steps included checking water run-off through the construction of bunds. The next step involved repairs to tanks and ponds and afforestation of wasteland with drought resistant species. Initially, they had to depend on the rainfall. Gradually, species of economic value were introduced for fruits, fodder, timber and oilseeds.

Farming came after basic land regeneration. There are eight farms now scattered over a fairly large area. Landbreaks and hedges were put up. The farms worked with a mixed system, dairy, poultry, aquaculture, vegetable, garden, dryland farming, orchards, windmills, biogas, biodynamic (French) method etc. They wished to experiment with no-tillage rice farming and an Indonesian technique of reclaiming wasteland with different types of cover crops. New crops were planted before removing the old. They mulch trees with leguminous crops, use certain legumes which can survive six months in the dry season, so that some biological activity always continues in the soil, instead of leaving it in a desert-like condition. They had presented a project to the Department of Environment to evaluate organic farming methods, particularly in terms of input-output ratios, self-sufficiency, applicability to different places in the country etc. For propagation of trees, they used a minimum of thirty indigenous species including neem, acacia, pongamia. A minimum of 30-50% of the area was under tree or shrub cover. Crops were protected from grazing animals with a live fence. Such live fences or thorny bushes themselves produced a lot of fodder. They spray leaves of young saplings and trees with a dung solution to keep goats away. They raised saplings in tall plastic bags till they were two metres high before they were actually planted on the roadsides.

About slurry from the gas plant, they were aware of some schools of thought which considered slurry unfit for use in the fields, since the process is the opposite of what happened in a healthy soil. They find slurry an excellent activator for compost and led their slurry directly from the plant to a compost pit.

Claude Alvares intervened at this stage to explain how farmers in koratagere Taluka in Karnataka protected their tamarind saplings from grazing animals. Tamarind seeds were germinated in small pots in their backyard. The saplings were encouraged to grow fast by constant removal of the lateral leaves and stems. The crown of the plant was never touched. Within two years, the plants were at least six feet high. They were then planted just before the monsoons, safely out of the reach of animal.

An inconclusive discussion next took place on how best slurry could be used as a fertilizer and its virtues in relation to compost.

The next presentation was made by Prof. Dabholkar, a former professor of mathematics who had been working hard to demystify science. Interested in wasteland development, he left his profession five years back, in order to find out why a wasteland aggregate was not a real type of soil aggregate and how to make it so. In other words, what were the components of a real soil aggregate. The second question he asked, concerned the ecological potential of an area – what was the maximum one would get from it. The third question was, what was the nature of a biochemical process which gave maximum returns. He was able to produce two kgs. of potato in one square foot of area, 11 kgs, of rice in 5-6 square feet and 3 kgs. of sugarcane in one square foot and 2 kg. of grapes in the same area. Prof. Dabholkar was writing up his technique of using microbes to create humus from within the roots and those notes would be available later to the participants.

The next presentation was made by Prof. Joshi who went into the history of chemical farming as a strategy required to feed larger populations. He observed that within the first 25 years, any soil brought under the plough, 20–30% of its fertility was lost. In another 15 years, another 20% was lost and this continues. In 50–100 years, stable condition of fertility

was obtained. This low fertility could, at the most, maintain a population of 25-30 crores. Population pressure had determined the move to chemical farming. Today, for 120 million tonnes of food, some 18 millions tonnes of fertilizers were required. Of this 7–7.5 million tonnes was organic, 5 million tonnes chemical and 8 million tonnes was deficit every year. He then proceeded to present a graph which described experiments using different quantities of either chemical fertilisers or organic manures or both. Those were available in a paper, Joshi prepared for rhe seminar.

Second Day – Morning Session

The Murugappa Chettiar Research Centre was introduced by Dr. Sheshadri. He said the Institute worked on algae as food and fodder resource, wind energy, bio–gas plants, solar dryers, food processing and had targeted its work to women and children in the rural areas. They had successfully propagated the bio-dynamic method of kitchen gardening (detailed monograph available from MCRC). They had also done work on neem extract as an insect repellant and on some plants that had stem nodulants for nitrogen fixation. Following bio-dynamic principles, planting and transplanting were done following the phases of the moon. Banwarilal intervened to say that it was their practical experience that when crops were harvested on a full moon, they were more liable to pest attack.

A few other participants also made brief presentations. These included Khode, Naval Kishore Vajpayee, Mr. Patankar and Ashok Bang. Khode said it was necessary to grow food without additives which they were trying to do, so that sick people could eat it. One way to reduce energy consumption was to cook food less, but for that vegetables must be safe to eat raw, which the use of pesticides made practically impossible today. Vajpayee described in brief the Gonda project which focussed on health care, poultry, fisheries and dairy. He said if we used the same amount of care for our own breeds like Gir and Amrutmahal as we did for the exotic ones, then we could get reasonably good milk yields. The foreign breeds could not tolerate the heat of the tropics. They requested their farmers to see that atleast 75% of their fertilizers were

organic. Their seeds were kept in cow urine for two hours, (250 mililitre for 5 kgs. seeds) and then planted within 12 hours. This process helped correct micro-nutrient deficiency.

Patankar described basically their techniques for making compost and propagation of this in their villages. Ashok Bang of Chetna Vikas next described their very practical efforts to eliminate chemical farming and revert to local resources. He said their villagers have taken to composting with great enthusiasm. They had attempted to make compost cooperatively in a more scientific way and had succeeded in about 20 villages.

50% of pesticide used in the country was basically for the cotton crop. Chetna Vikas had attempted to gradually eliminate such high doses, and bring it down to a minimum and use even this minimum scientifically. They had reduced pesticide consumption by 50% and yet became three times more effective. The American bowl-worm had become resistant to most pesticides. In four villages in twenty farms, a 2-10% solution of neem cake has been used to control the pest. The result was not very encouraging for cotton but quite effective on Arhar-dal. The mechanical removal of the worms by shaking the plants over the baskets early in the morning was also effective. The worms were then fed to poultry or just buried. They had succeeded in controlling the use of pesticides in 22 villages.

Hybrid cotton would have to be phased out gradually. Farmers had to pay high prices for the seeds and were totally dependent on big companies. Indigenous cotton seeds were no longer available. Efforts were being made to generate their own hybrid seeds.

Chetna Vikas had also got 1000 families in 30 villages to plant trees. The trees which included mango, papaya, carvandar, sitaphal, amla, suffered a mortality rate of 80% due to drought.

In Wardha, hybrid jowar had a 4-month duration. The pests which first attacked the hybrid then went on to attack the native jawar which was of 6-month duration.

In a discussion on crop rotation and multi-cropping, Banwarilal mentioned the practice of Satgajra farming in which crops are grown simultaneously. Such farming was an insurance against crop failure, kept up soil fertility, provided a balanced diet and because of the differing maturing periods permitted something to be harvested all the time.

Claude Alvares provided a brief account of the groiwng of rice according to natural principles, at the Friends Rural Centre, in Rasulia, Hoshangabad. (M. P.)

Second Day – Afternoon Session :

Ashok Jhunjhunwala of the PPST began the session by observing that there seemed to be a mistaken impression that only those who could not afford chemicals were using organic fertilizer and that in the competition between chemical and organic farming, the latter was losing. That this was not so, could be understood if one looked at what happened historically. He introduced the Voelcker Report on Indian Agriculture and also pointed out that even the Cambridge Economic History of India recently admitted that till about 1900, yields in Indian fields were higher than scientific agriculture's yields in England.

In the 1850s, rhe organic relation between forests and agriculture, was disrupted, as trees were set aside for railways, ship building and other industrial needs. This in itself necessitated the use of cowdung as a fuel. The centralization of all the revenue receipts by the British led to the decline of irrigation tanks and their maintenance which were a local responsibility. The export of oilseeds and bones further deprivd our agriculture of fertilizers. These policies struck at the basis of our traditional farming systems. The astronomical tax imposed by the Britishers precluded any re-investment on land.

The system of agriculture started collapsing and its knowledge base got steadily eroded. One can guage its strength from the fact that even after more than a century of such erosion, it still survived and mainly fed our population till 15 years ago. It was at this point that modern agriculture intervened. It never had to compete with a healthy traditional agriculture but with its degraded version.

It was important also to point out that modern agriculture was not just harmful for the environment but was industry oriented. Not only did its inputs come from industry, its output fed industry in return.

The tasks were two-fold : first, to collect indigenous knowledge still available with people or described in old books and reports and second, to re-establish the link between forest resources, irrigation and water, indigenous seeds, etc.

Dharampal said it was necessary to understand the process of the decline of Indian agriculture. The Edinburgh Chronicle recorded higher production and better wages for workers in 19th century India. Agriculture implements from India used to be sent regularly abroad. He observed that if central control and central guidance was chosen as the only way to run the country best, then, perhaps chemical farming was suitable for such an objective.

Dr. R. H. Richharia then introduced himself and his work at the Rice Research Institute at Cuttack and the Madhya Pradesh Rice Research Institute, Raipur, He suggested that this conference should be re-named as "The Rediscovery of the Organic System in Indian Agriculture." The first point he made was that we should decide whether we want to make our agriculture, factory-oriented or based on local resources. Centrally controlled scientific organisations would never work. Hardly, 5% of research from Institutions reached cultivators. Conditions differ from village to village so centrally delivered programms had no future. Richharia spoke of the 19000 varieties of rice that he collected in Madhya Pradesh. He also introduced some of the major varieties of rice and their specific qualities. He said that out of 1,20,000 varieties of rice in the world, 40-50,000 could be found in India alone.

A detailed interview with Dr. Richharia on his work with indigenous rice varieties, was under preparation and would be available to participants on request.

After Dr. Richharia's talk on indigenous rice varieties, Banwarilal spoke on indigenous cattle breeds. He observed that in India, cattle raising was a family occupation. Indian cattle were dual purpose breeds – raised for milk and for

draught. Foreign or exotic cattle were mainly for milk and beef. There were at least, 15-16 indigenous varieties which were important. Indigenous cross-breeding took place mainly to increase milk and not for better working cattle. At times, the worst of both the Indian and exotic breeds, resulted in a totally useless breed like the Taylor Breed.

Operation Flood was outcrossing our herds using exotic breeding. Exotic cattle could not tolerate our environment and were susceptible to disease. In India, the best breeds that gave milk were found in areas of low rainfall, as in Rajasthan. The imported breeds, like Jerseys and Holsteins, which also required exotic high quality feeds, were destroying the traditional system. If they could not be given concentrate feeds, their milk yields was no more than 2-3 liters. In one village only 2-3 males (cattle) out of 50 were capable of working the plough. Banwarilal felt that there was a conspiracy to finish off our breeds. The whole programme was for the cities and not for the villages. The key village centre scheme in M.P. which emphasized local breeds was terminated. Lots of concessions and subsidies were given for exotic breeds. None for local ones.

Korah Mathen observed that comparative figures of the yields of exotic and indigenous animal were generally cooked up. Generally, the best of the exotic was compared to the average of the indigenous species. Banwarilal remarked that as of now, only 1-2% of cows were exotics; yet all development finance was directed towards them. Dharampal wanted to know whether the cattle policy was part of a larger policy oriented towards tractorisation. Richharia felt it was a case of biological warfare. Ashok Bang dissented to say that in some cases the exotic male animals were better than ours. Banwarilal admitted that 4 out of 20 were better, but the rest were useless.

Vandana Shiva next spoke on the third area of concern in organic farming, namely forestry resources. She observed that traditional practices had transferred fertility from forests to soil through animals and through green mulch. With the decline of forest areas, a massive afforestation progamme was started with CIDA and World Bank help, but of a kind which was then damaging our agriculture.

The forest departments, she said, were the biggest landlords for the past 100 years. A forest seen as a timber mine demanded a different regimen than a forest seen as a living system. The reason why the Chief Forest Officer was called Conservator of Forests, was because his job was to conserve forest revenue. In the Western Ghats, the first onslaught on the forests was for constructing cantonments, for shipbuilding and laying railway lines. A massive decline of forests took place. The so-called scientific management of forests began in the 1870s. Attention was focussed on production, not on soil conditions. In the middle of this century, fresh demands like the production of paper led to clear felling of natural forests and the raising of large monoculture plants, like, for example, eucalyptus. The eucalyptus tree returns only 40-50 kgs. of leaf litter to the soil. It provides zero cattle fodder.

Shiv Narayan concluded the day's session by saying that organic farming was not just organic fertilizers and organic pesticides but a natural way of doing things. Both modern and traditional agriculture looked at nature with hostility. While chemical farming fights nature with both hands, organic farming fights nature with one hand. Even to plough the soil was eventually wrong. One should encourage more of tree agriculture and forests. Trees can give much more nutrition. 12 lakh calories could be obtained, for example, in one hectare of land, through a judicious mix of trees.

Third Day - First Session :

As the participants wanted to have a clearer picture of the Operation Flood Debate, Claude Alvares spoke on the subject for half an hour. The major rationale for Operation Flood, he said, came neither from the EEC nor from the Government of India but from the Gujarat Dairies which were disturbed by the news, that the EEC planned to gift away its surplus milk powder to countries, like India. This would certainly affect the milk powder market hitherto controlled by Amul. In 1956, Kurien, a metallurgist, was sent abroad to study the dairy business. The NDDB was constituted in 1965. Government of India provided the initial impetus. The Board

of Directors came from Amul. Kurien insisted on keeping the NDDB a private organisation, despite the fact all its funds came from the Government of India. When Operation Flood was conceived a few years later, the Law Ministry said the NDDB, being a private Society, could not handle the project. Therefore, the Indian Dairy Corporation was formed in 1970. However, NDDB retained full control of the Indian Dairy Corporation. The Board of Directors of both were common. They were controlled, in turn, by Amul and the original 49 shareholders of Amul constituted the ruling political elite of Gujarat.

The NDDB controlled all daily development in the country henceforth and Kurien eliminated all trained and independent dairymen from leading positions. The NDDB at Anand had total control over any information on dairy development. It prepared the documents for the Ministry of Agriculture. Till 1981, there was no independent study of the Anand model. Advertising agencies prepared the research, instead.

The project ran into trouble because the money earned from the sale of gifted milk powder was used to construct extensive processing plants and not for milk production enhancement. The strategy was to improve milk production indirectly. The plant would provide a ready market for the milk and farmers seeing this, would come, to invest in more cows. The strategy did not work. Korah Mathen observed that organic farming had been transfering good indigenous cattle from outside its areas to its fold and, claiming the credit for producing the milk.

There was a strong discussion later among some of the participants whether organic farming alone could sustain the population. Anand Kumar countered that by asking whether inorganic farming could sustain the population, too. E. P. Menon suggested that we would have to go back to Vinoba Bhave and to change land patterns and the relations of man to land. Richharia wanted an appeal to farmers to conserve plant genetic resources. He said those resources should be

maintained in a living condition in the fields and not as seeds frozen in seed banks.

Last minute participants Fr. Paul and Mathai from the Gadalur Taluka in Tamil Nadu made a presentation on the Gudalur Farmers' problem.

Third Day – Second Session :

Participants broke up into two groups, in order to discuss specific areas of co-operation and future strategies for propagation of organic farming. The following were some of the decisions :

1. The preparation of a directory of organic farming techniques being tried out today in the country. Participants were expected to send brief but descriptive notes of techniques they used, to Kanakmal Gandhi of Sevagram Ashram pratishthan by 31st May, 1984.

2. There should be national level meetings on indigenous seeds, indigenous dual purpose animals and on organic manures.

3. Participants should, at any rate, get together at least once a year. Regional meetings should perhaps be held before the next national level meeting.

4. A directory should be prepared of resource persons with their addresses.

5. More publicity and propaganda including articles in the press should be generated.

6. Traditional sayings, proverbs, etc: should be experimented with for testing their validities.

7. There was a need expressed by most of the participants for a co-ordinating body or an association. An Ad-hoc Committee was set up to go into the possibility of setting up an

association to further the objectives of organic farming and the preservation and strengthening of indigenous living resources including plants, animals, trees. The Ad-hoc Committee was to consist of Claude Alvares, S. N. Ghosh, M. j. Cherian, Vandana Shiva, Pratap Agarwal, J. K. Bajaj, Banwarilal Chowdhry, Kanakmal Gandhi and Korah Mathen as the Convenor of the Ad-hoc Committee. If found acceptable, the Memorandum of Association would be adopted by participants at the Rice Seed Seminar. It was proposed to hold the Indigenous Cattle Seminar at Kasturba Gram in Indore. Tentative dates were 18-20th October. The Rice Seed meeting would probably be held at Friends Rural Centre, perhaps in September 1984.

Participants to the Organic Farming Convention

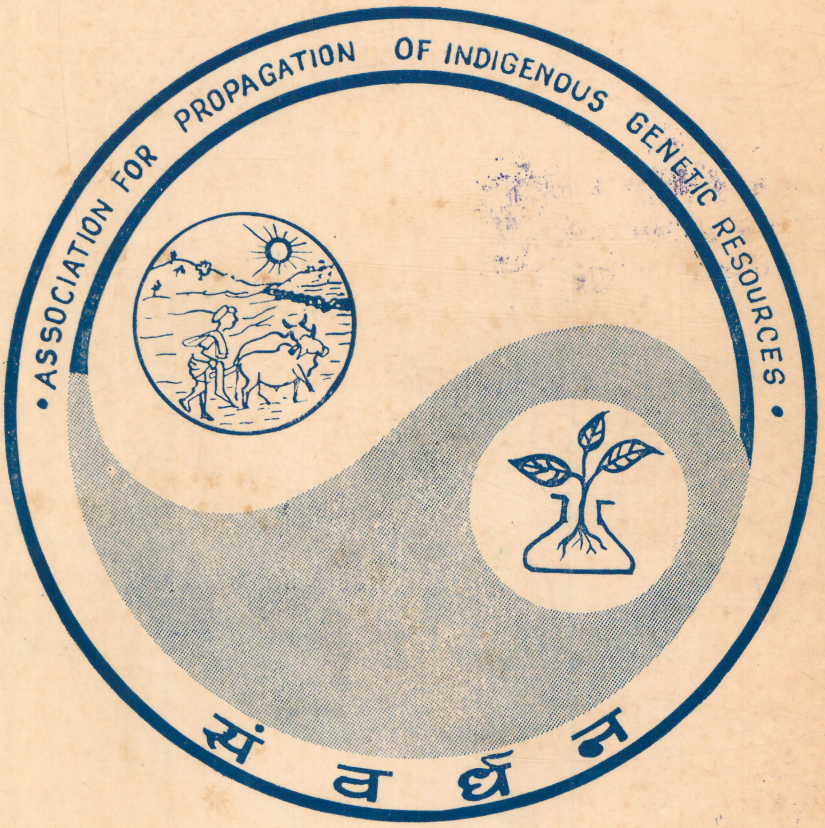
(Sevagram, 19-21 March 1984)

1. Shri Banwari Lal Choudhary	Gram Seva Samiti, P. O. Raisalpur, Hoshangabad -- 451001 (M. P.)
2. Dr. Sailen Ghosh	42/22 East Patel Nagar, New Delhi -- 110 008.
3. Dr. Claude Alvares	Almeida Vaddo, Parra, Goa -- 403510
4. D. Vanadana Shiva	Research Foundation for Science Technology and National Resource Policy 105, Rajpur Road, Dehradun - 248001 (U.P.)
5. Dr. R. H. Richharia	Jaishree. D–1, Punjabi Bag, Govindpura, Bhopal -- 462023 (M.P.)
6. Dr. K. G. Joshi	Dhanwantri, Dharampeth, Nagpur - 10
7, Dr. Nawal Kishore Bajpaye	(Deen Dayal Research Institute) B-3, Rawatpur Colony, Kanpur - 208002 (U.P.)
8. Dr. Ashok Jhunjhunwala	D 1/113, Bonn Avenue, Indian Institute of Technology, Madras - 600036

9. Shri S. Seshadri	A. M. M. Murugappa Chettiar Research Centre, Taramani Madras - 600113
10. Shri S. Nambi Varatharajan	A.M.M. Murugappa Chettiar Research Centre, Taramani Madras – 600113
11. Shri Bernsrd de Clereq	Aspiration Farm, Kottakupam Aurobille - 605104, Pondicherry
12. Shri Jaap den Hollander	Kottakarai, Auroville -- 605101 Pondicherry
13. Fr. Paul Vellakunnathu	Director, Gudalur Farmers Association, M. T. Nagar Gudalur - 643250, Nilgiris, Tamilnadu.
14. Shri P. Mathai	Organiser, Gudalur Farmers Association, Oliplare, P. O. Kayyuni, Nilgiris -- 643205
15. Prof. S. A. Dabholkar	Prayoga Pariwar, 103, Salunkhi Nagar, Kolhapur - 7 (M. S.)
16. Shri Shivanarayan Aadhao	Jagar Society, P. O. Shendurjana Ghat, Talu. Warud, Dist. Amaravati – 444907
17. Shri Champalal Kesharmal	P.O. Sevalpimpri, Ta· Pusad Dist. Yeotmal (Maharashtra)
18. Shri Korah Mathen	C/o. Arvind Mills Ltd., Naroda Road, Ahmedabad - 380025 (Gujarat)

19. Shri Nochiketa Das	Lalbhai Group Rural Development, Ramnagar, Sabarmati, Ahmedabad - 380005 (Gujarat)
20. Shri T. Haranath	Visakha Jilla Navanirmana Samiti, Sivaramanilayam, Narsipatnam - 531116, Visakhapatnam (A. P.)
21. Shri P. R. Parchuri	Convenor, School of Social Scientists, Chitturpu -- 521132, Krishna Dist (A.P.)
22. Shri E. P. Menon	Friends World College, Kumara Park East, Bangalore -- 560001
23. Shri G. U. Patankar	Gram Swarajya Ashram, Karajgaon, P. O. Rondha -- 460002, Dist. Betul (M.P.)
24. Shri Ramakant Khode	Viswasakha Prakritik Swasthya Kendra, Bistan Road, Khargone, Dist. West Nimar (M. P.)
25. Shri Anand Kumar	Ganesh Bhavan, Opposite Madhyavarti School, Babajipura, Baroda - 390001 (Gujarat)
26. Priya Deshingkar	(Centre for Science and Environment) F 12/6, Model Town, Delhi -- 110009
27. Shri Anil Kumar Sing	Association for Sarva Seva Farms, Munger Project, P.O. Khadigram, Dist. Munger 811313 (Bihar)

28. Shri Ram Khelavan Shastri	Shram Bharati, P.O. Khadigram, Dist. Monghyr -- 811313 (Bihar)
29. Shri Lal Bahadur Singh	Bharat Sevak Samaj P. O. Orabagicha, Dist. Monghyr (Bihar)
30. Shri Ashok Bang	Chetana Vikas, Gopuri, Wardha Pin -- 442114 (Maharashtra)
31. Shri Devendra Kumar	Centre of Science for Villages, Maganwadi, Wardha
32. Dr. Tarak Kate	Centre of Science for Villages, Maganwadi, Wardha
33. Shri Ranjit Desai	Gram Seva Mandal, Gopuri, Wardha
34. Shrimati Shobhana	Jagriti Kendra, Mahila Ashram, Wardha
35. Shri Atul Kumar Sharma	Maharogi Seva Samiti, Dattapur, Wardha
36. Shri R. P. Jyotishi	Maharogi Seva Samiti Dattapur, Wardha
37. Shri Dharampal	Ashram Pratishthan, Sevagram, Wardha
38. Shri Kanakmal Gandhi	Secretary, Ashram Pratishthan, Sevagram, Wardha - 442102.


• ASSOCIATION FOR PROPAGATION OF INDIGENOUS GENETIC RESOURCES •
संवर्धन